Phase I

CANADA-NEWFOUNDLAND AND LABRADOR

OFFSHORE HELICOPTER SAFETY INQUIRY

Volume 2
Expert and Survey Reports

The Honourable Robert Wells
Commissioner

Offshore Helicopter Safety Inquiry
Canada-Newfoundland and Labrador

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Review of Selected Offshore Petroleum Regulatory Regimes

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador, Canada
May 2010

Presented by
Aerosafe Risk Management

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LIST OF ABBREVIATIONS

AC	Advisory Circular
ALARP	As low as reasonably practicable
ANPR	Advanced Notice of Proposed Rulemaking (United States of America)
AOC	Air Operators Certificate
AoC	Acknowledgement of Compliance (Norway)
API	American Petroleum Institute
APOSC	Assessment principles for offshore safety cases (United Kingdom)
AVAD	Audio Voice Alerting Devices
BOE	Barrel oil equivalent
CAA	Civil Aviation Authority
CAA-N	Civil Aviation Authority – Norway (Norway)
CAP	Civil Aviation Publication (United Kingdom)
CAAP	Civil Aviation Advisory Publication (Australia)
CASA	Civil Aviation Safety Authority (Australia)
CFR	Code of Federal Regulations (United States of America)
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board (Canada)
CNSOPB	Canada Nova Scotia Offshore Petroleum Board (Canada)
DCR	Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 (United Kingdom)
DMR	Department of Mineral Resources (South Africa)
FAA	Federal Aviation Administration (United States of America)
FSA	Formal Safety Assessment (Australia)
HID	Hazardous Installations Directorate (United Kingdom)
HSAC	Helicopter Safety Advisory Conference (United States of America)
HSE	Health and Safety Executive (United Kingdom)
HSE	Health, safety and environment
HSWA	Health and Safety at Work etc Act 1974 (United Kingdom)
HUMS	Health and Usage Monitoring System
INC	Incident of Non Compliance (United States of America)
IRF	International Regulators' Forum
JOHSC	Joint Occupational Health and Safety Committee (Canada)
MAE	Major accident event (Australia)

MCMPR	Ministerial Council on Mineral and Petroleum Resources (Australia)
MHSC	Mine Health and Safety Council (South Africa)
MMS	Minerals Management Service (United States of America)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MRM	Minerals Revenue Management (United States of America)
NCS	Norwegian Continental Shelf
NPD	Norwegian Petroleum Directorate (Norway)
NOPSA	National Offshore Petroleum Safety Authority (Australia)
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act 1953 (United States of America)
OEMM	Offshore Energy and Minerals Management (United States of America)
OHS	Occupational Health and Safety
OLF	Norwegian Oil Industry Association (Norway)
OPGGSA	Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Australia)
OPS	Offshore Petroleum (Safety) Regulations 2009 (Australia)
OSD	Offshore Division (United Kingdom)
OSH	Occupational Safety and Health Act 1970 (United States of America)
OSHA	Occupational Safety and Health Administration (United States of America)
PAA	Petroleum Activities Act 1996 (Norway)
PFEER	Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (United Kingdom)
PINC	Potential Incidents of Non Compliance (United States of America)
PPE	Personal Protection Equipment
PSA	Petroleum Safety Authority (Norway)
PSLA	Petroleum (Submerged Lands) Act 1967 (Australia)
SCR05	Offshore Installations (Safety Case) Regulations 2005 (United Kingdom)
SEMS	Safety and Environmental Management System
SMS	Safety Management System
UKCS	United Kingdom Continental Shelf
USCG	United States Coast Guard (United States of America)

1 Executive Summary

The approach to the regulation of safe offshore petroleum operations varies depending on the country; the state of the industry in that country, the degree of prescription of the regulations, and the method by which the regulators enforce and promote safety. This variation is then manifested in the effectiveness of the regulator and the regulations at creating safe offshore working environments. This report examines the offshore petroleum regulators from five nations in order to provide an overview of the different types of safety regulations and the way in which safety is enforced, as well as an overview of the Regulator itself and the degree of oversight of helicopter operations as a form of transportation to and from offshore installations.

The United Kingdom, through the "Health and Safety Executive", and the "Petroleum Safety Authority" in Norway, and "National Offshore Petroleum Safety Authority" in Australia, each use performance and risk reduction-based regimes to ensure the safety of workers on offshore installations. These regulatory systems are then supplemented by enforcement systems which monitor whether the operator has implemented the safety and management plans accepted by the Regulator.

The United States and Nova Scotia, Canada, each have one body to regulate safe offshore operations, promote the petroleum industry and provide licenses to conduct activities. The United States regime however is further complicated by two agencies being responsible for safety: one for installation safety, the other for occupational health and safety. Both North American regulators are facilitating changes to improve safety regulations, as well as address any potential conflict which may arise from the existing system.

Offshore helicopter safety is varied in its level of oversight, with Norway and the United Kingdom investing resources to provide guidance to operators and improve the overall system through collaboration with the relevant industry parties. Other regulators have, to some degree, identified the need for improved helicopter safety but have yet to implement the necessary systems.

2 Introduction

The regulation of the offshore petroleum industry is crucial to the health and safety of those who work offshore. The regulatory regimes that exist vary significantly between nations, and on some occasions within nations. More than twenty regulators operate worldwide, each different in the level of oversight, structure, funding regime and the ability to make and enforce regulations. The nature of each regulator depends on a number of factors, such as the sophistication and size of the industry in that area, the degree of involvement each regulator has in the day-to-day operations offshore, the level of prescription of the regulations and the level of activity each regulator exhibits in creating safe and healthy working environments for the thousands of people who work in the offshore industry.

2.1 Background

This report provides an examination of offshore petroleum regulators from five countries: the United Kingdom, the United States of America, Australia, Norway, and Canada. These countries were selected for review based on the level of regulation they enforce, the type of industry they have oversight of and the political environment in which they operate. It was intended to include South Africa in this review; however the nature of the information publically and readily available made this difficult. A brief overview is included, as the nature of the South African offshore industry and its regulatory regime make it valuable to study in the future.

Excluding South Africa, each of the selected countries are members of the International Regulators' Forum for Global Offshore Safety (IRF). IRF was established in 1994 to enable members to exchange information, promote improved performance, and provide a network to support and advise each other when necessary. The Forum has the aim of improving the safety of offshore petroleum activities.

Canada is the only nation which has two distinct offshore petroleum regulators. The Canada Nova Scotia Offshore Petroleum Board (CNSOPB) is included in this report. The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) also regulates the industry in Canada. However their jurisdiction is two separate

geographical areas so it is possible to study one individually, as is done in this report.

Within the United States of America, the Minerals Management Service (MMS) is one of the responsible agencies for the health and safety of workers offshore. However, it is able to enforce the health and safety regulations of other agencies, and is also a member of the IRF. Hence MMS was chosen for this examination.

Both Norway and Australia have specific authorities who are responsible for regulating and enforcing safety in the offshore petroleum industry. The regulator in the United Kingdom, the Health and Safety Executive (HSE), is the agency responsible for ensuring workplace health and safety across the entirety of the United Kingdom. It has a specific division responsible for offshore health and safety.

2.2 Objectives

The objective of this report is to provide a summary of each of the regulators selected. In particular the following four areas were investigated in order to provide a comparison of how the offshore industry is regulated in different countries:

1. Regulator overall structure and governance
2. Safety practices and standards
3. Safety organizational structure
4. Standards and practices with respect to helicopter transportation offshore.

2.3 Report Structure

This report reviews the following petroleum regulators:

1. Health and Safety Executive (United Kingdom)
2. Minerals Management Service (United States of America)
3. National Offshore Petroleum Safety Authority (Australia)
4. Petroleum Safety Authority (Norway)
5. Canada Nova Scotia Offshore Petroleum Board (Canada)
6. Mine Health and Safety Inspectorate (South Africa)

The safety regime enforced and promoted by each regulator is of primary significance in this report. The Regulators' organizational structure and level of oversight of safety are covered in detail. An area of high significance is the oversight of helicopter transportation to and from offshore installations. Generally the aircraft airworthiness, operations and aircraft operator are under the jurisdiction of the relevant civil aviation authorities. However, due to the risks associated with helicopter transportation offshore, the offshore regulator may require the installation operator to take preventative measures. The extent to which the regulator ensures safe helicopter operations is therefore included in this report.

3 United Kingdom – Health and Safety Executive

The Health and Safety Executive (HSE) vision is "the prevention of death, injury and ill health to those at work and those affected by work activities" within Great Britain. The HSE supports the UK Government's strategic aims and current targets for health and safety at work. The HSE is a Non Departmental Public Body which is sponsored by the Department for Work and Pensions.

3.1 Overview

The HSE's primary function is to secure the health and safety of people at work and those affected by work activity. In this regard, the HSE seeks to promote safe work environments and to provide information and guidance in order to influence people and organizations to provide a high standard of health and safety at work. HSE also enforces, develops and revises legislation in order to ensure the safety and well-being of people at work.

Following the 1998 Piper Alpha disaster and subsequent inquiry by Lord Cullen, the Offshore Division was established within the HSE. The pre-existing prescriptive regulations of the offshore industry were replaced by goal-setting regulations. The foundation of the current regime is the requirement of a safety case for each installation that demonstrates how major accident hazards are controlled.

3.1.1 Industry

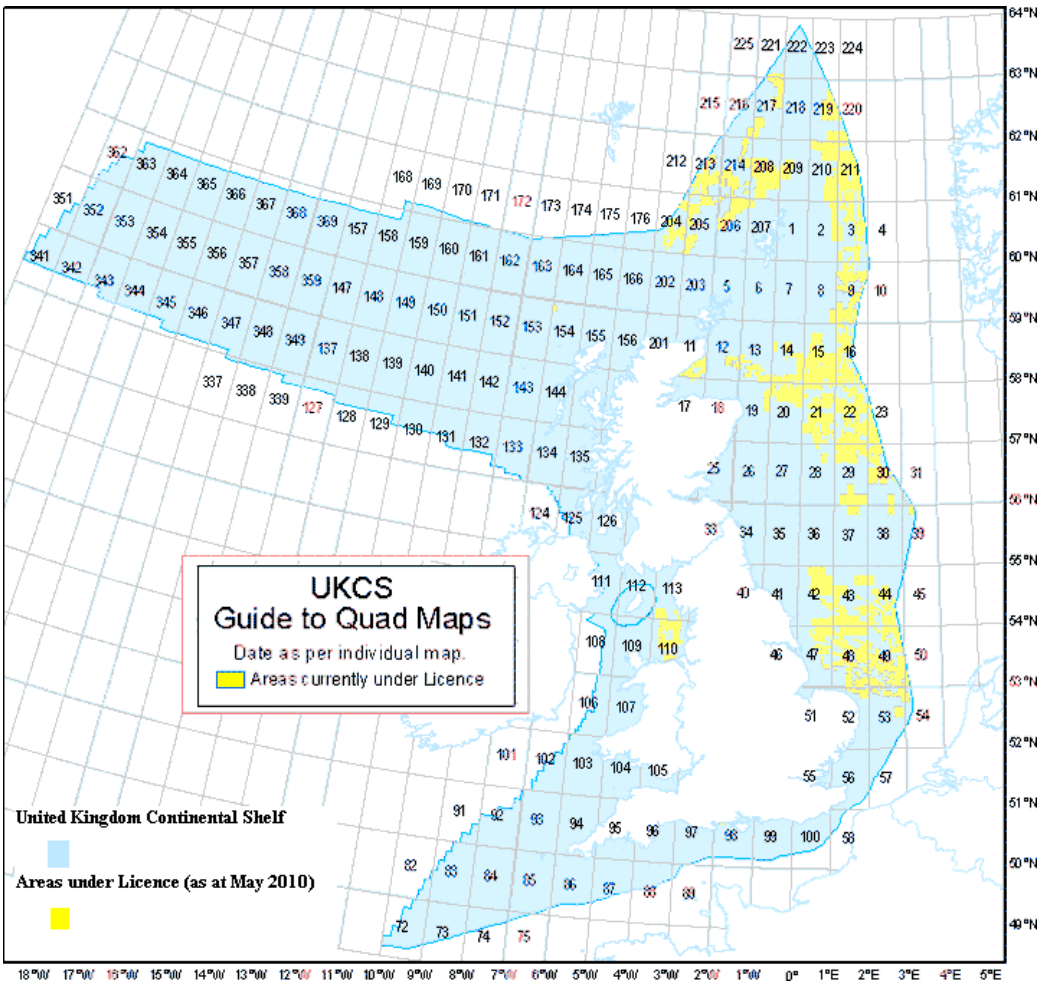
The United Kingdom Continental Shelf (UKCS) has a number of oil and gas fields, primarily in the North Sea. There has been a proven 3723

million tonnes of oil extracted from the UKCS and an additional 292 billion cubic metres of gas as at December 2008. The industry comprises around 300 installations on the UKCS.

Most of the offshore installations are accessed from Aberdeen in Scotland by helicopter. Three helicopter companies, Bristow, Bond Offshore Helicopters and CHC Helicopters, operate from Aberdeen to provide transportation to the offshore installations, making it the busiest heliport in the world. There are approximately 100 helicopters providing transportation on the UKCS.

The Petroleum Act 1998 vests all rights to the United Kingdom's petroleum resources in the Crown. However, the Government, through the Department of Energy and Climate Change can grant licences that confer rights to "search and bore for and get" petroleum. The Petroleum Revenue Tax and the Ring Fence Corporation Tax, and Supplementary Charge on ring fence trades are administered by HM Revenue and Customs Large Business Service. [Figure 1]

Figure 1 – Leases on the United Kingdom Continental Shelf



3.2 Organizational Structure

The HSE is established under the *Health and Safety at Work etc. Act 1974 (HSWA)*. It has combined a number of regulatory bodies since its inception, and it remains the body responsible for the encouragement, regulation and enforcement of workplace health and safety.

The Offshore Division is responsible for enforcing health and safety legislation in offshore oil and gas installations, exploration and so on. The Offshore Division (OSD) is one of three Divisions within the Hazardous

Installations Directorate (HID) as highlighted in Figure 2.

3.2.1 Board Structure

On the 1st April 2008, the Health and Safety Commission and the Health and Safety Executive merged to be a single body, under the name Health and Safety Executive. The HSE Board is specifically responsible for establishing and delivering HSE's strategic aims and objectives and ensuring that the responsible minister is kept informed of any changes which may impact HSE's strategic direction or attainability of its targets. The Board consists of the Chairperson and nine Non-Executive Board Members.

3.2.2 Offshore Division

The Offshore Division (OSD) is divided into five units, which are based in either Aberdeen or Bootle, see Figure 3. The core activities for OSD are:

1. Safety case assessment
2. Verification
3. Inspection
4. Investigation
5. Enforcement

This is reflected in the OSD mission "to assure safe management and effective control of major accident hazard risks and prevent catastrophic incidents in the Offshore Oil and Gas Industry."

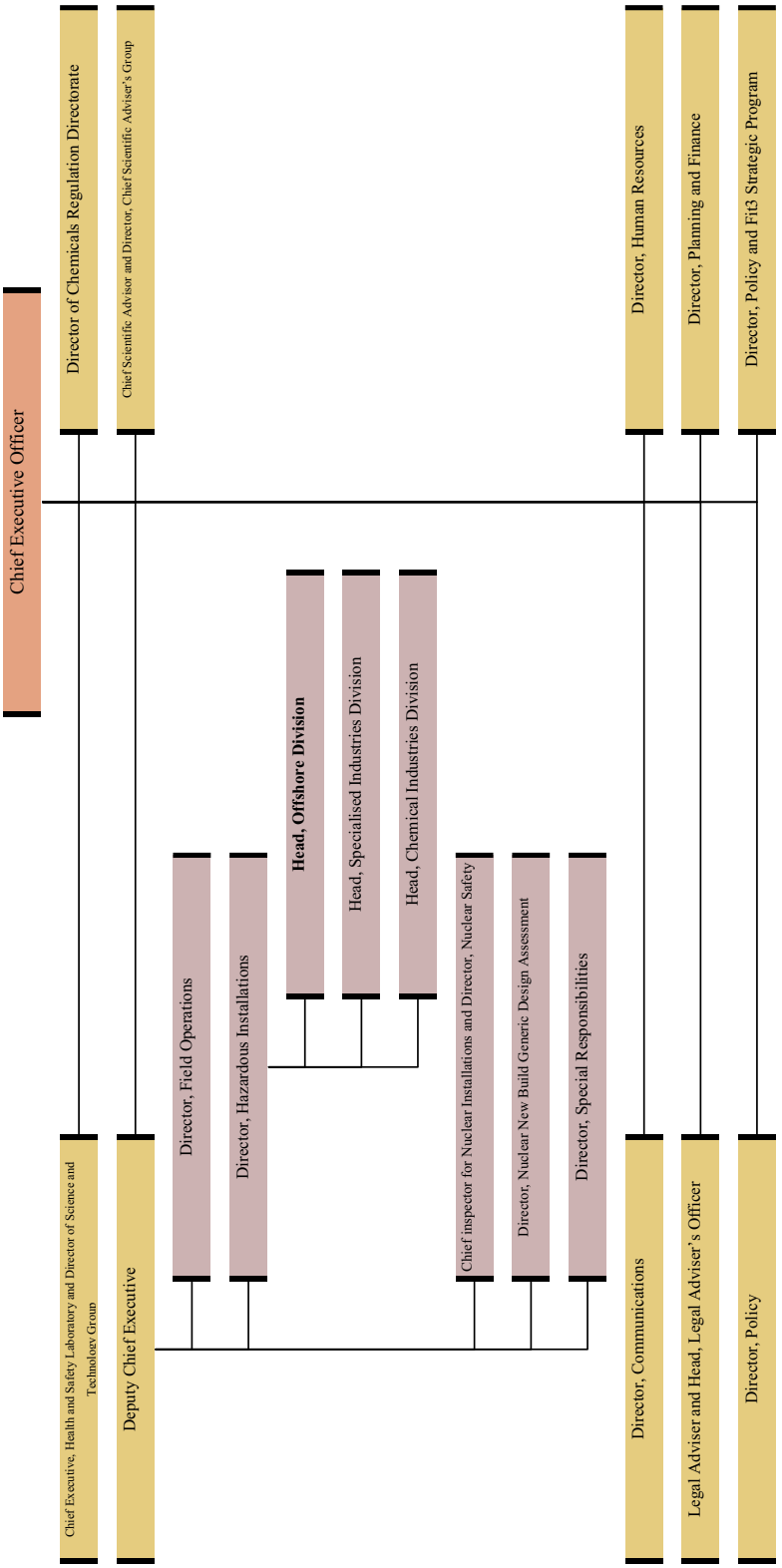
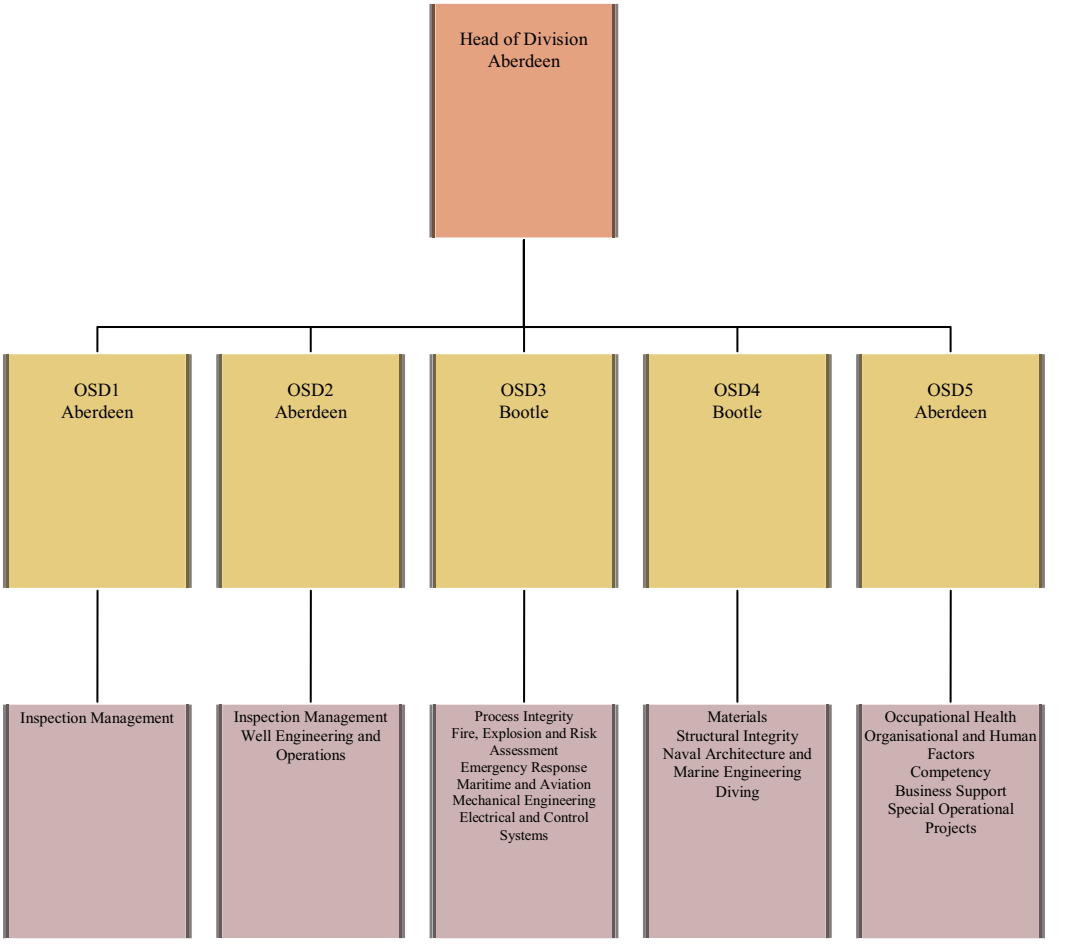


Figure 2 - HSE Organizational structure, highlighting position of the Offshore Division

Figure 3 - Organizational structure of the Offshore Division



3.3 Safety Oversight

In order to regulate and promote health and safety and reduce the major hazard risks present across the industries, the HID's activities include inspection of operations, investigation of accidents and incidents, enforcement of requirements as well as working with partners to identify, define, and advise on risk assessment and reduction.

Due to the nature of the HSE and the large area of responsibility it has for the health and safety of all people at work in Great Britain, there is a large number of Acts and Statutory Instruments and other legislation which the HSE enforces. Within the area of offshore petroleum exploration and production safety, the *Offshore Installations (Safety Case) Regulations*

2005 (SCR05) are the most significant piece of legislation by which the HSE, and in particular OSD, ensures the safety and well-being of those at work. The operator of an installation, as defined within the *Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995*, must ensure that the HSE has accepted the lodged safety case for that installation. Schedules 1 to 5 to *SCR05* detail the particulars to be included in the Safety Case, depending on the type of installation it is. Other regulations such as *Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER)* and *Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 (DCR)* provide specific details for the design and operation of installations.

3.3.1 Safety Standards

The *Health and Safety at Work etc Act* requires employers to ensure so far as is reasonably practicable the health, safety and welfare at work of employees. SCR05 replaces the previous requirement that risks to people from major accident hazards are reduced to "as low as reasonably practicable", to be that major accident risks are controlled to ensure compliance with the relevant statutory provisions (SCR05 Reg 12). In order to demonstrate compliance with these, the applicable Regulation should be referred to. For example the installation duty holders are required by Paragraph 5 of the *PFEER* Regulations to conduct an assessment which identifies events which could lead to a major accident, or require an evacuation, escape or rescue to avoid or minimize a major accident, the likelihood and consequences of such events and the selection of the appropriate measures to minimize and protect people from the event (PFEER Paragraph 5). This assessment is to be repeated as often as appropriate and made available to the HSE. This is slightly different from the previous requirements for risk to be reduced to "as low as reasonably practicable" (ALARP). Other regulatory requirements are phrased differently so that regulatory compliance exceeds ALARP, such as PFEER Paragraphs 17 and 19.

The *Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER)* and the *Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 (DCR)* and HSWA set the standards for the control of major accident risks.

The requirement from SCR05 for an approved safety case adds the requirement that the duty holder demonstrates that it has the ability to control major accident risks, i.e., SCR05 has the additional responsibility to ensure that the duty holder is in compliance with PFEER, DCR and HSWA. The safety case must be accepted by HSE prior to the installation being in use on the UKCS.

Following the introduction of SCR05, HSE published an updated "Assessment principles for offshore safety cases" (APOSC). It details the 27 principles (more in the case of combined operations) by which each safety case is assessed. These are (in abridged form):

1. Information should meet SCR05 requirements

2. Management system is adequate to ensure compliance with statutory provisions

3. Management system has an appropriate level of control during each stage of the installation life cycle

4. Systematic process to identify all reasonably foreseeable major accidents hazards

5. Clear methodology for major accident risk assessment

6. Any criteria to eliminate a risk in the evaluation should be explained

7. Risk assessment should take account of people exposed to the risks

8. The major accident risk evaluation should take account of human factors

9. Conclusions reached in risk assessment should account for uncertainty

10. Risk reduction measures should be systematic and take new knowledge into account

11. Describe reasoning for choice of risk reduction measures to be implemented

12. Risk reduction measures implemented if reasonably practicable

13. "Reasonably practicable" based on sound engineering, management and human factors principles

14. Risk reduction measures are implemented in considered timeframe

15. Describe measures taken to manage major risk hazards

16. Inherently safer design concepts applied

17. Measures for preventing major accidents take into account the various activities undertaken

18. Appropriate detection measures for a reasonably foreseeable event requiring emergency response

19. Appropriate control and mitigation measures in place to protect personnel from the consequences of a major accident

20. Arrangements for controlling an emergency take into account likely conditions in an emergency

21. Measures and arrangement for emergency management identified

22. Temporary Refuge provides sufficient protection

23. Temporary Refuge integrity maintained for the necessary time

24. Evacuation and escape arrangement integrated in a logical and systematic manner

25. Effective rescue and recovery arrangements for major accidents

26. Design Notification describes the principles of risk evaluation and management being applied to reduce major accident risks, as to ensure compliance with statutory provisions

27. Well engineering aspects included in Design Notification

In addition to SCR05 is the need for an early design notification to HSE when developing a new production installation.

Another introduction is the requirement for licensees to ensure that whoever they appoint as an operator is able to fulfill their legal responsibilities for safety.

3.3.2 Safety Assurance Regime

The duty holders are required, by the change to the SCR05, to conduct a thorough and fundamental review of their safety cases at least every five years, or as required by HSE. This removes the need for safety cases to be re-submitted every three years, as inspections will ensure that safety cases are implemented. The review is intended to allow updates and improvements to be made which account for additional information or practices made available since the original safety case was submitted. The review also ensures that the life cycle of installations is fully accounted for. Ageing is becoming more significant as infrastructure investment reduces.

The OSD conducts inspections of installations to ensure compliance but not within any definite period. An initiative to increase the number of inspections carried out has been underway since 2008. This program provides verification that the duty holder is compliant with the regulations.

3.4 Helicopter Operations Oversight

The HSE has been proactive in its approach to helicopter safety for transportation to and from offshore installations. This includes identifying the parties responsible for each element. The publication *How offshore helicopter travel is regulated* provides a definitive guide for what is the responsibility of the associated agencies and individuals. A Memorandum of Understanding between the UK Civil Aviation Authority (CAA) and

HSE ensures that the agencies together efficiently regulate helicopter travel offshore.

In addition to these clarification documents, the HSE has commissioned a report on the safety record of UKCS helicopter operations compared to other modes of transportation (John Burt Associates Limited and BOMEL Limited, 2004). An employee of the Offshore Division also undertook a study of offshore helicopter safety (Morrison, 2001), identifying trends in offshore helicopter safety as well as details regarding helicopter technology and helideck design.

The *Offshore Installations (Safety Case) Regulations 2005* require installation operators to identify and take action to reduce the risks associated with major accidents, including helicopter accidents. Requirements for the safety of helidecks and helideck operation are included in the following regulations:

- *Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995*
- *Offshore Installation and Pipeline Works (Management and Administration) Regulations 1995*
- *Offshore Installations and Wells (Design and Construction, etc) Regulations 1996*

Through inspections, the HSE ensures that helidecks and operations associated with helidecks conform with these Regulations, as well as the practices described in the installation safety case.

The CAA is responsible for regulating the airworthiness of aircraft and the safe operation of those holding Air Operators Certificates (AOC). Through the use of Air Navigation Orders, helicopter operators are only able to make flights to suitable helidecks. The Helideck Certification Agency within the CAA inspects helidecks operational in the UKCS and ensures the application of operational limitations and restrictions as necessary. The CAA published Civil Aviation Publication 437, which provides guidance as to good practice for the design and associated operations of helidecks.

The HSE accepts that compliance with CAP 437 is considered compliance with the HSE offshore regulations for helidecks. The CAA has mandated the use of Health and Usage Monitoring Systems for all helicopters providing support for the offshore oil and gas industry on the UKCS.

A Memorandum of Understanding between the CAA and HSE specifies the responsibility for each of the parties with regard to offshore helicopter safety. This document highlights

1. the role of the HSE to ensure that the Installation Manager has the appropriate safety provisions in place for any activities associated with the offshore installation, and

2. the role of the CAA to ensure that helicopter operators are able to meet the requirements for the safe transportation of passengers.

The CAA and HSE also participate in the twice-yearly meetings of the Offshore Industry Advisory Committee Helicopter Liaison Group, within the HSE. This provides a regular tangible way for stakeholders to improve safe helicopter operations.

4 United States of America – Minerals Management Service

The Minerals Management Service (MMS) is a US Federal Agency within the Department of the Interior. It is responsible for the minerals, oil and gas on the Outer Continental Shelf (OCS).

4.1 Overview

The regulation and enforcement of safe work environments on offshore petroleum installations is the responsibility of a number of agencies: the Minerals Management Service (MMS), the United States Coast Guard (USCG) and the Occupational Safety and Health Administration (OSHA). Through a number of pieces of legislation, Memoranda of Understanding (MOU) and guideline documents, the jurisdiction of each agency is defined.

The MMS regulates the structural integrity of OCS facilities as well as enforcing regulations pertaining to production, exploration, drilling and

similar activities on the OCS. The USCG regulates marine systems, such as life-saving and navigation equipment, and workplace safety and health. Any work conditions which the MMS or USCG have not accounted for by regulation are then enforced by OSHA. These agencies have jurisdiction only in federal waters, which generally "commence" from 3 nautical miles from land.

The MMS enforces USCG regulations as well as its own. These account for the majority of safety regulations enforceable on OCS facilities. For this reason, MMS will be the primary focus of this review as the offshore safety regulator.

4.1.1 Industry

The offshore oil and gas industry in the US is primarily based in the Gulf of Mexico with nearly 6000 oil and gas exploration and production installations in the Gulf of Mexico. The Pacific Region has 24 production installations and Alaska Region has none as at the end of 2009. There are several leases and wells in Alaska, but none producing at this point, see Figure 4.

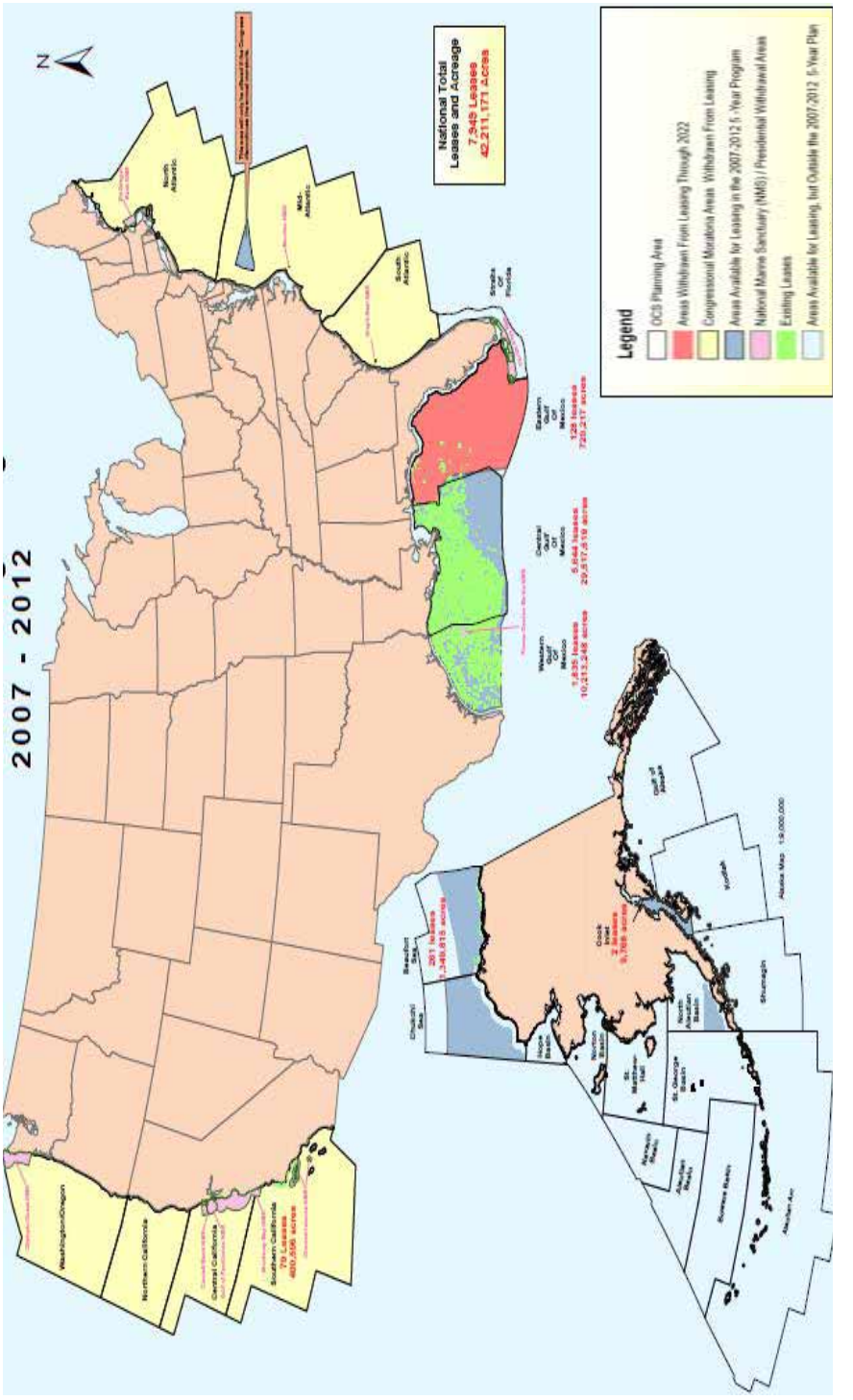


Figure 4 - United States offshore oil and gas leasing five year plan (2007-2012), as at July 2008

Following a statement by President Obama in March 2010, a number of areas in Alaska and on the Pacific and Atlantic regions of the OCS have been identified as possibly being available for lease in the 2012 release. This new strategy will form part of the 5 Year Plan that the MMS operates.

In the Gulf of Mexico, due to the large number of platforms and a total of 200 companies active in the region, there are 4000 helidecks. The small offshore distances and the large number of platforms operating in the Gulf has led to a large number of helicopter operators, with fleet size ranging from 1 to more than 200 aircraft. There are essentially two tiers of helicopter operators in the Gulf. The larger companies offer twin engine helicopters with the latest technology and are generally engaged in long-term contracts with oil and gas companies. The second tier of operators tend to partake in ad hoc charter for smaller companies. This restricts the investment in large, well-equipped IFR helicopters.

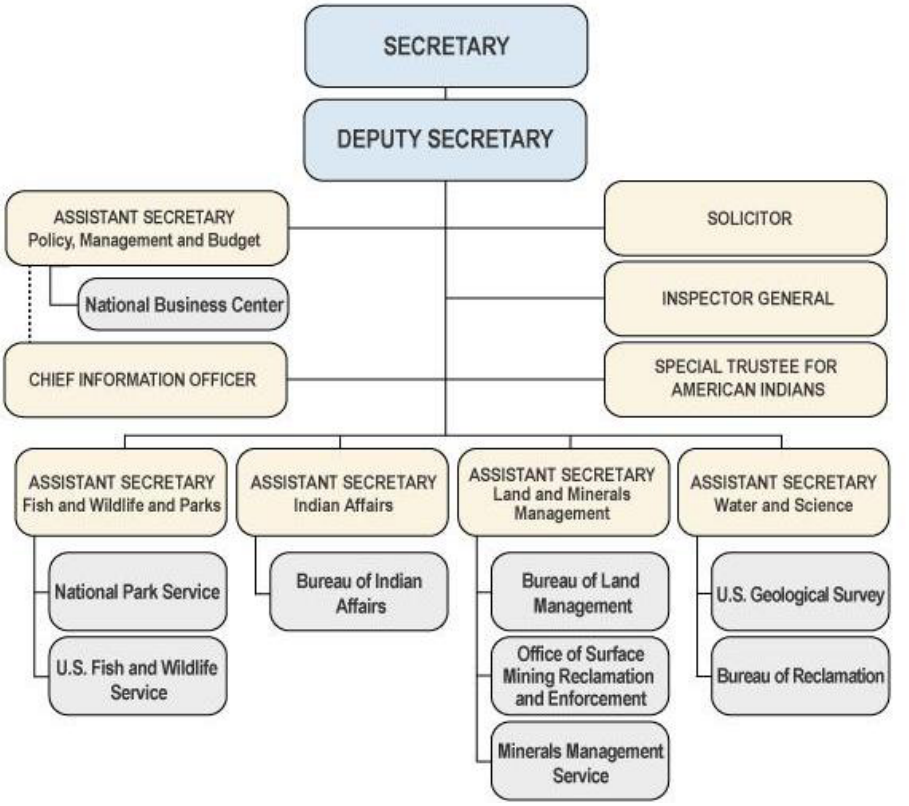
4.1.2 Legal Structure

The MMS was established in 1982 under Department of the Interior Secretarial Order No. 3071. This created a bureau-level agency responsible for managing the royalties from oil and gas and mineral production as well as leases of federal land. The position of the MMS within the Department of the Interior is highlighted in Figure 5.

4.2 MS Organizational Structure

The MMS is a bureau within the United States Department of the Interior. The MMS consists of approximately 1700 staff across 20 offices. The two main programs are the Offshore Energy and Minerals Management (OEMM) and Mineral Revenue Management (MRM). The OEMM manages energy and mineral development on the Outer Continental Shelf. It also issues leases for mineral, oil and gas exploration and production on the OCS through scheduled leasing programs. The MRM collects and accounts for revenue associated with onshore and offshore petroleum and mineral production. The MRM disburses funds to relevant parties such as the U.S. Treasury, eligible states and counties, and American Indian Tribes, as well as funds for conservation and preservation. On average US$8 billion is collected by the MMS annually from leasing and royalties.

Figure 5 - Organizational structure of the Department of the Interior



Following the Deepwater Horizon incident in April 2010, the Interior Secretary Ken Salazar announced plans to split the MMS into two parts. One would be charged with regulatory enforcement and inspection, while the other would issue leases and collect royalties. This would end what has been described by many commentators as an ineffective regulatory regime where the same agency is responsible for collecting money from the companies it is required to inspect.

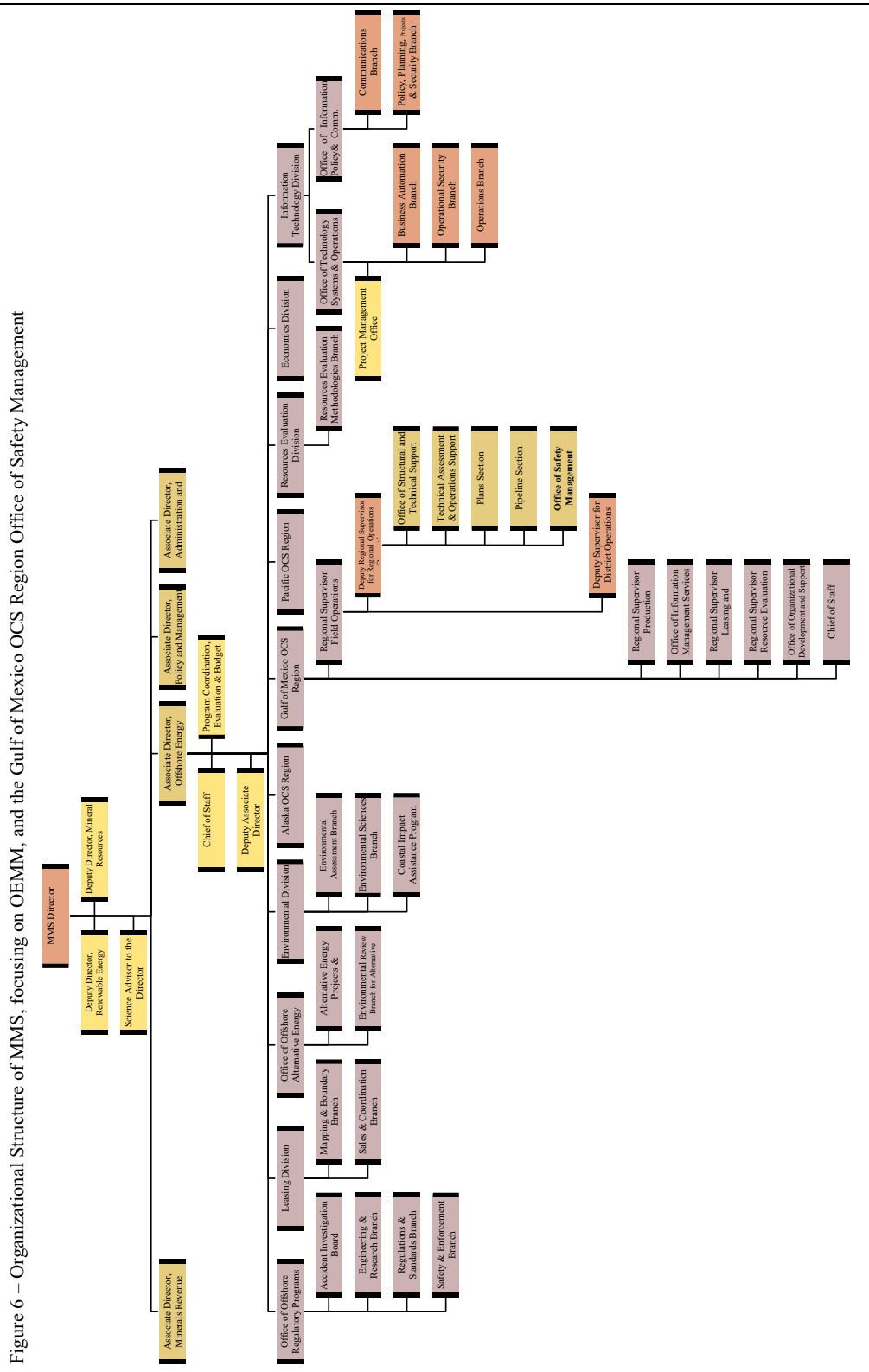


Figure 6 – Organizational Structure of MMS, focusing on OEMM, and the Gulf of Mexico OCS Region Office of Safety Management

4.2.1 Offshore Energy and Minerals Management

The OEMM program within the MMS is responsible for leasing federal land on the OCS, as well as regulating and enforcing safe, efficient and environmentally friendly operations on the OCS. The operations of the OEMM are primarily split into four regions: Pacific, Gulf of Mexico, Atlantic and Alaska. The Gulf of Mexico Regional Office conducts all leasing and resource management activities in the Atlantic, where there is currently no oil or gas exploration or production. The Gulf of Mexico is the most significant region. It accounts for most of the offshore activity in the United States, which is more than 6000 production platforms. The MMS has approximately 60 inspectors (Figure 6).

4.3 Safety Oversight

Under the *Occupational Safety and Health Act of 1970 (OSH)* Section 5(a)(i) each employer should provide employees "a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employee." The OSH is applied to the Outer Continental Shelf through the *Outer Continental Shelf Lands Act 1953 (OCSLA).* In subsequent amendments the Act also established the USCG's role as the principal safety and health authority on the OCS.[2] The USCG is therefore the primary federal agency on matters of health and safety for all offshore petroleum installations on the OCS. The MMS also has some safety and health regulations, particularly with respect to fire and explosion hazards. Any hazardous working condition for which the USCG or MMS has not yet promulgated a regulation is the responsibility of OSHA, primarily related to general industry and construction industry standards.

The USCG regulations for the OCS include Personal Protection Equipment (PPE), firefighting equipment, emergency equipment and evacuation plans. Details are stipulated in 33 CFR Chapter I.

4.3.1 Safety Standards

Under the OCSLA Section 6 and Section 8, a lease is issued which authorizes the exploration for, and development and production of minerals on the OCS in a specified area. The holder of the lease has the duty to

> maintain all places of employment within the lease area… in compliance with occupational safety and health standards and, in addition, free from recognized hazards to employees.

The lessee must submit to the MMS a Development and Production Plan under 30 CFR 250.204 and OCSLA 1351 which must include a description of any safety features on the facility, all safety standards to be met and how the standards will be met. The Plan may be requested by the MMS to be modified if the Plan does not show adequate provisions for safety. All production facilities are required by the MMS to be designed, installed, and maintained in a manner which provides for safety of operation. A number of American Petroleum Institute Recommended Practices (API RP 14C) are the standard for the Surface Safety Systems in place for Offshore Production Platforms.

The MMS and USCG minimum requirement for compliance is the use of "the best available and safest technology". This is defined in 30 CFR 250.105 to be technologies determined by the MMS Director as "economically feasible wherever failure of equipment would have a significant effect on safety, health, or the environment."

A number of operators on the OCS voluntarily have Safety and Environmental Management Systems (SEMS) in place. The American Petroleum Institute (API), in collaboration with industry organizations and MMS, developed API RP 75 "Recommended Practice for Development of a Safety and Environmental Management Program for Offshore Operations and Facilities". The degree of adoption of API RP 75 has varied, and the MMS has monitored this through the voluntary SEMS Performance Measures with an estimated 70 OCS operators having SEMS programs in place as at June 2009. The majority of these are what MMS defines as high activity operators, i.e., operators which produce at least 10 million barrel of oil equivalent (BOE) per year.

4.3.2 Safety Assurance Regime

The MMS and USCG under OCSLA are required to promulgate regulations which facilitate scheduled onsite inspections of each facility on the OCS. The inspection "shall include all safety equipment designed to prevent/ameliorate blowouts, fires, spillages, or other major accidents"(43

U.S.C. 1348 (c)). MMS conducts on-site inspections at least annually to assure compliance with lease terms and plans as well as safety and environmental considerations. The USCG conducts an initial inspection of all new fixed OCS facilities and further inspections as allowed for by resources during operation. The small number of inspectors employed by the USCG means that less than 10 percent of all facilities are inspected annually. The Department of Transportation authorized in 2002 an arrangement whereby the MMS on behalf of the USCG conducts inspections on fixed facilities on the OCS and enforces the USCG regulations applicable to the facilities. This system ensures that each facility is subject to an on-site inspection at least once a year, with both MMS and USCG able to conduct inspections at any time without notice, to ensure compliance. This increases the safety of workers on fixed OCS facilities and associated vessels through more frequent inspections of lifesaving and firefighting equipment among others. Any deficiencies found by MMS are processed according to MMS regulations and Incidents of Non Compliance (INCs) will be issued.

The following is adapted from the Memorandum of Agreement between the MMS and the USCG (MOA OCS-01) effective from 30 September 2004. It lists the lead agency for systems associated with OCS facilities, which are categorised and defined in the Memorandum of Understanding between the MMS and the USCG dated 30 September 2004. MODU, or Mobile Offshore Drilling Units, are vessels capable of engaging in drilling operations for exploring or exploiting subsea resources. Fixed facilities are defined as “bottom-founded OCS facilities permanently attached to the seabed or subsoil of the OCS, including platforms, towers, articulated gravity platforms and other structures.” A floating OCS facility is a “buoyant OCS facility securely and substantially moored so that it cannot be moved without a special effort.”

Table 1 - MMS and USCG Offshore Facility System Responsibility Matrix (Redacted)

System	Sub-System	Lead Agency		
		MODU	Fixed	Floating
Aircraft Landing and Refueling	Decks, fuel handling and storage	USCG	MMS	USCG
Fire Protection		USCG	USCG	USCG
Safety Systems	Emergency shutdown systems	MMS	MMS	MMS
	Gas detection	MMS	MMS	MMS
	Drilling, production, well control safety and shutdown systems	MMS	MMS	MMS
	General alarm (including public address system)	USCG	USCG	USCG
Lifesaving equipment		USCG	USCG	USCG
Workplace health and safety		USCG	USCG	USCG
General arrangements	Access/egress and means of escape	USCG	USCG	USCG
	Safety plan, fire control or fire equipment and lifesaving equipment plans	USCG	USCG	USCG
	Emergency evacuation plans	USCG	USCG	USCG
	Drills – fire, abandon and life boat	USCG	USCG	USCG
	Safe welding, burning and hot tapping	MMS	MMS	MMS
	Diving operations and equipment	USCG	USCG	USCG
	H_2S contingency plan (including detection, PPE, and control systems)	MMS	MMS	MMS
Safety analysis	Industrial systems	USCG	MMS	MMS

The basis of the MMS regulatory enforcement is through the Self-Inspection Program. This is built on 27 specific Potential Incidents of Non-Compliance (PINCs) which were developed by USCG and MMS. The program is conducted according to 33 CFR Sub Chapter N, and is carried out by either MMS inspectors acting on behalf of USCG or USCG marine inspectors. The 27 may each be addressed, forming a full Self Inspection, or only key safety items, comprising 8 to 10 PINCs (depending on the OCS region) may be inspected. The PINCs allow operators to ensure that they are compliant with the requirements as well as providing the inspectors a checklist of the necessary conditions. The enforcement actions range from "Warning" to "Shut-in Facility". The 27 PINCs are (in redacted form):

1. Previous 2 years of self-inspection forms filed

2. Adequate quantities of PPE available, used and well maintained

3. Respiratory protection equipment available, used and well maintained

4. Use of safety belts or harness when personnel in an activity where they may fall more than 10 feet

5. Use of approved personal flotation device if hazard of falling into water

6. Eyewash equipment immediately available

7. Walkways cleared of tripping and slipping hazards

8. Openings in decks covered or guarded when not in use

9. Required number of operational obstruction flights and fog horns are in place

10. Required types and number of means of escape for personnel

11. Personnel landing maintained to allow safe access/egress at water surface

12. Floors, decks, catwalks and stairways protected with suitable guards, rails or fence

13. Helideck perimeter protection

14. Two approved life floats/rafts etc to evacuate all onboard personnel at one time available and accessible

15. Life preserver provide for each person

16. Four life ring buoys

17. First-aid kit available and readily accessible

18. Safety litter available and accessible

19. Operational emergency communication equipment on board

20. Readily accessible required lifesaving equipment

21. Additional lifesaving equipment if required for unmanned platform

22. Required number and type of fire extinguishers available

23. Buoyant work vests available for use by personnel

24. General alarm system installed

25. Person assigned to each life float/raft etc who is responsible for launching it in the event of an emergency

26. Emergency drills conducted on each platform

27. Complete station bill prepared and displayed

4.4 Helicopter Operations Oversight

Helicopter landing and refueling sites are included as one of the 27 PINCs. The regulations for this are promulgated by USCG for floating and MODU facilities, and by the MMS for fixed facilities on the OCS. The USCG has numerous regulations covering helideck design, markings and fire preparedness, all stipulated in 46 CFR Parts 107 to 109. The MMS is the lead agency for helideck facilities on fixed OCS facilities but has not promulgated specific regulations for markings etc.

Both the FAA and MMS are associate members of the Helicopter Safety Advisory Conference (HSAC) which primarily focuses on improving helicopter operations within the Gulf of Mexico. HSAC, established in 1978, has issued a number of Recommended Practices which provide information and guidance on many issues, such as the use of Helicopter Underwater Escape Training and Night Offshore Helicopter Flight. While none of these guidelines is binding, these and other initiatives have improved the overall safety and awareness of safety-related issues in the Gulf.

4.4.1 FAA

The Federal Aviation Administration (FAA) does not regulate the helidecks on the OCS. It has published an Advisory Circular, AC 150/5390-2B Heliport Design, which provides guidance on designing and operating a heliport. In addition there are a number of Advisory Circulars providing guidance for Approved Offshore Standard Approach Procedures. The Rotorcraft Directorate with the FAA is responsible for regulations and policy relating to rotorcraft. No specific program or regulatory work is underway with respect to offshore helicopter travel by the FAA.

4.5 Upcoming Rulemaking

The Department of the Interior issued a Proposed Rule on June 17, 2009 which would require oil and gas operators in the OCS to develop and implement a Safety and Environmental Management System (SEMS). The MMS believes that implementing an SEMS will reduce the risk and number of accidents, injuries, and spills when operating on the OCS. The SEMS would consist of four elements:

1. Hazard Analysis,
2. Management of Change,
3. Operating Procedures, and
4. Mechanical Integrity.

These four areas were selected as they generally account for more than 90% of Incidents of Non-compliance observed. The MMS proposes to require each offshore lessee/operator to develop, implement, maintain and operate under an SEMS program composed of the four elements.

An Advanced Notice of Proposed Rulemaking (ANPR) was issued on May 22, 2006 which provided an opportunity for operators and relevant parties to make comments on the proposed regulatory requirement for an SEMS. The ANPR indicated MMS's goal of introducing a regulatory system which would further improve the existing regime to protect people working on the OCS in oil and gas exploration activities and the environment. In addition it would make the regulatory system more responsive to innovation and changes in the technology and the environment.

5 Australia – National Offshore Petroleum Safety Authority

The vision of the National Offshore Petroleum Safety Authority (NOPSA) is that "Health and safety risks in the Australian offshore petroleum industry are properly controlled." It is with this vision that NOPSA has been in operation since 2005, ensuring a health and safety regulatory regime for offshore petroleum operations in Australian waters, administered by a single national entity.

5.1 Overview

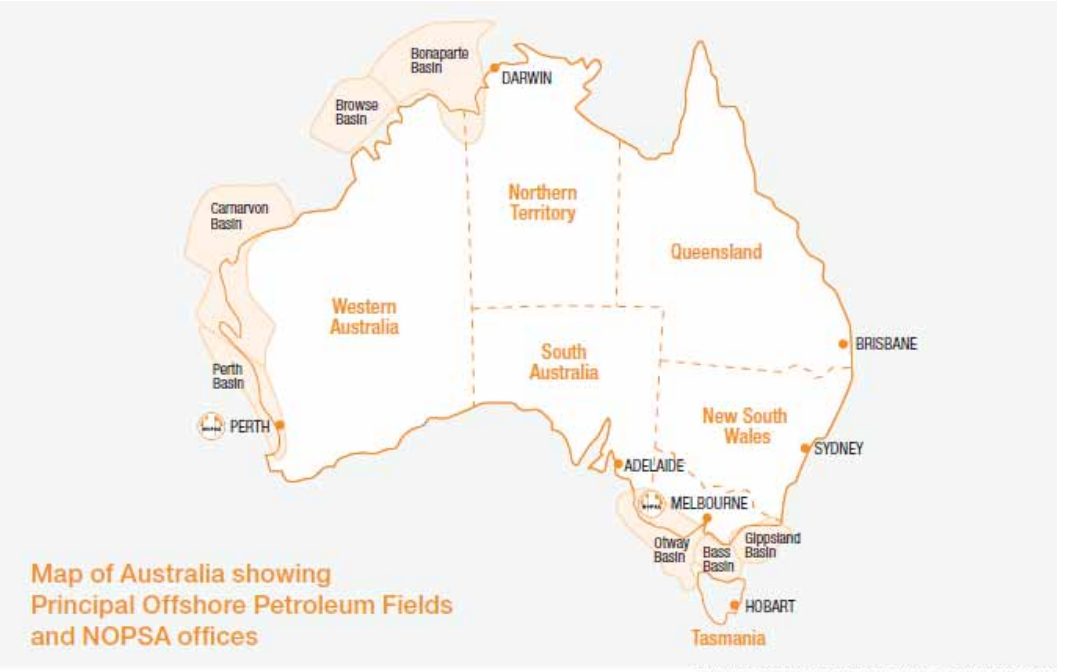
The National Offshore Petroleum Safety Authority (NOPSA) commenced operations 1 January 2005. Following the Piper Alpha disaster in 1988, the Australian Commonwealth Government, in conjunction with the States and Territories, considered what lessons could be drawn that were applicable to the Australian offshore petroleum industry. Prior to this point, the offshore petroleum industry was regulated by a combination of State and Commonwealth Law. "It was decided to introduce a safety case approach and the law was modified although some prescriptive aspects remain." [3]

Australia has implemented a performance-based safety regime which imposes general duties of care on each entity associated with the regime, primarily the operator of the facility. NOPSA regulates the operator through the acceptance and oversight of the operator's safety case.

5.1.1 Industry

The Australian offshore petroleum is continually increasing with a number of ventures in 2010 expected to further expand the industry. The offshore industry in Australia, as at December 2009, consists of 166 offshore facilities (Figure 7).

Figure 7 - Principal offshore petroleum fields in Australia



A number of helicopter companies service the offshore industry in Australia. These include CHC Helicopters, Bristow Australia, Jayrow Helicopters and Esso's own fleet.

5.1.2 Legal Structure

The Ministerial Council on Mineral and Petroleum Resources (MCMPR) comprises the relevant Commonwealth, State and Territory Ministers. It facilitated the formation of a consistent national approach to offshore safety regulation in all Australian waters. This is necessary because the States and Territories have title and power to make laws for the first three nautical miles of waters seaward adjacent to State or Territory land, with the Commonwealth Government having title to any petroleum seaward of the three mile mark. As petroleum resources are located in both waters, a collaborative approach was required to ensure cost-effective delivery of safety outcomes. In September 2002, the MCMPR recommended that the safety of offshore petroleum activities in both Commonwealth and State and Territorial waters be regulated by a single national statutory authority, formed under Commonwealth legislation.

NOPSA was established under the *Petroleum (Submerged Lands) Act 1967 (PSLA)* by Commonwealth legislation introduced in 2003. The *Petroleum (Submerged Lands) Amendment Act 2003* established NOPSA as a safety regulator, amended OHS provisions and cancelled State and Territorial laws and maritime law at offshore facilities. The amended laws and NOPSA commenced 1 January 2005. The PSLA has been replaced by the *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGSA)*.

NOPSA regulates the occupational health and safety of people engaged in offshore petroleum operations under the *Offshore Petroleum (Safety) Regulations 2009 (OPS)*. This is pursuant to Schedule 3 to the *OPGGSA*. The cost recovery to fund NOPSA activities is the result of *Offshore Petroleum (Safety Levies) Act 2003.* Annual safety case levies cover all of NOPSA's budget. Any investigation following a major incident is funded by the operator.

5.2 Organizational Structure

NOPSA consists of approximately 60 staff, see Figure 8. The majority of staff are based at the Head Office in Perth, Western Australia. An additional office is located in Melbourne to oversee activities in the Bass,

Gippsland and Otway basins to the south east of Australia. Twenty-six inspectors are employed over these two locations.

5.2.1 Board Structure

The NOPSA Board provides advice to the relevant ministers on policy and strategic matters relating to occupational health and safety of offshore petroleum activities. It also advises the Chief Executive Officer of NOPSA about operational policies to be followed. The Board consists of seven members, including one Chair, as appointed by the Commonwealth Minister. Secretariat services to the Board are provided by the Department of Resources, Energy and Tourism. The Board and NOPSA are separate legal entities, with the Board performing an "advisory" role, rather than a management approach.

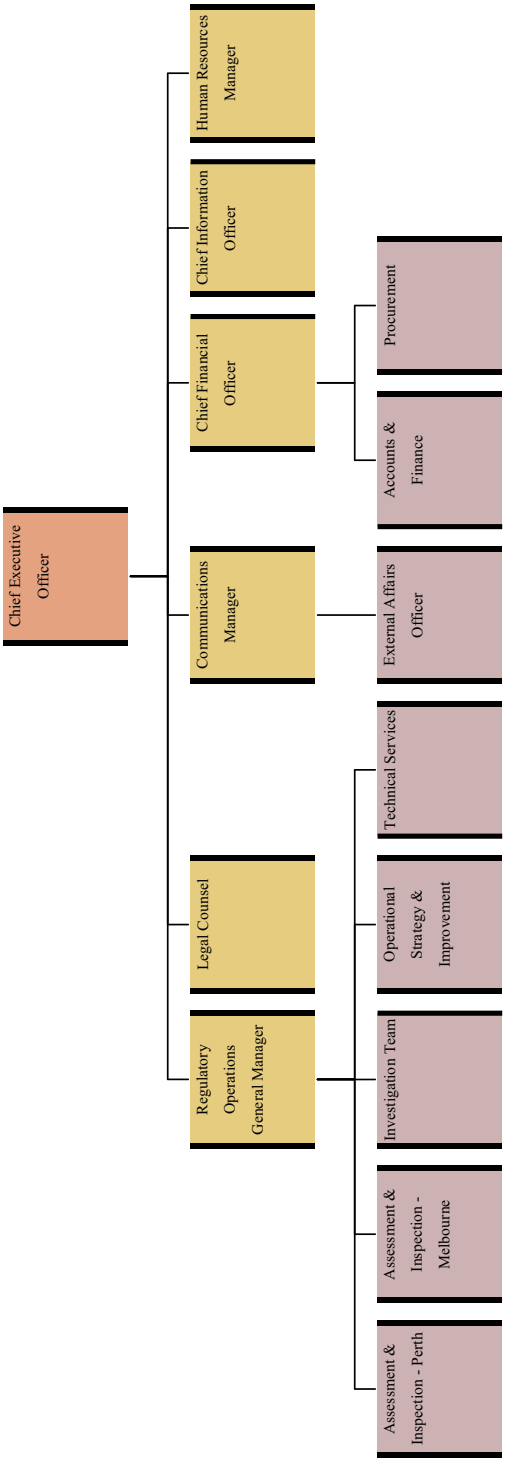


Figure 8 - Organizational structure of NOPSA

5.3 Safety Oversight

The *Offshore Petroleum (Safety) Regulations 2009 (OPS)* is the legislation by which NOPSA ensures the occupational health and safety at offshore installations in Australia. This creates a safety case regime for compliance. NOPSA, through safety case assessments and inspections, operates on a quality assurance basis. The safety case consists of a Facility Description, detailed descriptions of the Formal Safety Assessment and the Safety Management System. NOPSA also administers a number of State and Northern Territory laws, which are Schedules 3, 4, 5 and 7 to *Petroleum (Submerged Lands) Act 1982* and subsequent State and Territory-specific regulations.

NOPSA has two objectives, the first to regulate the industry to assist it to reduce the health and safety risks to an acceptable level, and the second, to achieve performance excellence in the provision of quality services to the industry.

NOPSA addresses its core regulatory responsibilities through monitoring and enforcement strategies that include planned inspections, themed audits, assessment and acceptance of safety cases (safety management plans for diving and pipelines), investigation of incidents or complaints and enforcement activities that include measures for prosecutions and withdrawal of safety case approvals.

5.3.1 Safety Standards

An accepted safety case is required for operations in Australian waters, and the safety case must be in force in all activities throughout the entire lifecycle of the facility. The Facilities Description consists of information about the design and the use of the facility, as well as technical and other control measures in place, as a result of the Formal Safety Assessment (FSA). The FSA identifies

1. hazards having the potential to lead to a major accident event (MAE),

2. a detailed and systematic assessment of the risks, and

3. the control measures in place to reduce the risk to "as low as reasonably practicable" (ALARP).

The Safety Management System (SMS) should be integrated and comprehensive, as well as continual and systematic in the management of risk management, in order to maintain risks at the ALARP level.

Well and structural integrity of offshore petroleum installations are covered by the relevant State or Territorial laws. [Figure 4]

5.3.2 Safety Assurance Regime

NOPSA must accept a safety case if

(a) It is appropriate to the facility and the activities conducted at the facility, and

(b) The contents are compliant and fulfill any validation requirements.

When assessing the safety case, NOPSA has published a policy dictating the assessment approach. This consists of three areas: General, Detailed and Validation, as described in Table 3.

NOPSA undertakes planned inspections of offshore facilities to verify the risk management commitments of the operator as specified in the accepted safety case. Both field-based inspections and topic-based inspections are conducted by NOPSA in order to ensure that the relevant OHS regulations are being adhered to. Field-based inspections generally focus on the implementation of control measures in the safety case, while themed audits usually inspect organizational issues and maintain a common theme. The frequency of planned inspections is based on a risk assessment of the facility, as summarized in Table 2, with the Inspection Team Leader determining the appropriate frequency.

Table 2 - NOPSA planned inspection frequency guide

		Operator Maturity	
		Low	High
Facility complexity	High	At least once per year, plus themed audit of SMS issues (onshore)	Once/year
	Medium	At least once per year	Once/year
	Low	Once per safety case lifecycle (up to 5 years), or following significant change	Once/safety case lifecycle (up to 5 years)

Table 3 - NOPSA safety case assessment policy

Part	Assessment Area	Safety case assessment criteria overview
1	General	• Safety case generally appropriate to the facility and activities undertaken at facility, i.e., compliant with all items in Division 1 of OPS
2	Detailed - Specific Regulations	Safety case complies, in content and appropriateness, with respect to: • FSA description: identifies all hazards with potential to cause MAE, has detailed and systematic assessment of risk associated with those hazards, and identifies the control measures to reduce the risks to ALARP level • SMS description provides evidence the system is comprehensive and integrated • SMS description provides evidence that the system reduces risks to health and safety to ALARP level • Safety case developed in effective consultation with and participation of members of the workforce, such that the workforce is able to arrive at informed opinion about the risks and hazards which they may be exposed to at work

Part	Assessment Area	Safety case assessment criteria overview
2	Detailed - Sampling	NOPSA conducts a detailed assessment of three topic areas. Where possible at least two of these topic areas should be focused on particular MAEs. Factors considered should include: levels of risk, uncertainty and use of novel technology.
2	Detailed - Disconnectable facilities	NOPSA shall assess if the command structure is appropriate for facilities which have the capability to disconnect from the production riser. This assessment shall be conducted with the Australian Maritime Safety Authority.
3	Validation	In the case that validation is requested, NOPSA will assess that the validation complies with OPS 2.40.

Investigations are instigated by NOPSA when information indicates that there have been incidents of non-compliance with the relevant OHS laws. The outcome of investigations may include a written warning, the issuance of an Improvement Notice or a prosecution.

5.4 Helicopter Operations Oversight

The Memorandum of Understanding between NOPSA and the Civil Aviation Safety Authority (CASA) executed in September 2009 ensures a consistent and comprehensive regulatory regime to protect the health and safety of those working at offshore petroleum facilities. This highlights NOPSA's responsibility to regulate the facilities operators' arrangements for the provision of a safe working environment. NOPSA is therefore the lead agency for issues concerning design and operation of the helideck, the management of helideck operations, and for the provision of a safe and healthy workplace for people on the facility. CASA is responsible for the safety regulation of civil air operations in Australian territory and the operation of Australian aircraft. As such CASA is responsible for helicopter safety during landing and taking off from offshore facilities, and the competence of the helicopter crew.

NOPSA commissioned HART Aviation to conduct a review of offshore helicopter operations in order to gain an in-depth knowledge of issues surrounding current and future helicopter usage in offshore operations in Australia. This report, published in 2007, outlined the current position of helicopter transportation in Australia compared to other industries and based on the research, highlighted some potential areas which NOPSA could influence in the future. These included the compulsory use of technology such as Health and Usage Monitoring Systems (HUMS) and Audio Voice Alerting Devices (AVAD), as well as immersion suits and helideck standards. NOPSA at this stage has not initiated any changes as a direct result of this report.

5.4.1 CASA

CASA has issued a Civil Aviation Advisory Publication (CAAP) 92-2 (1) Guidelines for the establishment and use of helicopter landing sites in 1992. The document provides some factors that may be used to determine the suitability of a helicopter landing site.

5.5 Legislative Changes

At present, the structural integrity of facilities and wells is not within the jurisdiction of NOPSA. This was particularly evident in the inquiry following the Montara incident in 2009 when the well failed and there was a prolonged hydrocarbon release. NOPSA submitted to the Commission of Inquiry that it would be beneficial to change the legislation to ensure the integrity of wells is more regulated. Currently the relevant State or Territory agencies have responsibility for the assessment of Well Operations Management Plans. If the role of NOPSA was expanded to include structural integrity, NOPSA believes that it would be well placed to administer legislation, as well as further ensuring objectivity, by removing the enforcement role from the States and Northern Territory, who receive revenue from petroleum activities.

NOPSA also recommended to the Montara Commission of Inquiry that its powers be extended to issue Prohibition Notices to prohibit entry to facilities where immediate risk may occur. This would allow NOPSA to pre-emptively stop entry to facilities in the event that risk is foreseeable.

6 Norway – Petroleum Safety Authority

Norway's Petroleum Safety Authority is responsible for the supervision of safety, emergency preparedness and the working environment for both offshore and onshore petroleum facilities.

6.1 Overview

The Petroleum Safety Authority (PSA) was established January 1, 2004. Prior to this time the regulation of safety on offshore petroleum installations was the role of the Norwegian Petroleum Directorate (NPD). Establishing a separate agency has allowed the PSA to continue to enforce the performance-based safety regime operation in Norway, without the additional role of managing petroleum resources, including collecting revenue generated by petroleum activities. PSA and NPD have offices in the same building at Ullandhaug in Stavanger.

The PSA's responsibilities are:

1. Ensure that petroleum and related activities are supervised in a unified manner, through cooperation with other regulatory authorities and self-audits.

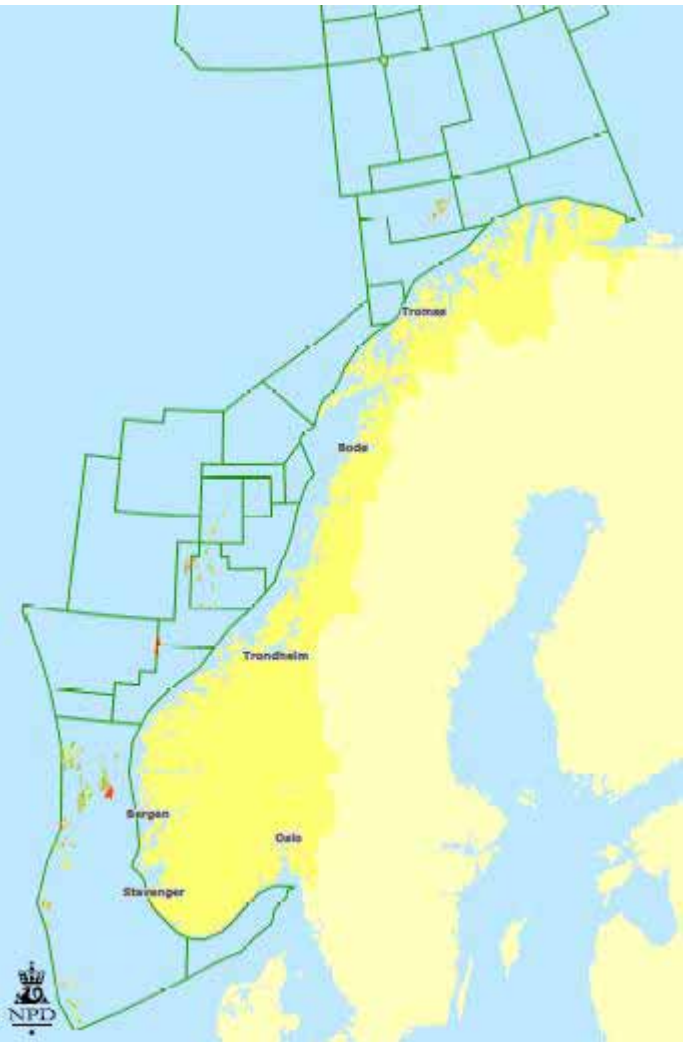
2. Contribute actively to transfer knowledge from the Health, Safety and Environment (HSE) area to society in general, by collaborating with the industry and other HSE regulators, both nationally and internationally.

3. Provide input to the supervising ministry on issues at hand, and support the ministry on issues upon request.

6.1.1 Industry

Norway is the world's fifth largest oil exporter and the third largest gas exporter. In 2008, revenue generated by petroleum activities accounted for 34% of the nation's income. Licences to operate on the NCS are issued through the Ministry of Petroleum and Energy. Figure 9 depicts the oil and gas fields on the Norwegian Continental Shelf, and highlights the location of Stavanger, where PSA is headquartered.

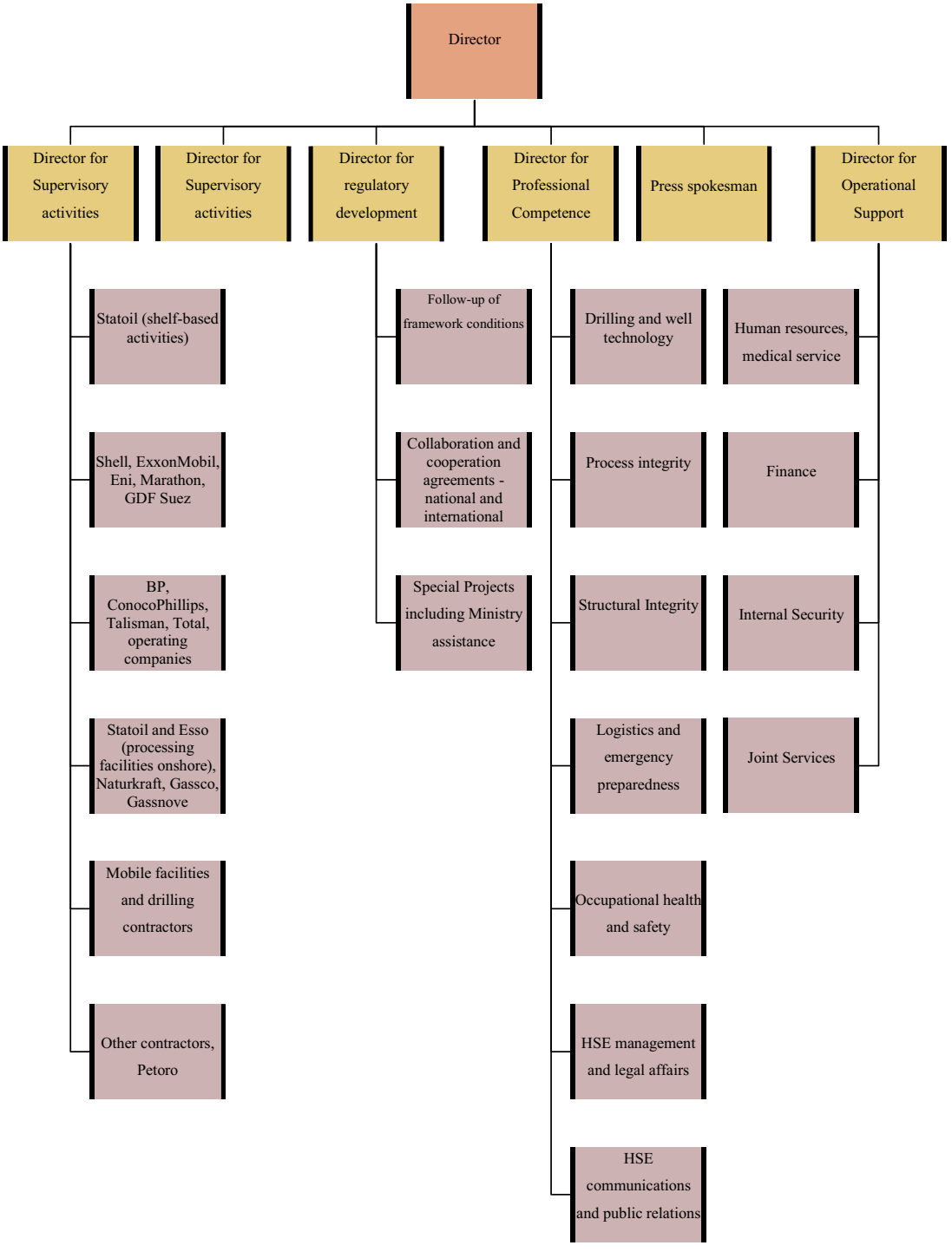
Figure 9 - Oil and gas fields on the Norwegian Continental Shelf



6.2 Organizational Structure

The PSA is within the Ministry of Labor and employs approximately 165 staff. Since its creation in 2004, responsibility for safety regulation of onshore petroleum activities has also been included in PSA's jurisdiction. The structure of PSA, as shown in Figure 10, encourages a partnership approach between operators and the relevant supervisory branch.

Figure 10 – PSA Organizational Structure



6.3 Safety Oversight

Under the *Petroleum Activities Act 1996 (PAA)*, operations on the Norwegian Continental Shelf (NCS) must be carried out in compliance with a reasonable standard of care, taking into consideration the safety of employees. The Petroleum Act specifically requires that operations be carried out in such a manner that a "high level of safety is maintained and further developed in accordance with the technological development" (PAA Section 9.1).

6.3.1 Safety Standards

The trend from 1985 in Norway has been a slow progression from prescriptive regulations to a performance-based regime strongly based on risk management. Regulatory reform has enabled this transition. There was major reform in 2002 when the NPD, the Norwegian Pollution Control Authority, and the Board of Health adopted joint regulations on HSE for the petroleum sector. Five regulations control safety of design and operation on offshore installations on the NCS:

- *Regulations relating to Health, Safety and the Environment in the Petroleum Activities (the Framework regulations) 2002*
- *Regulations relating to Management in the Petroleum Activities (the Management regulations) 2002*
- *Regulations relating to Material and Information in the Petroleum Activities (the Information Duty regulations) 2002*
- *Regulations relating to the Design and Outfitting of Facilities etc. in the Petroleum Activities (the Facilities regulations) 2002*
- *Regulations relating to Conduct of Activities in the Petroleum Activities (the Activities regulations) 2002*

The Framework regulations are high level and overarching, with details described in the supplementary regulations. The Framework regulations stipulate the Norwegian equivalent of "as low as reasonably practicable":

> Harm or danger of harm… shall be prevented or limited in accordance with the legislation related to health, the environment and safety, including internal requirements and acceptance criteria. Over and above this level the risk shall be further reduced to the extent possible. (Framework regulations, Section 9)

The Management regulations define the requirements for management in the areas of health, safety and the environment. These include the requirement to identify and address risks which contribute to major accidents, including the risk connected with the transportation of personnel to and from the facilities, as well as emergency preparedness analyses. These regulations also identify the need for barriers, which are a system of functions which prevent or reduce harm in the event of an incident. The strategies or principles implemented to create a barrier, whether it be physical or non-physical, are to be identified and described in the risk assessment.

The Information Duties regulations set the standard for information and material which is to be submitted or made available to authorities. This includes requirements to applications for consent, incident reporting and so on.

The Facilities regulations specify the design and outfitting of facilities, particularly defining minimum requirements for safety functions, loads, materials and other engineering considerations.

Operations and activities undertaken on the facility are governed by the Activities regulations. These lay out requirements for planning, working environment, health-related aspects, maintenance and emergency preparedness.

New regulations replace these from 1 January 2011. The new regime continues the full integration of onshore petroleum-related activities, and places a strong emphasis on risk- reduction principles to HSE.

6.3.2 Safety Assurance Regime

Under the NPD, the term “inspection” was exchanged for “supervision”, and “approvals” was replaced by “consent.” This change in language is not

merely superficial, but rather it represents the philosophy of the Norwegian regulatory regime. Supervision is not confined to monitoring, which is undertaken through audits, verifications and investigations, but it also refers to an interaction between the industry and the regulator. This can be through research programs, seminars and the development of regulations. Supervision embraces all the activities which PSA undertakes in order to gather information about the safety status of operations, promote safety and health in the workplace and ensure that all operators conduct their activities in accordance with regulatory and agreed additional requirements. This extends to the consent process and other application considerations including Acknowledgement of Compliance and plans for development of operation/installation.

In a similar sense, the use of the word "consent" does not imply that PSA guarantees the safety of activities, but that it provides consent to operate. This allows the PSA to express confidence in the operator and how it will go about its activities. The operator and the PSA engage in discussion prior to the operator seeking consent. An official consent is also required at important milestones of operation in order to continue. The consent application includes the current Safety Management System (SMS) as well as a number of binding commitments specific to that facility. There are minimum standards which the operator must meet, and any commitments made beyond this minimum constitute a legal requirement for the operation.

An Acknowledgement of Compliance (AoC) is a statement verifying that a mobile installation's technical condition, as well as the organization and management systems are considered to comply with the relevant requirements in Norway's offshore regulations. A total of 41 mobile units had received AoC as at the end of 2009. An AoC is mandatory for mobile drilling units to operate on the NCS.

Each year a supervisory plan is established within the PSA which determines all planned supervisory activities including audits and verifications. The plan is based on yearly priorities established by the Ministry, the operating companies' own activity plans, accidents and incidents, and the experience and observations of the PSA and other HSE agencies. Audits consist of a systematic examination of management and

control systems, while verifications check that the actual circumstances on facilities conform with regulatory requirements.

The PSA has a 'step' approach to enforcement, which generally starts with a dialogue with the operator. This is generally an effective approach in the industry as official Notices of Orders and Orders (enforcement measures) are published on the PSA website. Given the nature of the petroleum industry and its stature in Norway, the potential for public embarrassment is a sufficient deterrent for companies to engage with the Regulator. Dialogue is a key part of the supervisory role, and is influential in causing changes. Fines and charges, as well as the removal of consent, are considered last steps, or only necessary in serious cases.

6.4 Helicopter Operations Oversight

Norway has long been recognized as a leader in helicopter safety for offshore transportation. This is highlighted by the three Helicopter Safety Studies undertaken by SINTEF Industrial Management. These reports aim to contribute to the improved safety of personnel travelling to and from installations on the NCS. The first two reports were conducted by Sintef on behalf of the Committee for the Review of Helicopter Safety on the Norwegian Continental Shelf, as appointed by the Ministry of Transport and Communications in 2000. The most recent report, Helicopter Safety Study 3 (HSS 3), was commissioned by a group of eight oil companies. While only the Executive Summary of HSS 3 has been translated into English at present, it utilizes a number of techniques in order to make judgments on the present situation and recommendations for future areas of improvement. The final recommendation of this report is that the Norwegian Oil Industry Association (OLF) and the Civil Aviation Authority – Norway (CAA-N) form a body to follow up on the reports evaluations and potentially implement some of the recommendations.

7 Nova Scotia – Canada Nova Scotia Offshore Petroleum Board

The Canada Nova Scotia Offshore Petroleum Board (CNSOPB), or the Board, was established in 1990. CNSOPB is an independent joint agency of the Canada and Nova Scotia Governments, which ensures the activity in the Nova Scotia offshore area is undertaken in a safe, environmentally sound, and efficient manner. The Board is currently overseeing regulatory

change and shifting towards a goal-orientated regime. This will allow the operators in Nova Scotia to comply with regulations more effectively and in a way that takes into account the latest technology and culture changes.

7.1 Overview

The CNSOPB is responsible for ensuring that offshore operations are conducted safely and in a manner which protects the environment. The Board also has responsibility for managing offshore resources, issuing licences for offshore exploration and development, and collecting and distributing resource data. Federal and provincial regulations set the standards for occupational health and safety in the offshore industry but the Board is responsible for enforcement.

7.1.1 Industry

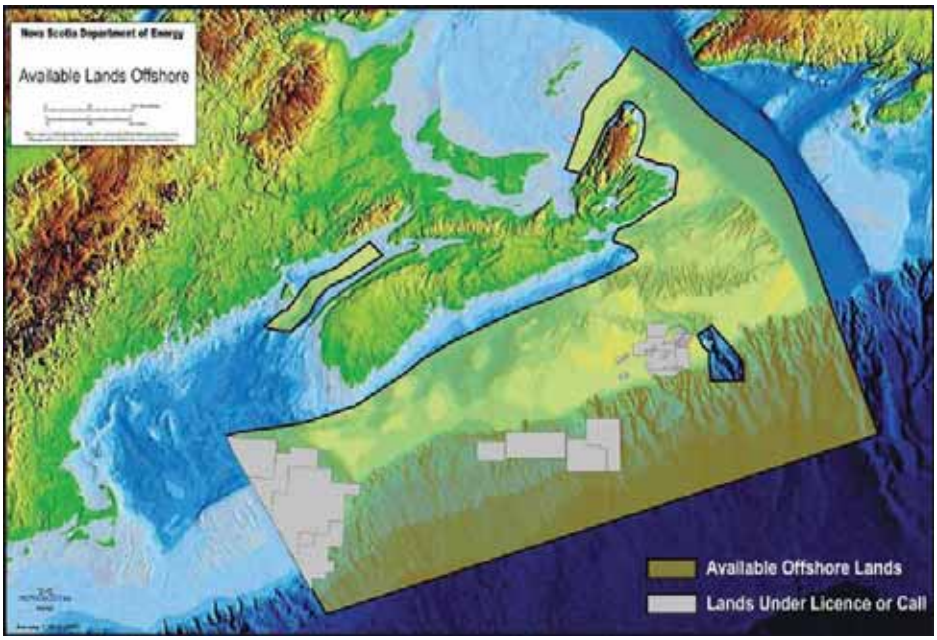
The offshore petroleum industry in Nova Scotia is relatively small but increasing rapidly, as can be seen in Figure 11. The Cohasset-Panuke Project in 1992 was the first Canadian offshore oil project. The current Sable Energy Project in the Nova Scotia area consists of 5 offshore facilities. The Deep Panuke Project is expected to see 'first gas' in early 2011.

Helicopter transportation is provided by two large multinational corporations, Cougar Helicopters Inc. and CHC Helicopters. These companies utilize the large, twin-engine helicopters such as the Super Puma, Sikorsky S-76 and S-92.

7.1.2 Legal Structure

CNSOPB was established as a joint agency of the Canada and Nova Scotia Governments, pursuant to the federal *Canada Nova Scotia Offshore Petroleum Resources Accord Implementation Act* and the provincial *Canada Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act. C*ollectively they are called the *Accord Acts*. Under the Accord Acts, the CNSOPB regulates the Nova Scotia Offshore Area with respect to the safety of operations in the area and managing the resources through research and licencing.

Figure 11 - Nova Scotia offshore area



7.2 Organizational Structure

The Chief Executive Officer Reports to the Board and oversees the operations of the Board and the approximately 35 staff. There is no one employed specifically as an inspector but as is evident in Figure 12, a number of staff are Advisors within the Operations and HS&E Branch.

7.2.1 Board Structure

The Board consists of five members and a Chair. The Chair is appointed jointly by the Government of Canada and the Government of Nova Scotia. Each Government appoints two members each, and may choose an alternate member.

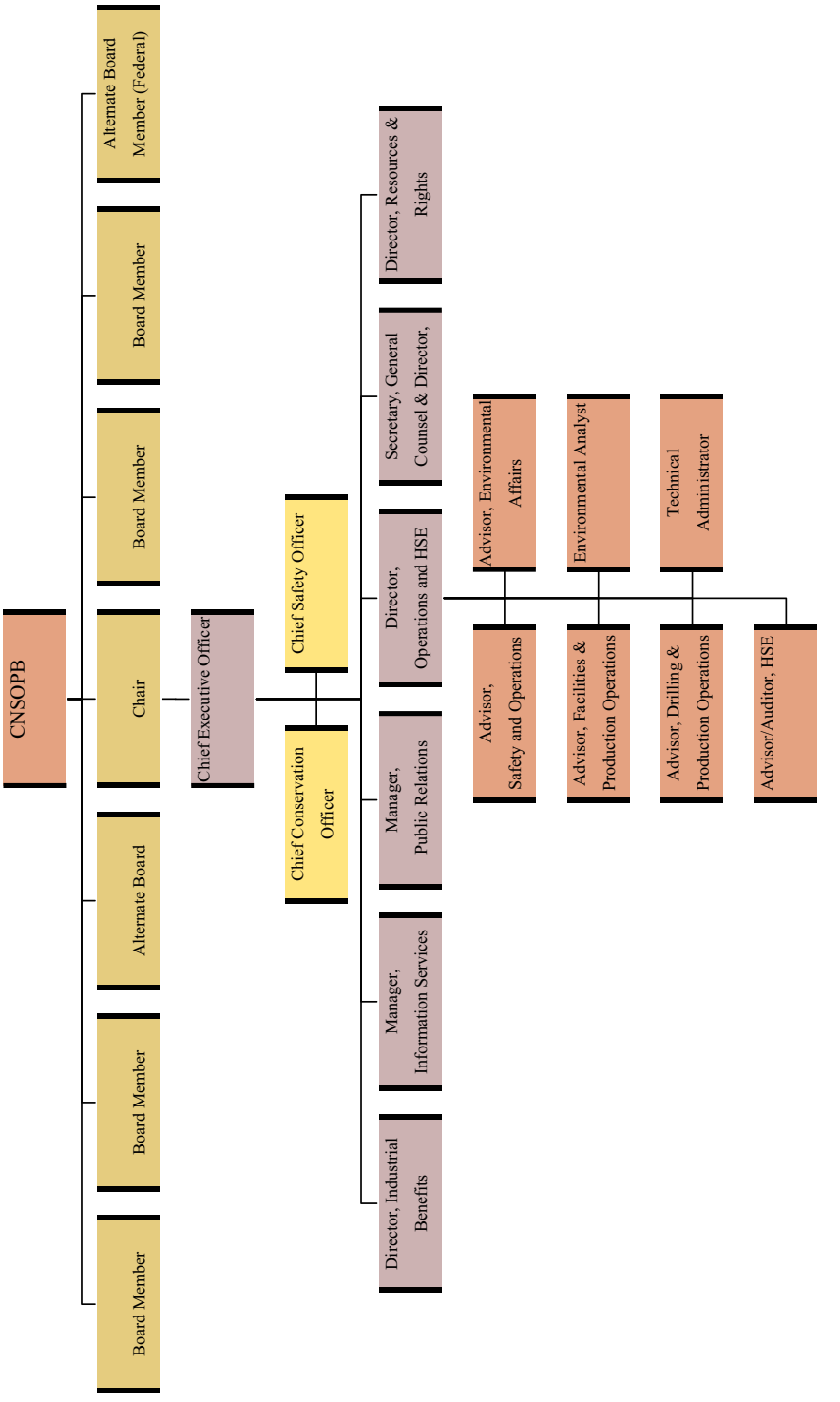


Figure 12 - CNSOPB Organizational Structure

7.3 Safety Oversight

The Accords Acts and subsequent regulations are intended to ensure the safety of offshore petroleum activities. The Board is responsible to ensure that offshore operations are conducted in a way where hazards are identified and the associated risks are assessed and managed.

In order to conduct activity in the offshore area, operators require an authorization from the Board. As a part of the process to gain authorization, operators are required to submit a number of documents, including the Operator Safety Plan. The safety plan identifies critical requirements for safe operations.

7.3.1 Safety Standards

When reviewing safety plan submissions, attention is given to the following:

1. Command structure
2. Risk assessment
3. Operation and maintenance
4. Contingency planning
5. Training and qualification

CNSOPB has issued draft guidelines for safety plans in December 2009. These guidelines were published in conjunction with the Canada-Newfoundland and Labrador Offshore Petroleum Board (CNLOPB) and the National Energy Board, and are undergoing a one-year consultation phase.

The *Drilling and Production Regulations* require that the operator "take all reasonable precautions to ensure safety". This is not explicitly requiring the risks to be reduced to "as low as reasonably practicable" (ALARP); however, the Draft Safety Plan Guidelines state that "The Board expects that [the ALARP] concept will continue to be a factor when considering a safety plan." [Draft Safety Plan Guidelines, Section 4.5.1]

The *Nova Scotia Offshore Petroleum Installation Regulations 1995* stipulate requirements for installations in the Nova Scotia Offshore Area. These include general requirements such as a lifesaving equipment

standard, fire preparedness, as well as design and operation requirements for installations.

7.3.2 Safety Assurance Regime

The safety plan which is required for authorization to commence operation in the Nova Scotia offshore area must meet the requirements in the *Drilling and Production Regulations* Section 8. The safety plan should include the procedures, practices, resources, and monitoring techniques which ensure the safety of the activity. The safety plan should include:

1. Summary of the management system which demonstrates how it will be applied to the proposed activity and how safety requirements will be fulfilled.

2. Description of the technique used to identify the hazards and evaluate the risks associated with the activity.

3. Description of the hazards identified and the risk evaluation.

4. Summary of the risk reduction or management techniques.

5. Description of the organizational and command structure of the installation including the person accountable for the safety plan and its implementation.

6. Measures used to protect the installation if possibility of sea ice or icebergs exists.

7. Description of arrangements for monitoring compliance with the safety plan, and measuring its performance.

Once the safety plan is accepted by the Board and an authorization of the activity has been issued, the operator must continue to demonstrate that the management system and safety plan effectively identify, assess and reduce risks posed to worker health and safety.

Daily or weekly status reports are required by the Board, depending on the type of activity been undertaken, which are reviewed to identify any health

or safety compliance issues. In addition to this the Board reviews the minutes from the Joint Occupational Health and Safety Committee (JOHSC) meetings to ensure that any OHS issues raised in this forum are appropriately dealt with by the Operator. [5]

7.4 Helicopter Operations Oversight

Under the *Drilling and Petroleum Regulations* the management system is required to ensure the integrity of all facilities, structure, installations, support craft and equipment to ensure safety. Helicopters used to transport workers to and from offshore installations are included within the term "support craft". Furthermore, the duty of the operator is to ensure that:

1. any operation necessary for the safety of persons on a support craft has priority, at all times, over any work or activity, and

2. all persons in transit to or from an installation receive instruction in and are familiar with safety and evacuation procedures… including emergency response procedures.

Under this regulation then, the operator of the installation is responsible for the safe operation of support craft, i.e., personnel transfer helicopter, and the training people receive prior to boarding the craft. Through the acceptance and enforcement of the management and safety plans submitted for activity authorization, CNSOPB is ensuring that this is adhered to.

The *Nova Scotia Offshore Petroleum Installations Regulations* state that every helideck which forms part of an offshore installation must conform to Transport Canada TP 4414, Guidelines Respecting Helicopter Facilities on Ships. CNSOPB issued a Notice to Operators in April 2010, authorising the substitution of TP 4414 with the standards of CAP 437 Offshore Helicopter Landing Areas – Guidance on Standards, where parts of CAP 437 are deemed to be a higher standard. This is the result of TP 4414 being published in 1987, and the United Kingdom Civil Aviation Authority publication representing a "worldwide standard" and a document which incorporates the "latest technological changes and research regarding helicopter aviation safety." [7]

The use of helicopter passenger transportation suit systems is regulated under *Canada Aviation Regulations* 602.63(7).

7.5 Upcoming Legislation

The Canada, Nova Scotia, and Newfoundland and Labrador Governments have drafted new occupational health and safety (OHS) regulations which are currently in the consultation phase, and are expected to be passed through the respective parliaments in late 2010. The aim of the new legislation and amendments to the Accord Acts is to ensure that offshore workers have at least the same protection as onshore workers. It would also provide some separation of the potentially conflicting priorities of ensuring the safety and health of offshore workers, while simultaneously promoting continued offshore development.

Presently the safe operation of offshore activity is regulated under the Accord Acts, and the OHS provisions are regulated by the specific provincial regulations. This change would ensure that the Accord Acts provide the sole authority for offshore OHS.

8 South Africa – Mine Health and Safety Inspectorate

The Mine Health and Safety Inspectorate, within the Department of Minerals Resources (DMR), regulates the safety of mines, and the offshore petroleum industry in South Africa.

The *Mine Health and Safety Act 1996 (MHSA)* provides for the health and safety of employees at mines. The definition of mine extends to offshore oil and gas facilities. The object of the Act is to protect the health and safety of people at mines, to require employers and employees to identify hazards and eliminate risks relating to health and safety, as well as to promote a culture of safety, cooperation and increased training within the industry. The Act establishes the Mine Health and Safety Inspectorate and the Chief Inspector whose role is to ensure that the provisions within the Act are adhered to. The Mine Health and Safety Council (MHSC) is also established by the MHSA. The role of the Council is to advise the Minister on health and safety at mines, and to facilitate sustained improvement in OHS at mines.

South Africa is currently reviewing the mine health and safety regulations in order to achieve greater efficiency and effectiveness of the regulations and regulators, as well as to improve the occupational health and safety of those working at mines. The DMR is working with a number of institutions such as the MHSC to strengthen its health and safety monitoring and evaluation practices, as well as further building on the existing work of inspectors.

9 Conclusion

The safety of the offshore industry on the United Kingdom Continental Shelf is regulated by the Health and Safety Executive, and the Offshore Division in particular. This regulatory regime has been very effective in encouraging safe operations through use of safety cases. Risk assessment has been an integral part of the UK technique to address major accident hazards. The United Kingdom has been a world leader in safety regulation for offshore regulations following changes instigated by the Cullen Report. Continued recent improvements have allowed the industry to maintain high standards of safety. The Health and Safety Executive and the UK Civil Aviation Authority have been proactive in conducting research in order to improve offshore helicopter safety. A number of guidelines are available to operators, as well as a definitive publication, stipulating the responsibilities of all parties to ensure safe helicopter operations.

The number and type of regulations and the number of agencies responsible for regulating safety within the offshore petroleum industry in the United States has resulted in a regulatory regime that is not very effective and not respected by the industry. The Minerals Management Service has proposed new regulations in order to improve safe operations. The Minerals Management Service and the United States Coast Guard are jointly responsible for the safety of offshore installations, and while the responsible agency is clearly identified for each system, a simplified system may be beneficial. The Notice of Proposed Rulemaking reflects upcoming legislative developments, and the more recent commitments from the Secretary of the Interior to form a separate safety agency indicate that a positive change is expected for the offshore petroleum industry and those who work on the installations. A more closely regulated service or the provision of more guidelines for operators, with respect to offshore

helicopter transport, would be highly beneficial, particularly in the Gulf of Mexico where such a large number of installations are located.

The National Offshore Petroleum Safety Authority of Australia is a relatively new agency and has been able to establish an effective regime of regulations for safety and a well- defined inspection and auditing system. The ongoing development of the Authority, and the potential to extend its jurisdiction to include structural integrity of offshore installations, will allow NOPSA to become more effective. The commissioning of the review of helicopter operations indicates an awareness of the risks associated with the helicopter operations offshore, but continued actions are required to mitigate the potential of a major accident event involving a helicopter.

The Norwegian Petroleum Safety Authority has benefitted significantly from the separation of the safety and licensing bodies. The large role that the offshore petroleum industry plays in the Norwegian economy is reflected in the resources allocated to the PSA. The philosophy behind the regulator engaging in dialogue and providing consent and supervision is successful in creating a collaborative regime in which the safety of people and the environment are clear priorities for the industry. The enforcement regime is effective in that companies do not wish to have their shortcomings made public, so dialogue prior to an official notice of orders is typically very successful. The resources invested in improving helicopter safety have resulted in Norway being a renowned world leader in the field.

The regulatory regime in Nova Scotia is under reform, so at this point it difficult to draw any particularly valuable conclusions. What is evident is the need to introduce a clearer separation of the safety and the licensing roles of Canada Nova Scotia Offshore Petroleum Board. The new regulations will facilitate this, as well as improve the occupational health and safety of the workers offshore. The size of both the industry and the regulator is comparatively small, but as the potential of the Nova Scotian offshore area increases, the resources allocated to promoting and enforcing safety in the area will need to also increase. Collaboration between CNSOPB and Transport Canada in order to provide guidelines or legislation would enable the offshore helicopter operators to improve or

validate their existing regime.

Overall the use of a performance-based regime has been proven to be successful for many offshore safety regulators. What has been demonstrated in several examples is the benefit of having a specific body or division that is responsible for promoting and enforcing safety. A strict initial assessment of the operator's safety and management systems enables a good regime to be established. However it is through the consistent follow up, whether by inspections that are more than just ticking boxes, or a collaborative approach to address potential safety issues, that the established systems are actually valuable. Ensuring that the efficient regulations are in place is one step, and an integrated and effectual enforcement system is the second.

With respect to the offshore petroleum regulators' role to ensure safe helicopter travel, it is not sufficient to look solely at the petroleum regulator. Due to the jurisdiction of the regulations, it is essential to look first and foremost to the civil aviation authority. Most of the petroleum regulators have a Memorandum of Understanding or similar in place with the respective civil aviation authority. However in order to make the significant changes required to improve the regulations, and through that the overall safety, a commitment is required from both parties. In Norway, which is recognized as best practice for offshore helicopter safety, two significant reports were commissioned by a committee which has representatives from both regulatory authorities. This initiated many improvements. The third report in the Norwegian 'series' has now been commissioned by the oil companies. This highlights not only the need for the regulators to make the first step, but also that the industry is equally eager to facilitate change and improve safety.

From the perspective of the ability for the petroleum regulators to improve helicopter safety, this is emphasized through the need for operators to anticipate the risks from a major accident, and take measures to reduce the likelihood and consequences of these risks. Several regulators specifically identify helicopter operations as an example of a major accident. Operators must demonstrate that they have taken precautions to ensure that the risk of a helicopter accident is "as low as reasonably practicable". This is one already demonstrated way that the regulators can specifically ensure that

the risks to employees' safety when being transported offshore by helicopter are minimized.

Many changes are underway in several nations to improve the way in which safety on offshore installations is regulated. This can be done through new systems as well as through enforcement. What is evident is that safety has been identified as a priority for each operator by the regulators, and that safety should be integrated into all operations, to prevent major accidents, improve safety culture and reduce hazards and risks.

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Review of New Zealand Offshore Petroleum Regulatory Regime

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador, Canada
July 2010

Presented by
Aerosafe Risk Management

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Figure 1 – Offshore oil and gas fields in the Taranaki Basin, New Zealand

LIST OF ABBREVIATIONS

CAA	Civil Aviation Authority of New Zealand
CAR	Civil Aviation Rules
DOL	Department of Labour
HUEBA	Helicopter Underwater Emergency Breathing Apparatus
HUET	Helicopter Underwater Escape Training
NZ	New Zealand
TAIC	Transport Accident Investigation Commission

1 Executive Summary

This report has been prepared in order to enable a comparison of offshore petroleum regulatory regimes for use by the Offshore Helicopter Safety Inquiry (OSHSI), Newfoundland and Labrador, Canada. The report is to be read in conjunction with the OSHSI publication also prepared by Aerosafe Risk Management *Review of Selected Offshore Petroleum Regulatory Regimes (May 2010)*.

The approach to the regulation of safe offshore petroleum operations varies depending on the country, the state of the industry in that country, the degree of prescription of the regulations, and the method by which the regulators enforce and promote safety. This variation is then manifested in the effectiveness of the regulator and the regulations at creating safe offshore working environments. This report examines the New Zealand offshore petroleum regulatory environment to elicit an overview of the safety standards and safety oversight of the offshore industry and, in particular, helicopter transportation to offshore installations.

The New Zealand regulatory regime is a performance-based system, which places the employer in the position to ensure the provision of a safe working environment. This system is overseen by the Department of Labour, who require a "safety case" for the installation activities to be sent to them. The Department of Labour makes comments on the safety case, and carries out inspections to ensure that the safety case is implemented. However, the nature of the industry and regulations means that the industry is the key player in ensuring the safety of offshore installations.

There is only one operator currently providing helicopter transportation services to the New Zealand offshore petroleum industry. The operator has been involved in the industry since 1968 and also provides services to the industry in other parts of the world. While the operator complies with the Civil Aviation Rules as enforced by the regulatory government body, the Civil Aviation Authority of New Zealand, there is no guidance from either this Regulator or the Department of Labour specifically regarding helicopter operations to offshore petroleum installations.

2 Introduction

The regulation of the offshore petroleum industry is a key element in the organizational regime which governs the health and safety of those who work offshore. The regulatory regimes that exist vary significantly between nations, and on some occasions within nations. More than twenty offshore petroleum regulators operate worldwide, each different in the level of oversight, structure, funding regime and the ability to make and enforce regulations. The nature of each regulator depends on a number of factors, such as the sophistication and size of the industry in that area, the degree of involvement each regulator has in the day-to-day operations offshore, the level of prescription of the regulations and the level of activity each regulator exhibits in creating a safe and healthy working environment for the thousands of people who work in the offshore industry.

2.1 Background

One of the Expert Reports provided to the Commissioner of the Offshore Helicopter Safety Inquiry was the *Review of Selected Offshore Petroleum Regulatory Regimes (May 2010)*. This tabletop review provided a high-level summary of five regimes from around the world. During the Inquiry it became evident that a similar review of the New Zealand regulatory regime would also be of high value to the Commissioner and the Inquiry. This is primarily due to the size of the New Zealand offshore petroleum industry, which is to some extent comparable to that of the Newfoundland and Labrador offshore petroleum industry.

In order to maintain consistency, this New Zealand-focused report was undertaken using the same philosophy and methodology as the previous Expert Report: *Review of Selected Offshore Petroleum Regulatory Regimes (May 2010)*.

2.2 Objectives

The objective of this report is to provide a summary of the New Zealand offshore petroleum regulatory environment. In particular the following four areas were investigated. They are identical to those used in the previously cited report (May 2010):

1. Regulator overall structure and governance
2. Safety practices and standards
3. Safety organizational structure
4. Standards and practices with respect to helicopter transportation offshore.

3 New Zealand – Department of Labour

The Department of Labour (DOL) is responsible for the ongoing improvement of New Zealand's labour market, with the overall goal of strengthening the New Zealand economy. DOL's responsibilities therefore span the wide-ranging areas of sustainable employment, employment relations, immigration, workplace health and safety, accident compensation, labour market analysis and research, managing relations with relevant international bodies, and policy advice.

3.1 Overview

The Department of Labour works towards the following outcomes for New Zealand:

- Improved labour market outcomes for sectors, regions and firms
- All people having the opportunity for meaningful and well–paid employment
- The current and future needs of the labour market are catered for by the skills available
- Workplaces are attractive, innovative and productive
- New Zealand is well represented internationally with respect to labour market, migration and humanitarian issues

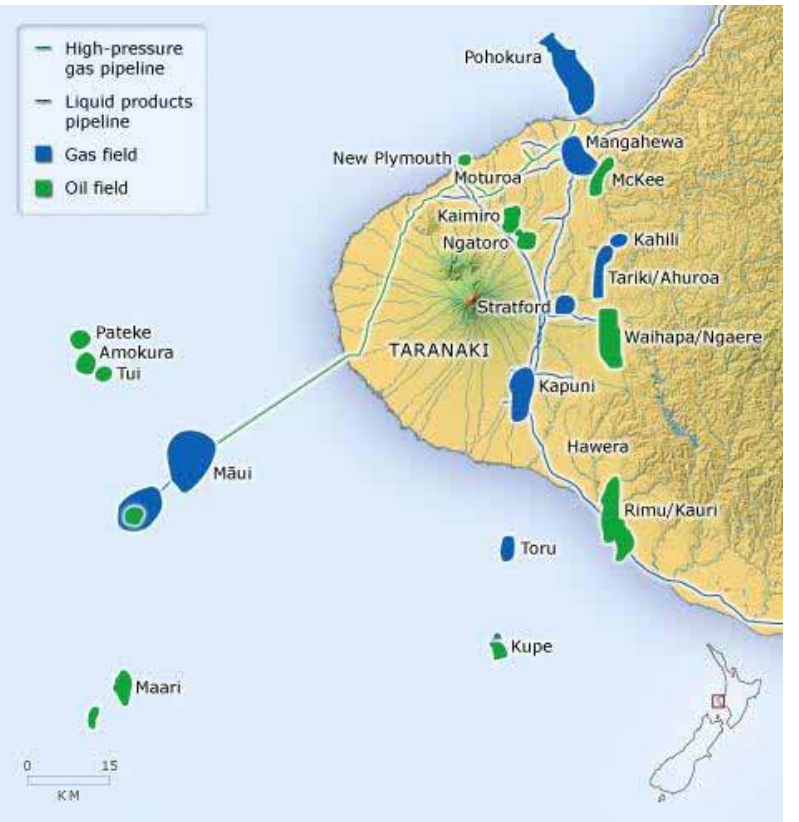
New Zealand legislation for workplace health and safety is generally performance-based, placing industry in the position of responsibility. The philosophy is to empower the industry to ensure that they are operating within the law without a large number of prescriptive elements. The regulations which apply specifically to the offshore petroleum industry have both prescriptive and performance elements, and are based on a safety case being provided to the DOL.

3.1.1 Industry

The offshore oil and gas industry in New Zealand commenced with the Continental Shelf Act 1964, which allowed offshore oil and gas exploration and extraction to commence. The first location at which gas was discovered, and later drilled in 1969, was the Kapuni gas field, on the western side of the North Island. The Maui oil and gas field, which is still operational today, was also discovered in 1969.

Crown Minerals, within the Ministry of Economic Development, is responsible for managing New Zealand's oil, gas, mineral and coal resources. Crown Minerals reports to the Minister and Associate Minister of Energy and Resources. All exploration and mining permits are issued through Crown Minerals. There are currently eight offshore installations operating off the New Zealand coast and all are in the Taranaki Basin on the western side of the North Island. The location of the oil and gas fields is depicted in Figure 1.

Figure 1 - Offshore oil and gas fields in the Taranaki Basin, New Zealand



The existing number of installations operational in New Zealand is set to expand in the future with the New Zealand Government promoting further exploration and development of the minerals estate, including petroleum resources. This government activity will include the stimulation of investment in the New Zealand mineral estate through Crown Minerals initiatives such as increasing the availability of seismic data and increasing regulatory effectiveness.

Offshore installations, and a number of other offshore activities in New Zealand, are serviced by HNZ. This helicopter operator has been servicing the Maui field since 1968. HNZ currently provides transportation of offshore petroleum workers in the Taranaki Basin through a joint sharing agreement with the installation operators in the area. The company flies out of New Plymouth airport, where a staff of 30 are based. HNZ use Augusta Westland AW139 and Bell 412 helicopters. The journey to the Maui A installation is approximately 45 minutes from New Plymouth.

3.2 Organizational Structure

The Department of Labour (DOL) is responsible for improving the performance of the New Zealand labour market. The Chief Executive of the DOL is the Secretary of Labour. The Secretary is responsible for carrying out the work as detailed through four Government Ministers: the Minister of Labour, the Minister of Immigration, the Minister for Social Development and Employment, and the Minister for the Accident Compensation Commission. The scope of the work undertaken and the Acts and Regulations overseen and enforced by the DOL are therefore large, with a total staff of approximately 1570 people based in 23 offices.

The DOL is organized into six workgroups: Workforce, Workplace, Work Directions, Corporate, Legal & International, and the Executive Branch. The Workplace Group is responsible for delivering policy and services related to employment relationships, workplace practices and workplace health and safety. The Senior Advisor High Hazards – Petroleum and Geothermal works within the Workplace group to oversee workplace safety in the offshore petroleum industry, among other types of workplaces.

3.3 Safety Oversight

The DOL administers a number of statutes, however the most significant to ensure the safety of workers is the *Health and Safety in Employment Act 1992*. Under this Act are the *Health and Safety in Employment (Petroleum Exploration and Extraction) Regulations 1999*. The Regulations require the submission of a Safety Case to the DOL prior to any operations. Schedule 4 to the Regulations stipulates the details required of safety cases. The Regulations and this report refer to "employer", meaning "a person who controls a place of work, including the person who controls a place of work at which a contractor or subcontractor works" (Regulations r 3(1)) .

In addition to the safety case, an employer must "take all practicable steps to ensure that the installation is not operated unless there is a current certificate of fitness" in respect of the safety of the installation structure and the equipment necessary for safe operation (r 28(1)). An alternative means of compliance is the operation of a verification scheme (r 28(3)).

3.3.1 Safety Standards

The *Health and Safety in Employment Act* Part 2 requires that every employer take "all practicable steps" to ensure the safety of employees while at work. This includes developing "procedures for dealing with emergencies that may arise at work" (Section 6 (e)). This term "all practicable steps" is defined to mean "all steps to achieve the result that it is reasonably practicable to take in the circumstances" (Section 2A).

The Act requires that employers ensure that there are systems in place to effectively identify hazards to employees at work and, where a hazard is assessed to be significant, that the employer take all practicable steps to eliminate it. Where the hazard is unable to be eliminated, that is, it is impracticable to do so, then the employer shall take steps to isolate it from employees. Failing that, the employer shall minimise the likelihood of the hazard, monitor employee exposure to the hazard and provide equipment to employees to protect them from harm that may be caused by, or may arise out of the hazard.

The particulars to be included in the safety case for an installation are, in redacted form:

1. Description of the means by which the employer intends to ensure that the installation will be operated in a manner that will minimize hazards

2. Description of the safety management system, its implementation and audit procedures

3. Details of any significant hazards

4. Details of quantitative risk assessments and consequent measures to minimize hazards

5. Description of the principal features of the design and construction of the installation that will ensure hazards are minimized

6. Details of the equipment in place to detect and protect workers from the consequences of fire, explosion, heat, smoke, gas and toxic fumes

7. Demonstration of all practicable steps to be taken to ensure that equipment essential for personnel safety or controlling the consequences of a major accident event will be capable of functioning in fire, explosion, flooding, inclination or strong vibrations

8. A scale plan of the installation and details of the weather and ocean conditions expected in the location, and the properties of the seabed at the installation's location

9. Description of structure and materials of the installation and its plant and equipment

10. Specifications of the design requirements of the installation, its plant and equipment, including safety limitations

11. Specification of the design of the installation, its plant and equipment, including codes of practice to be complied with

12. Details of the limits of environmental conditions beyond which the installation cannot safely operate, including the properties of the seabed and subsoil if applicable

13. Particulars of each operation to be carried out

14. The maximum number of petroleum workers expected to be on the installation at any one time, and of those who will require accommodation

15. Provisions to be made for a temporary refuge to prevent significant harm and for facilities capable of operating and monitoring emergency shutdown systems and maintaining communication with onshore facilities

16. Systems in place to enable a full and safe evacuation, escape and rescue of petroleum workers in an emergency

17. Details of plant, equipment and procedures for diving support and hyperbaric rescue

18. Statement of the performance standards of the systems in place to enable a full and safe evacuation of petroleum workers, and the period for which the systems can operate in explosion, fire, heat, smoke, gas and toxic fumes

19. Demonstration that the performance standards used in relation to the installation are adequate in minimizing hazards

20. Details of the frequency and scope of reviews of the safety case

In addition to developing and implementing the safety case, the employer is required by the Regulations to ensure that all petroleum workers are informed of the relevant parts of the safety case and any actions that need to be undertaken to be compliant with the safety case.

The "certificate of fitness" required for each installation (r 28) must be issued by an inspection body recognized by the DOL, thus fulfilling the appropriate requirement (r 24). An inspection body is required to be a demonstrated independent person or organisation that operates an effective quality assurance program, and carries out work in an objective fashion that promotes safety, and is in the interest of the public. The inspection body carries out inspections of installations and equipment fixed or related to installations to determine the safety of the installation and equipment. The inspection body may issue certificates of fitness following the inspection of the installation and equipment, and impose limitations or conditions in the case of non-compliance. The certificate of fitness must be valid for all activities and at all times throughout the installation operation. The maximum period of validity is five years. The details to be included in a Certificate of Fitness are stipulated in Schedule 5 to the Regulations.

An inspection body must be accredited by International Accreditation New Zealand (IANZ) or the National Association of Testing Authorities, Australia (NATA). IANZ is the accreditation body of the Testing Laboratory Registration Council, an autonomous Crown entity which recognizes the conformity of assessing or inspection bodies based on predetermined factors. NATA is a not-for-profit organisation based in Australia and is responsible for the accreditation of laboratories, inspection bodies and so on.

An alternative method of compliance with Regulation 28 is the operation of a verification scheme. A verification scheme which conforms to the particulars in Schedule 6 to the Regulations, as well as a demonstration that the verification scheme will be satisfactorily implemented, must be provided to the DOL.

In practice, it is slightly more common for installation employers to satisfy Regulation 28 through the provision to the DOL of a certificate of fitness.

3.3.2 Assurance Regime

The safety case is sent to the DOL at least two months prior to the commencement of the construction, operation or abandonment of any installation, where practicable. The safety case is reviewed by the DOL to ensure compliance with the Regulations. The DOL submits comments on

the safety case to the employer, typically in a question form. The comments do not necessarily have to be acted upon; however, they are required to be addressed by the employer. Should an incident occur in which it becomes evident that the comments should have been acted on, then the employer would face enforcement action.

Due to the resources available at the DOL, the workplace inspection of offshore petroleum installations is somewhat limited. Generally there is an attempt to visit each location approximately twice a year. The timing of the inspections does become ad hoc due to varying priority occurrences within DOL.

During these inspections the DOL Senior Advisor is checking whether the employer has taken all practicable steps to ensure that the installation is being operated in accordance with the safety case. The actual certificate of fitness or proof of the verification scheme of the installation is also inspected on these occasions.

The DOL enforcement tools include written warnings, improvement notices, prohibition notices and infringement notices, and for serious non-compliance, prosecution will be taken. Professional judgement of the situation by inspectors determines which option is the most appropriate.

3.4 Future Rulemaking

With the oil and gas industry in New Zealand set to expand in the near future, recent occurrences in the industry world wide, and the fact that the existing Petroleum Exploration and Extraction Regulations are eleven years old, a timely review of the existing regulatory regime of offshore petroleum is on the DOL agenda. The Deep Horizon incident in the Gulf of Mexico has particularly highlighted the potential need for a degree of prescriptive regulations in the offshore petroleum industry. The review is expected to commence in September 2010, and will involve public consultation. While it is not wise to speculate on possible inclusions or changes to the Regulations, the resources currently allocated to the regulation and oversight of the petroleum industry may be increased in order to facilitate these changes.

3.5 Safety Helicopter Operations Oversight

The Civil Aviation Authority of New Zealand (CAA) establishes national safety standards for civil aviation and monitors adherence to those standards. The CAA is also responsible for aviation accident and incident investigations, although some serious occurrences are investigated by the Transport Accident Investigation Commission (TAIC). There is no formal agreement between the DOL and the CAA with respect to the responsibilities of each agency for offshore helicopter transportation.

Under the *Health and Safety in Employment Act* the definition of a place of work would include the helicopters, which petroleum workers must use or pass through to reach a place of work. Section 3A clarifies that the Act applies to the aircraft as a place of work. With this definition of a place of work, it is the responsibility then, of the employer to ensure that all practicable steps are taken to provide and maintain a safe environment, and that procedures are developed in order to respond to emergencies while at work. This includes the aircraft.

If a helicopter accident were to occur and the employer was at fault, the CAA, or the TAIC if appropriate, would carry out the investigation, and that agency would be able to prosecute if need be, under the *Health and Safety in Employment Act*, as allowed for by Section 28B.

Helicopters travelling to offshore petroleum installations are certified under Civil Aviation Rules (CAR) Part 135. There is no requirement under Part 135 for helicopters or small aircraft travelling over water to be certified for ditching. With that in mind, however, there has not been a helicopter ditching while transporting petroleum workers to offshore installations in New Zealand. In addition to this there have been no fatal air transport operations accidents involving fare-paying passengers in New Zealand for the last five years. The excellent safety record of New Zealand civil aviation and the surveillance provided by the CAA are recognized by industry professionals, and in the recent ICAO audit of the CAA.

Only one operator, HNZ, provides helicopter transportation services to offshore installations in New Zealand. This company has been involved in servicing the oil and gas industry in New Zealand since 1968. Under Part

119 HNZ requires a general aviation air operator certificate. In order to fly helicopters to offshore locations under CAR Part 135, HNZ is required to ensure the provision of immersion suits (CAR 135.87).

HNZ is audited every two years by the installation operator, Shell, as a part of its own internal policy regime. This audit covers a wide range of topics, as defined by Shell, and is made available to other oil and gas operators as a part of a joint sharing agreement. The audit includes a review of the helidecks and helideck support facilities at the installations where Shell is an operator. Under the requirements of CAR Part 91 and 135, there are specific standards which a helicopter operator must ensure are in place for an aerodrome/landing site/heliport to and from which an aircraft may operate. HNZ is therefore bound by the Civil Aviation Rules to ensure that the helidecks on the installations are up to the specified standards. Advisory Circular 139-8 provides guidance on acceptable means of compliance with the Rules.

Rebreathers, a form of HUEBA, have been used by operators in the area since around 2006 and have been made mandatory by the petroleum operators for all passengers since 2008. The provision of rebreather and HUET and the standard of the immersion suits worn by passengers are driven by the industry, not by either the aviation regulator or the petroleum industry regulator.

4 Conclusion

The offshore petroleum regulatory regime in New Zealand is based on the philosophy that employers are responsible for ensuring that all practicable steps are taken to minimise hazards present at work and provide a safe working environment for employees. The Department of Labour oversees the industry, and requires that an installation safety case is provided to the Department. The Department in turn comments on the safety case. These comments are not binding and the operator is not forced to take the comments into account. The provision of a certificate of fitness for the installation or the implementation of a verification scheme is also required by the Regulations. This is to ensure the safe and appropriate operation of the installation and its associated plant and equipment. Certificates of fitness and approval of the verification scheme are provided by a third party, who is in turn accredited by a New Zealand or Australian

Government agency. Surveillance of the industry is primarily through DOL workplace inspections, which are performed approximately once every six months.

The size and complexity of the New Zealand offshore oil and gas industry has meant that safety and performance standards have, to some extent, been led by the industry. The Department of Labour has very limited resources allocated to the oversight of the offshore industry and the regulatory regime is very performance based. Due to the nature of the industry, primarily large oil operators, or partnerships of well-established operators, have mirrored the NZ safety standards against those from offshore jurisdictions around the world.

The Civil Aviation Authority of New Zealand is the responsible agency for the oversight of offshore helicopter transportation. Its involvement in the offshore petroleum industry has been minimal, primarily because there is only one operator providing services to offshore installations, and the safety record of this operator has been very good over a long period of time. HNZ is audited by Shell every two years, and both the Regulators and the other operators who contract HNZ appear satisfied with this level of oversight. There is no formal arrangement between the Department of Labour and the Civil Aviation Authority to define responsibilities or initiatives to ensure the safety of offshore helicopter transportation.

A number of factors have culminated to initiate a review of the offshore petroleum regulations in NZ this year. These changes will most likely include the creation of some more prescriptive aspects of the Regulations, and potentially a larger role or level of oversight by the Department of Labour. The existing arrangements have one individual at DOL overseeing the industry. This may not be practicable with an increased number of regulations and a larger industry.

The New Zealand offshore petroleum industry has to this point in time had a good safety record, and the regulatory regime has been effective. The safety performance of the installations and helicopter transportation has been primarily driven by the industry; however, this may change in the future as the industry expands and regulatory changes are made.

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Overview of Best Practice in Organizational & Safety Culture

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador, Canada
May 2010

Presented by
Aerosafe Risk Management

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LIST OF ABBREVIATIONS

ATSB	Australian Transport Safety Bureau
BASI	Australian Bureau of Air Safety Investigation
CAAP	Civil Aviation Advisory Publication
CASA	Civil Aviation Safety Authority (Australia)
CRM	Crew Resource Management
DNV	Det Norske Veritas (global provider of services for managing risk)
ICAO	International Civil Aviation Organization
NPD	Norwegian Petroleum Directorate
PPE	Personal Protective Equipment
OH&S	Occupational Health and Safety
ORP	Operational Risk Profiling
RCS	Relative Cultural Strength
SMS	Safety Management System
VRMP	Venture Risk Management Planning

1 Executive Summary

Culture surrounds us and influences the values, beliefs, and behaviours that we share with other members of a group. In the case of an organizational culture, the culture is determined by the set of beliefs that underpin the accepted 'norms', decision making and behaviours of an organization and its people. When it comes to safety, the safety culture of an organization will heavily influence the level of risk willing to be accepted, the openness of communication and trust. Culture serves to bind together members of groups and provides clues and cues as to how to behave in normal and abnormal situations.

This paper has been developed as a resource to the Offshore Helicopter Safety Inquiry and provides a theoretical basis for understanding culture. This paper does not provide an expert assessment of the safety culture of the Offshore Oil and Petroleum Industry in the Newfoundland and Labrador area, but rather provides modern and accepted models and concepts for appreciating culture and how to recognise the traits of a positive safety culture.

One of the key aspects of defining a safety culture is in understanding the role national, professional and organizational cultures play in safety decisions. The key to shaping the safety and risk culture of an organization is in how an organization creates the environment for risk to be managed and how safety decisions are to be made and safety actions to be taken. When an organization adopts a formal approach to safety oversight through the implementation of a safety management system, an environment is created that influences behaviour which then eventually shapes the beliefs and attitudes of those in the organization.

When trying to identify the traits of a positive safety culture, the key demonstrator is the set of safety behaviours that are present. These safety behaviours are portrayed through open reporting systems, adoption of "just culture" principles in investigation and incident review, an atmosphere of trust between staff and management, effective communications and closed loop processes for passing information back to those that have raised concerns.

There is a key role for formal safety management systems and risk management practices in the development and improvement of safety culture. By adopting a systematic approach to the management of safety risks, an environment for consistent practice is established. The global aviation industry has been proactive toward the development of positive safety culture for the past twenty to thirty years. The key for high-risk industries that rely on the use of aviation is to successfully "integrate" the frameworks, processes and philosophies for safety to achieve a common, visible, positive and acceptable safety culture.

2 Introduction

The terms safety culture, safety management and error management are now commonplace in many high-risk industries including oil and gas, petrochemical, medical, transport and in particular aviation. Much of this stems from the work of Professor James Reason in the 1990s and others such as Professor Patrick Hudson and Doctor Bob Helmerich. This paper is not, and does not attempt to be, an academic paper on safety culture. It provides an overview of safety culture through a review of relevant literature and an examination of organizations which have implemented the concept. It aims to assist a reader in understanding the basic concepts of safety culture and to make informed assessments of organizational performance.

Aerosafe Risk Management has been engaged by the Offshore Helicopter Safety Inquiry as a leading global specialist in aviation risk management and safety management systems. One of the underpinning elements of any successful risk or safety management approach is the organizational and safety culture. The disciplines are closely related and can not be considered independently.

It is commonly recognised that the offshore oil industry is higher risk than many other industries and therefore a high-risk workplace. In line with the International Standard on Risk Management (ISO31000), "risk is the chance of uncertainty impacting upon an organization's objectives". In relation to safety, safety of workers in the workplace is a very practical and real issue. When managing the safety risk exposure of any high-risk workplace, the key questions to examine in relation to the underpinning

organizational and safety culture should include:

- What is safety culture?
- How is a safety culture developed or achieved?
- Why is safety culture considered such a key factor in overall organizational safety?
- How is a safety culture implemented successfully?
- How can the presence of a best practice safety culture be identified?

2.1 Limitations and Caveats

While references are provided as annexes, they are not ordered as in a traditional bibliography. Rather, they are provided as a reading list in a sequence which will allow a busy reader to access the most useful reading first. A list of additional texts which may be of interest is also attached.

Safety culture is a complex area which is still subject to academic debate. It is not possible in the time available to provide an exhaustive paper on the subject and readers should seek further advice on any issue on which they are unsure.

This paper is provided to the Offshore Helicopter Safety Inquiry as a reference document that can be used in inquiry deliberations. This paper does not provide an assessment of the culture of the Offshore Oil and Petroleum industry in the Newfoundland and Labrador area.

2.2 Background

Hudson (1999: p 1-11) describes safety as "something that has to be actively managed to allow profit or advantage to be gained...(management) of risk is the name of the game. Those organizations which manage their risks best are in place to make the most profit. Those that do not manage so well are either perceived as dangerous or are forced to scale down their operations to achieve acceptable levels of safety."

The evolution of thinking on safety has accelerated since the early 1990s. In aviation for example advances in safety have traditionally been achieved through the investigation of accidents, sometimes known as the "smoking hole" approach. Although learning through the investigation of accidents is necessary and is still used by investigative agencies it is seen as insufficient due to its high cost both in lives and damage. Many investigations also place blame, usually through such conclusions as "pilot error".

Following James Reason's work, the Australian Bureau of Air Safety Investigation (BASI, now the Australian Transport Safety Bureau) was the first agency to use the model for all major reports, directing attention to organizational factors underlying aviation accidents (Hudson, 2003: p10). A key element of this and subsequent investigations was formalised in International Civil Aviation Organization (ICAO) Accident Investigation, as the "no blame approach". This encouraged free and open reporting. Indeed it allowed the introduction of legislations around the world in Member States that permitted the investigation authority to require parties to answer questions even though such answers may be self-incriminating. Such information is regarded as being so important to a successful investigation that safeguards of confidentiality and immunity to its use in future litigation are also included.

In more recent years it became apparent that if the "no blame" concept was taken to the extreme it could be used to absolve individuals from accepting accountability for their actions. Everything could become an "organizational issue" even if people at the "sharp end" had not acted reasonably and professionally. A "just culture" approach developed to address this problem.

3 Defining Safety Culture - What is a Safety Culture?

It is difficult to find a specific starting date for the field of "safety culture" in the aviation or other high-risk industries. It can be argued that as organizations have always had a culture, safety culture per se has always been present. However as previously discussed, there is a close link between safety management and safety culture; safety culture is an intrinsic part of safety management and there can't be effective modern

safety management without a culture which addresses safety. It is generally accepted that the science of safety culture evolved from the aftermath of a series of disasters, mainly in Europe. Safety cases grew from the Flixborough accident in 1974. This was followed by the Seveso incident in 1976, and the Piper Alpha disaster of 1988. The Piper Alpha inquiry, conducted by Lord Cullen, identified the requirement for systematic safety management with safety cases used to prove the effectiveness of the system.

In the mid-eighties the oil and gas industries started to implement systems and address cultural issues by realising safety was of prime importance and that it was not just a matter of individual personal responsibility. They developed a set of eleven principles of enhanced safety management based largely on the experience of the industry leader DuPont. This occurred in a generally top-down, prescriptive regulatory environment which could at times be contrary to common sense or even sound engineering practice.

Piper Alpha can be identified as a turning point. Lord Cullen proposed extending a goal-setting regime which meant that society sets overall goals and organizations find their own way of achieving these goals. He also referred to the ISO 9000 and BS5750 standards and the use of safety cases as living documents to prove that the systems were working. This approach is used in the Norwegian Petroleum Directorate's (NPD) legislative basis (Hudson, 2001:p 2).

This evolution has been characterised as having four phases. The first is generally considered the "technical period" during which there were rapid technological developments and accidents were viewed as having mechanical causes. The second phase was the "human error" period where the limitations of humans were identified as being the major cause of breakdowns. The third phase is referred to as the "sociotechnical" period where the negative impact of ergonomics and poor design were seen as a cause of human error. The final stage is often called the "safety culture" period, which recognises that operators are not performing their duties or interacting with technology in isolation, but are rather working as coordinated teams within an organizational culture (Wiegmann et al, 2007: p1-12).

4 Key Traits & Features of Culture

The safety culture of an organization has a large role to play in effectiveness of safety and risk management practices of an organization. The safety culture sets up the environment in which the workers of an industry operate. When it comes to aviation, the culture influences how the crew and passengers of an aviation operation interact. It is important to understand the influences that are affecting the environment and the safety culture within which people work. This section of the paper seeks to provide a clear definition of safety culture and what it means to an organization.

4.1 Defining the Different Aspects of Culture

"Culture represents the values, beliefs, and behaviours that are shared by members of groups. Culture binds us together as a group and provides the clues and cues as to how we should behave in both normal and novel situations" (Helmreich, 1999: p1). When thinking of culture, what comes to mind first is national culture, the attributes that differentiate between natives of one culture and those of another. For pilots, however, there are three cultures operating to shape actions and attitudes. The first, of course, is national culture. But there is also a strong professional culture that is associated with being a member of the pilot profession. Finally, organizations have their own cultures that are closest to the daily activities of their members. While national cultures are highly resistant to change because they surround an individual from birth, professional and organizational cultures may be modified if there are strong incentives (Helmreich, 1999).

4.2 National Culture

On National Culture, Helmreich (1998) states:

> National culture represents the shared components of national heritage. These include behavioural norms, attitudes, and values. Some aspects of national culture that have been identified as critical in aviation include Individualism-Collectivism, Power Distance, and Uncertainty Avoidance or regard for Rules and Order.

4.3 Professional Culture

On Professional Culture, Helmreich states:

> A very positive aspect of the culture of pilots is pride in their profession. They love their work and are strongly motivated to do it well. This can help organizations work toward safety and efficiency in operations. The professional culture of pilots also has a strong negative component in a near-universal sense of personal invulnerability. It has been found that the majority of pilots in all cultures feel that their decision making is as good in emergencies as normal situations, that their performance is not affected by personal problems, and that they do not make more errors in situations of high stress. This misplaced sense of personal invulnerability can result in a failure to utilize the Crew Resource Management (CRM) practices that have been outlined in this course as countermeasures against error. (1998)

4.4 Organizational Culture

On Organizational Culture, Helmreich states:

> The organization provides the shell within which national and professional cultures operate and is a major determinant of behaviour. It is at the organizational level that the greatest leverage can be exerted to create and nourish a safety culture. To achieve this requires the strong and demonstrated commitment of senior management as well as policies that encourage open communication and action instead of denial as a reaction to problems and risks uncovered. (1998)

4.5 Safety Culture

National Culture, Professional Culture, and Organizational Culture all have major influences on an organization's Safety Culture. Wiegmann et al (2002) conducted a comprehensive study of safety culture and from the various definitions, both inside and outside the aviation industry, found several commonalities that exist regardless of the industry being considered.

These commonalities are:

1. Safety culture is a concept defined at the group level or higher, which refers to the shared values among all the group or organization members;

2. Safety culture is concerned with formal safety issues in an organization, and closely related to, but not restricted to, the management and supervisory systems;

3. Safety culture emphasizes the contribution from everyone at every level of an organization;

4. The safety culture of an organization has an impact on its members' behaviour at work;

5. Safety culture is usually reflected in the contingency between reward systems and safety performance;

6. Safety culture is reflected in an organization's willingness to develop and to learn from errors, incidents, and accidents; and

7. Safety culture is relatively enduring, stable and resistant to change.

From these commonalities Weigmann et al (2002) determined the following definition of Safety Culture:

> Safety culture is the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behaviour based on lessons learned from mistakes, and be rewarded in a manner consistent with these values.

It is important to note that this definition is stated in neutral terms. The definition implies that an organization's safety culture exists on a continuum and that the safety culture can either be a good or bad culture.

4.6 Safety Climate

Wiegmann et al (2002) identified that the term *safety climate* was often used synonymously with the term *safety culture*. There is, however, a distinction between the two terms. Wiegmann et al (2002) found that *safety climate* differs from *safety culture* in the following ways:

1. Safety climate is a psychological phenomenon, which is usually defined as the perceptions of the state of safety at a particular time;

2. Safety climate is closely concerned with intangible issues such as situational and environmental factors; and

3. Safety climate is a temporal phenomenon, a "snapshot" of safety culture, relatively unstable and subject to change.

Using these points and a detailed study of various definitions for safety climate, Wiegmann et al (2002) determined the following definition:

> Safety climate is the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on the features of the current environment or prevailing conditions.

4.7 Maturity of the Safety Culture

Westrum (cited in Westrum & Adamski, 1999) suggests that the critical feature of organizational culture is information flow. Hudson (2001) further developed this work by defining five distinct climates that define stages of an organization's safety culture. These five stages are:

1. **Pathological**: The organization cares less about safety than about not being caught;

2. **Reactive**: The organization looks for fixes to accidents and incidents after they happen;

3. **Calculative**: The organization has systems in place to manage hazards; however the system is applied mechanically. Staff and management follow the procedures but do not necessarily believe those procedures are critically important to their jobs or the operation;

4. **Proactive**: The organization has systems in place to manage hazards and staff and management have begun to acquire beliefs that safety is genuinely worthwhile; and

5. **Generative**: Safety behaviour is fully integrated into everything the organization does. The value system associated with safety and safe working is fully internalised as beliefs, almost to the point of invisibility (Hudson 2001).

These five stages provide a model for measuring the maturity of an organization's safety culture, culminating in the Generative stage. See Figure 1 on the following page.

Figure 1 - Descriptions of the different types of safety culture

	PATHOLOGICAL	REACTIVE	CALCULATIVE	PROACTIVE	GENERATIVE
COMMUNICATION	Nobody is informed, no feedback, everybody is passive, no care/knowledge about safety, don't see(k) or ask the problem, collect what is legally required	Management demand data on HSE failures, denial until forced to admit, top-down flow of information, bottom-up incidents, lots of statistics nobody understands, safety hot issue after accident	Environment of command and control by management, lots of HSE graphs, statistics but no follow-up, info goes top-down, failures bottom-up, little top-down feedback, toolbox meetings, procedures exist but are only once read. Action is delayed after knowledge.	Management go out and seek, discuss for themselves; they know what to change and how to manage, the feedback loop (bottom-up and top-down) is closing at supervisory level, safety topics become part of other meetings, asked for by workforce, they need detail to understand WHY accidents happen	No threshold between management-workforce, management participates/shares activities (dialogue), HSE is number 1, all feedback loops are closed, safety is integrated in other meetings; no special safety meetings required, workforce keeps itself up-to-date, they demand information so they can prevent problems
ORGANIZ-ATIONAL ATTITUDES	No belief or trust, environment of punishing, blaming and controlling the workforce	Failures caused by individuals. No blame but responsibility, workforce needs to be educated and follow the procedures, management overacts in eyes of workforce	Workforce is more involved, little effect on procedures, designs, practices. Workforce does not understand the problem, management is seen as obsessive with HSE, but they don't 'mean' it (Walk-talk)	Workforce involvement is promoted but ruled/organized by supervisory staff which is obsessed by HSE statistics	Management is recognized as a partner by workforce, management respects workforce, management has to fix systematic failures, workforce has to identify them.
HEALTH, SAFETY AND ENVIRONMENT (HSE)	No HSE status, HSE issues are ignored, minimal requirements, no rewards for good performance, safety is inherited but not known, reliance on experience	Meets legal requirements, collects statistics but no follow-up, design is changed after accidents, procedures are rewritten to prevent accidents, no update or improvement.	HSE well accepted, advisor collects data and creates own statistics, HSE rewards for positive and negative performance, design: quantitative methods, procedures to solve unsolved problems, standard procedures preferred from the shelf, large numbers of procedures but few checks on use/knowledge.	Separate line HSE advisors promoting improvement, but try to reduce the inconvenience to line, for good HSE initiatives there is career enhancement for senior staff, HSE is in the early stages of design, procedures are rewritten by workforce, integration with competency, complaints about externally set targets.	HSE department is small, advising the management on strategy, group, no special rewards, individual pride, procedures are written by workforce, continuous improvement, small numbers of procedures are integrated in training.
ORGANIZATI-ONAL BEHAVIOUR	Denial anything is wrong, avoids HSE discussion, management is hierarchical and stagnant to changes, focus on profits not on workforce, workforce has lots of freedom as management don't care	Management holds workforce responsible for failures, overacting, management states that it takes safety seriously, but it is not always believed by workforce.	Detail focused/playing with numbers, believe company is doing well in spite of contrary, targets are not challenged, inability to admit solutions may not work the first time	Management knows the risks, interested in HSE, takes culture into account, safety priority over production which leads to incompatible goals, lots of management walk-abouts, communication and assessment about accidents and near-misses and their consequences	Safety is equal to production, enthusiastic communication between workforce and management and vice versa, workforce has a lot of freedom due to trust.
WORKING BEHAVIOUR	Workplace is dangerous, messy, no (legal) health requirements, management does not CARE and does not KNOW.	Basic legal requirements implemented, housekeeping is temporary, improved when inspection comes, management KNOWS but does not always CARE.	Clean and tidy working environment, housekeeping is very important (prizes). Management CARES but does not always KNOW.	Management CARES and KNOWS, discussion about prioritization, time and resources are available for improvements even before accidents happen.	Management CARES and KNOWS, workforce furnishes its own environment, management passes the experience around to other sites.

5 Developing a Positive Safety Culture

Changing the culture of an organization is not as difficult as it seems. You can't always make everyone in the organization happy, but making sure that people have a positive attitude towards safety is a good start. Reason (1997) developed a series of 'components' that must be present in an organization with a positive safety culture. They include the following:

1. Reporting Culture;
2. Just Culture; and
3. Flexible Culture.

5.1 Engineering a Reporting Culture

It can be difficult to convince the employees of an organization to report hazards and risks. The tendency can be for people to think it is too time-consuming; they are sceptical of the use of the data; they may not trust the fact that they will not be getting their colleague or themselves into trouble, or they may act on the natural desire to forget that the incident occurred. Therefore, the reporting system must be designed with these elements in mind. Reason (1997) describes the characteristics that are required of a reporting system, as well as the ways to achieve these.

5.2 Engineering a Just Culture

A just culture recognises that it is not appropriate to punish all errors or unsafe acts, and just as inappropriate to provide protection from punishment for all errors and unsafe acts. The key to engineering a Just Culture is establishing a clearly defined line between acceptable and unacceptable behaviour (Reason, 1997). Instilling the belief that an organization handles praise and punishment fairly and consistently is important in developing trust in the company amongst the employees.

5.3 Engineering a flexible culture

Due to the rapidity of change that occurs within organizations today, they must have mechanisms in place to manage complex technology, and to constantly meet the fluctuating demands on their industry. Safety concerns can arise rapidly due to these factors, and they often need to be dealt with quickly and accurately. Reason (1997) describes some of the

characteristics of organizations with flexible cultures, and how to ensure that all organizations can establish this.

An understanding of these cultures and how they are developed within an organization leads to a positive safety culture. The aim is to change the way people perceive safety. Staff should want to report hazards with the confidence that action will be taken; management should support them in this and vice versa. While it is an organizational goal to develop a positive safety culture, an employee has a responsibility to always consider the safety implications of the actions he or she may take.

One of the alternate models for a positive safety culture is defined by Hudson. He notes the following attributes of an organization's culture that gives safety priority:

- An **informed culture** where those who manage and operate the system have a current knowledge of the human, technical, organizational and environmental factors that determine the safety of the system as a whole;

- A **reporting culture** where people are willing to report errors and near misses;

- A **just culture** where an atmosphere of trust is present and people are encouraged or even rewarded for providing essential safety-related information. There is however a clear line between acceptable and unacceptable behaviour;

- A **flexible culture** which can take different forms but is characterised as shifting from the conventional hierarchical mode to a flatter professional structure; and

- A **learning culture** where there is the willingness and the competence to draw the right conclusions from the safety information system, and the will to implement major reforms when the need is indicated.

The true test of the culture however is in the aftermath of a major incident or accident. Here, the professed values and beliefs are placed under pressure as senior management struggle with competing priorities such as defending the organization's reputation, protecting it from potential litigation, cooperating with investigations by regulators, investigation agencies and perhaps the police. The temptation to withdraw behind barriers and blame directly involved employees may perhaps be too overwhelming.

James Reason (Reason, 1998, p.294) discussed safety culture. He defines safety culture as "Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioural norms (the way we do things around here)". Hudson then provides an evolutionary progression of cultures from Pathological through Reactive, Calculative and Proactive to Generative (Reason 2005). These ideas come together to provide the table in Figure 1 above.

6 The Relationship between Culture & the Management of Risk

It has long been recognised that risk is inherent in everything we do. By adopting a structured approach to how risk is managed and communicated, a culture of sensible risk taking will emerge. The level and type of risk behaviour is a key component of an organization safety culture. The relationship between risk and safety is very strong and as a result, the safety culture will drive what level of risk an individual will accept within an organization.

Developing and identifying a positive safety or risk culture within an organization is not easy. So how is it developed? The answer lies in the relationship between the organization's environment and the adopted behaviours of the people within the organization. An ideal safety or risk culture is one where understanding, managing and accepting appropriate risks is part of the organization's everyday decision-making processes.

6.1 Creating an Environment for the Right Safety Culture

The key to shaping the risk culture of an organization is in how you create an environment where risk is well managed. When an organization adopts a framework for managing risk, it helps create an environment that influences behaviour and eventually shapes the beliefs and attitudes of those in the organization (Figure 2).

Figure 2 - Safety Culture

Culture is often described as “the way things are done around here”. A positive safety culture would mean that accepting risk at the right level is just part of how things are done. A negative safety culture may be demonstrated through people being risk averse, ignorant of risk or overconfident with risk taking.

It is not uncommon for an organization to take three to five years to reach the point where a positive safety or risk culture is visible and can be attributed to the proactive implementation of a risk-management framework, which includes the application of consistent risk practices and principles. For larger or more complex organizations, it can take even longer.

7 The Role of Safety Management Systems in Culture

Safety culture and safety management have been described as ongoing, work in progress, a journey rather than a destination reached. It is therefore not possible to point to organizations which have a completely implemented safety culture but rather to point to those who have moved significantly along the path. The following case studies examine companies that have implemented a safety management and safety culture initiatives.

7.1 What is a Safety Management System

"Good safety management is more than just a legal and moral requirement. Around the world, there is a growing recognition that safety programs can improve a company's operating performance and profits as well as its safety defences." This statement was taken from the Civil Aviation Safety Authority's (CASA) Aviation Safety Management operator's guide and reflects the fact that Safety Management has further benefits than the improvement of safety measures.

There are many different ideas people have about what managing safety involves, however one of the more widely accepted definitions is one that Australia's Civil Aviation Advisory Publication (CAAP) (2009) provides:

> A safety management system is a business-like approach to safety. It is a systematic, explicit and comprehensive process for managing safety risks.

The inherent structure of a well-established Safety Management System allows for there to be a successful framework for good Governance. This is because of structures such as the escalation of risks, communication channels, and documentation management processes. This is particularly important in the receipt of information by the Board regarding safety-related matters. Without the appropriate communications channels such as regular Safety Committee meetings, safety alert processes, and information escalation, the Board may receive a reduced level of 'honesty' in the safety information received.

Therefore, along with the appropriate Compliance and Assurance structures, Safety and Risk Management structures and processes are an integral component of achieving good Governance practices.

7.2 Key Elements of an SMS

Figure 3 - Safety Management System (SMS) Diagram

Element 1: Safety Governance & Oversight Safety governance is defined as the system by which management directs and controls the safety practice of its organization. There are three key components of safety governance: safety compliance, safety assurance and safety risk management. These components reflect and integrate with an organization's broader Corporate Governance arrangements, which include corporate compliance, corporate assurance and an enterprise risk management framework.

Element 2: Safety Planning Effective and detailed planning is a key component of this element of an organization's Safety Management System. The organization should adopt a businesslike approach to managing safety, which includes setting and updating safety objectives and targets annually, task identification and allocation, resource planning and performance measurement.

Element 3: Safety Responsibilities Safety accountabilities and responsibilities should be outlined for the organization. It is recognised that there are different levels of responsibilities for safety. These responsibilities need to be documented and updated as required.

Element 4: Action Management The best way to establish safety as a core value is to make safety an integral part of the management plan. This element requires a "process", identification of tasks to reduce risk, allocation of tasks, follow-up and close-out.

Components of the action management element of an SMS usually include:

- Incident and accident reporting system
- Closed loop reporting system
- Safety program activities
- Safety audits and evaluations
- Hazard management

Element 5: Safety Policy & Standards Safety policy and procedures are formal documents that form the basis for instruction on the philosophies, processes and practices required in a SMS. Internally within an organization a company has a formal policy and document structure in which they have linked process and procedurally-based information on the SMS elements.

Element 6: Safety Assurance The safety assurance element of the SMS is aimed at providing confidence that safety risks are being managed, and

the SMS is working the way it was designed to. The reassurance that is provided through the safety assurance module is required for all staff, stakeholders, insurers, the community, and families. Safety assurance is provided in many ways. Some key methods for the provision of assurance are:

- Internal and external Audits
- Annual Evaluation
- Internal and external inspections

Element 7: Operational Risk Management The Operational Risk Management or ORM module of an SMS covers both the hazard and risk management elements of the SMS. Each organization must adopt three different levels of risk management planning: corporate risk profiling, venture risk management planning (VRMP) and operational risk profiling (ORP). All levels of risk management planning are based upon the risk management process outlined in the International Risk Management Standard, ISO 31000.

Element 8: Incident / Occurrence Management & Reporting The aim of an occurrence reporting system, at a very basic level, is communication. The effective communication of occurrences can provide valuable information that can be used as an educational tool to help reduce the risk of that event occurring again. Data on occurrences can be collected in a secure manner, allowing analysis of that data to be explored. Utilising a web-based system allows the entry of data from almost any location, ensuring that information can be captured in a timely manner before any clarity of detail is lost. It also allows transparency of information across a variety of business units, and emphasises management's commitment to safety. This is an extremely important point if organizations' members and staff are to feel comfortable using the system.

Element 9: Safety Communications The safety communications element of the SMS is a key component in developing an organization's safety culture by increasing safety awareness and knowledge of safety and risk practice. As well as communicating safety-related information to relevant

staff and members, it is important to also consider the role of safety promotions. These play a role in raising safety consciousness amongst members, and providing regular reminders of their safety-related responsibilities to themselves and others.

Element 10: Safety Training The safety training component of an SMS is broad in scope and includes training on the SMS itself, as well as specific safety-related training courses. It is important to train staff and members in the skills, knowledge and competencies required to make the Safety Management System's processes and practices work.

Element 11: Records and Data Management Part of a formal SMS is the systematic and logical organization of safety and risk information. Safety practices are part of day-to-day operations and management, and are usually embedded into operational procedures and practices. In conjunction with this, some specific safety data and information needs to be recorded so it is easily accessible and able to be used by all staff.

Control of documentation and data management ensures that safety and risk management information is communicated effectively, accurately, and in a timely manner and remains accessible to management and staff members according to their particular requirements

Element 12: Cultural Development The primary aim of an SMS is to develop and maintain a positive safety culture. It is also to ensure an organization is committed to monitoring its safety climate and proactively guide what activities are needed to shape the organizational culture.

In order to develop a positive safety culture, there is a link to creating an environment in one's organization that will influence the behaviour of staff and members, which will in time shape the desired culture.

8 Has Safety Culture been implemented successfully? Can this be measured?

Safety culture and safety management have been described as ongoing, work in progress, a journey rather than a destination reached. It is therefore not possible to point to organizations which have a completely

implemented safety culture but rather point to those who have moved significantly along the path. The following case studies (see Appendices A and B) examine companies that have implemented safety management and safety culture initiatives.

9 Conclusion

Every organization has an organizational culture and every organization has a safety culture of sorts. The overall culture, be that organizational or safety-specific, influences thoughts, beliefs and ultimately decision making and behaviours. The true measure of an effective safety culture is depicted by the adequacy of decision making and behaviours by the workforce of the organization. There are many ways in which an environment can be created or 'engineered' to shape these behaviours, yet ultimately a positive safety culture is one that is consistent and one that can be duplicated despite any change in leadership or workforce.

There are many theories and models to aid in cultural development. Ultimately an organization needs to determine what type of behaviours it is after and create the environment through the leadership, processes, frameworks and influencing activities to achieve the desired goal.

Safety culture is a much used but sometimes difficult to define concept. When used in conjunction with or as part of a safety management system, it can enhance both the safety and economic performance of the company.

10 Appendices

10.1 Appendix A: Case Study One (1) – Du Pont

Du Pont began operations in 1802 with the establishment of a powder mill. Their first safety rules came into force in 1811 with the following principles (Leinweber, 2009):

- Safety is a line management responsibility.
- No employee may enter a new or rebuilt mill until a member of top management has personally operated it.

The above makes a very strong statement which relates to current key principles of safety culture. Firstly, that line management (and workers) are the people who have responsibility for day-to-day safe operations. Secondly, top management involvement and commitment are vital. Du Pont began to collect safety statistics in 1912. The belief that all injuries are preventable developed in the 1940s. Off-the-job safety programmes began in the 1950s and Du Pont's "goal is zero" programme was established in the 1990s. Given these longstanding initiatives, a strong safety culture would be expected. However, the company understands that more is yet to be done. They identify trends in workplace safety:

- The inadequacies in workplace safety management
- Escalating cost of injuries
- Global news and the internet provide the public with increased insight into serious safety incidents
- Better tools are required to measure and manage safety performance and
- A strong safety culture is a key to achieving their "Zero" programme objectives.

Du Pont base their safety management system on ten key principles including management accountability, employee involvement and the need for all deficiencies to be corrected promptly. They identify the components of achieving cultural excellence as:

- Leadership: what does management do to lead employees to safety excellence?
    - Management commitment
    - Policies and principles
    - Goals, objectives and plans
    - Procedures and performance

- Structures: what are the organizational structures that enable the pursuit of safety excellence?
    - Line management accountability and responsibility
    - Safety personnel
    - Integrated organizational structure
    - Motivation and awareness

- Processes and Actions: what actions does the organization take on a regular basis to improve safety performance?
    - Effective communication
    - Training and development
    - Incident investigation
    - Audits and observations.

They then develop the Du Pont/Bradley curve, which relates decreasing injury rates to a progression from Reactive to Interdependent cultures. The issue of understanding and measuring the effectiveness of safety culture is made against formal criteria:

- How internally consistent is the safety culture?
- Does the safety culture vary across sites?
- Have recent events changed the culture?
- Do business goals compete with the safety focus?
- Do new employees receive the same training and hold the same values as long-term employees?
- Does the pressure to "do more with less" compete with the safety values?

They have implemented "perception surveys" to benchmark globally whether overall targets or pre-established goals have been reached. They find that benchmarking helps in the understanding of performance standards and can assist in analysing the company's safety perceptions against others in the industry and across industries. Benchmarking provides many benefits including:

- Employees are more likely to accept data
- Employees see themselves as part of the bigger picture
- There are shifts in the corporate mindset
- Employees and leadership both play a role in establishing performance targets and focussing resources and
- Best practices are shared among benchmarking partners.

The benchmarking data is updated annually and includes more than 9 years of data, over 250,000 responses across 55 industries including energy, food, paper, chemicals, manufacturing and transportation in 41 countries and 1,687 sites. They contend that the perception survey effectively measures a company's safety culture through:

- 24 core questions
- A cross-section of employees
- The comparison of data across departments, levels and responsibilities
- Testing whether safety is a core value held through all levels,
- Examination of employee involvement in audits, accident investigation, and safety meetings
- Understanding the hidden pitfalls in culture

- Identifying cultural gaps across sites.

They then developed a benchmark of world-class criteria, the Relative Culture Strength (RCS). This index compares the site score against the benchmark's best and worst. Interestingly, the oil industry comes in with a moderate position in the survey. They have found that most industries have moved from the Reactive state and as relative cultural strength improves, safety performance improvement becomes more sustainable. The survey also revealed that major issues are :

- Lack of management commitment
- Breakdowns in communication and
- Inconsistent safety leadership.

Du Pont is acknowledged as a leader in the area of safety management and safety culture. Although they have extensive systems, research facilities and a consulting area specialising in these disciplines, they appreciate that they still have to learn and work towards continuous improvement.

10.2 Appendix B: Case Study Two (2)—State Energy Provider, Australia

This case study has been selected as it demonstrates the challenges faced by an organization which operates in a high-risk environment. It has established safety systems and culture. It also contracts the services of a helicopter company to perform tasks which require their employees (workers) to fly in a contracted aircraft. It has several parallels to issues raised in the offshore helicopter accident in St. John's, Newfoundland Labrador. The company concerned is not identified in the Australian Transport Safety Bureau (ATSB) report and this practice is respected in this case study.

In New South Wales, the State electricity supply is privatised. Several companies compete for consumer business and are responsible for provision of infrastructure. One of the tasks which must be undertaken is line inspection. This is particularly important in bushfire (wildfire)-prone areas and must be undertaken in accordance with a State-specified schedule.

10.2.1 Factual Data

The ATSB report outlines the accident as follows:

> On 4 April 2006 a Bell Helicopter Company 206B III helicopter was being operated on a survey of powerlines in the St Albans area of New South Wales with a pilot, two power supply company personnel and a photographer on board. At about 1000 Eastern Standard Time, the pilot observed a previously unseen single–strand telecommunication cable support wire rubbing against the copilot's door, and attempted to manoeuvre the helicopter clear of the wire. The helicopter lost directional control and commenced spinning to the right. However, the pilot cleared the wires and attempted a landing in an adjacent paddock. The helicopter came to rest on its right side and was severely damaged. One of the power supply company personnel received serious head injuries and the remaining occupants received minor injuries.

10.2.2 Discussion

The power company had a well established internal safety management system and culture. It focussed mainly on the occupational health and safety issues relevant to electricity supply operations. It did not extend to aviation operations. Governance structures were in place through a Board and several subcommittees.

The company had formal processes in place for contract development and the examination of responses to requests for tender. There was a strong management commitment to providing a safe workplace and in the case of the helicopter contract they undertook a review of safety issues through a risk assessment. However, specialist aviation advice was not sought. The assessment addressed operational risks but tended to assume that these are mitigated by the helicopter company meeting the requirements of the regulator, the Australian Civil Aviation Safety Authority (CASA). Perhaps the assumption was that regulatory compliance equates to safe operation.

As part of the contracting process, staff visited the helicopter company. CASA audits were reviewed as well as the company's safety record. It should be noted that for this type of operator, CASA could be expected to

undertake an operational audit every three years and a maintenance audit every year. A follow-up call was made to CASA; the following advice was received:

> They are a good operation and there are no issues with regards to their safety record.

Their operations manual was also reviewed. This review would have been more thorough and may have raised issues if an expert in helicopter operations had been in attendance. The company has a strong policy statement on safety that states "We will not take shortcuts when it comes to safety". The policy also profiles that:

- *Safety is our first priority*
- *All injuries can be prevented*
- *Working safely is everyone's responsibility and a condition of employment*
- *Safety observations are a must*
- *Our work is never so urgent or important that we don't have time to do it safely.*

This policy, signed by the Chief Executive Officer, provides a strong safety commitment by senior management. It is the basis for a progressive and robust safety culture.

The company had their safety management systems in place since 1994, a system provided by Det Norske Veritas (DNV) (global provider of services for managing risk). This was replaced in 1999 by a 20-point system. They were working with DuPont towards ongoing improvements to their system. Appropriate parts of the company are ISO-accredited.

Their principal safety concerns were in the area of employment safety in workplace OH&S, and their systems have been developed to concentrate on this. The Safety Management Plan (2004) describes the system. Each

member of the OH&S Branch was given elements of the plan to review and continually improve. Part of this work was addressing the issue of contract management.

The company was therefore an experienced user of safety management systems but their systems tended to be internally- and OH&S- focused. They also had the elements of a safety culture in place. When contractors were employed, they may or may not have been required to have safety management systems. This was very different from requiring that a system be in place that provides an equivalent level of rigor to the risk management and safety assurance provided by the company's internal systems.

10.2.3 Response to the Accident

Immediately following the accident, the power supply company (the company) acted to:

- Suspend all helicopter inspections

- Appoint an internal investigation team to:
  - investigate and report on matters relating to the accident
  - make recommendations in relation to the resumption of helicopter inspections

- Appoint an aviation risk management consultant to assist the internal investigation team.

During its investigation, the internal investigation team provided the company's employees with regular updates regarding the progress of the investigation and the planning for the resumption of helicopter inspections. This included using staff newsletters and targeted briefing sessions for those employees that were normally engaged in aerial surveillance work.

In its Report, the internal investigation team made a number of recommendations, some of which required action prior to the resumption of helicopter inspections. In response, the company invoked a number of safety actions prior to resuming helicopter powerline inspections on 21

August 2006. Subsequently, a number of additional safety actions have and continue to be actioned by the company.

10.2.3.1 Risk assessment of the conduct of helicopter inspections

The company engaged an aviation risk management consultant to develop and assist with the implementation of Task/Risk Profiles and Operational Risk Plans. Those profiles and plans were intended for application in the five task categories for which the company conducts helicopter inspections. The content of the Operational Risk Plans included: the conduct of helicopter maintenance and refuelling; communication requirements affecting the conduct of aerial inspections; pre-flight briefing requirements; the identification and recording of hazards; the assessment of relevant risks; the applicability and use of personal protective equipment (PPE); training requirements in support of the aerial inspection task; the requirement for and conduct of audits; the management of helicopter service providers; and airborne procedures for application during the conduct of aerial inspections.

In addition, the Operational Risk Plans required the conduct of 'reconnaissance flights' prior to the conduct of aerial line inspections in order to identify and assess risks and hazards applicable to the planned inspections. Criteria have been developed for application during the consideration of whether a reconnaissance flight is required prior to an inspection.

10.2.3.2 Risk assessment of the operator

The aviation risk management consultant was also tasked to audit the contracted helicopter service provider's (the operator's) operations. Those audits included a review of the operator's Operations Manual.

Subsequent to the completion of the follow-up audit, the aviation risk management consultant recommended the resumption of helicopter inspections. The operator underwent an additional audit on the day on which helicopter inspections resumed.

10.2.3.3 Risk assessment affecting the use of PPE

The company also engaged the aviation risk management consultant to conduct a risk assessment of the relevant PPE for consideration for use during aerial inspections. That included the consideration of the relevance of the use of helmets and fire-resistant gloves and suits during inspections, and the circumstances in which such PPE, if adopted, should be used. Company employees that were involved in the conduct of aerial inspections were consulted during the risk assessment, and PPE suppliers provided exemplar equipment for examination by those employees as part of that process.

As a result of the risk assessment, and in consultation with the relevant employees, the company directed that all employees engaged in the conduct of aerial inspections must wear:

- Fire-retardant flying suits and gloves

- An appropriate helmet that included a visor and communications system. Employees were permitted to try a range of helmets and, based on the results of those trials, orders will be placed for the delivery of individually-fitted helmets.

There were also amendments to company policy. This resulted in the development of a Helicopter Operations Manual, which consolidated the company's policies.

10.2.3.4 General training - Employee Workshop

A training workshop was carried out on 18 July 2006 that involved all company employees engaged in the conduct of aerial surveillance and inspection work. During that workshop, the employees were provided with, among other things, information, instruction and training in the:

- Lessons learned from the accident at St Albans

- Requirements for, and use and care of employees' PPE

- Helicopter Operations Manual, including the explanation of the implications of the amended policies affecting the conduct of helicopter inspections

- Content and effect of the Task/risk Profiles and Operational Risk Plans

- Application of the company's risk assessment policies to the aerial inspection task

- Specific training - Crew Resource Management.

The aviation risk management consultants were also engaged to deliver a number of Crew Resource Management (CRM) workshops to the company's employees who could expect to be involved in aerial surveillance and inspection work. That training addressed the risks, human factors and crew coordination issues affecting crews during the conduct of helicopter operations. In addition, the company has mandated an annual CRM currency requirement for relevant employees.

Further still - prior to the resumption of helicopter inspections, the company negotiated an amended interim contract with the operator. That contract was based on the Task Risk Profiles and Operational Risk Plans.

10.2.3.5 Safety actions implemented shortly after the resumption of flights

Formal performance review and audit of the operator

One week after the resumption of helicopter inspections, the aviation risk management consultant conducted a formal audit and review of the operator's performance. Follow-on audits and performance reviews of the operator's performance were carried out three weeks after the recommencement of aerial inspections and at the end of October 2006.

The aviation risk management consultant assisted in the preparation of the 'Request for Tender', and will also be involved in assessing the tender submissions from prospective helicopter service providers.

Continued involvement of the aviation risk management consultants

The aviation risk management consultant has been retained by the company in support of any decisions affecting the use of helicopters for aerial surveillance/inspection.

10.2.3.6 Sharing lessons with the Industry

The company coordinated the development of an Industry Forum that was held on 18 August 2006. That forum was attended by other power supply companies and industry bodies from throughout Australia. At the forum, the company presented the lessons learnt as a result of the accident, and encouraged the establishment of industry standards and a uniform industry approach to the conduct of aerial surveillance/inspections.

Following the forum, a second power supply company invited the company to make a similar presentation to the second power supply company's staff. As a result of that presentation, the second power supply company has modified some of its existing aerial surveillance/inspection procedures.

10.2.4 Conclusion

The energy company had a well established safety management system and a safety culture, but still the accident happened. The problems of managing safety and safety culture when third parties are contracted are highlighted by this example. There is nothing to suggest that the helicopter company was "unsafe" but the internal culture was not the same as in the energy company.

The actions of the company after the accident highlight its safety culture through the immediate suspension of operations and the instigation of a "no holds barred" investigation. It immediately acquired expert help and involved employees in the investigation. They were kept fully informed and recommendations and training were immediately implemented. They further moved to share their lessons with others in the industry.

That an accident occurred is always a tragedy; however, the actions of the company, based on the attitudes of a robust safety culture, allowed

operations to be resumed as soon as possible. In addition, the actions sent strong messages to employees and minimised the risk of a recurrence throughout the industry.

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REPORT FOR THE
OFFSHORE HELICOPTER SAFETY INQUIRY

REPORT No: SC176

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1.0 INTRODUCTION

1.1 Background

Dr Susan Coleshaw was approached by Commissioner Wells, to prepare a report covering a number of 'Issues for Consideration' relating to the Offshore Helicopter Safety Inquiry, posted 2010-03-24. Four of these issues, relating to personal protective equipment, research into the prevention of inversion of helicopters, offshore helicopter safety training and personal accountability have been considered and are discussed in the report herein.

The views expressed in this report represent the professional opinion of the author, unless otherwise stated. They are based primarily on experience of helicopter safety relating to the UK offshore industry, and to a lesser extent on worldwide operations.

1.2 Credentials of SRK Coleshaw

Susan Coleshaw is an independent research consultant working in the field of marine, offshore and aviation safety. With a background in human applied physiology, she has considerable experience in immersion hypothermia, cold water survival, helicopter underwater escape and personal protective equipment. She is a Fellow of the Institute of Ergonomics and Human Factors. Clients include the UK Civil Aviation Authority (CAA), UK Health and Safety Executive, Oil & Gas UK; numerous oil and gas operators such as Shell UK, BP, Marathon, and Talisman; OPITO; and a number of equipment manufacturers including Shark, Survival-One and Viking.

With a background in human and applied physiology, she has a BSc in Physiology from the University of Leeds, and a PhD from the University of London covering thermal problems in divers, immersion hypothermia and mental performance at low body temperatures. After 10 years in an academic environment working in the field of thermal physiology she moved to the RGIT Survival Centre in Aberdeen (now a division of Petrofac Training), where she remained until 2000. There she was

responsible for research and consultancy in various aspects of offshore safety, and managed a test laboratory assessing lifejackets, immersion suits and other safety equipment.

Susan Coleshaw is actively involved in the development of technical standards for lifejackets, immersion suits and other safety equipment for small craft. She is Chairman of the BSI Technical Committee responsible for buoyancy garments (PH3/6) and attends the European and International mirror committees (CEN TC 162/WG6 and ISO TC 188/WG14) as UK principal expert. She is currently working on a project to develop a technical standard for helicopter emergency breathing systems on behalf of the UK Civil Aviation Authority (CAA).

2.0 WHAT PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING IS NECESSARY FOR HELICOPTER PASSENGERS AND PILOTS; WHAT ARE THE STANDARDS AND SHOULD THE C-NLOPB REQUIRE GUIDELINES TO ENSURE SUCH EQUIPMENT IS PROPERLY FITTED?

2.1 The need for personal protective equipment

In general, helicopter crew and passengers flying over water in hostile environments, where sea temperatures can be very cold and sea states severe, need a range of personal protective equipment to protect them in the event of a water impact accident.

Following impact, the first hazard will be the temperature of the water. In water temperatures below 15˚C the use of an insulated immersion suit will help to protect the wearer from both cold shock and the longer term effects of cold water immersion that can lead to the development of hypothermia. Cold shock is a reflex response to a sudden decrease in skin temperature. It is characterised by an initial gasp and an inability to control breathing during the first few minutes of immersion in cold water. When faced with the need to undertake underwater escape from a capsized helicopter, it becomes very difficult to breath-hold for sufficient time to complete the escape process. Risk of drowning is high as a result. Emergency breathing systems (EBS) provide a means of mitigating this problem,

extending the time that can be spent underwater, and allowing users to overcome any problems that might slow the process of escape.

On escaping from the helicopter, the occupant will be exposed to waves and wind. Buoyancy, either supplied as part of the suit or through the use of a lifejacket, is used to support the head of the wearer in the water, keeping the airways above the water surface and thus reducing the risk of drowning. Spray hoods play a vital role in further protecting the airways from breaking waves.

As time in the water progresses, peripheral tissues will gradually cool. Manual dexterity will be quickly lost, particularly if gloves are not worn, making it difficult for the individual to help themselves in the rescue and recovery process. The limbs cool and fatigue quickly. There are many cases of even good swimmers, who are not supported by buoyancy, drowning before reaching safety. It is thought that 'swim failure' may be due to an inability to coordinate an increased breathing rate (due to the cold) with the swimming stroke (Golden & Tipton, 2002). The chance of taking in water increases, and swimming becomes inefficient. In trying to keep the head above water, the individual tends to swim with a more upright posture, which increases the sinking force, and makes it yet more difficult for the individual to swim and stay afloat. Rapidly cooling muscles and fatigue will add to the problems of coordinating breathing. Without the buoyancy provided by an immersion suit or suit and lifejacket system, drowning could result long before the onset of hypothermia.

Hypothermia, defined as a decrease in deep body temperature to below 35°C, will develop with time in cold water. Body temperature decreases when heat loss to the environment exceeds metabolic heat production. The insulation of an immersion suit will reduce heat loss and thus delay the onset of hypothermia. The insulation is provided by air trapped in the thermal lining and clothing worn under the suit. Good thermal performance of an immersion suit will depend upon the suit being correctly sealed. Water leaking or flooding into the suit will wet the thermal lining and clothing, greatly reducing the insulative value of the suit. Without the protection of an immersion suit, some individuals would develop hypothermia within the first hour of immersion in very cold water, and the risk of drowning would be greatly increased in all.

In recent years, helicopter crews and passengers have been equipped with personal locator beacons (PLBs). Following escape from the helicopter, survivors will attempt to board a liferaft. This can prove difficult, particularly in high sea states, whilst there have been many accidents where the liferafts are damaged or fail to deploy. In these circumstances survivors left in the water often drift apart, and may drift some distance from the accident site. In these circumstances, PLBs allow the rescue services to home in and locate the individual.

2.2 Immersion suit performance

Helicopter immersion suits are designed to protect the wearer both from cold shock and from hypothermia. The level of protection from cold shock will be dependent upon the area of skin covered, preventing rapid cooling of the skin. Protection from hypothermia will be dependent upon the level of insulation provided by the suit system. When assessing the level of insulation needed in a suit system, the decision should be based on the water temperatures that might be experienced in use, as well as a consideration of the likely time needed to locate and recover the last person from the water in the event of an accident.

Insulation is primarily provided by air trapped in a clothing system. Air can be trapped within the fabric and between layers within the clothing. The insulation of suit fabric is generally related to thickness; if the fabric is compressed, insulation will be reduced. On immersion in water, trapped air will be forced out of a suit due to hydrostatic forces. By forcing out this air, insulation will be reduced. This is also a time when some water can leak into the suit due to the seals being broken by the escaping air. (One-way valves can be used to mitigate this problem, although faulty valves can also be a source of minor leakage).

Maximum insulation is achieved if the suit and clothing remain dry. The ingress of water into a suit will result in a decrease in the amount of insulation provided, with a wet trunk being much more critical than wet limbs. Work by Tipton (1997) demonstrated that a 500ml leak of water in the trunk area produced a 30% reduction in clothing insulation. A 200g leak did not affect rates of body cooling whereas a leakage of 500g of water into a suit increased body cooling.

Whilst it is possible to measure the insulation of a suit, it is difficult to control the level of clothing worn under the suit, and hence to know the total insulation of the suit and clothing system. In the UK offshore sector, operators have summer and winter clothing policies where they advise on and check the numbers of layers of clothing worn under the suit.

It has been said that insulation is primarily provided by trapped air. Thus, the more air trapped in the suit, the warmer the suit will be and the higher the level of thermal protection provided in the event of cold water immersion. Indeed, on reaching the water surface after submersion it may be advantageous to allow air back into the suit (to replace the air that was squeezed out when underwater). However, the trapped air that is beneficial for thermal protection has a very adverse effect when it comes to escape from a submerged helicopter. Any air trapped in the suit will provide buoyancy. If the helicopter sinks in the upright position, then the body will tend to float up towards the surface on release of the seat harness, making it more difficult to escape. The occupant may have to pull themselves down to an exit or escape window in order to escape. Conversely, if the helicopter capsizes, the occupant will be forced back into their seat by the upwards buoyant force, and float up as soon as the harness is released. Again the occupant will need to pull down to reach the exit. Following the inversion caused by capsize, helicopter occupants commonly feel very disorientated, making it much more difficult to find the exit, particularly if it is dark. Thus, the more air is trapped in the suit, the higher the buoyancy and the harder it may be to escape.

There is therefore a conflict and a balance to be made between the amount of insulation (thermal protection) provided and the inherent buoyancy of the suit which can cause problems during helicopter underwater escape. Manufacturers are currently looking at innovative technologies such as phase change materials that may allow the same level of thermal protection with thinner, less bulky materials. At the current time the benefits of such technology are limited, but improvements may be made in the future. In the meantime, training should be used to familiarise passengers and crew with the problems of buoyancy during escape.

The buoyancy of the suit will not only be affected by the fabric used to provide insulation, but also the fit of the suit and the size of the suit. A

large suit, using more fabric, will have higher inherent buoyancy than a smaller sized suit. The overall buoyancy of the suit when worn will depend on the amount of air trapped in the suit, which will be a function both of size and fit. A well fitting suit will trap much less air than a poorly fitting loose or over-sized suit. Conversely, there is also a case to suggest that a large individual will be better able to cope with a given absolute level of buoyancy than a small individual.

The fit of the suit will itself depend on a number of factors:

- The range and number of sizes supplied - the more sizes, the greater the probability of achieving a good fit.

- Body shape - suit sizing tends to be based on height and chest size; these are likely to fit a person of average build better than a person who fits the average proportions less well.

- Whether the correct size of suit is selected - who decides which size shall be selected and how is this monitored?

It is therefore concluded that, if the buoyancy problem is to be reduced to a minimum it is important that helicopter suits are well fitted to the individual, limiting the air that can be trapped. Measures to check that the correct size of suit was being worn by each passenger would also be beneficial.

A further conflict exists between the level of insulation provided to protect the individual in the event of cold water immersion and the degree of thermal comfort that can be achieved in the helicopter cabin. Helicopter cabins can get very warm during summer months, at times when sea temperatures are still very cold. Helicopter suits of the type used by the Canadian offshore industry are warm under normal cabin conditions due to the high level of insulation. If the suits were worn fully deployed, with the hoods and zips up, there is no doubt that the wearers would feel very uncomfortable at times and could be exposed to a degree of thermal stress. The suits, with a central zip and face seal are therefore normally worn with the hood down and zip undone, allowing air to circulate. In the event of an emergency, the hood must be donned and the zip pulled right up to seal

the suit. There are also double seals at the wrist cuff that must be adjusted. If there is some warning of an emergency, the occupants will have time to carry out this action. They may or may not do this effectively in the panic that could ensue. However, there are other scenarios where the occupant will have no warning and little or no time to seal the suit. This could lead to the suit being flooded with water on immersion, and much of the thermal insulation of the suit being lost.

The design of helicopter suits worn in the UK sector of the North Sea was changed following the water impact accident close to the Cormorant Alpha platform in 1992. At that time, passengers wore a suit with central zip and neck seal. Whilst most of the passengers were reported to have managed to don their hoods and zip up the suit to "at least 3 inches from the top", one of the non-survivors was found with his suit partially unzipped and had taken in a considerable amount of water (AAIB, 1993). When the RAF Institute of Aviation Medicine investigated the suit leakage (Appendix J of AAIB, 1993) they recorded that some of the survivors had later said that they had been in the water with their immersion suits partially unzipped, although they had not been aware of leakage. Rescuers also described finding bodies with their suits partially undone and full of water. Tests were undertaken to measure water leakage into a partially unzipped suit. Over 20 minutes, 17 litres of water leaked into the suit, compared to just over 500ml in the zipped up suit. The authors stated "it is pointless providing a person with a watertight immersion suit, if at the time of immersion it is not properly sealed". They also pointed out that large amounts of water in the suit would increase initial cold shock, would hinder attempts at climbing into a liferaft as well as destroying the insulation of the clothing worn under the suit.

Following the Cormorant Alpha accident, the design of helicopter suits used by the UK offshore industry changed to incorporate a bellows neck seal, with an across chest zip that was done up and sealed at all times during flight. The only action that must now be taken in an emergency, in relation to the suit, is to don the separate suit hood.

One further issue is worth consideration in relation to these interconnecting issues. When a suit is fully donned and sealed it is recommended that the suit be vented to remove as much air as possible

from the suit. If the suit is fully donned before flight this can be done by crouching down, squeezing air out of the suit, while releasing the seal. This will help to limit the buoyancy problem that can be experienced during underwater escape. If a suit is worn with the hood off and zip partially undone, and is only fully donned in an emergency, it is likely that excess air will be left in the suit.

To overcome these problems, careful consideration must be given to the level of thermal protection provided in the suit and balance this with what are considered to be acceptable levels of buoyancy. Whilst both escape from the submerged helicopter and protection from the cold water are both critical, the policy of flying with the suit unzipped means there may be some cases where the insulation of the suit is greatly reduced due to water ingress. There is no obvious solution to this problem meaning that compromises must be made.

2.3 Immersion suit standards

A number of standards have been written for helicopter immersion suits:

- CAA (1991) – CAA Specification No 19: Helicopter crew members immersion suits.

- CGSB (1999) Helicopter passenger transportation suit systems. CAN/CGSB-65.17.99.

- EASA (2006) European Technical Standard Order. Helicopter crew and passenger integrated immersion suits. ETSO-2C502.

- EASA (2006) European Technical Standard Order. Helicopter crew and passenger immersion suits for operations to or from helidecks located in a hostile sea area. ETSO-2C503.

Reference may also be made to the international standard for constant wear immersion suits:

- ISO 15027-1 : 2002 *Immersion suits — Part 1: Constant wear suits, requirements including safety;*

- ISO 15027-3 : 2002 *Immersion suits — Part 3: Test methods.*

CAA Specification 19 has now been superseded by ETSO-2C503, but the approvals of suits meeting this standard are still valid. Most of the suits currently in use in the UK sector of the North Sea are approved to CAA Spec 19. Several new designs of suit have now been developed by European manufacturers, meeting the new ETSO standards.

Insulation

CAA Spec 19 did not include a requirement for thermal protection as such. Its scope covered dry coverall types of suit that are designed to keep the wearer dry, relying on the clothing worn underneath to provide insulation. Water leakage was assessed (see below). Information was provided regarding the thermal performance that can be expected if a standard range of clothing is worn under an approved suit. The standard did call for 2 Clo of insulation in the hood.

The ETSO states that helicopter suits approved to this standard shall provide the user with thermal protection to meet a Class B suit tested to para 3.8 of EN ISO 15027-3:2002. This involves 4 hours immersion in water < 2˚C. This was considered to be equivalent to insulation of 0.5 immersed Clo.

This compares to the Canadian standard that requires 0.75 immersed Clo of insulation if measured using a manikin or, a 6-hour test in water at 0-2˚C if conducting tests with human subjects. This higher minimum requirement for insulation reflects the colder average sea temperatures off the eastern seaboard of Canada in relation to average sea temperatures experienced in European waters. Immersion suits developed in Norway tend to have a higher insulation than those developed in the UK, again due to differences in average sea temperatures.

The measurement of thermal protection in immersion suits is currently under review by an ad hoc group of the ISO (International Standards

Organisation) committee responsible for immersion suits. Consideration is being given to requirements and methodology, the reproducibility of thermal manikin measurements and their correlation with data from human subject studies.

Leakage

Water leakage is a test normally included in suit standards, particularly for suits classified as 'dry' suits, with the test methods varying dependent upon the likely use of the suit. Methods include measuring leakage following a feet-first jump into water, or following a period of swimming. The European standards for helicopter crew and passenger suits (ETSO-2C502 and ETSO-2C503) allow maximum water ingress of 200g, as did CAA Spec 19.

The Canadian standard includes a measurement of leakage for dry suit systems within the thermal protection test, involving a jump into water and 60-minute swim. The measured leakage is introduced into the suit before the thermal protection test.

Buoyancy

The effects of buoyancy are measured both by checking that test subjects can escape from a helicopter underwater escape simulator (HUET), and by specific measurements of the buoyancy due to air trapped within the suit and clothing system.

ETSO-2C502 states that the maximum trapped buoyancy of a suit and recommended clothing, with the suit fully vented, shall be no more than 150N. The figure in CAA Spec 19 was 15 kg, equivalent to 147N.

In the Canadian standard it is stated that the maximum escape buoyancy shall be no more than 175N. It is understood that this higher value was allowed to assist helicopter suit manufacturers meet the thermal insulation requirements of the Canadian standard, this being $0.116^{\circ}C.m^2.W^{-1}$ / 0.75 Clo (see Brooks, 2003). This is explained by the problems described in the previous section of this report.

Previous work investigating the amount of buoyancy that would permit or prevent escape showed that trained divers failed to escape through a simulated helicopter exit with added buoyancy levels varying between 173 N and 267 N (Brooks & Provencher, 1984). However, a group of non-divers found escape more difficult, with escape failures occurring between 98 N and 178 N. A number of possible reasons for the poorer performance were given including shorter arm reach and less upper body strength.

In follow-up trials (Brooks 1987, Brooks 1988) undertaken using a helicopter underwater escape training simulator, 12 mixed gender naïve subjects wearing a specially designed immersion suit with 134 N buoyancy were all able to escape from an inverted helicopter simulator, from a seat in the centre of the cabin and 20 cm in front of an unoccupied cabin window seat. The exit measured 51 cm by 66 cm. The author concluded at this time that inherent buoyancy in crew/passenger immersion suit systems should not exceed 146N.

It is understood that the level of added buoyancy is currently under review by the CGSB committee. A reduction in buoyancy would most likely mean the development of less bulky suits with less trapped air, and could compromise the level of thermal protection provided.

2.4 Buoyancy equipment

Different strategies are used in different sectors of the offshore industry with respect to the provision of buoyancy to support the head of the wearer and reduce the risk of drowning. The Canadian and Norwegian sectors provide suits that have sufficient buoyancy to provide flotation, with an integral additional inflatable buoyancy element to further support the head. In the Canadian standard a minimum flotation buoyancy of 156N is currently required (CGSB, 1999). It is understood that spray hood performance, to protect the airways and further reduce the risk of drowning, is provided in CAN/CGSB-65.16-2005 'Immersion suit systems' (CGSB, 2005). The suit system must provide a stable floating position i.e. once the user is floating on their back, it must be easy for them to stay in that position.

In the UK offshore industry, a separate lifejacket is worn over the helicopter suit. This is a manually operated inflatable jacket. Once the user has escaped from the helicopter they are required to pull a tag to inflate the jacket. An oral inflation backup is provided. CAA Specification 5 (CAA, 1979) required an aviation lifejacket to have a minimum buoyancy of 16 kg (157N), and capability to turn the unconscious wearer to a face-up position. Later requirements were brought in to ensure compatibility between helicopter suits and any lifejacket worn with them.

The European standards cover both options. ETSO-2C502 covers helicopter suits which incorporate the functionality of a lifejacket. The wearer must be able to turn themselves from a face-down into a stable face-up position. ETSO-2C504 covers helicopter constant wear lifejackets. This standard requires the lifejacket to turn an unconscious wearer from a face-down into a stable face-up position. No minimum buoyancy value is stipulated; buoyancy must be sufficient to support the wearer in the required floating position. A spray hood is required.

The overall performance requirements for flotation are thus similar in Canada and Europe.

2.5 Emergency breathing systems (EBS)

2.5.1 EBS performance

It has been recognised for some years that the time needed to escape from a submerged or capsized helicopter, estimated to be 45 to 60 seconds in a real accident, exceeds the time that most individuals can breath-hold in cold water due to the effects of cold shock. In subjects wearing helicopter suits, immersed in water colder than 10˚C, mean breath-hold time is likely to be close to 20 seconds, but can be as little as 10 seconds in some individuals (Tipton and Vincent, 1989, Tipton et al, 1995, Tipton et al, 1997). This would allow very little time for an individual to escape from a capsized helicopter. Maximum breath-hold time is therefore a limiting factor in the survival of the individual. EBS provide a means of extending the time that can be spent underwater, and thus a means of increasing the

probability of making a successful underwater escape in water impact incidents.

The effectiveness of EBS will to some extent be dependent upon the type of water impact that occurs. In a controlled ditching, the crew and passengers will have some warning of the impending alighting on water, and therefore have some time and opportunity at least to think through the escape process and prepare for impact. In sea states up to 4 or 5 there is a reasonable chance that the helicopter will remain afloat for long enough for occupants to be evacuated from the cabin. However, in controlled ditchings, relatively few lives are lost and the incidence of drowning is low, despite the helicopter inverting immediately of sinking in at least 24% of cases (Clifford, 1996). Given the low incidence of drowning, the benefits of EBS may be limited to incidents occurring in the higher sea states. In this situation, EBS users will have the best chance of having time to deploy the equipment if the need arises.

In vertical descents with limited control, there is likely to be a little warning, and less time to prepare than might be expected in a controlled ditching. In these situations, fatality rates are much higher, and the majority are due to drowning. Clifford's data shows that inversion occurred immediately in about 60% of cases. The incidence of drowning increased further with fly-in accidents. In these accidents there would be no warning and it can be assumed that in many cases the cabin would rapidly flood. Time to deploy an EBS could be very limited in this situation. The ability to deploy underwater would then be an advantage.

The last category of water impact described by Clifford related to uncontrolled impacts with high impact forces. Fatalities due to impact injuries predominated over drowning in this group. It must be questioned how many occupants would manage to deploy and use EBS in this type of accident.

To be effective in these circumstances, EBS must be easy to use under emergency conditions, must be quick to deploy, must be compatible with other equipment and must not impair the normal escape process (see Coleshaw, 2003). When this is achieved, EBS may reduce the level of panic experienced, increasing the likelihood of a successful escape.

Successful deployment would allow the user additional time to complete a number of complex actions which must or may have to be undertaken in the process of escape:

- overcome disorientation;
- release the seat harness - particularly if the harness jams or snags;
- locate an exit - allowing time to cross the cabin if the nearest exit route is blocked;
- jettison an exit - operate a handle, remove window rip cord if present, push out window;
- escape through exit - overcoming any snagging;
- overcome impact injuries which would slow but not prevent escape.

The ability to deploy the EBS with one hand would allow the occupant to keep one hand locating the nearest exit. Two hands could be used as long as the harness is still secured, but the user would need time to relocate the nearest exit once deployment was completed. Once the harness is released, both hands will be needed to maintain a grip on the escape route, bearing in mind that buoyancy problems may be experienced.

EBS are likely to be of little or no benefit to individuals who are seriously injured by impact with the water, particularly serious head and facial injuries or hand/arm injuries incurred as a result of flailing, both of which would prevent deployment.

Three generic designs of EBS have been developed for helicopter underwater escape; compressed air devices (being introduced for the Canadian offshore workforce, and favoured by the military), rebreather systems (used by the Norwegian offshore workforce) and a hybrid system consisting of a rebreather bag with a small cylinder of additional air (used by the UK offshore workforce). All tend to be carried in a pouch or

pocket, which may be fitted to the lifejacket or suit. In all cases, it is important that it is easy to open this pouch and remove the EBS.

Compressed air systems tend to be relatively simple to deploy, with air on demand. They have the disadvantage that once deployed, the air supply is starting to run out, so they should only be deployed just before submersion. A big advantage is that, with training on purging techniques, they can be deployed underwater. Rebreather systems must be activated once the mouthpiece is in place. This is an additional task compared to the compressed air device, but it has the advantage that, if time allows, the user can deploy the mouthpiece in advance, breathing to the atmosphere, and only switch to breathing to the counterlung just before submersion. Some rebreathers have been designed with automatic activation, opening the system to allow breathing from the counterlung when immersed. This simplifies deployment, but has the disadvantage that if not deployed before submersion, the system will be open to the water, making successful underwater deployment very unlikely. In general, most rebreathers have been designed for the scenario where there is time to deploy before submersion, whereas compressed air systems have the capability for underwater deployment. The hybrid system used in the UK was originally designed for the controlled ditching scenario. However, with manual activation, it is possible to purge water from the system during underwater deployment, before switching to breathe to the bag. The additional air means that the user has sufficient air to breathe from the counterlung. Thus, though not designed for this purpose, underwater deployment is possible.

With compressed air systems, including the hybrid EBS, there is a very small risk of barotrauma injuries if the user holds their breath during ascent to the surface. This is only of concern during training, with many hundreds of personnel trained in a year. Some authorities regard compressed air EBS as mini diving equipment, meaning that specific requirements may be imposed in relation to medicals.

When introducing EBS it is important to make certain that the benefits outweigh any disadvantages, to ensure that there is an overall improvement in safety.

2.5.2 Standards for EBS

As far as is known, there is no published technical standard for helicopter emergency breathing systems.

The OLF's "Recommended Guidelines Relating to Requirement Specifications for Survival Suits for Use on the Norwegian Continental Shelf" (OLF, 2004) requires a breathing aid as one of the components in their integrated survival suit. The system is required to extend the time that can be spent underwater when compared to the individual's capacity to hold his/her breath. A number of further requirements are made:

- The breathing system must be compatible with the survival suit and must not reduce the suit's efficiency.

- The breathing system shall be automatically activated when submerged.

- The breathing system shall provide sufficient air supply for 60 seconds of breathing time at a depth of $\leq$ 2m and at an activity level corresponding to 40% of maximum aerobic capacity of a person weighing 90 kg.

- It is mandatory that all suit users undergo training in how to use the breathing system. It is a further requirement that none of the breathing systems that become used requires training beyond the standard training for breathing systems.

- It shall be possible to activate the breathing system by one single operation using one hand.

In 2003, a review of the implementation and use of various types of EBS identified the need for a technical standard to ensure that minimum acceptable levels of performance and health and safety standards were met (Coleshaw, 2003). As a result an "Example Draft Technical Standard for Helicopter Emergency Breathing Systems" was published as an appendix

to this CAA report. The draft technical standard contained a number of suggested requirements:

- Limits for work of breathing, respiratory pressure and hydrostatic imbalance;
- Deployment using one hand only;
- Use whilst manoeuvring in different orientations;
- Deployment and use during a helicopter underwater escape exercise - assessment of snagging hazards and compatibility with other equipment;
- Maximum additional buoyancy (applicable to hybrid systems);
- Cold water performance.

At the time of publication, the UK CAA decided not to produce a formal specification as they considered that there was no compelling case to mandate the use of EBS, and it was not normal practise to produce a formal specification for non-mandated equipment. However, use of EBS is seen by the UK CAA as a short-term solution to the problem of post-capsize survival, pending availability of the side-floating helicopter scheme (see section 3.2.5). As a result, work was commissioned in 2008 to complete the technical standard, filling gaps in the requirements and investigating areas where there was insufficient published data to allow performance criteria to be set. This study has considered issues such as speed of deployment, underwater deployment and performance in cold water. Deployment trials demonstrated the benefits of a simple system, where the mouthpiece could be located easily and without error. When stored in a pouch, it must be easy to remove the EBS. Nose clips were beneficial, but could be 'fiddly' to put on. (In a real situation, the nose clip could be deployed once first breath from the EBS had been achieved). Cold water trials demonstrated reduced endurance, with high variability between individuals. The results of the trials are currently being analysed

to allow test requirements and methods to be further developed. The revised standard will then go through a consultation process, with the work due for completion later in 2010. The technical standard will be published in the public domain for the industry to use on a voluntary basis, and will be offered to EASA for adoption as an ETSO (see section 3.2.4).

2.6 Personal locator beacons

Personal locator beacons (PLB) have recently been provided to helicopter passengers as an additional aid to location, in addition to the use of retroreflective tape and lights on the suit or lifejacket. PLBs are radio beacons used to alert the emergency search and rescue (SAR) services and allow both aircraft and marine vessels to home in and locate those in distress. PLBs carried on helicopters generally transmit on two frequencies; 406 MHz and/or 121.5 MHz. Beacons using the 406 MHz frequency send out a distress signal which is picked up and can be uniquely identified by satellite, providing information about the location of the beacon. The 121.5 MHz frequency is used for homing, allowing SAR aircraft and surface vessels to come to the aid of the aircraft or personnel.

All helicopters operating offshore in the UK offshore sector are equipped with at least one emergency location transmitter. Each helicopter liferaft also has a beacon operated manually by the occupants in the liferaft. Helicopter pilots and co-pilots all carry a PLB which transmits on 406 and 121.5 MHz. By mid 2010, all passengers will carry a PLB that transmits on 121.5 MHz only. All crew and passenger PLBs can be activated automatically or manually when submerged in water. The PLB models carried by passengers in the UK sector are turned off once the passenger reaches the liferaft to reduce the number of transmitting beacons, improving the likelihood that those remaining in the water will be located.

3.0 SHOULD THE C-NLOPB MORE DIRECTLY INVOLVE ITSELF IN STUDIES AND RESEARCH INTO THE PREVENTION OF INVERSION OF DITCHED HELICOPTERS AND ENHANCEMENT OF PASSENGERS' ABILITY TO ESCAPE?

3.1 The need for helicopter flotation systems

Whilst considerable consideration has been given to the use of personal protective equipment (PPE) such as survival suits and EBS, the provision and use of PPE should always be the last step in the risk reduction process. The first consideration should be to reduce the risk of exposure, in this case to the hostile environment.

Whilst it is almost inevitable that occupants will be immersed in cold water in the event of a helicopter water impact, means of keeping the helicopter afloat and upright will reduce the risk of occupants being submerged and having to make an underwater escape. In so doing, the risks of cold shock and drowning should be greatly reduced. Thus, whilst there will still be a need to use an immersion suit to provide thermal protection, the likelihood of needing to use EBS for underwater escape could be reduced.

The need for a helicopter to remain stable and upright on the water following ditching is thus fundamental when considering the probability of passengers and crew successfully evacuating from the helicopter. Over the years many reports have suggested that improvements to the flotation system are needed to achieve improvements in occupant survivability (e.g. CAA, 1984; Chen et al, 1993; Benham, Redman & Haywood, 1995; Clifford, 1996). Following a review of helicopter ditchings and water impacts published in 1993, Chen et al concluded that "flotation equipment performance was generally found to be inadequate in keeping the rotorcraft upright and afloat, in both ditchings and water impacts".

With an effective flotation system, in a ditching situation in calm seas, it should be possible for the helicopter to stay upright. (N.B. A ditching is defined as a controlled landing on water). In the best case situation,

occupants are able to use the emergency exits and transfer into liferafts, without any prolonged immersion in cold water. The longer the helicopter stays upright, the greater the chance that occupants can safely evacuate into a liferaft. It has been estimated that the helicopter must remain afloat and upright for about 5 minutes to allow all occupants to escape.

That said, even following a controlled ditching, there are conditions where the helicopter will invert after a variable period of time. This is due to helicopters being top-heavy, with a high centre of gravity. Certain conditions will increase the likelihood of capsize. Sea state is a critical factor. In some areas of the North Sea, helicopters need to have ditching capability in conditions up to Sea State 6 (with significant wave heights of 4 to 6m) to minimise the risk of capsize in the event of a ditching at any random time during the year (winter months generally being most critical). Steep, breaking waves pose the highest risk for capsize, which can be exacerbated by the risk of a rotor strike.

If the helicopter does capsize either immediately or a little time after a controlled ditching, an undamaged flotation system should ensure that the helicopter at least stays afloat despite being inverted. In this situation, any occupants within the helicopter will be forced to make an underwater escape. Likelihood of survival is reduced further if damage causes the flotation to fail, with the helicopter then sinking. It goes without saying that escape will be much more difficult if the helicopter sinks below the water surface. The provision of effective and undamaged flotation systems is thus essential if occupants are to have a reasonable chance of survival.

In a controlled ditching where the helicopter remains afloat, the risk of drowning is relatively low (Clifford 1996). Survival probability will be greatly reduced in the event that the helicopter inverts or sinks; accident data demonstrate that this occurs in about 60% of all water impacts (Rice & Greear, 1973; Brooks, 1989; Clifford 1996). Clifford reported that drowning accounted for more than 50% of the fatalities in accidents where cause of death was known. He considered that this reflected the scale of post crash survival problems. Improvements to flotation systems could help to reduce this high incidence of drowning.

A recent review demonstrated a significant positive relationship between the presence of flotation systems and the helicopter staying on the water surface, and a relationship between the helicopter staying on the water surface and occupant survivability (Taber and McCabe, 2007). The study failed to show a relationship between installation of flotation devices and occupant survivability. This may reflect a need to improve flotation systems.

As previously mentioned, the term ditching is used to describe the situation where there is still some control of the landing. In many water impacts, there is only limited or no control of the impact, involving much higher impact velocities and forces. Current flotation systems are located low down on the helicopter where it is most susceptible to damage. For flotation systems to be fully or partially effective under this wider set of circumstances, it is necessary for the emergency flotation equipment to be crashworthy, whilst recognising that there will be some high impact events where flotation systems will be ineffective. Currently, emergency flotation systems are designed to withstand controlled ditching loads only.

3.2 UK CAA/EASA research into the prevention of inversion of ditched helicopters and enhancement of passengers' ability to escape

3.2.1 Background

An extensive programme of work into the mitigation of helicopter ditchings and water impacts has been ongoing in the UK for many years. In 1984, as the disappointing safety record of helicopters in transporting passengers to North Sea installations became evident, a committee was set up to look at improvements in airworthiness, resulting in the publication of the 'HARP' report (CAA, 1984). Amongst the many recommendations from this proactive report were several relating to crashworthiness and ditching:

- "Recommendation 7 - A study should be initiated forthwith to identify suitable requirements for an improved standard of crashworthiness of the structure as a whole, landing gear, seats and possible restraint systems ...".

- "Recommendation 10 - We propose that resolution of the problems of stability of a ditched helicopter be urgently pursued".

They also stated "the need for stability is emphasised by the very limited practicability of escape from a capsized helicopter. The conditions on which the stability of the helicopter should be demonstrated must take account of realistic wind speeds accompanying severe sea states. Special consideration needs to be given to conditions in the very inhospitable areas such as the northern North Sea." These recommendations led directly to the programme of research into ditching and crashworthiness funded by the UK CAA along with industry partners.

The HARP Report was followed some 11 years later by the RHOSS Report (CAA, 1995). This further review of helicopter offshore safety and survival was published following the helicopter accident close to the Cormorant Alpha platform in 1992, when 5 out of 17 occupants failed to escape from the inverted helicopter. In this uncontrolled water impact, the crew did not have time to manually activate the flotation system.

The RHOSS report recognised that efforts should be placed on "safety measures related to heavy impacts as opposed to ditching", based on the high survivability record related to ditching, but cautioned against "prejudicing ditching survival in an unrealistic attempt to help the victims of non-survivable crashes".

Of the many recommendations within this report, Recommendation 14.2 (g) stated "The CAA should accelerate and/or coordinate current studies into helicopter crashworthiness, flotation and stability parameters and the automatic activation of flotation gear ... Particular account should be taken of the need to improve provision for flotation after a severe impact, including the possibility of installing extra flotation devices specifically to cater for a crash".

Research into the stability of helicopters and the prevention of inversion has been ongoing since the 1980s. This work is summarised in CAA Paper 2005/06 "Summary Report of Helicopter Ditching and Crashworthiness Research" (CAA, 2005), covering work conducted up to

2005. The following section further summarises some of the key issues that have been investigated within this research programme.

3.2.2 Stability and capsize of ditched helicopters

In 1992, BMT were commissioned to review work undertaken into ditching performance, looking at the characteristics of waves that would capsize a helicopter, and the probability of experiencing such a wave. They identified the need for more work to characterise the wave, to allow improved performance in a seaway. In almost all cases, the helicopter was capsized by a breaking wave, at a point when the lower float 'dug in' and the upper float was out of the water. Factors such as a large range of static stability and a low above-water profile were considered beneficial in preventing inversion.

Sea anchors

BMT noted that in model tests fewer capsizes occurred in wind, due to the helicopter turning into the wind and waves. It was therefore suggested that a device such as a sea anchor, that would help to turn the helicopter nose in to the wave, would be beneficial. There was some evidence that sea anchors were difficult to deploy, potentially taking too much time to be effective.

'Wet floor' approach

In the mid 1980s the British Hovercraft Company investigated two possible means of improving the static stability and capsize performance of a ditched helicopter. The first looked at the level at which a helicopter floats. At that time helicopters were required to float with the sill of any exit above the calm water flotation line. Studies were undertaken to investigate whether stability could be improved by allowing the helicopter to sit lower in the water with a 'wet floor'. Results were inconclusive, with very variable results dependent upon the helicopter weight, type and test conditions. Whilst raising the floats could improve stability in some circumstances, the lower float position increased the risk of rotor/blade strike on the wave, and there were concerns about the flotation system

impeding escape routes and increased exposure of the occupants to cold water. The 'wet floor' approach was not pursued.

Float scoops

The second study conducted by the British Hovercraft Company demonstrated the potential benefits of float scoops similar to those used to improve the stability of inflatable liferafts. In all cases the scoops improved stability. In some cases this was partially attributed to the tendency to keep the helicopter more head to the waves, but the improvement was mainly due to increases in righting moment and roll damping. The CAA then commissioned BMT and Westland Helicopters to examine the additional load forces and weight penalties. The float scoops were shown to increase the helicopter's capsize threshold by about one sea state; i.e. a helicopter with ditching capability in sea state 4 could be increased to sea state 5. It was considered that the risk of capsize would be significantly reduced following a ditching at minimal cost and weight.

Means to prevent total inversion

Research was conducted to look into means of preventing total inversion following a ditching, with the aim of mitigating the consequences of capsize. When helicopters capsize on the water surface they tend to fully invert, turning through an angle of 180˚. Occupants trapped inside must make a rapid escape through exits and escape windows that are under the water. If the capsize occurs immediately after water impact, the occupants are likely to be still strapped in by their harnesses. Inversion results in severe disorientation that makes the location of escape routes yet more difficult. The risk of drowning is high in this situation.

In 1997 BMT was commissioned to investigate novel flotation systems. The aim was to develop a system that would result in a floating attitude where one set of exits and windows remained above the water surface. A panel of experts was first brought together to consider different flotation options. Three potential systems were shortlisted:

- Foam filled engine/gearbox cowling panels - inherent buoyancy fitted in to the airframe high up on the helicopter.

- Long buoyancy bags along the upper cabin wall, above the windows.

- Tethered inflatable flotation bags.

The first two options proved to be effective. The most effective was the buoyant engine cowling panel. The second most effective was the long buoyancy bag system. In calm conditions, most of the cabin was clear of water, with one set of exits above the water surface. In waves, occasional large waves swept in through the doors and windows.

One concern with both of these systems was that the helicopter could roll into two positions. A single wave turned the helicopter to a position with the exits on the lee side, away from the oncoming waves. The helicopter remained stable in this position for some time until hit by another large wave, which resulted in a further rotation of the aircraft so that the opposite side of the helicopter was now above the water with the exits facing the waves. No further rotations were observed. There were concerns that this double rotation could make it much more difficult for the occupants attempting to escape from the cabin.

This problem was solved by an asymmetric configuration. A combination of the buoyant engine cowling panel plus a single long flotation bag on one side of the helicopter resulted in a single stable flotation position in waves.

The main advantage of this 'side-floating' system is that, following a capsize, there is the potential to create a large air pocket in the cabin and cockpit, with doors and exits on one side of the helicopter above the water. The hypothesis was that this would give occupants a much better chance of escape from the capsized helicopter. The next step was to investigate any problems that might be experienced by occupants escaping from the partially inverted helicopter.

One further advantage of the proposed system was that it provided additional flotation to the helicopter, creating some redundancy. This could be beneficial in severe impacts if the traditional flotation system were to incur damage. Current flotation systems are located low on the airframe where they are likely to be exposed to damage. The proposed additional flotation would be positioned high up where it would be at lower risk of damage, thereby potentially improving the overall crashworthiness of the emergency flotation system.

Human Factors Study - Escape from side-floating helicopter

RGIT Limited was commissioned to investigate escape from a side-floating helicopter, developing an appropriate technique and associated training procedures for escape from a partially inverted helicopter. Benefits and problems associated with the system were assessed by comparison with escape from a fully inverted cabin. A helicopter underwater escape trainer was configured to invert through angles of either 150˚ or 270˚, with buoyancy bags fitted above the escape windows to simulate the asymmetric additional flotation system.

Different escape procedures were first investigated using trained personnel. It was established that escape could best be achieved if, following partial inversion, the lowest edge of the window was close to the water surface. In a series of trials conducted with naïve subjects the majority (90%) preferred escape from the side-floating helicopter to underwater escape from the fully inverted helicopter. Overall, escape was found to be easier and subjects were more satisfied with the way they coped. Levels of disorientation and the difficulty of finding their exit were rated much higher in the fully inverted underwater escape, particularly in a cross-cabin exercise. In the side-floating helicopter, time spent with the head underwater was much shorter, requiring much shorter breath-holds (no EBS used). On surfacing within the cabin, subjects had time to assess the situation and plan their escape route once they had reached the air pocket in the cabin.

Some further work was recommended to look at uneven loads on the seat harness, as occupants in some seats would be above the water and fall a short distance to the water surface. This caused some problems with

harness release. Consideration must also be given to the effects of large waves that may wash into the cabin. Overall, the benefits of escaping from the partially inverted helicopter were considered to outweigh any problems, giving the occupants a much better probability of escape and survival.

Type-specific design study

The most recent research in this area has been undertaken by Eurocopter and Aerazur and was funded by the European Aviation Safety Agency (EASA). Design objectives for an additional emergency flotation system were considered for both a light (AS355) and heavy (EC225) helicopter. Designs were based upon floats along the top of cabin walls, foam- filled cowling panels, and a combination of the two.

For the EC225, five different additional flotation systems were tested using scale models in a wave tank, with irregular waves (sea state 5). Both symmetrical and asymmetrical designs were considered. In each case, a stable flotation position following capsize was achieved with a rotation of between 150˚ and 160˚. Additional flotation system designs incorporating the buoyant cowling panel proved to be the most effective, with respect to stability and the number of windows remaining above the waterline following partial inversion. Both the asymmetrical design (cowling panel + flotation bags on one side of the upper cabin), and the symmetrical design (cowling panel + flotation bags on both sides of the upper cabin), remained effective when one of the standard (lower) flotation bags was damaged. This demonstrated the benefits of buoyancy redundancy.

The authors cited a number of reasons for preferring the symmetrical flotation configuration over the asymmetrical one:

- The volume of the inflatable flotation on each side of the cabin was lower compared to the asymmetrical design with floats on only one side;

- The airspace inside the cabin was larger with the symmetrical design, due to a higher inclined flotation position following capsize;

- The asymmetrical design suggested a different level of safety depending upon which side of the helicopter the occupant was seated;

- When one standard lower float was damaged, better buoyancy redundancy was achieved, with the helicopter stabilising at a 45˚ angle whichever side the damage occurred.

Future work included the need to develop new fabrics for the floats to withstand high temperatures in the upper part of the helicopter. Further analysis was needed regarding the interaction between the blades and the additional floats, as well as some consideration of the effects of blade damage during helicopter capsize.

3.2.3 Crashworthiness research

This work focussed on crashworthiness issues that specifically relate to water impact. It should be recognised that flotation systems are likely to be much less effective when a helicopter crashes into water due either to the floats being damaged by impact or due to the fact that the crew are unable to manually activate the system.

The review of UK military and world civil helicopter water impacts from 1971 to 1992 (Clifford, 1996), previously described, was part of this programme. Clifford found that, in fatal accidents where cause of death was known, drowning was the major cause of loss of life. This was particularly true of vertical descents with limited control and fly-in accidents. Fatalities due to impact injuries only predominated in the category of uncontrolled impacts. (Crashes considered to be non-survivable were excluded i.e. where forces exceeded human tolerance and/or where the airframe did not stay sufficiently intact to permit survival). This was likely due to the fact that the helicopter inverted or sank in more than 50% of cases before the evacuation of occupants could be completed.

Structural loads and the probability of occupant injury in helicopter water impacts were found to depend on both the impact velocity and the behaviour of the structure on water entry. Designing the airframe to

withstand water pressures without excessive deformation and without water entering into the internal structure or occupied areas was seen to be the key issue for water impact resistance. There were no requirements calling for the airframe to be so designed at the time the study was undertaken.

The major factor for improving occupant survival was considered to be design techniques for increasing the capability of the helicopter structure to remain afloat after water impact for long enough for occupants to escape.

The CAA then commissioned two studies investigating means of improving the crashworthiness of helicopter emergency flotation systems. The first, conducted by WS Atkins, looked at the crashworthiness of both the airframe and the flotation system. They recommended several design modifications to the emergency flotation system that would improve performance following a severe impact, including automatic arming and deployment of the system. A number of these modifications have been implemented in modern designs, but it is understood that they have not been addressed in the requirements and advisory material.

An associated study by BMT looked at water impact loading on typical flotation system components. They looked at various scenarios relating to horizontal and vertical impact forces, angles of water entry and sea states. Their studies showed that additional redundant flotation, of the type described for preventing complete inversion, will reduce the probability of a helicopter sinking following a high-impact crash. They considered that with conventional flotation systems, with buoyancy low down on the airframe, substantial increases in design loads would be needed to improve survivability. They highlighted the benefits of flotation redundancy, where additional floats are positioned high on the cabin wall, where they are protected from all but side impacts (CAA, 2005).

3.2.4 EBS research

Initial study of implementation and use

During the early years of the ditching research programme, RHOSS (1995) considered that there was no clear advantage to be gained from introducing emergency breathing systems (EBS). However, in 2000, a workshop on EBS was set up in response to the wide and increasing deployment of EBS by the UK offshore industry. One of the key issues explored was that the time to escape from an inverted helicopter (estimated as 45 to 60 seconds) was greater than the average breath-hold time in cold water (mean values vary from 20 to 30 seconds, but values may be as little as 10 seconds in some cases). As a result of this workshop, the CAA, on behalf of Joint Aviation Authorities' Helicopter Offshore Safety and Survivability (HOSS) working group, commissioned a study into the implementation and use of EBS (Coleshaw, 2003).

The study aimed to establish the extent of knowledge and testing performed on various EBS designs. Clifford's (1996) data on water impacts was reviewed, with the high incidence of drowning accounted for by the effects of cold shock. The effective use of EBS would allow users to overcome cold shock and allow them time to make an underwater escape, extending underwater survival time.

Whilst it was considered that reliance on EBS for escape should be minimised, it was reported that successful use of EBS can reduce levels of stress experienced during helicopter escape under simulated conditions. Satisfactory performance of EBS was considered to depend on good design, reliability of the equipment, ease of use and performance on demand. Other key factors included individual human capabilities, training, environmental conditions, helicopter design, and the circumstances of the helicopter accident.

The author felt that in-water training was required to maximise the benefits of EBS and minimise the risk of human error during deployment and operation. It was considered important that competence be maintained to prevent any failure of deployment.

An example draft technical standard was also prepared (see also 2.5.2), identifying minimum performance requirements to ensure that equipment is manufactured to consistent and satisfactory standards, and that basic health and safety requirements are met. Compatibility with other personal protective equipment was also considered to be an important issue that a technical standard would address.

The main conclusions from the study were that EBS could provide a viable solution to bridge the gap between breath-hold time and escape time, but that careful attention would have to be paid to equipment design and user training. The study recommended that a technical standard should be produced for EBS, and highlighted the knowledge gaps that would need to be filled.

Development of full technical standard

A follow-up study was commissioned in 2008 with the aim of completing the technical standard for EBS. To achieve this aim, gaps in the draft standard needed to be filled, whilst further research was needed to deal with knowledge gaps in areas such as realistic emergency deployment times and cold water performance. This work, which is ongoing at the present time, has looked at three generic designs of EBS: a compressed air device, a rebreather and a hybrid (rebreather with additional air). The results of the research will be used to develop the test methodology and set performance criteria. The completed standard will then be circulated to interested parties for review, before being submitted to EASA for possible publication as an ETSO (European Technical Standard Order).

3.2.5 Overview of research

At the time of writing this report the UK CAA/EASA programme of research is ongoing, with responsibility for future work having been transferred to EASA. The research has provided a much better understanding of the problems, particularly in relation to helicopter flotation, allowing design improvements to be made.

Following personal communication with the UK CAA, the CAA consider that

There is a fundamental mismatch between the certification standards in terms of ditching stability and the wave climate in the North Sea, and between escape times from an inverted helicopter and realistic breath-hold times in typical sea temperatures.

Measures for improving the sea-keeping performance of helicopters such as float scoops do exist and could provide a worthwhile improvement; unfortunately the present certification standards do not drive the industry to improve ditching stability. However, it is recognised that there is a practical limit to what can be achieved with helicopters (probably Sea State 5), which could be inadequate for areas such as the northern North Sea where the previous UK standards recommended Sea State 6. Furthermore, capsize during ditching could occur due to imperfect alighting on the water (e.g. due to limited control caused by tail rotor failure or some other mechanical defect), or due to the rotor striking a wave. Means to mitigate the consequences of a capsize are therefore considered to be necessary and could take the form of EBS or modification of the emergency flotation system to allow a reversionary side-floating attitude.

In addition, accident experience indicates that in almost all cases the helicopter will invert immediately in the case of a (survivable) water impact. CAA believes that the case has been made for automatic float arming and deployment, and for the provision of emergency flotation system redundancy at a flotation unit level (rather than the present 'critical' float compartment level). An additional hazard in the case of water impacts is that the helicopter may sink, further reducing the chances of successful escape and survival. Studies have indicated that the additional floatation needed for the side-floating scheme considered for post ditching capsize would provide the redundancy required to prevent sinking and, in many cases, retain an air gap within the cabin. EBS is less likely to be effective in water impacts due to the likely increased difficulties associated with deployment (e.g. impact injuries, underwater deployment), and the reduced probability of survival in the event that the helicopter sinks.

In view of the above, CAA believes that a properly designed EBS could provide a satisfactory short-term solution to the problem of post capsize survival pending availability of the side-floating

> scheme. The side-floating scheme is, however, considered to present the optimum solution and the CAA is not aware of any insurmountable problems that would render the scheme impractical or ineffective at least for new build/design helicopters. Should the side-floating scheme prove impractical to retrofit, however, it may be possible for EBS to provide a degree of long-term mitigation.
>
> CAA and its industry partners are completing work on a technical standard for EBS. This will be published in the public domain for the industry to use on a voluntary basis, and will be offered to EASA for adoption as a formal standard (ETSO). As regards the side-floating scheme, EASA currently proposes to establish a workshop in 2011 to review all of the helicopter ditching and water impact requirements, advisory material and research. It is hoped that the good consensus for the adoption of the side-floating scheme achieved within the JAA HOSS Working Group (formed to consider the recommendations of the RHOSS report), and the FAA/JAA Joint Harmonisation Working Group on Water Impact and Ditching Design will prevail (see Appendices F and G of CAA Paper 2005/06) (CAA, 2010).

If the C-NLOPB were to more directly involve itself in research of this kind there would be benefits, in particular, an improved knowledge base relating to helicopter safety in the offshore transport sector. The support of a wider audience could also help this work to progress, with the hope that further improvements to flotation systems will be realised.

4.0 WHAT ARE THE APPROPRIATE STANDARDS OF HELICOPTER SAFETY TRAINING TO ENSURE THAT THE RISK TO PASSENGERS IS AS LOW AS REASONABLY PRACTICABLE, BOTH DURING TRAINING AND HELICOPTER TRANSPORT?

4.1 The need for training

Helicopter underwater escape training (HUET) has been developed over many years in response to helicopter crew and passengers having great

difficulty escaping or being trapped inside the helicopter following submergence or capsize, with many fatalities due to drowning.

In-rushing water, disorientation and an inability to reach or open exits have all been cited as problems experienced when attempting to escape the helicopter (Rice and Greear, 1973), resulting in a recommendation for realistic underwater escape training. Ryack et al (1986) reviewed helicopter crashes at sea and reported data from the US Naval Safety Centre showing that 92% of those who had received training in the 'Dilbert Dunker' survived such crashes, compared to a 79% survival rate for those who were untrained. They considered that the training provided individuals with familiarity with the crash environment and confidence in their ability to cope with the emergency situation, recommending HUET training for all navy helicopter crew. Others have reported the benefits of HUET training. Hytten (1989) described one particular accident where HUET training was believed to have been critical to those who escaped. Training provided reflex conditioning, provided a behaviour pattern to follow, reduced confusion and reduced panic. The real situation was said to have been different to the training scenario but nonetheless, their training was considered to have been very important in their survival.

Training has been said to develop a positive expectancy for future coping (Hytten, Jensen & Vaernes, 1989). Thus, individuals who cope well with training develop some confidence that they will be able to cope with a real emergency, gaining more confidence in helicopter transport. Hytten (1989) has also reported how individuals can adapt to stressful situations over time, stating "when fear is confronted and coped with at one intensity, it is probable that one will cope with a new fear-provoking situation of greater intensity". Thus, coping with a training situation allows the individual to develop coping mechanisms and thus manage a real life-threatening event more effectively.

In real emergencies, victims show a range of behaviours in response to the threat. Muir (1999) described a number of behavioural responses experienced by passengers involved in transport accidents. These included fear, anxiety, disorientation, depersonalisation, panic and inaction. Inaction or 'freezing' is a real problem in the helicopter emergency situation. If a person seated next to the exit freezes, they are less likely to

make a rapid escape and will effectively block the exit for someone seated on the inside. Leach (2004) suggested that 'freezing' could be accounted for by time constraints on the cognitive processing of information in a rapidly unfolding, real-time environment. This is at the other extreme to panic where the individual reacts very quickly but perhaps inappropriately. Training should aim to reduce the likelihood of such behaviours, through familiarisation with typical scenarios, familiarisation with equipment and practise in the procedures that must be carried out.

4.2 Fidelity of training

There is much debate regarding the fidelity of training. This may be applied to the similarity of the environmental conditions, the similarity of equipment, and the similarity of tasks undertaken. For example, disorientation is known to be one of the most difficult factors that individuals must learn to cope with in an inverted helicopter. By experiencing disorientation in a controlled environment its impact in a real event can be diminished. However, in a real emergency it might be dark, there could be oil floating on the water, and there may well be damage to the helicopter structure in all but controlled landings on the water. It would therefore not be sensible or practical to recreate all aspects of this environment in training. Whilst some military and crew training takes place in the dark, this would be a much more difficult for training organisations to control, and the risks of training would increase. The stress of training would undoubtedly increase and this would be undesirable.

When trying to achieve physical fidelity of equipment, success will depend on the number of different helicopter designs that trainees may be exposed to in reality. Different helicopters have different designs of exits and escape windows, and many different exit release mechanisms. Thus, if only one helicopter design were to be used by a particular occupational group it might be possible to achieve reasonable physical fidelity. Where different helicopters are used, the best that can be achieved is some fidelity with, for example, a typical exit release. What is most important is that each trainee does get the opportunity to at least operate a generic exit mechanism and have some idea of the types of mechanism that might be

experienced (this needs to be backed up by pre-flight type-specific briefings).

That said, it has been argued that exact physical fidelity is not needed. Summers (1996), in a study of procedural skill decay and optimal retraining periods in helicopter underwater escape training, considered that physical fidelity was not necessarily required for effective transfer of training from the simulator to the real environment. She considered that task analysis was more important when identifying the information needed for learning i.e. it was more important to physically go through the actions required to locate an exit and operate the exit mechanism than for the exit door to look like a real exit door. Summers stated that the most important factors in simulator training were operational realism and functional similarity. As an example Summers cited a study where training in a plywood aircraft cockpit mock-up produced transfer of training that was similar to that achieved with a high fidelity, sophisticated and expensive cockpit simulator. To back up this contention, several accident reports have suggested that even if a helicopter simulator bears little physical resemblance to the cabin of a real helicopter, the training will still have positive benefits when it comes to surviving a real accident (Hytten, 1989; AAIB, 1993).

When considering the fidelity of escape procedures it is therefore important that each step in the escape process is covered by the practical training. Trainees need to be familiar with their personal protective equipment (PPE), and know what, if any, actions have to be taken to make the PPE ready for use in the event of an emergency (such as doing up zips or locating and donning hoods). Release of the seat harness must be experienced and practised, whether this be with a four-point or two point harness. With a two-point harness, confusion can be caused if direction of release is different to the commonly used car seat harness. Release of the less familiar four-point harness must be learnt, but there is less likelihood of confusion (and this will be practised under non-emergency conditions when flying offshore).

Issues have been raised about the number of delegates in the HUET at one time, and the possibility of practising escape from seats other than those next to an exit. In the past, in UK training centres, higher numbers of

delegates were seated in the HUET for each exercise, with some seated next to exits and others on inside seats, having to wait for the person seating next to them to escape before they could then move to the exit and escape. This regime resulted in some injuries to delegates, when someone in an inside seat panicked and went to escape ahead of the person sitting next to the exit, kicking that individual as they escaped. (This occurred at a time when no EBS was used during training, so that trainees were having to breath-hold during escape). The training procedures now stipulate a maximum of 4 delegates in the HUET to reduce the risk of injuries (and to allow competence to be assessed). This means that no 'cross-cabin' escape is undertaken. The advent of EBS use could make this feasible in the future without unduly increasing the risks of training.

Another issue in the UK has been the requirement to physically remove an exit/escape window when escaping from the HUET, this being a task that was not included in training until recently (see Coleshaw, 2006b). A study of HUET by Muir and Mills (1999) concluded that delegates must be given training and practice in the operation of representative exits if they were to meet minimum competency levels and adequately simulate the real environment. It was found that higher fidelity training including the operation of exits caused more stress but individuals were more confident as a result of their training. The authors also supported the need for "part-task learning whereby trainees' skills are built up in an incremental fashion" (Mills and Muir, 1999).

A more recent study (Kozey et al, 2006) also investigated the effects of training fidelity and practice on egress performance. They found that participants who had experienced use of push-out windows once during training had a greater success rate (81%) during a test HUET escape 6 months after the training than those who had no experience of pushing out windows during training (54% success). A further group who, during training, undertook four HUET inversions during which a window had to be pushed out, demonstrated a 96% success rate when carrying out the test HUET escape. This work clearly demonstrated the combined benefits of including the operation of exits during training and of practicing underwater escape using exits. The results also demonstrated that if sufficient training in a task is given, the learning will be retained for at least 6 months.

4.3 Stress in training

When it was first proposed that the operation and removal of exits be introduced into the basic and further offshore emergency response training in the UK, concerns were raised regarding the levels of stress and anxiety that may be experienced by some course delegates, the possibility that stress levels may be increased by the introduction of exit operation and the potential health risks associated with such a change. OPITO therefore funded a project to assess the impact of the proposed changes (Coleshaw, 2006a). Previous studies had identified high levels of anticipatory anxiety in some individuals undergoing HUET training (Harris, Coleshaw & Mackenzie, 1996). Anxiety levels were higher in those participating in training for the first time, and in younger age groups, possibly suggesting that older, more experienced individuals who had attended training on multiple occasions knew what to expect and had developed coping strategies. The work of Muir and Mills (1999), which aimed to develop a training standard for underwater survival, found that higher fidelity training (including operation of emergency exits) caused more stress, although trainees were more confident as a result of the training.

Whilst some stress can be advantageous, helping the individual to react to a challenge or threat, too much can have negative effects on health. As part of the OPITO study (Coleshaw, 2006a) registered occupational physicians were consulted and they identified a number of issues. They discussed both the potential threat posed by stress in some individuals, but also the fear that job security depended upon successful completion of the HUET training. The personal view of one medical officer was that emergency response training was much less stressful than it had been 10 to 15 years previously, related to continuous changes and improvements to the training and the way it was delivered (e.g. less machismo attitudes). The physicians supported a strategy of minimising stress in training where possible.

When considering changes to HUET training it is therefore necessary to balance the need for training fidelity against the stress that may be induced in some individuals when making training more and more realistic. Concerns have also been raised that offshore medicals are enhanced due to

the need to be fit for emergency response training, over and above the needs of fitness to work. Again, a balance must be achieved.

4.4 Training frequency

Skills decay and the frequency of training is another area of ongoing discussion. In the UK, further training must be taken within four years, though many repeat the training after three years. The study by Summers (1996) looked at training frequency. She pointed out that procedural skills that are infrequently practised decay rapidly, and she considered that a two-year training interval was too long. The Association of Oil & Gas Producers (OGP) recommend a 3-year goal for frequency of training, but recognise that this may vary according to the operation, exposure, identified threats and the quality of training given. Offshore workers who have been in the industry for many years tend to complain about having to come back and repeat training every few years. This requires a sense of personal responsibility on their part, to acknowledge the benefits of refresher training, and recognition that while they may think that they know what to do, some skills may have been forgotten.

4.5 Training standards

It is considered that helicopter safety training should include a positive message about helicopter safety in addition to practical skills training. Helicopter flight has been included in a list of stressors experienced by offshore workers. It is therefore necessary to limit fears about helicopter travel and provide a balanced and realistic view of helicopter safety.

Training needs to cover the different types of water impact that could occur, recognising that a controlled ditching is more likely to occur than a fly-in or uncontrolled impact. To cover the different scenarios that could be experienced, a number of different training scenarios are needed:

- Evacuation from a floating helicopter, leaving the cabin in a controlled manner, using an emergency exit, and exiting into a liferaft.

- Underwater escape from a submerged helicopter.

- Underwater escape from a capsized/inverted helicopter.

Within these exercises, a number of issues and essential procedures need to be covered within either the classroom or practical training:

- Familiarisation with personal protective equipment that is likely to be worn;
- Preparation for water impact;
- The possible impact of in-rushing water;
- Use and release of harness;
- Importance of locating exits;
- Awareness that it might be necessary to cross the cabin in a real accident;
- Effects of buoyancy;
- Liferaft deployment;
- Actions to take once in the liferaft e.g. turn off PLB, find survival bag etc.;
- Inflation of lifejacket (if used);
- Actions to take in the water whilst awaiting rescue.

In the UK and many other parts of the world, HUET training is conducted to the standards laid down by OPITO (2008). Their standards lay down learning objectives, a detailed and prescriptive training programme, competence assessments and optimum contact time with delegates.

The Basic Offshore Safety Induction and Emergency Training (BOSIET) incorporates more exercises than the Further Offshore Emergency

Training (FOET). The BOSIET includes 7 HUET exercises (dry evacuation including removal of exits; three submersions and three capsize exercises, each including one escape on a breath-hold, one escape using EBS, and one escape using EBS and removal of exits). The FOET includes 4 exercises (dry evacuation including removal of exits; one submersion with EBS; one submersion with EBS and exits; plus one capsize with EBS and exits). Some exercises are still conducted without the use of EBS to ensure that subjects practise taking a deep breath and escaping as quickly as possible on a breath-hold. This may still be the best option in an accident without warning and with no time to deploy EBS before submersion, if the helicopter occupant is next to an escape window and can escape quickly. Repeated exercises are also conducted with EBS. If sufficient preliminary EBS training has been given the delegates should be able to practise rapid deployment of the EBS and then concentrate on the escape process during these exercises. Exits are removed in three exercises with both the BOSIET and FOET courses, providing a reasonable level of practise.

It is understood that the Canadian offshore workforce complete some of their training under real sea conditions, in cold water. This has some merit as a process that will familiarise trainees with what might be expected in a real emergency, and perhaps reinforce the need to wear an immersion suit that is correctly fitted and sealed. However, this is a very uncontrolled environment in which to conduct training. The severe distracting effects of cold water are likely to limit the learning process. Procedures such as liferaft boarding are more likely to be learnt well if they are practised in a controlled pool environment. In the UK, pool training in water as cold as 20˚C, was stopped following action by the Unions (Spiller, 1997), with most training facilities now operating HUET training in water temperatures close to 25˚C. The disadvantage of this cool rather than cold water temperature is that some delegates can develop a misconception regarding just how cold water temperatures may be in the real environment.

4.6 EBS Training

In-water training is recommended for all types of EBS. Emergency deployment should be practised with the trainee in an aircraft seat with

two or four-point harness as appropriate (both if both types could be encountered). Deployment should be attempted with both the left and right hands, as the best hand for deployment will depend on seating position and the location of the exit. Single-handed deployment is seen as the worst case scenario, and allows one hand to remain locating the exit.

Users must be trained to breathe normally when using compressed air systems, to overcome the distraction of the exhalation bubbles and to learn that they must not hold their breath at any time with this type of device. With rebreather systems, some breathing resistance will be experienced, particularly when swimming face down. Most users should be able to rebreathe for more than a minute without feeling the effects of a rising carbon dioxide level.

It is recommended that users learn to breathe from the EBS in a shallow water area, being given enough practise for each to breathe from the EBS with confidence. Only then should the EBS be used in a helicopter simulator.

5.0 SHOULD OFFSHORE WORKERS HAVE A LEVEL OF PERSONAL ACCOUNTABILITY FOR THEIR OWN SAFETY IN HELICOPTER TRANSPORT?

There are a number of areas where offshore workers can take personal responsibility for their own safety. RHOSS (1995), reporting on the evidence given by two survivors of the Cormorant Alpha accident, suggested that their survival was in part due to "their own stamina and presence of mind". It was considered significant that both were strong and confident swimmers "who were able to remain clear-headed and in control of their breathing when underwater", having an effect both during escape from the cabin and afterwards when coping with heavy seas whilst awaiting rescue. In his testimony to this Inquiry, Robert Decker, the survivor of Flight 491, described how he had had previous experience of being thrown into cold sea water, that he felt some of his reactions were therefore instinctive and that this helped him to stay calm and not panic. In the study of stress during offshore survival training, non-swimmers demonstrated higher levels of anxiety during training (Harris et al, 1996)

resulting in a recommendation for water confidence classes for this group prior to training, to reduce pre-course anxieties and improve coping skills.

These comments support the view that confidence in water is likely to increase the chance of survival in a helicopter ditching. Those who are familiar with the sensation of being immersed in water and having the head underwater are more likely to cope well than those without this experience. Training every three to four years may not be sufficient to provide this familiarity with the water environment. The issue of exposure to cold water is problematic. Whilst exposure would increase familiarity with the environment, and could result in some habituation to cold shock if repeated on a regular basis, it would not be recommended for all. Older members of the workforce are more likely to have undetected cardiovascular disease, and sudden immersion in cold water, without the protection of an immersion suit, could put this group at some risk.

Personal accountability is also important when considering the use of personal protective equipment. Section 2.2 of this report considered the issues of immersion suit sizing and fit. Members of the workforce must take responsibility for ensuring that they are issued with a well fitting suit. There is also a need to check seals at the face and wrists, to ensure that there is no damage to seals, whilst care must be taken to ensure that seals sit on the skin, and that there is no hair or clothing trapped under the seals that would allow water to track into the suit. There are times that zips are not fully done up as the end of the zip feels uncomfortable digging into the face. Some level of discomfort may be necessary to ensure a good seal when used in an emergency.

Comfort will also be dependent upon the level of clothing worn under the suit. This will affect the overall insulation of the suit. In the UK, clothing policies have been instituted in an attempt to put some control on the level of clothing worn under the suit; either two layers or three layers dependent upon the time of year. The problem comes when sea temperatures are cold but air temperatures in the cabin are hot. It may not be in the best interest of the individual to strip down to a minimum layer of clothing under the suit. As previously mentioned, this is a balance between thermal comfort in the cabin and protection from cold in the event of immersion. Again, the passenger must accept some level of discomfort.

A positive attitude to survival training is recommended. Those who achieve this are more likely to learn skills and complete training with a positive outcome than those who do not want to be there and resent the time spent on the training. This carries across into helicopter transport. Those with a positive attitude to safety are more likely to build up their own survival strategy, taking time to check escape routes and exit mechanisms in the particular helicopter used for flights. Those individuals will be better prepared in the event of an accident, providing positive benefits.

Some oil and gas operators now operate policies where the workforce must take responsibility for the safety of themselves and those they work with, speaking up if they see an unsafe act. This aims to reduce preventable accidents but also gets the workforce to think about personal safety.

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National Research Council Canada
Institute for Ocean Technology

Conseil national de recherches Canada
Institut des technologies océaniques

HUMAN PERFORMANCE IN IMMERSION SUITS

Prepared for:
The Honourable Robert Wells, Q.C.
Offshore Helicopter Safety Inquiry

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National Research Council of Canada – Institute for Ocean Technology

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Introduction

The National Research Council of Canada's Institute for Ocean Technology (NRC-IOT) is committed to the development of technologies that preserve human life at sea. Of particular importance are those technologies that allow survival in harsh environments, in the event of accident or system failure. The Institute's Marine Safety Research Program is wholly dedicated to the characterization of safety equipment performance in extreme conditions, for use by private and public sector clients to increase the safety of those who work or travel at sea. One of the driving goals of the program is to address the knowledge gap that currently exists between the performance of Life Saving Appliances in the calm water conditions they are often tested in, and in the real world situations in which they are often used. The following is a summary of research on human performance in survival suits, both at NRC-IOT and elsewhere, and its implications for safety regulation in the offshore industry.

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5.0 References

1.0 Review of Existing Work

A large number of individuals work or travel over the cold ocean waters off the east coast of Canada every day. Immersion in cold water represents a significant risk to those both at leisure and at work in the country. If an unprotected human is suddenly immersed in cold water, a series of physiological responses termed the "Cold Shock Response" (CSR) occurs and is responsible for the majority of drowning deaths in cold water within the first few minutes of immersion [8]. Upon sudden immersion in cold water, a person can experience a large involuntary gasp [4] and hyperventilation [11]. These sudden changes in respiratory responses increase the likelihood of aspirating water upon immersion in cold water, leading to death by drowning as opposed to hypothermia, which is defined as a drop in deep body temperature of 2°C or more. Even in unprotected individuals, hypothermia does not usually occur before 30 minutes of immersion [11]. Additionally, an increase in cardiac output is caused by immersion in cold water [11]. While this increased cardiac output is of little danger to healthy individuals, it can be lethal to people with pre-existing cardiac conditions such as hypertension or heart disease [17].

The best approach to protecting people from cold water is to keep them out of it. In an emergency situation, however, there is always a chance that people will be immersed in water. In these situations, immersion suits can greatly increase the chance of a person being able to avoid the CSR and prolong their survival times. Current Transport Canada (TC) regulations require immersion suits to be carried on board all class 9 ships and higher in sufficient quantity so that every person has one. Offshore oil installations follow a similar policy.

Immersion suits are usually a one-piece suit system that provides thermal protection and buoyancy to the wearer [2]. Immersion suit systems can be loosely placed into two separate categories: marine abandonment suits, and helicopter transportation suits. The most appreciable difference between the two styles of suits is highlighted in the scope for the standard of each one. Both styles of suits are meant to reduce thermal shock, delay the onset of hypothermia, provide acceptable flotation and minimize the risk of drowning [1-2]. The largest difference between the two suits is with respect to buoyancy, with the marine abandonment suit not having a

maximum buoyancy requirement and the helicopter transportation suit requiring specified minimum and maximum levels of buoyancy.

The Canadian General Standards Board (CGSB) requires both helicopter and marine abandonment suits systems to have their thermal protective properties tested. The thermal protective properties can be tested using either human participants or thermal manikins. For human participant tests, deep body temperature is measured using a rectal thermistor; the skin temperature of the index finger and large toe are also measured. The participant is immersed in calm, circulating water with a temperature between 0-2°C for up to 6 hours. The test is terminated if the participant's deep body temperature drops 2°C lower than baseline conditions (hypothermia), if the finger or toe skin temperature drops below 5°C, or if the attending physician determines that the participant should not continue [1]. When testing with a thermal manikin, the suit system has to have a mean level of thermal insulation of at least 0.75 Clo [1-2], where 1 clo = 0.18°C/m^2/W, which is equal to the amount of clothing insulation required to keep a person comfortable in 21°C air moving at 0.1m·s^{-1}, and less than 50% relative humidity [8].

Previous work by Hayward highlights how important immersion suits are to a person's ability to survive a sudden immersion in cold water. Ten males and ten females dressed in light clothing performed immersions in 0°C water. Within 30 minutes of immersion, the participant's deep body temperature dropped by 2.0°C, and they experienced a 49% increase in heart rate after only 2 minutes in the water [10]. In a subsequent study Hayward examined the effects of immersion in 1.0°C water on thirty males who were wearing dry, insulated survival suits. The mean decline in deep body temperature was significantly less, 0.8°C over six hours, when wearing survival suits compared to just light clothing [10]. As well, there was no significant increase in heart rate for the males wearing the survival suits compared to the volunteers wearing only light clothing [10-11].

As effective as immersion suits are, a knowledge gap currently exists between the calm testing conditions used to determine a human's thermal responses in immersion suits, and a real world scenario where a person could experience high winds and waves. Hayes et al. attempted to address this knowledge gap, reporting that "Other factors which are of importance

[for survival] but are extremely difficult to quantify, are the sea conditions of waves and splash, and the effectiveness of the survival aids in fair and adverse conditions" [9]. The authors examined the effect of wave motion on study volunteers who were wearing a variety of clothing ensembles across a range of water temperatures. The clothing ensembles varied from semi-nude in 30.0°C water, to flight suits with a Clo value of 0.84 in 7.0°C water. The authors found that the rate of cooling was higher in waves in 8 out of the 10 cases tested, but the results were not statistically significant [9]. They suggest that the detrimental effects of waves are more pronounced when wearing little clothing, however they state that the importance of proper neck/face seals for suits is important in any appreciable level of wave motion. Hayes et al. concluded that their study demonstrated a trend for waves to increase cooling in some cases, but a more definitive experiment would be required.

Later work by Steinman et al. examined the effects of rough seas on the thermal protective properties of a variety of suits, including wet suits, coveralls, and dry immersion suits [16]. Calm water tests were performed in the ocean near a set of docks with a mean water temperature of 10.7°C, no wave action, and wind speeds between 2.5-5.0m·s^{-1}. A 44-foot motor lifeboat and a 17-foot rigid hull inflatable boat generated rough sea conditions. The boats were able to produce 1-2m swells, 0.5m chop, with occasional 1.5m breaks in the 11.1°C water, with wind speeds ranging from 5-10m·s^{-1}. The authors found that the rate of decline in deep body temperature was significantly greater for some clothing ensembles in the rough weather conditions compared to calm [16]. Oddly, one of the two immersion suits had a significantly greater rate of cooling in calm conditions compared to rough seas. There were no significant differences in the rate of deep body cooling between calm and rough seas for the second immersion suit tested. The authors conclude that immersion in rough seas may result in significantly lower survival times than those estimated from calm water [16].

The results from Steinman et al.'s work suggest that rough sea conditions may only significantly affect wet suit style garments, and that dry immersion suits may not be adversely affected. A limitation of the study is the lack of control over the environmental conditions. Due to the random nature of the wave action created by both boats, combined with the already

random effects of the weather, it would have been extremely difficult to ensure that each of the every 8 volunteers experienced the same conditions as the other. It is possible that the lack of significant difference in cooling rates between calm and rough seas in the two styles of immersion suits could be attributed to variations in the conditions experienced by the volunteers. This is a common limitation of testing outside laboratory conditions, as the environmental conditions are strongly influenced by the weather that introduces a degree of randomization in what the volunteers experience.

A later study conducted by Tipton in a laboratory setting allowed for more control of the conditions experienced by the volunteers [18]. Ten healthy males volunteered to perform two 4-hour immersions in 4°C water using two different styles of helicopter passenger immersion suits. One suit did not provide any inherent insulation, while the other was an inflatable suit that used small CO_2 cylinders for inflation. The subjects wore swimming trunks, short-sleeved cotton vests, woollen socks, polyester/cotton long-sleeved shirt and long pants, and a polyester/cotton pullover. During the 4-hour immersions the environmental conditions consisted of 15cm waves generated by a wave maker, wind with an average speed of $3.1 m \cdot s^{-1}$, and 9 litres of water sprayed every 15 minutes on the volunteers. The mean immersion time for the volunteers wearing the first immersion suit was 71.5 minutes. The immersions were ended for a variety of reasons including low deep body temperature, volunteer request, and low skin temperature. The mean immersion time for the second immersion suit was 189.5 minutes, with 4 of the participants completing the full 4 hour immersion, while the other 6 requested to end the test early. Tipton concluded that there exists a possibility for calculations to overestimate survival time if they are based on laboratory conditions that do not recreate the stresses placed upon a suit in adverse conditions during a real emergency. [18]. Tipton suggests that this limitation could be reduced if laboratory tests could be made more realistic, which would result in minimizing the discrepancy between laboratory-based assessment of protection provided by a suit, and the actual level of protection provided in real-world scenarios [18].

The immersion conditions used in Tipton's study [18] can be considered relatively mild compared to those found in the ocean. Remarkably, both

helicopter immersion suits suffered large amounts of water leakage. The first suit had 1.32 litres of water leak into it after only 71.5 minutes of immersion, and the second had 2.2 litres [18]. A later study by Tipton and Balmi investigated how deleterious the effects of water leakage into suits can be [20]. Twelve male volunteers performed immersion in 10°C agitated water wearing an uninsulated immersion suit with a woollen insulating garment ("woolly bear") underneath. The volunteers performed 2 immersions dry, and 4 additional immersions with 200, 500, and 1000ml of water added to the suit. When 500ml of water was sprayed over the torso, it produced a rate in drop of deep body temperature between the 200 and 1000ml leak. Interestingly, when 500ml of water was applied over the limbs, it resulted in a change in deep body temperature equivalent to the no leakage conditions. The 500ml applied to the torso resulted in a 30% reduction in clothing insulation [20].

Tipton's previous work [18, 20], demonstrated that testing in calm water underestimates the performance of suits in rough sea states. The leakage of water into the suits in the previous studies resulted in a decrease in suit insulation, which may possibly explain the degradation in performance compared to calm conditions. Ducharme and Brooks investigated the effects of varying wave heights on heat flow in humans at NRC-IOT's facilities [7]. Six healthy males performed nine 1-hour immersions in waves ranging from 0 to 70cm in height in steps of 10cm, with another immersion performed, vertically, in calm water up to the neck. The water temperature was 16.0°C, and the air temperature was 16.6°C. The volunteers wore uninsulated dry immersion suits with one-piece undergarments. Water leaked into the suits on only 2 of the 54 runs, with the leakage being estimated as only a few grams [7]. Deep body temperature was not affected by wave heights, but this is not unexpected given the duration of the immersion and temperature of the water and air. Mean heat flow was affected by wave height, with the larger waves (30cm and higher) producing a significantly greater amount of heat flow compared to calm water. Ducharme and Brooks concluded that the total thermal resistance of dry immersion suits is decreased by waves, compared to calm water, and that further studies are necessary to determine the practical limit of this reduction [7].

A large body of work has been completed to date that has examined the effects of rough sea states on human thermal responses. Earlier work has shown the importance of immersion suits [10-11] but these were limited to calm water pools. Later studies [9, 16] began to investigate the effects of rough sea states on volunteers, but the variability of the environmental conditions possibly resulted in a lack of conclusive results being produced. Later work [7, 18, 20] conducted in laboratory conditions clearly showed that wind and waves would result in degradation in immersion suit performance compared to calm conditions. In his paper "Immersion fatalities: Hazardous responses and dangerous discrepancies" Tipton discusses the potential for laboratory tests to overestimate the performance of immersion suits [19]. Volunteers performed two separate immersions wearing the same clothing ensembles, with the only difference being one immersion was performed in 15cm waves, with periodic surface spraying, and 3.1m·s^{-1} of wind. These mild weather conditions resulted in a 30% reduction in predicted survival time when compared to the calm water immersions [19]. Tipton stated that tests defined in a standard must give an accurate indication of the level of protection offered by equipment during an emergency.

> To do this, tests must either recreate the tasks which may have to be undertaken and the environmental conditions which may exist during an accident, or provide a reliable and valid way of predicting performance in such situations. If they do not, then there is a danger that 'approved' suits will be inappropriate, or not as appropriate as they might be. Tipton [19]

The result of not considering the environmental conditions where protective equipment is used, and the resulting human responses, will lead to a different level of performance compared to calm conditions. An excellent diagrammatic representation of the results of considering or ignoring these factors was created by Tipton, and is presented in Figure 1.

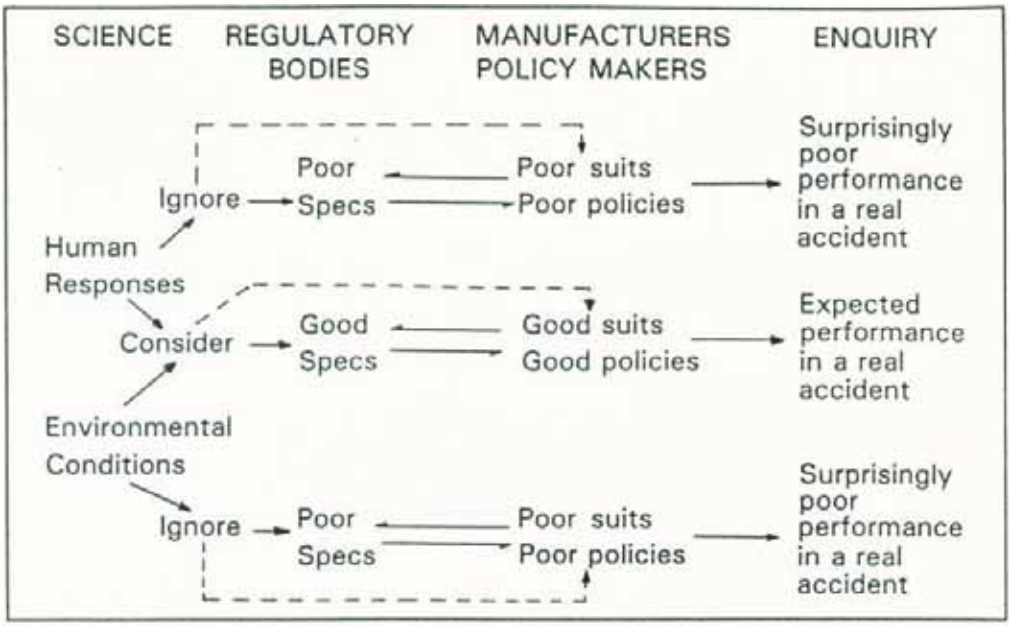

Figure 1: Relationships between the groups involved in survival in the sea. Note: "Specs" = specifications, regulations, standards, and guidelines. (Reprinted with permission from [19]).

It is extremely important for future studies to recreate as realistically as possible the conditions where protective equipment will be used, and to measure the human responses during these tests. Unfortunately, this can be challenging to do, as not many facilities in the world are capable of recreating consistently the environments where the equipment will be used. While testing in the open ocean can provide valuable insight into the performance of the equipment and humans, these trials can be extremely expensive and difficult to conduct. Randomized environmental conditions due to weather can result in not all study volunteers experiencing the same sea states as the others. Additionally there is a very narrow range of weather conditions with sea states more turbulent than calm water, but still safe enough to test in.

2.0 Summary of NRC-IOT Led Work

Assessing the performance of protective equipment in realistic conditions can be challenging. Testing in the ocean will allow for a measure of

performance of the equipment, but these trials can be very expensive and difficult to complete. Varying weather conditions can also result in some test volunteers not experiencing the same sea states as others do, which does not give an "apples to apples" comparison. As well, there is a very narrow range of weather conditions where the sea state is turbulent enough not to be considered "calm, circulating water", but still safe enough to work in.

The advantage of laboratory-based tests is the ability to ensure that each test volunteer experiences the same conditions as the rest. However, there are few laboratories in the world capable of generating both wind and waves of a level close to that seen in real-world scenarios.

In 2007, the NRC-IOT multi-year project "Human Thermal Regulation in Wind and Waves" was proposed to examine the effects of varying weather conditions on human thermal responses. While previous studies have examined the effect of simulated and actual rough sea states on immersed humans, NRC-IOT sought to add to this body of work by using its Offshore Engineering Basin (OEB) to address earlier shortcomings of these studies. The OEB is one of the few facilities in the world capable of generating programmable waves up to 1 meter in height, as well as being able to produce wind speeds up to $10 m \cdot s^{-1}$. By conducting experiments in the OEB, the project's research team was able to ensure that each participant experienced the same test conditions as the others did, conditions that were significantly worse than the calm, circulating water used for current immersion suit certification.

Three separate experiments were conducted over the course of three years that examined the effects of varying weather conditions on human thermal responses. The first experiment was conducted in 2008, and investigated the effects of 4 separate immersion conditions on 12 human volunteers during 1-hour immersions. The four immersions were in calm water (no wind or waves), wind only (no waves), waves only (no wind), and wind + waves (wind and waves). The wave spectrum used in the experiment was created from data collected in February 2008 from a wave buoy located on the south west margin of the Grand Banks. The 20-minute, irregular Joint North Sea Wave Analysis Project (JONSWAP) wave spectrum had a maximum height of 0.67m, with a wind speed of $4.24 m \cdot s^{-1}$, which was

matched to the sea state associated with the given wave height. Water temperature ranged from 10.8-11.1°C, and air temperature was between 17.6-18.5°C.

Compared to the calm immersion, all immersion conditions produced a significantly greater increase in heat flow. The wind + waves condition caused a 36.8% increase in mean skin heat flow compared to the calm immersion, with no significant change in water or air temperature [14].

Building upon the results collected from the first phase of the project, the second experiment examined the effects of varying wind speeds and wave heights on human thermal responses during 3-hour immersions. The findings of the first phase of the project showed that immersions in environments consisting of both wind and waves will cause a significantly greater increase in heat flow compared to immersions in calm water, wind only, and waves only. The main objective of the second experiment of the project was to investigate if the human thermal responses changed proportionally to increasing wind speeds and wave heights.

For the second experiment conducted in March 2009, 12 participants performed 3 hour immersions in three separate conditions: calm water, Weather 1, and Weather 2. The calm water condition consisted of no waves or wind, with a water temperature of 11.4°C, and an air temperature of 17.2°C. The Weather 1 condition had a 20-minute, irregular JONSWAP spectrum with a maximum wave height of 0.34m, wind speed of $3.5 m \cdot s^{-1}$, water temperature of 10.9°C, and air temperature of 17.4°C. The Weather 2 condition had a 20-minute, irregular JONSWAP spectrum with a maximum wave height of 0.67m, wind speed of $4.6 m \cdot s^{-1}$, a water temperature of 10.9°C, and air temperature of 17.3°C.

Similar to the previous experiment, the two immersion conditions consisting of wind and waves resulted in a significantly greater increase in mean skin heat flow compared to the calm conditions [15]. There were no significant differences in the change in deep body temperature between the three immersion conditions. The lack of differences in deep body temperature was possibly the result of the high level of protection provided by the immersion suits used, and the relatively warm water and air temperatures in each environmental condition. Due to these factors, the

study volunteers' own thermoregulatory responses were sufficient to cope with the added thermal stress placed on them by the environmental conditions.

A third experiment was conducted in March 2010 that examined the effect of water leakage on the thermal responses of 12 volunteers performing 3-hour immersions in varying weather conditions. The objective of the third experiment was to determine if the effects that varying weather conditions have on the thermal responses of humans are increased due to the presence of 500ml of water in the suit. The weather conditions used in the third experiment were the same as in the second, with water and air temperatures being only slightly cooler in the former as compared to the later. At this time, the data collected from the third experiment has not been fully analyzed, but volunteers were observed to have blue lips, intense shaking, and near hypothermic level drops in deep body temperature during the tests.

In related investigations, NRC-IOT has also conducted studies that have investigated the ability to use thermal manikins to determine immersion suit thermal protection under non-uniform cooling conditions [13], and the correlation of human thermal responses to manikins [12, 14]. NRC-IOT has participated in a series of international, round robin style tests tasked to determine if thermal manikins are viable to be used for international immersion suit approval testing. The results of the NRC-IOT study show that under non-uniform cooling conditions (different water and air temperatures), further research would need to be conducted before thermal manikins could be used with confidence for suit evaluation [13].

Before, and during, the round robin testing NRC-IOT has undertaken studies to correlate human thermal responses to those of manikins. In a pilot study, two separate thermal manikins were tested alongside two human volunteers dressed in immersion suits in calm water. While there was some slight variation in heat loss between the manikins and the humans, this was attributed to the fit of the suits on the humans and manikins. The results from this pilot study suggest that heat lost from manikins in the conditions tested was a good representation of heat loss from humans [12]. A similar study by NRC-IOT correlated the responses between a thermal manikin and 12 humans across four separate weather

conditions [14]. Heat flow from the human volunteers increased significantly from calm conditions when they were immersed in conditions consisting of wind and/or waves. There were extremely similar responses measured between the increase in heat flow in humans and manikins when moving from the calm conditions to the weather conditions [14]. When comparing the increase in heat flow between calm and the wind + waves condition, there was only a 1.6% difference measured between the human's and manikin's responses. The results obtained from the thermal manikin during these tests also provided more support that testing in calm conditions will result in an overestimation of performance, as the thermal insulation of the suit (as measured by the manikin) dropped 20% by adding wind and waves without changing the temperature [14].

The results collected so far from the NRC-IOT lead work have established that wind and waves will significantly increase the cooling capacity of an environment, without a significant change in temperature. Testing the thermal protective properties of immersion suits and people in calm water pools will not provide accurate assessments of their performance in real world scenarios.

3.0 Existing Knowledge Gaps in Immersion Suit Performance

3.1 Performance- vs. prescriptive-based regulations

As shown by Tipton [19], it is possible for a knowledge gap to exist in how a suit performs under standardized test conditions, and in real world scenarios. Current prescriptive-based regulations require suits to be tested in conditions not representative of where they may actually be used. Performance-based regulations require more realistic testing, and would help to address the knowledge gap that exists. In this section we will differentiate between specification-based regulations and goal-based regulations and will attempt to explain how a goal-based regulatory regime may be useful in circumstances that require innovation, which is the case with immersion suit systems in cold regions, as well as to draw attention to some of the arguments and cautions raised concerning the use of a goal-based regulatory regime.

Specification-based regulations are prevalent in the shipping industry. On matters relating to marine operations the offshore petroleum industry adopted many of these regulations and the regulatory approach in which they were developed. In many jurisdictions both the shipping and offshore petroleum industries are governed by prescriptive specification-based conventions and regulations in matters of EER. In general this is applicable to emergency response's escape, evacuation and rescue (EER) and more specifically to helicopter emergency operations with regards to ditching and subsequent EER. The EER technology developed to ensure compliance with marine regulations has been widely adopted by the offshore industry.

The inherited regulatory apparatus and corresponding EER technology may not be adequate in terms of its coverage of and utility for cold east coast of Canada EER. In these circumstances, compliance with regulations and off-the-shelf solutions is inadequate. The current trend by the shipping and offshore petroleum industries towards activities in northern ice-covered regions will require them to deal with a host of issues that will involve innovative solutions that are unlikely to be fully addressed under existing regulations and existing technical solutions. In these circumstances, developments in northern cold regions may be most effectively advanced under a goal-based regulatory approach. The goal-based approach is described below, along with practical definitions of the roles of both regulators and operators under such a regime. To highlight the differences in the approaches the contrasting features of the specification-based approach are presented as well.

In a goal-based regulatory environment, a regulatory body establishes performance goals. The regulator presents clear statements of the goals and corresponding expectations of what is required and sufficient to be addressed in order to achieve adequate safety. In broad terms, performance goals will generally reflect society's values and norms, and should specifically reflect any requirements of the law. Embodied in regulations, these effectively become matters of public policy whose application is mediated in some way by a regulatory agency. In practical terms, a performance goal is the objective or purpose of a piece of equipment, procedure, system, or other element of a particular installation,

ship or for this specific purpose, an immersion suit system as it relates to helicopter operation.

The operator has the responsibility to meet or exceed the performance goals, and establish the means by which to achieve and maintain them. The operator must present clear arguments and evidence to give confidence that the regulatory goals are met. The operator must further ensure that there are clear, auditable connections between the goals and expectations, and the arguments and evidence. In many instances in the attempt to demonstrate capability, knowledge gaps are identified which require innovative solutions. The general expectation from the added responsibility is that goal-based regulations promote a culture of safety rather than one of compliance.

A performance standard is the operator's specification of a solution to achieving a given goal. It constitutes the basis of the operator's argument that safety goals can and will be met. It is a verifiable statement of the performance required of the equipment, procedure, or system. Performance standards should be cast in terms of reliability, functionality, availability, survivability, independence. They should contribute to the overall goal of reducing the risk of harm. Each standard should provide a basis for monitoring and maintaining the basic performance of the equipment, procedure, or system throughout its life cycle, and should account for the specific circumstances particular to the installation, ship, immersion suit system, etc. and its operation. In the context of East Coast of Canada EER, for example, the performance standards must reflect factors such as cold temperatures (air and water), fog, high wind and waves and possibly sea ice cover.

For a goal-based regulatory approach to work, performance standards must be supported by evidence and be open to objective evaluation. Goal-based regulations can incorporate existing specification standards, as they provide a window into what has been accepted under a specification-based regime and may still be acceptable to the regulator under a goal-based system. In general, where engineering design and operation matters are covered by codes of practice, classification society rules, industry guidelines, or other accepted norms, the goal-setting approach gives the

operators some flexibility in choosing a way forward, including a facility to adopt evolving best industry practice without the delays experienced in jurisdictions where specification regulations are embodied explicitly in legislation.

An operator may choose to claim that compliance with an international standard or code of practice constitutes meeting best practice and therefore the goal. This may be a reasonable approach, but it is generally insufficient to claim that compliance in one jurisdiction equates to compliance in another: evidence must be presented that addresses specific goals.

In the absence of acceptable norms, the operator has an additional responsibility to propose a new performance standard and demonstrate its efficacy in achieving the performance goals. This can be a challenging requirement involving added uncertainty for the operator in terms of meeting the obligations of the law, but can also stimulate innovation. In the goal-based regulations regime innovations must find their way into practice if the advantages are to be realized. By this measure, a framework in which regulations are set out as high-level goals, rather than detailed specification standards, should facilitate the relatively rapid adoption of evolving best practice and improved technology.

With this in mind the high-level goal for helicopter emergency operations related to ditching can be stated as follows:

> In circumstances that necessitate a ditched helicopter escape, personnel must be fitted with abandonment suit systems that permit escape from the ditched helicopter safely, clearance from the helicopter and survival until rescued, and have a reasonable expectation of successfully escaping harm in the environmental conditions that can be expected to prevail in the area of helicopter operation. The survivor fitted with the suit system must maintain a 2° C threshold on deep body temperature for as long as it takes the SAR to perform the rescue.

When innovations with demonstrated benefits in terms of reducing the risk of harm are available at costs that are not grossly disproportionate to the benefits, the operator should adopt them; otherwise, the regulator should

insist they do. Such provisions (e.g. that best available technology be used) can be incorporated in both specification-based and goal-based regulations to help ensure the adoption of effective innovations.

The regulator accepts the operator's proposed performance standards or not, and holds the operator to the stated standards. Rather than using inspections as the key mechanism to ensure operators are in compliance with regulations, as is generally the case under a specification type regulatory framework, regulators in a goal-based framework rely more heavily on audits of the operators' safety plans. The relatively heavier use of auditing than inspecting has given rise to some criticism of goal-based regulations as entailing self-regulation by industry, and too much focus on the management of safety rather than the matter of safety. Subsequently, this has led to some opposition to change from specification-based regulations to goal-based regulations, although the latter seem to be ascendant. In practice, the regulator is the ultimate authority under both types of regulatory system, although the activities and skill sets required by regulators are likely to be quite different under the different regimes.

There are other arguments against the move away from specification-based regulations, including that they capture a wealth of historical knowledge and experience, are relatively easy to use by designers and operators, and are relatively easy to check by regulators and their designated inspectors. Indeed, existing specification regulations do incorporate valuable experience, including that from accidents, although the context is sometimes lost once the specification-type regulation is constituted. Routine application of regulations without clear understanding of their context then provides some unspecified level of safety that is still accepted by the regulator. This is the situation even when the value of the specification standards derives from experience with installations that differ significantly from a given specific situation at issue.

It is sometimes argued that specification regulations are fair in the sense that they apply equally to all operators so that no commercial advantage can be sought through variance from the specified rules. There is also the view that as safety is often considered to be a cost, it will therefore generally be eroded over time unless specific regulations are applied and enforced. Goal-based regulations have also been criticized as relying too

heavily on risk management, particularly on quantitative risk assessment and its attendant uncertainties.

The advantages and disadvantages of both prescriptive- and performance-based standards are summarized in Tables 1 and 2 below.

Table 1: Prescriptive-based standards: advantages and disadvantages

ADVANTAGES	DISADVANTAGES
Easy to create and implement	Compliance may not provide best solution
Provides certainty for operators and regulators as to compliance	Reduces the flexibility available to operator to provide best solution
	Does not account for improvements in technology
	Reduces innovative solutions
	Operators tend to become passive in their approach to safety

Table 2: Performance-based standards: advantages and disadvantages

ADVANTAGES	DISADVANTAGES
Puts responsibility for solutions on operators	Requires that the regulators, inspectors, and operators be highly qualified
Provides flexibility in developing solutions	Management system must be adaptive and closely monitored in order to change the system if required.
Fosters innovative solutions	Regulators and Operators must work together harmoniously to provide the best solutions available
Allows for continuous upgrading of system	
Allows adaptation of new technologies	

3.2 Current Regulations, Standards and Guidelines

In this sub-section we will identify standards that deal specifically with immersion suit or helicopter passenger transportation suit systems.

CAN/CGSB-65.16-2005 Marine Abandonment Suit System and **CAN/CGSB-65.17-99**. Helicopter Passenger Transportation Suit system.

These two standards aim to provide the evacuee(s) with a system that offers protection against the cooling effects of immersion in cold water, and provides adequate floatation.

The Canadian General Standards Board standards for immersion suits are among some of the most rigorous in the world. The leakage test for suits require that both jump and one-hour swim tests be conducted. Once the tests are completed, the values used to calculate the water ingress for both the jump and swim tests are to be one standard deviation above the mean for the results from eleven subjects. The values from the one- hour swim test are then multiplied by 3 and added to the jump tests to give the total water ingress for the suit. By using one standard deviation above the mean as the calculated value, this helps to create a safety factor by over reporting the average water leakage for eleven subjects.

Prior to the start of the thermal protective tests, the amount of water to be added is the value calculated from the water leakage tests. By using the value of one standard deviation above the mean, the thermal protective tests are more challenging for the suit due to the increase in water leakage.

The CGSB test conditions for using humans to evaluate the thermal protective properties of immersion suits is for them to be immersed in calm, circulating 2°C water. If the suit prevents a drop in deep body temperature of 2°C in six hours, and keeps the finger, toe, and buttock temperature from dropping below 10°C, then it passes the test. Thermal manikin tests are conducted in turbulent water with a wave height of 40cm, with there being at least a 3°C difference between the water temperature, and the target temperature for the manikin.

ISO15027 – International Standard under the general title of "Immersion Suits" meeting the requirements of persons carrying out activities on or near water and consisting of the following:

Part 1: ISO15027-1:2002 ~ Constant wear suits, requirements including safety

Part 2: ISO15027-2:2002 ~ Abandonment suits, requirements including safety

Part 3: ISO15027-3:2002 ~ Test methods

The ISO standards (ISO15027-2:2002 and ISO15027-3:2002) are often used by others to define the testing criteria for immersion suits. The leakage measurement tests require that water leakage only be measured after a jump from 4.5m, and a 20-min swim. The average amount of water that leaked into the suit during this test (jump and 20-min swim) is then recorded.

The thermal protective tests for the ISO standards are very similar to those defined in the CGSB. However, the amount of water to be added to the suit prior to the start of the tests is the value recorded during the water ingress tests. This value could possibly be significantly less than that recorded in the CGSB if the same suit was used, resulting in a less challenging thermal test.

European Aviation Safety Agency

ETSO - European Technical Standard Orders offshore industry.

ETSO-2C502 ~ Helicopter Crew and Passenger Immersion Suits for Operations to or from Helidecks located in a Hostile Sea Area

Specifies the minimum standard of design and performance of helicopter and integrated immersion suit. This standard refers back often to ISO 15027-3:2002 to define the testing standards, and acceptable pass criteria.

Civil Aviation Authority United Kingdom

Specification No.19 ~ Helicopter Crew Members Immersion Suits

This standard addresses the minimum standard of design and performance. In contrast to the previous three standards, the UK standard requires that

no more than 200g of water leak into a suit when performing tests similar to those outlined in the ISO and CGSB standards. There is no proposed test in the UK standard to check the thermal protective properties of a suit. Instead, it is stated that if any suit allows less than 200g of water into it, and the person is wearing the recommended clothing under the suit, then it should provide 3 hours of protection from hypothermia in 5°C water.

The Norwegian Oil Industry Association (OLF)

This standard is similar to that of the European Aviation Safety Agency in that it often refers back to ISO 15027-3:2002 for suit requirements. It differs from the European standard by requiring stronger testing conditions. The OLF requires that leakage tests be performed as outlined in 15027-3:2002, but that no more than 200g of water enter the suit. The thermal protection tests are also conducted according to 15027-3:2002, but are made more strenuous by adding 5 $m \cdot s^{-1}$ of wind and pouring water over the front of the body every 10 minutes. For determining suit floatation and stability, the OLF standards require that the suits give the test subjects a stable position lying on their back, and placed crosswise in relation to waves. The OLF requires that the tests be conducted under controlled conditions with a minimum of 80cm waves.

3.3 Example of use of prescriptive- and performance- based approaches

In this sub-section we will use as illustration the CAN/CGSB 65.17-99, Floating Characteristics, paragraph 6.2.3, and Stability and Floatation Characteristics, paragraph 8.1.3.7, as the prescriptive approach and subsequently we will present an approach that we believe is more in tune with goal-based regulatory approach.

> **6.2.3** ***Floating Characteristics*** -When tested as described in par. 8.1.3.7, the suit system shall provide a stable floating position, with a face plane angle between 30 and 80° to the horizontal, in which the subject is face-up with the mouth and nose at least 120 mm above the surface of the water. This shall be achieved for at least eight out of the eleven subjects.

> **8.1.3.7** ***Stability*** **and** ***Floating Characteristics*** -Each subject, while wearing a suit system, shall enter the water gently, activate the inflatable buoyancy element and adopt a face-up position with the legs together and the arms at the sides. After a period of 5 min it shall be established that the subject is stable in that position by depressing each shoulder in turn to ensure that the subject returns to the face-up position and does not invert.
>
> With the subject in a relaxed position, measure the freeboard to the mouth and nose, perpendicularly from the surface of the water.
>
> Measure the angle, relative to the surface of the water, of the plane formed by the most forward part of the forehead and chin of the subject floating in the attitude of static balance in which respiration is least likely to be impeded. For each subject determine the stable position and the face plane angle.

In the above paragraphs of the CGSB standard an understanding of suit system floating stability is sought. In the approach used the regulatory body ignored both the human response as well as the environmental conditions, both pre-requisites for assessing the performance of the suit system in a real-world accident scenario. A "pass/fail" approach doesn't address anthropometric characteristics of the human volunteers, only attempts to looks at the suit system static stability, even though the magnitude of the disturbing force and the point of application aren't quantified, and doesn't consider the effects of the environment, wind and waves, on the floatation stability. As manufacturers apply the standard requirements for suit system floatation they address only the minimum requirement "pass/fail" and they don't delve into the details of performance required of the equipment. This results in a suit system that meets standard requirements but for which the environment and the human components are not fully understood. The example of a performance-based approach will read more like the following:

> Goal: Determine the stability and floatation characteristics of a suit system for the population distribution it intends to fit and for the weather conditions predominant in the area of operation.

How to meet the goal: initially perform floatation stability measured in calm water for a number of participants that is both representative of the wearer population and in sufficient numbers to be statistically reliable. Mark on each participant's suit the location of the point of application of the disturbing force. For each participant measure the suit's reserve buoyancy after the air is purged in order to establish the individual subject/suit baseline. Measure each individual suit system/subject water plane, the angle that the legs below the knee make with the horizontal plane, the freeboard and the face plane angle. After the calm water baseline floatation characteristics are reliably established test the stability and floatation functionality of the suit system in a range of environmental conditions composed of wind and waves as an approximation to a real sea state and for different orientations in order to establish the dynamic characteristics of the suit system.

The manufacturer, instead of meeting a bare minimum, will get insight into the stability and floatation characteristics of the design and will be in a position to effect changes that maximize the performance of the suit system, taking into consideration the human and the environment.

3.4 General knowledge gaps across major topics

In this sub-section we will identify the knowledge gaps identified by reviewing the Canadian standards dealing with immersion and abandonment suit systems.

CAN/CGSB-65.16-2005 Section 6.8: Donning Time - Current CGSB testing standards require that immersion suits be donned while on a stable platform. For helicopter transportation suit systems, this does not present much of an issue, as most suits are donned while at the helicopter terminal, or on the offshore installation itself. Assessing the donning of a suit on a stable surface may lead to an overestimation of performance for marine abandonment suits. These suits are often donned during an emergency (e.g. a vessel sinking), where the people may not be situated on a stable surface. Unstable surfaces due to vessel motion may result in a degradation of performance in the ability to don the suit.

CAN/CGSB-65.17-1999 Section 6.1.9.2: Mobility and Hand Dexterity - CGSB testing standards require that all hand dexterity tests be performed in water "not less than 18°C". Vincent and Tipton have found that hand immersion in 5°C for as little as two minutes can produce significant reductions in maximum voluntary grip strength in an unprotected hand [21]. Given that temperatures in the North Atlantic can drop to below 0°C during certain periods of the year, it is extremely important to conduct standard tests in water that has a temperature similar to that of the area of operation. There may be a surprisingly large degradation in expected performance of hand dexterity if tests are only conducted in "warm" water.

Additionally, there is no requirement in the current CGSB standards for people to be able to manipulate a replica of the buckle used for the seat restraints on the helicopter.

CAN/CGSB-65.17-1999 Section 8.1.3.7: Stability and Floating Characteristics - CGSB testing standards require that all flotation and stability tests be performed in calm water pools. It is unknown at this time how wave motion will influence the stability and floating characteristics of immersion suit systems. It is possible that the orientation of the person to the waves (feet first, head first, side on etc.) may also change their stability in the water.

CAN/CGSB-65.17-1999 Section 8.1.4: Vertical Positioning - In order for an immersion suit system to pass the CGSB vertical positioning tests, a study volunteer must be able to stand vertical in the water for 2 minutes, unassisted. Similar to the previous ones, these tests are to be conducted in calm water pools. It is unknown how wave action will affect the ability of a person to maintain a vertical position in the water.

CAN/CGSB-65.17-1999 Section 8.1.6.1:Water Ingress - CGSB testing standards require that water ingress be calculated to determine the volume of water to add before the thermal protective tests. The water ingress evaluation is composed of two parts: a jump from not less then 3m, and a 60-min swim in calm water. Work conducted by the CORD Group Ltd. has shown the potential for the calm water swimming tests to underestimate the amount of water leakage into a suit [5-6]. When the swimming tests were performed in conditions with wind and waves, the

suits allowed more water leakage to occur due to the environmental conditions proving to be more challenging to the immersion suit seals.

CAN/CGSB-65.17-1999 Section 8.1.6.2: Thermal Protection - manikins - Testing standards for manikins require them to be immersed in 40cm waves, at a water temperature not less than 3°C different from the manikin skin temperature. There is no specific reason given for requiring a wave height of 40cm for this test. Work conducted by NRC-IOT has shown that an environment consisting of both wind and waves will cause a greater amount of heat flow compared to either condition by itself [14].

CAN/CGSB-65.17-1999 Section 8.1.7: Thermal Protection –humans - The testing standards prescribed for humans are less strenuous than those for manikins. Humans are to be immersed in calm, circulating 2°C water. Previous work by NRC-IOT has shown that the heat lost in the current prescribed test conditions is significantly less than in an environment that has both wind and waves. Without a significant change in temperature, wind and waves can increase the heat lost to an environment by as much as 37% compared to immersions in calm water [14-15].

Additionally, the humans used for these tests are specified to be between 160-185cm tall and not more than 10% over or underweight. It is unknown at this time if the anthropometric characteristics prescribed for these tests are representative of the offshore work force that will have to use these suits.

4.0 Suggested Safety Approaches and Emerging Technologies

There currently exists a knowledge gap between the results observed in the current prescribed testing standards for immersion suit systems, and their performance in real-world conditions. As discussed throughout this report, a large body of work has shown that this current knowledge gap can result in surprisingly large degradations in the performance of humans in immersion suits during real-world accidents. This knowledge gap is the greatest threat to the safety of people who work and travel over the ocean since it results in a level of uncertainty of the performance of Life Saving Appliances (LSA), uncertainty that often leads to injuries and fatalities.

Due to their nature, prescriptive-based standards can create the knowledge gaps that will often result in poor performance of LSA. When a standard prescribes a specific set of test conditions and values to be obtained, it creates a focused avenue for the performance of the LSA. Testing standards, either due to technical limitations or lack of information, will rarely prescribe for tests to be conducted in the conditions that LSA will be used in. The underlying assumption is that if a LSA passes a prescribed test, then it will exhibit the same level of performance in any situation. It is rare when a LSA fails in a spectacular fashion in a real-world situation, that the merit of the test that it passed for approval is questioned. Instead, the LSA itself is given an intense level of scrutiny and will no doubt undergo some level of redesign, only to be evaluated by the same prescribed tests that the first LSA passed. There will still be no indication that the "new" LSA will perform significantly better in real-world conditions compared to the older design, since it will still be evaluated by the same test that the latter passed.

In his article "Ship/Rig Personnel Abandonment and Helicopter Crew/Passenger Immersion Suits: The Requirements in the North Atlantic", Brooks discussed the problems involved in manufacturing immersion suits that are both dry and comfortable [3]. Brooks thought that it would be "inappropriate to legislate towards or away from specific design concepts, such as types of seals to be used", with the understanding that doing so would result in excluding helpful innovations [3]. In a similar fashion, moving away from standards that prescribe the test conditions to performance-based ones would be the best approach to addressing the current knowledge gap. As stated by Tipton, LSA should be tested in the conditions that they will ultimately be used in so that an accurate level of performance can be assessed [19].

A shift from prescriptive-based standards to performance-based ones would improve the safety of everyone who uses the LSA that they govern. For example, the current CGSB thermal protective tests using humans require that a suit prevent a drop of 2°C or more in deep body temperature in 6 hours while the person is immersed in calm, circulating 2°C water. Assuming that the suit has passed all the other tests, it is now approved for use anywhere in Canada. This suit can now be used off the West coast of British Columbia, in a sheltered harbour in P.E.I., in the Arctic Circle, and

off the East Coast of Newfoundland. The average environmental conditions vary greatly in each of these locations, yet the suit is expected to perform to an acceptable level in each of them based on prescribed testing conditions that do not match any of them.

By shifting to a performance-based standard, the testing certification for the immersion suits would change, eliminating the knowledge gap of their performance. If we were to change the prescriptive-based tests in the previous example to performance- based, they would read something like the following:

> The suit must prevent a 2°C drop in deep body temperature in conditions representative of the area of operation for the amount of time it would take search and rescue to respond. The size distribution of the test subjects should have anthropometric dimensions equal to that of the workforce using the suit.

Allowing the area of operation, response time of search and rescue assets, and size of the people using the LSA to set the conditions for the testing standard, a large amount of uncertainty would be eliminated as to how it would perform with the people using it.

The best way to eliminate risk due to uncertainty in immersion suit performance is to test in the most realistic, representative conditions possible with people who will be ultimately using the suits. This would pose a series of logistical challenges since it would require a constant assessment of the conditions that people use LSA in, and the ability to accurately simulate them in a controlled fashion. As well, it would require constant monitoring of the ever-changing population who use the LSA. It is recommended that further research be conducted in the following areas to help increase the safety of the offshore workforce:

1.) The cost and feasibility to shift from prescriptive-based regulations to performance-based.

2.) New fabrics and materials for immersion suits that would allow for increased performance in realistic conditions. This would include the use of “intelligent” fabrics that change their properties based on

temperature, suit seals that would allow an assessment of their watertight integrity, and reinforcing existing materials.

3.) The redesign of the suits' thermal balance during flight by including "suit vents" as a way of keeping the user more comfortable while keeping the integrity of the suit system.

4.) Holistic design of the transportation environment and all the components of the suit system so they work together as one, e.g. redesign of seat buckles that can be operated with the gloves donned.

5.) Development of training simulators for helicopter emergency operations, escape, evacuation and rescue.

6.) Re-evaluation of the risks associated with each seat on the airframe. Re-evaluation of the "fit-for-purpose" of the airframe for operation in east coast of Canada given the impairment caused by the auxiliary fuel tank.

7.) Continuous monitoring and assessment of the offshore work force's anthropometrics and physical capabilities. By keeping an on-going database of these parameters, this information can be fed back to the standards and manufacturers to allow for further refinement of the LSA, airframe passageways, seat sizes, etc.

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2010

OFFSHORE HELICOPTER SAFETY REPORT

Michael Taber

This report details five key areas of interest as they relate to offshore helicopter travel safety. In order to contextualize the report, the first section identifies previous helicopter events (crashes and ditching) within the offshore oil and gas industry. This is followed by a discussion of additional operator requirements outlining the need for an integrative approach associated with operational requirements and human performance of helicopter underwater escape procedures. The third section of this report then addresses the current understanding of Helicopter Underwater Escape Training (HUET) standards in an effort to identify possible improvements to survivability. The fourth section focuses on personal protective equipment associated with helicopter transport over water in order to discuss standardization limits. The fifth section of this report details the need for a collaborative approach to the implementation and monitoring of helicopter safety initiatives. The sixth section of the report calls for an understanding of personal accountability with regard to helicopter travel safety and suggests that in order to achieve maximum survivability in the event of a ditching, all stakeholders share in the responsibility of risk mitigation. The final section offers a list of information related to influencing factors associated with helicopter ditching survivability. This list is divided into known and unknown information in an effort to offer some direction for future research

Prepared for the Offshore Helicopter Safety Inquiry • Newfoundland and Labrador • Canada

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PREAMBLE

Transporting offshore personnel to installations located hundreds of kilometers off the North Atlantic coast represents some unique challenges. The considerable distance from shore, difficulty of personnel transfer, and variability of weather all play key roles in a decision of how best to safely transport individuals to these remote work sites. Not surprisingly, helicopters have been adopted as the primary means of moving individuals due mainly to their efficiency and have become an elemental part of the offshore environment. As evidence of their popularity, approximately 900,000 flight hours are completed each year during normal personnel transport to offshore installations around the world (Hart, 2008). However, as the search for hydrocarbons moves further offshore, the need to address specific safety issues related to helicopter transportation increases. Therefore, the following report is intended to provide a review of existing information related to offshore helicopter transportation safety. Specifically, this report is designed to aid in developing future guidelines related to operational requirements for operators, helicopter safety training standards, personal protective equipment for passengers and pilots, worker and pilot participation in safety initiatives, and finally, personal accountability related to helicopter safety.

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LIST OF ABBREVIATIONS

AAIB	Australian Aviation Investigation Board
ALARP	As Low As Reasonably Practicable
ASRS	Aviation Safety Reporting System
AWM	Airworthiness Manual
BCAR	British Civil Airworthiness Regulations
BP	British Petroleum
BST	Basic Survival Training
BST/R	Basic Survival Training/ Recurrent
CAA	Civil Aviation Authority
CAPP	Canadian Association of Petroleum Producers
CGSB	Canadian General Standards Board
CHC	Canadian Helicopter Corporation
C-NSOPB	Canada-Nova Scotia Offshore Petroleum Board
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CSB	U.S. Chemical Safety and Hazards Investigation Board
EASA	European Aviation Safety Agency
EBS	Emergency Breathing System
ETSO	European Technical Standard Order
FAA	Federal Aviation Authority
FAR	Federal Airworthiness Regulations
HPTS	Helicopter Passenger Transportation Suit
HUEBA	Helicopter Underwater Emergency Breathing Apparatus
HUET	Helicopter Underwater Escape Training
ICAO	International Civil Aviation Organization
JAR	Joint Airworthiness Regulations
METS™	Modular Egress Training Simulator
MI	Marine Institute
NASA	National Aeronautics and Space Administration
NTSB	National Transportation Safety Board
OGP	Oil and Gas Producers
OLF	Norwegian Oil Industry Association
OPITO	Offshore Petroleum Industry Training Organization
PLB	Personal Locator Beacon
PPE	Personal Protective Equipment
QMS	Quality Management System
SMS	Safety Management System
SSTL	Survival System Training Limited
TC	Transport Canada
TSBC	Transportation Safety Board of Canada

1. INTRODUCTION

Based on combined reports from the National Transportation Safety Board, Civil Aviation Authority, and various other sources, the international offshore community experienced 60 helicopter ditchings/crashes between January 2000 and December 2009 (Table 1). Of the 60 events, 29 (48%) involved fatalities and resulted in the death of 152 of the 294 (52%) individuals onboard. The information in Table 1 has not been divided into classifications such as a ***ditching*** (controlled/semi-controlled intentional emergency landing on water) or a ***crash*** (uncontrolled flight into terrain/water); however, the number of fatalities represents a survival rate well below that suggested by previous studies (Table 2).

Table 1. World offshore helicopter ditchings for 2000 – 2009.

	Helicopter Type	Offshore Location	Number Onboard	Fatalities	Survival Rate (%)
29/04/00	Bell 206	Gulf of Mexico	2	0	100
07/09/00	Bell 206	Gulf of Mexico	1	0	100
26/12/00	Bell 206	Gulf of Mexico	1	1	0
08/01/01	Bell 206	Gulf of Mexico	3	0	100
04/05/01	Bell 206	Gulf of Mexico	1	0	100
04/08/01	Bell 206	Gulf of Mexico	2	0	100
05/08/01	Bell 206	Gulf of Mexico	3	0	100
26/09/01	Bell 206	Gulf of Mexico	3	0	100
18/10/01	Bell 206	Gulf of Mexico	5	5	0
01/12/01	Bell 407	Gulf of Mexico	1	0	100
29/12/01	Bell 407	Gulf of Mexico	1	1	0
08/01/02	Bell 206	Gulf of Mexico	1	0	100
23/03/02	Bell 206	Gulf of Mexico	1	1	0
08/04/02	AS 355	Gulf of Mexico	2	2	0
16/07/02	S 76	North Sea	11	11	0
25/07/02	Bell 206	Gulf of Mexico	2	0	100
01/09/02	Bell 206	Gulf of Mexico	4	0	100
09/01/03	AS 350	Gulf of Mexico	5	0	100
16/01/03	Bell 206	Gulf of Mexico	4	1	75
21/01/03	Bell 206	Gulf of Mexico	5	0	100
16/02/03	Bell 407	Gulf of Mexico	5	2	60
11/05/03	Bell 407	Gulf of Mexico	4	0	100

Date	Helicopter Type	Offshore Location	Number Onboard	Fatalities	Survival Rate (%)
08/07/03	EC 120	Gulf of Mexico	3	0	100
11/08/03	Mi-172	India	27	27	0
13/08/03	Bell 206	Gulf of Mexico	5	3	40
12/09/03	Bell 206	Gulf of Mexico	4	0	100
10/10/03	Bell 206	Gulf of Mexico	3	3	0
01/12/04	Bell 407	Gulf of Mexico	1	1	0
18/02/04	Bell 407	Gulf of Mexico	4	1	75
06/03/04	Bell 206	Gulf of Mexico	3	0	100
24/03/04	S 76	Gulf of Mexico	10	10	0
24/06/04	Bell 206	Gulf of Mexico	3	3	0
17/07/04	Bell 206	Gulf of Mexico	1	1	0
21/07/04	Bell 206	Gulf of Mexico	3	0	100
19/08/04	Bell 412	Gulf of Mexico	9	0	100
29/09/04	Bell 206	Gulf of Mexico	3	0	100
18/02/05	Bell 206	Gulf of Mexico	3	0	100
13/03/05	Bell 206	Gulf of Mexico	1	0	100
13/05/05	EC 120	Gulf of Mexico	2	0	100
18/06/05	AS332L	Indonesia	13	3	77
17/07/05	Bell 412	Mexico	2	2	0
18/08/05	Bell 206	Gulf of Mexico	2	2	0
06/09/05	S 76	Gulf of Mexico	12	0	100
06/10/05	Bell 206	Gulf of Mexico	3	3	0
19/03/06	Bell 222	Gulf of Mexico	2	0	100
05/05/06	EC 120	Gulf of Mexico	1	0	100
27/12/06	AS365N	North Sea	8	8	0
22/07/07	Bell 206	Gulf of Mexico	3	0	100
13/10/07	Mi-8T	Caspian Sea	6	6	0
15/12/07	Bell 407	Gulf of Mexico	2	0	100
29/12/07	Bell 206	Gulf of Mexico	5	1	80
09/04/08	Bell 206	Congo	1	1	0
04/09/08	Bell 212	Dubai	7	7	0
25/09/08	Bell 407	Australia	7	0	100
11/12/08	Bell 206	Gulf of Mexico	5	5	0
04/01/09	S 76	Gulf of Mexico	9	8	11
18/02/09	AS332L	North Sea	18	0	100
12/03/09	S 92	North Atlantic	18	17	6
01/04/09	AS332L	North Sea	16	16	0
01/11/09	Bell 206	Gulf of Mexico	2	0	100
Totals – Average			**294**	**152**	**48%**

Although not an exhaustive list, Table 2 shows past ditching study survivability results. The combined (day/night + trained/untrained) survival rate for the ditching studies does not appear to fluctuate dramatically from one time period to the next. Brooks, MacDonald, Donati, and Taber (2008) suggest that the average worldwide ditching survival rate is approximately 78%. With this in mind, it is noteworthy that the world offshore ditching survival rate shown in Table 1 is at least 24% less than that of previous reports. Based on the assertion that 85% of all aircraft crashes are survivable (Shanahan, 2004), the rate indicated in Table 1 is a full 36% below what should be considered an acceptable average. Further statistical analyses of these offshore cases would be beneficial in identifying survival factors related to external flotation, amount of warning, time of day, previous underwater escape training, and position of the helicopter when passengers and crew escaped.

Table 2. Reported helicopter ditching survivability rates.

Study Population	Author(s) – (Study Date)/ Time Period	Survival Rate
US Navy	Cunningham (1978)/1963-1975	91.5% (with training) 66% (without training)
Canadian military	Brooks (1988)/1952-1987	77%
Royal Navy	Vyrnwy-Jones & Turner (1988)/1972-1984	85%
US Navy	Brooks (1989a, b)/1978-1987	79% (daytime) 72% (night)
World (civilian) and US military	Chen, Muller, & Fogarty (1993)/1982-1989	82%
US Navy	Kinker, Loeslein, & O'Rourke (1996)/1985-1997	88% (daytime) 53% (night)
World civilian statistic	Clifford (1996)/1971-1992	62.5%
World (civilian and military)	Taber & McCabe (2006)/1993-2005	70% (daytime) 39% (night)
World (civilian and military)	Taber & McCabe (2007)/1971-2005	66%
Canadian registered helicopters	Brooks, MacDonald, Donati, & Taber (2008)/1979-2006	78%
Average Survival Rate (combined)		**72%**

Considerable attempts have been made to mitigate known risks associated with helicopter transportation over water; however, survivability rates remain lower than what should be expected and these events stand as a sobering reminder that a more critical understanding of how to manage helicopter emergency situations is needed. Specifically, a better understanding of Helicopter Underwater Escape Training (HUET) standards and how they might affect survival rates is essential to directing future research.

Based on the survival rates presented in Table 1, 2, and recent ditching information, the primary focus of this report is aimed at increasing the safety of offshore helicopter travel. In order to accomplish this goal, it is necessary to contextualize the key areas of interest by outlining previous helicopter ditching survivability research. Therefore, this first section addresses factors known to influence overall survival rate.

1.1 Survival Rates Based on Time of Day and Position in Water

To examine the effect of factors such as cause of event and time of day, Kinker, Loeslein, and Contarino (1998) reported that US Navy/Marine Corps daytime ditching survival rates were 88% while nighttime rates were only 53%. In a similar examination of world helicopter statistics, Taber and McCabe (2006) examined 151 helicopter ditchings that occurred from 1993 to 2005 and reported that one of the most significant contributing factors to survivability was the time at which the ditching occurred. They noted that if a ditching occurred between 18:00 and 23:59 (local times), survival rates were only 39%, whereas a ditching that occurred between 06:00 and 17:59 resulted in a survival rate of 70% (Taber & McCabe 2006). It was further identified that if the helicopter inverted immediately following impact (occupants had to escape while upside down underwater), survival rates were significantly lower than if the helicopter remained upright long enough for passengers and crew to evacuate. In a larger meta-analysis, Taber and McCabe (2007) examined over 500 ditching reports from various sources around the world. In this meta-analysis, it was noted that the overall survival rate was 66% and that the majority of the fatalities resulted when the helicopter rapidly inverted and sank (see also Chen, Muller, & Fogarty, 1993). Taber and McCabe (2007) further noted that 63% of the helicopters capsized and filled with

water regardless of whether external flotation devices were installed and/or deployed.

1.2 Survival Rates Based on Amount of Warning

Research also shows that the amount of warning just prior to impact plays a considerable role in overall survival rates. Brooks et al. (2008) report that of the 46 ditchings investigated, 83% occurred with less than 15 seconds of warning. Of the ditchings that occurred with minimal warning time, the survival rate was 86% while those ditchings that afforded longer warning times showed a survival rate of 100%.

1.3 Survival Rates Based on Type of Injury

Although impact injuries are often assumed to be the single greatest contributor to fatalities in a ditching (Civil Aviation Authority, 1995), this is not borne out by results. For example, in a detailed examination of cause of death, Clifford (1996) reported that the majority (57% for civilian ditchings and 73% for British military ditchings) of fatalities were the result of drowning as opposed to impact injuries. Cunningham (1978) reported that 19% of the 196 ditching fatalities he investigated were the result of drowning. After examining the 46 Canadian registered ditchings between 1979 and 2006, Brooks et al. (2008) indicate that, when cause of death was reported, 63% of the fatalities were the result of drowning. The Transportation Safety Board of Canada (TSBC) (1994) also cites drowning as the primary cause of death in fixed-wing ditchings that occurred between 1976 and 1990. In fact, the TSBC (1994) report clearly points out that, of the 168 fatalities examined, only 10% were as a result of impact injuries while 67% died of drowning while trapped inside the fuselage.

Limited data exists regarding the point at which drowning occurs post-impact. In the majority of cases, recovery of casualties takes place several hours or days after the initial occurrence, thus making it difficult to identify the exact time that water ingestion took place (during the impact and subsequent inversion or after breath-hold capabilities have been exceeded). Although the identification of ingestion time may at first appear to be irrelevant, detection of the precise moment is crucial to

understanding whether a ditching is considered survivable. If, for instance, all of the passengers and crew drown as a result of impact forces causing unconsciousness, possible egress difficulties are less likely to be investigated. If, however, the passengers and crew survived the impact and were unable to egress due to poor design of exits, suits, or aircraft interior configuration, identification of these difficulties is paramount to ensuring that risks are mitigated. Based on previous research and survivor testimony (personal communication, Canadian military aircrew), egress difficulties typically relate to locating and operating emergency exits, disorientation, lack of visual acuity, poor breath-hold ability in cold water, and aircraft attitude immediately after impact; such difficulties have been implicated as the cause of low survival rates (Brooks, et al., 2008; TCSB, 2006).

1.4 Survival Rates Based on Previous Training

Taken together, these results indicate that if the impact forces are considered survivable, passengers and aircrew need to be trained in how to escape from the helicopter fuselage when it is inverted and filled with water. This assertion is supported by the fact that survival rates are higher for those trained in helicopter underwater escape procedures (Brooks & Bohemier, 1997; Bohemier, Brooks, Morton, and Swain, 1998; Canadian Forces, 2008; Hytten, 1989; Ryack, Luria, & Smith, 1986). In addition, Cunningham (1978) reports that overall survival rates for those without underwater escape training was 66% while those who had training showed a survival rate of 91.5%. Past underwater escape training is not typically recorded during the ditching/crash investigation. For example, Brooks et al. (2008) indicate that only one of the 46 (2%) ditching reports examined states whether individuals had completed underwater escape training. In order to better understand the relationship between survival and training, it is important to record past training experience and identify the amount and quality of this training (see Section 3 below). Only then will it be possible to effectively explore correlations between training and survival.

2. NEED FOR ADDITIONAL OPERATOR REQUIREMENTS

This section of the report addresses the need for operators to ensure that an effort is made to reduce the risks associated with helicopter transport so

that they are as low as reasonably practicable (ALARP). Although considerable effort has been made to ensure helicopter transportation is safe, specific investigation of the interrelatedness of multiple factors has yet to be explored. Therefore, a holistic examination of crashworthiness related to seat position, window locations and size, number of personnel required to utilize one exit, physical requirements needed to open a primary and secondary exit, placement of auxiliary equipment (i.e. fuel cell, liferaft, survival or first aid kit), and an understanding of how these factors affect one another are needed. Research and anecdotal results following emergencies have clearly shown that, without fully examining the practical requirements necessary to survive a helicopter ditching, it is difficult to predict the consequences of untested strategies used during egress (Taber & McCabe, 2009). For example, those who have never opened an exit underwater may believe that the functionality and forces required to open it will be similar to that in air. Preparation based on this false sense of the skill set requirements may reduce the likelihood of survival.

2.1 Interior Safety Component Crashworthiness Related to Underwater Escape

Although there is a requirement for military and civilian helicopters to be examined for crashworthiness, testing is primarily directed at fuselage and seat designs during impact on land and does not specifically address the underwater escape environment experienced by those egressing after an event has occurred (Jackson, Fasanella, & Lyle, 2006). This fact is borne out by the fact that manufacturers of civilian helicopters are not required to test the escapability of a particular interior seat configuration in case of a ditching/water impact. Manufacturers may decide to incorporate crashworthiness components used in military helicopter design; however, there is no requirement to do so. Therefore, it is important to consider the interior environment (i.e. in-rushing water, floating debris, floatation angle or sink rate, compression and displacement of seats, etc…) to ensure that post-impact egress is possible.

If crashworthy components are incorporated into a helicopter safety system, testing under realistic (high fidelity) underwater egress conditions should be carried out to ensure that there are no complications during

escape. For example, the decision to install crashworthy seats in the passenger cabin of an offshore helicopter has obvious benefits for those that might be involved in an incident that places considerable impact forces on the occupants; clearly the individuals need to survive the impact before they can begin an escape. Benefits of crashworthy seats have been demonstrated in fixed-wing aircraft (Cherry, Warren, & Chan, 2000) and it is implied that these benefits would be transferred to any aircraft that might need a seat to attenuate (compress or lower) during impact forces that exceed 20 Gs (G = acceleration/gravitational constant of 32.2 ft/sec^2 or 9.8 m/sec^2). In addition, crashworthy seats typically incorporate a four-point seat harness, thereby transferring the impact loads away from the occupant during the critical portion of the impact as well as reducing the strike envelope (area immediately surrounding the individual in which flailing may result in contact with objects and other personnel) during and immediately following impact (Shanahan, 2004).

Although crashworthy seats are likely to increase survivability during a crash, there is no straightforward answer to: "*What is considered a survivable ditching G force*?" This is mainly due to the fact that survivability calculations are based on specific constraints related to the impact forces associated with aircraft structural components (Ubels & Wiggenraad, 2002). Additionally, there is a difference with regard to occupant survivability depending on the direction and duration of impact force as well as the type of restraint, physiological condition of the individual (i.e. fitness level, age, sex), and any possible re-direction of the forces (i.e. the seat breaks free and the individual accelerates forward or sideways immediately after impact). Based on previous research, an average person would be expected to survive a minimum of approximately 20 Gs of positive deceleration force within a duration of between 0.005 and 0.5 seconds in a four-point harness facing forward in a seat that remains in place during the impact (Shanahan, 2004; see also Desjardins, & Laananen, 1980).

Shanahan (2004) suggests that, based on the criteria that impact forces are within human tolerances and the immediate environment surrounding the individual is relatively intact, 85% of all aircraft crashes are considered survivable. However, these estimates are based on crashes that occur on land and there is no immediate danger of drowning. During human crash

tolerance testing in the 1960s, Colonel John Stapp showed that a rear-facing seat was far better than a forward-facing one and that, under the right conditions, a person could withstand over 40 Gs. (Stapp, & Taylor, 1964). More recently, however, data from Indy car racing has shown that several drivers have withstood impact forces in excess of 100 Gs (Society of Automotive Engineers, 1999, as cited by Shanahan, 2004) due to the use of crashworthy seats. Given the fact that 20 Gs is within the limits of human tolerance, the installation of crashworthy seats appears to be beneficial. However, examined from a post-event perspective, these same seats may inadvertently place significant restrictions on mobility in the event of a required escape if they are placed too closely together or positioned next to an obstruction such as an auxiliary fuel cell (Figure 1).

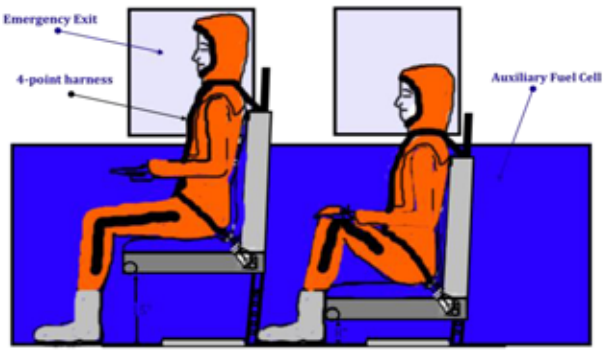


Figure 1. Crashworthy seat in full up (pre-impact) and compressed position (post-impact).

Based on the stroke distance of crashworthy seats installed in the S92, if the seat compresses to its full down position (from 15 inches to 8 inches - 380 mm to 203 mm), the individual's knees and upper thighs will be rapidly forced into the chest and any seat harness release mechanism that was easily reached during the full up seat position may now be firmly buried in the person's lap (Figure 1). Additionally, if there is any possibility that individuals can roll their feet up under the seat prior to it collapsing, there exists the possibility that the full force of their body and chair, multiplied by the G-forces, will compress and injure the lower portion of the leg and ankle during impact. These problems are particularly troublesome if the seats are located in such a position that individuals are unable to stretch their feet out in front of them (typical offshore

configuration). Additionally, the lower position of the individual after the seat has compressed changes the physical distance between the seat pan (lower portion of seat) and the emergency exit, thus increasing the distance that an individual needs to reach out in order to locate an emergency exit. The average functional reach of American males in a seated position has been reported as 793.1 mm (31.2”) (Kozey, Reilly, & Brooks, 2005; Uppu, Aghazadeh, & Nabatilan, 2006; Sengupta & Das, 2000); therefore, any exit positioned beyond this distance cannot be reached if the shoulder harness lock has been engaged during the impact. If the exit is placed outside the functional reach envelope, individuals may be required to disconnect their seat harness prior to opening an exit. The implications of disconnecting a seat harness to reach an emergency exit will be discussed in further detail in the next section, as they require some thought regarding task analysis and skill performance.

With regard to distances between seats, the Civil Aviation Authority (CAA) Airworthiness Notice 64 regulates that the minimum required distance between the back cushion of one seat and the back of the seat in front of it is 660 mm (26”) (Quigley, Southall, Freer, Moody, & Porter, 2001). Quigley et al. (2001) point out, however, that when the 95th percentile European male is considered, this measurement should be increased to a minimum of 711mm (28.2"), which increases knee clearance by 25mm (1"). These minima do not consider the fact that, when crashworthy seats are used, passengers are not able to place their feet under the seat in front of them as a barrier is placed around the base of the seat to prevent crushing injury during heavy impact forces. In addition, the minimum distance between the seats does not consider that the seat will move slightly forward on the compression rails in a crash, which will further decrease the amount of space for the individual post-impact. Therefore, an analysis of crashworthy seat placement in offshore transport helicopters should be included during the design testing and certification process.

2.2 Window Location/Size and Human Factors of Underwater Escape

This section of the report explores the influence of emergency exit ergonomics (window locations and size), body size and number of personnel required to utilize one exit, physical requirements needed to

open a primary and secondary exit, and placement of auxiliary equipment (i.e. fuel cell, liferaft, survival or first aid kit) on the ability to successfully egress a capsized/flooded helicopter. Additionally, this section discusses the possible consequences associated with current interior configurations of helicopters used to transport offshore personnel in Atlantic Canada.

2.2.1 Emergency Exit Ergonomics

After conducting underwater escape trials with 48 aircrew egressing through nine different emergency exits, Brooks, Bohemier, and Snelling (1994) concluded that the lack of standardized emergency exits and placement of release mechanisms presented considerable problems during testing of required egress tasks. Difficulties ranged from disorientation to inability to locate and operate exit mechanisms. Based on these findings, as well as an identification of more than 23 exit types, Brooks and Bohemier (1997) concluded that the ergonomic confusion created by different exits needed to be addressed in order to enhance overall survival rates. Coleshaw (2006b) also points out that the different helicopters used for offshore transport in the North Sea have several different types of exits and doors with different operating mechanisms. Operators of helicopters may assume that the aircraft manufacturer will conduct user interface and survivability testing to ensure that passengers can operate an emergency exit without undue difficulty even though there is no such requirement related to underwater escapability.

The Federal Aviation Authority (FAA) does regulate the number of emergency exits and states that there must be a minimum of 2 emergency exits (Type III or IV, listed below) located 1 per side for helicopters carrying more than 16 passengers (FAR 27.807). Emergency exits are defined by the FAA and CAA as follows (BCAR – Chapter G4-3; JAR/FAR 29.807):

- ***Type I*** – a rectangular opening of at least 610 mm wide by 1219 mm high (24" by 48"), with corner radii not greater than one third the width of the exit, in the passenger area in the side of the fuselage at floor level and as far away as practicable from areas that might become potential fire hazards in a crash.

- ***Type II*** – the same as Type I, except that the opening must be at least 508 mm wide by 1118 mm high (20" by 44") and, if located over a wing or sponson, a step up inside the rotorcraft of not more than 254 mm (10”) and a step down outside the rotorcraft of not more than 432 mm (17”) is permitted.

- ***Type III*** – a rectangular opening of at least 508 mm wide by 914 mm high (20" by 36") with a step up inside the rotorcraft of not more than 508 mm (20”) and, if located over a wing or sponson, a step down outside the rotorcraft of not more than 668 mm (27”).

- ***Type IV*** - a rectangular opening of at least 483 mm wide by 660 mm high (19" by 26"), with corner radii not greater than one third the width of the exit, in the side of the fuselage with a step up inside the helicopter of not more than 737 mm (29") and, if located over a wing or sponson, a step down outside of the rotorcraft of not more than 914 mm (36”).

Johnson, Robertson, and Hall (1989) recommend that an emergency exit should be at least 22” (558 mm) square to accommodate the 95th percentile male US Army troop shoulder breadth during egress. Federal Airworthiness Regulations (FAR) suggest that an emergency exit should “admit a 483 by 660 mm (19" by 26") ellipse” (FAR 27.807). In an examination of a relevant workforce, Kozey, Brooks, Dewey, Brown, Howard, Drover, MacKinnon, and McCabe (2009) reported that the average (this includes the 5th, 50th, and 95th percentile) shoulder breadth of male offshore workers in Atlantic Canada was 20.3” (515 mm) in normal work clothes; however, this value increased to 21.7” (553 mm) when wearing an immersion suit. Quigley, Southall, Freer, Moody, and Potter (2001) reported that the average shoulder breadth (bideltiod measurement) of a United States dataset was 22.2” (563 mm) for the 95th percentile. Of particular relevance to this discussion, the CAA (Leaflet 11-18, 2006) reported that “Underwater escape through a rectangular aperture of 17” x 14” (432mm x 355mm) has been satisfactorily demonstrated by persons of a size believed to cover 95% of male persons wearing representative survival clothing and uninflated lifejackets” (Part 11, Leaflet 11-18, p. 1). Interestingly however, Reilly, Kozey and Brooks (2005) report that the 95th percentile offshore worker in Atlantic Canada has a crest breadth of 15.35” (390 mm) and a bi-acromial breadth of 17.5” (446 mm) without an

immersion suit and these measurements increased to 16.46" (418 mm) and 19.13" (486 mm) respectively with a suit on. Therefore, an exit that measures 17" x 14" would not accommodate the 95th percentile worker even without an immersion suit. Furthermore, if a 95th percentile individual is seated next to someone of a similar size at a small exit (Figure 2) the possibility of successful underwater egress is greatly diminished.

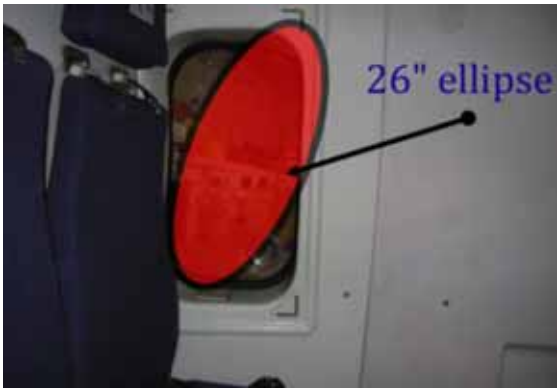
Figure 2. AS332L (Super Puma) rear exit and seats.

In order to identify difficulties associated with helicopter emergency egress and size of personnel that may need to escape through smaller exits, Taber (2007) completed a functional task analysis of helicopter underwater escape skill sets needed to successfully egress a capsized/flooded AS332L (Super Puma) offshore helicopter configuration. In addition to finding that several of the emergency exits were positioned outside the functional reach of most offshore personnel (wearing a four-point seat harness), Taber (2007) reported that the aftmost exits of the AS332L measured only 12" (305 mm) by 21" (533 mm) (Figure 3, panel A). Although these exits are not considered "emergency exits" they are positioned in the helicopter in such a manner that anyone sitting next to them would presumably try to utilize them as a primary escape route in the event of an emergency. Not surprisingly, participants requested to complete the task analysis while sitting side by side at these smaller exits raised concerns about the exit size

and the ability to complete the underwater escape procedures (Taber, 2007). However, as the participants used in the task analysis were selected for their past training experience (safety divers and offshore survival instructors), no significant difficulties were recorded (Taber 2007).

Conversely, given the nature of a real-world ditching situation, with less qualified individuals (typical offshore worker), it is not difficult to imagine some of the complications that a smaller exit may pose for larger personnel (individuals requiring a large to extra large helicopter transportation suit). Based on the available anthropometric data regarding average shoulder breadth of the Atlantic offshore workers, it can be reasonably assumed that this small Super Puma window may represent a considerable egress challenge for half of those flying in the configuration currently used in Eastern Canada. As a comparison to this small Super Puma exit, the majority of exits installed in an S92 measure 17" (431.8 mm) by 20" (508 mm) and therefore represent a more reasonable egress solution for those seated next to them. Figure 3 shows an approximated representation of a 26" ellipse overlaid on both the small Super Puma (Panel A) and S92 passenger exit (Panel B).

A



B

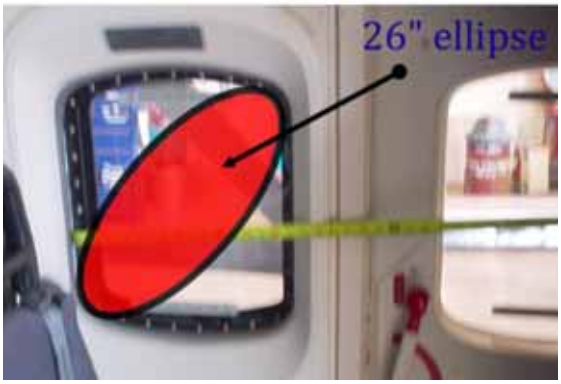


Figure 3. AS332L (Super Puma) rear cabin and S92 main cabin emergency exit with 26" ellipse overlay.

In order to better identify human factors issues during egress it is important to understand the position and functionality of an emergency exit as well as consider the size of the individuals that may need to utilize these escape routes under less than ideal conditions. It is also important to point out that any exit, regardless of whether it is designated an emergency exit or not, will be used by individuals attempting to escape a capsized and flooded cabin. With this in mind, the following sections address a combination of influencing factors in order to outline key aspects of underwater escape training.

2.2.2 Physical Requirements to Open Primary/Secondary Exit

In addition to recommending that emergency exits should be able to

accommodate the 95th percentile troop in full combat gear, Johnson et al. (1989) suggest that an exit should take no longer than 5 seconds to open. FAA regulations (FAR 27.807) require emergency exits to:

- Open without interference from flotation devices whether stowed or deployed;
- Have simple and obvious methods of opening, from inside and from outside, which do not require exceptional effort;
- Be arranged and marked so as to be readily located and opened even in darkness (including from a capsized and submerged cabin); and
- Be reasonably protected from jamming by fuselage deformation (underline added).

Although FAA regulations indicate that exceptional effort should not be required to open an emergency exit, there does not appear to be a standard that indicates what effort is acceptable. Swingle (1995) examined the force (in lbs.) required to operate 12 different emergency exits in 6 different helicopters for the U.S. Army and found that there were considerable differences in both the operation and functioning of the release handles. Swingle (1995) reports that "There is no specific standardized method to describe emergency egress procedures in U.S. Army helicopters" (p. 16) and indicates that forces range from "minimal" to "substantial" with specific values ranging between 10 to 45 pounds.

Without a clear guideline, the FAA regulations are open to interpretation and aircraft manufacturers are free to develop an exit that adheres to general requirements. As evidence of this problem, the CAA (1995), in a review of helicopter safety and survival following a ditching off the Cormorant Alpha platform in 1992, reported that concerns were raised over the lack of "standardization in the operation of emergency exits, which present a variety of different mechanisms, operated by tags and/or handles located in various positions relative to the exit and operating in different directions" (p. 23). From these reports, it was recommended that the CAA should monitor the situation "with the aim of defining one standard method of exit release which could be fitted to all aircraft" (p.

23). This recommendation has not been employed in any of the new aircraft designs, which only adds to the number of operating instructions that must be recalled by passengers and crew. This becomes a particularly difficult situation for those flying in several different types of helicopter over a short period of time.

It should be noted however, that the majority of exits installed in the passenger cabin of offshore transport helicopters are of a push-out design and require minimal understanding of their operating system. This reduces the ergonomic confusion suggested by Brooks and Bohemier (1997). There do not appear to be any documented reports indicating the force that is required to jettison these push-out exits and without this information it is difficult to predict how many offshore personnel are capable of opening the exit while inverted underwater. If the forces required to open an exit exceed the physical capabilities of the individuals expected to use them, changes in design and training are required.

2.2.3 Placement of Auxiliary Equipment/Cargo

In order to explore the influence that auxiliary equipment has on underwater escape and survivability, this section continues the discussion surrounding the use of crashworthy seats. Given the fact that an individual will be in a lower position if a crashworthy seat has attenuated the impact forces, an obstruction such as an auxiliary fuel tank placed between the individual and an exit may impede egress. As previously indicated, the individual might not be able to physically reach the exit due to this lowered position and the additional distance required to reach around the obstruction only compounds the problem. This may be true regardless of whether the individual is attempting to use a primary (closest escape route) or secondary exit (across an aisle) as there are limited physical reference points on the outside of the fuel tank. Individuals that are suddenly plunged into a cold underwater environment and turned upside down would struggle to locate and jettison a primary exit even under ideal circumstances. Adding the additional effects of disorientation caused by the rapid attenuation of the crashworthy seat during impact may prove to be too difficult if an inexperienced individual is required to egress from this lower position without having experienced similar egress requirements during training.

Practical egress training may be able to mitigate these risks; however, a detailed analysis of the problems needs to clearly document what step-by-step instructions will be used to address any difficulties associated with equipment placement or use. If personnel are expected to use a secondary exit across the aisle and an auxiliary fuel tank has been positioned under the exits, reference points that can be reached from a full up and compressed position must be installed to ensure that individuals will be able to locate their way to the exit after releasing their seat harness. However, if the individuals are expected to climb over or move to the row of seats in front of them before egressing, performance of this skill set should be demonstrated during underwater escape training.

Figure 4. Crashworthy seat in full up positioned next to S92 auxiliary fuel tank.

Figure 4 clearly shows that if the crashworthy seat is lower as a result of heavy impact forces and the auxiliary fuel tank is positioned between the individual and the exit, individuals may not be able to reach the closest exit (lower windowsill for the S92 push-out exit is 914 mm – 36" above the floor) without disconnecting their seat harness. A combination of ditching factors such as rapid inversion of the helicopter immediately following impact, inrushing water, degradation of visual acuity, inherent buoyancy of an immersion suit, reduced tactile senses (due to cold water), and possible disorientation represents a critical time during which the seat harness should remain fastened. Wearing the seat harness represents one of the only physical cues to identify one's position relative to the airframe during inversion underwater and it should not be released until a known

reference point has been obtained. Furthermore, the added time needed to properly reference one's position prior to disconnecting the seat harness as well as the lack of mechanical advantage of having the harness in place, may be beyond the person's breath-hold (Cheung, D'Eon, & Brooks, 2001) and physical capabilities needed to egress safely.

With regard to additional equipment placement, the Norwegian Oil Industry Association (OLF) (2004) developed recommendations for offshore helicopter flights and suggests, "Cargo must not be placed in such a way that passengers do not have direct access to alternative escape ways (push-out windows). Passengers cannot be placed in a seat where the adjacent push-out window is blocked, or in a seat where cargo obstructs the free access to the nearest push-out window" (section 5.1.2). These recommendations, although meant for the placement of cargo, should be considered a minimum when planning seat configurations and passenger escape routes. For example, the current Super Puma (AS332L) used in Atlantic Canada has a seat configuration when carrying an external fuel tank that restricts the use of two push-out exits on the starboard side of the helicopter, thus requiring the forward-facing passenger on the starboard side to egress across the aisle after waiting for someone else to escape (Figure 5).

Figure 5. AS332L forward passenger seat of auxiliary fuel tank.
(*Note: the passenger must egress across the aisle*).

2.2.4 Interior Helicopter Seat Configurations

In their helicopter safety review, the CAA (1995) reported that the "seating configuration of some offshore helicopters has hitherto left much

to be desired" and indicated that changes were underway to improve the situation (p. 22). In a study of underwater escape procedures, Survival Systems International (1993) identified that the Super Puma AS332L used to transport offshore personnel represented a considerable challenge for passengers in particular seats and recommended that the interior configuration be modified. However, Taber (2007) writes, "modifying the helicopter interior configuration to meet the needs of all passengers during an event such as a ditching can be considered an excellent first step," but suggests that "it is also important to keep in mind that the passengers must be trained to escape from the modified configuration under simulated emergency conditions. Only then can it be reasonably predicted that an individual will be able to transfer the simulated tasks to a real-world event" (p. 2).

Quigley et al. (2001) strongly recommend that when considering the relationship between cabin seating configurations and evacuation of passengers, the 99th percentile population should be used as a guide to ensure that the space between seats will not impede movement of personnel. Inclusion of the larger personnel is important when considering the size of the exits needed during underwater escape; however, Taber (2007) clearly demonstrated that smaller individuals required more assistance from survival instructors and reported more difficulties than larger personnel when attempting to open a representative Super Puma push-out exit while inverted underwater. The difficulties in opening the exit were related to the ability to overcome buoyancy (inherent from the suit and trapped air) while forcing the push-out exit (Taber, 2007). Therefore, consideration of both the largest and smallest passengers should be used when testing helicopter seating and window configurations.

In addition to the size of individuals, Taber and McCabe (2009) found that, while conducting a functional task analysis of HUET for Canadian military land force troops being transported to offshore vessel platforms in a new configuration of a Sea King (CH124), the further away individuals were from an exit during underwater escape on breath-hold, the more difficulties they experienced. During their analysis, Taber and McCabe (2009) found that troops egressing from seats 3, 4 and 12 (Figure 6) rated the breath-hold egress tasks as considerably more difficult than those trials where they were sitting closer to an emergency exit. The recommendations

of this study were to ensure that troops were outfitted with Emergency Breathing Systems (EBS) and that the exit being blocked by seat 5 and 6 (Figure 6) should be moved to ensure access to an additional exit.

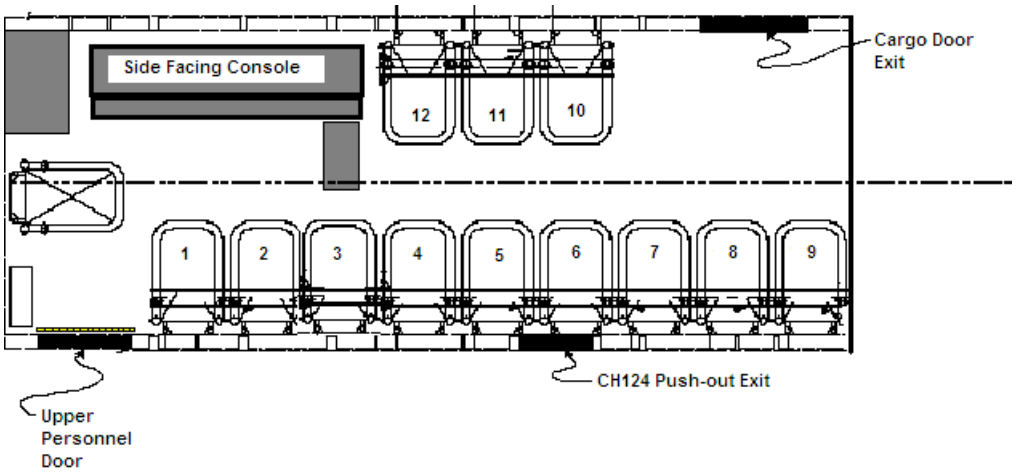


Figure 6. METS™ CH124 configuration for land force troop egress trials. (from Taber & McCabe, 2009 with permission).

At a minimum, each new seating configuration should be tested to ensure that egress is possible. This testing should use high physical fidelity (seat harnesses, exits and seats positioned in a configuration that closely resembles the actual helicopter interior) as well as a representative test population in an effort to identify snagging hazards, obstructions, and limitations of egress performance. Simulation fidelity and its influence on skill acquisition will be discussed in further detail in the Section 3.1.3; however, without a detailed level of testing that examines escapability, a new helicopter design may place the occupants in a non-survivable situation if the helicopter were to capsize and rapidly flood with water.

2.3 Interrelatedness of Egress Factors During Underwater Escape

After examining total underwater egress times from a fully loaded (18 passengers) Super Puma, Brooks, Muir, and Gibbs (2001) concluded that if an overall evacuation time for all personnel could not be completed within 20 seconds, “passengers should be provided with some form of air supply, or, after ditching, the helicopter should be modified so that it will stay afloat on its side and retain an air space in the cabin” (pg. 560).

Cheung et al. (2001) also point out that when testing offshore workers' egress performance, 34% of the 228 participants' breath-hold time (BHT) in water was less than the 28 seconds it took to evacuate under ideal conditions. Recent Canadian military ditchings have also indicated that an EBS aids in egress by affording additional time to deal with loose equipment, darkness, and disorientation (personal communication with ditching aircrew survivors, see also Brooks & Tipton, 2001, and Coleshaw, 2006a, b). Therefore, having EBS training combined with HUET courses is essential to mitigate a number of egress difficulties.

As further evidence for the need to consider the interrelatedness of multiple factors related to egress, Taber and McCabe (2009) clearly demonstrated that the placement of emergency exits and seating arrangements of the interior configuration significantly affected the performance of trained military troops. It was shown that when troops needed to wait for someone else to egress before attempting their own escape (i.e. not seating next to a window exit), overall escape time was significantly higher than the 20-second breath-hold egress threshold suggested by Brooks et al. (2000) (Taber & McCabe, 2009). Furthermore, it was reported that despite the fact that all personnel had successfully completed HUET requirements less than 60 minutes prior to testing, it was clearly shown that without the use of EBS, nearly half (48%) of the 12 troops involved in the breath-hold trial would have perished if they had been involved in a real-world helicopter ditching that rapidly capsized.

Given the paucity of available research and technical documentation on HUET requirements as they relate directly to operational requirements (i.e. the need for auxiliary fuel tanks, seat configuration, transport of miscellaneous equipment, need for night flights), future studies should focus on the integration of safety systems, human performance requirements, and the environments in which the specific skills must be completed. At a minimum, offshore operators should be encouraged to seek human factor/HUET expert advice regarding interior helicopter configuration changes and exit egress requirements that may impact survival rates. Operators should ensure that full-scale functional task analysis egress testing in a high fidelity simulator (discussed further in Section 3.1.3 below) is conducted prior to aircraft implementation in the offshore environment. Furthermore, HUET skill performance data should

be collected during offshore training courses in order to establish a baseline of existing difficulties experienced by the offshore workforce. Such a database could then be used to inform both operators and manufacturers of where strategic interventions might increase survivability.

3. HELICOPTER UNDERWATER ESCAPE TRAINING (HUET) STANDARDS

This section of the report examines the existing Helicopter Underwater Escape Training (HUET) standards used to prepare offshore workers in Atlantic Canada for a possible ditching at sea. First, internationally recognized HUET standards are outlined to identify differences in training methodology. Second, specific egress skill sets performed by offshore trainees at the two Canadian Association of Petroleum Producers (CAPP)-recognized HUET facilities in Canada are compared. Finally, a discussion concerning the fidelity of the training environment and focused research areas are detailed in order to answer the following questions:

- *How much HUET practice is needed to prepare an individual for a real-world ditching?*
- *How often do individuals need to refresh their HUET skill set?*
- *What level of training fidelity is needed to ensure transfer of task knowledge to a real-world situation?*

The final portion of this section is directed at answering these questions by proposing appropriate standards of offshore helicopter safety training needed to ensure that passenger risk is reduced to a level that is reasonably practicable.

3.1 Internationally Recognized HUET Standards of Training

Central to any investigation of human performance in extreme environments is the standard of training provided to individuals prior to an emergency. Despite HUET courses that have been provided to the offshore workforce for more than 25 years, no one international standard exists.

Currently, there several different HUET standards used to prepare personnel for offshore helicopter travel. As one of the most widely used standards, Offshore Petroleum Industry Training Organization (OPITO) has 49 approved HUET providers in 26 countries (http://www.opito.com/international/training-providers.html).
The majority of these OPITO providers are also certified to train individuals to the Norwegian Oil Industry Association (OLF) standards which require more HUET exercises from a submerged and inverted position. Other HUET providers conduct training similar to OPITO standards, yet disagree regarding the level of skill performance required to gain certification. In order to identify differences in current standards it is important to outline the certification requirements of several recognized HUET providers as well as the environments in which the training takes place. As OPITO issues certification to facilities around the world, HUET simulators must meet the following requirements to gain approval:

> Helicopter Underwater Escape Trainers (HUETs), used for OPITO training must meet the following criteria:
>
> - That it can be lowered on to the surface of the water, and then subsequently lowered below the water.
> - In an emergency it can be rapidly retrieved to the surface and if necessary to the side of the pool with the delegates still inside.
> - That it has *realistic seatbelt/harness fastenings* and a system for releasing delegates in an emergency should the buckle fail to open.
> - That the body of the HUET rotates with the seats i.e. not just the seats rotating within a fixed body.
> - There is a means of stopping the rotation in an emergency (usually a brake).
> - The *exits should be of a similar size to those found on the common commercial helicopters used in the offshore industry*.

- If the HUET is also used for the on-land evacuation exercise involving then [sic] *the exit operating mechanism should be similar to that on real helicopters*.

- The *exit(s) used to conduct an evacuation on the water surface should be similar in operation to a real helicopter*.

- The *HUET must be fitted with push out windows for operation by delegates*.

- That there is sufficient room within the HUET for an instructor/assessor as well as the (4 max) delegates (http://www.opito.com/international/approvals-faq.html - italics added).

Additionally, the International Association of Oil & Gas Producers (OGP) (2008) indicate that "HUET facilities should have the emergency exit mechanisms representative of the aircraft flown in offshore or water borne operations" (pg. 55). These minimum standards required for HUET simulation are generally accepted; however, the definition of representative *exits*, *seats*, and *harnesses* is open to interpretation as is the number of underwater escape trials required to gain certification. If not part of the OPITO certification process, it is typically left to the HUET provider to identify what constitutes a representative environment for underwater escape training and Appendix A is offered as an example of the different types of training simulators. The 29 different simulators shown in Appendix A clearly identify that HUET simulators range from a basic box with short plastic seats and non-representative lap-belts to a scale model of an actual helicopter complete with flight controls, electronic console panels, interior bulkheads, crashworthy seats, and 5-point harnesses that are the exact make and model of those used in the actual helicopter.

Although OPITO certification is recognized in most offshore environments, the Canadian Nova Scotia Offshore Petroleum Board (CNSOPB) and the Canada Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), in accordance with CAPP (2008) guidelines, also recognize OLF HUET from Norway and certification from two HUET training providers located in Atlantic Canada. The CAPP

(2008) requirements are similar to those outlined by OPITO in that offshore personnel are required to have HUET and simply state that "The isolated nature of offshore installations create safety and emergency preparedness training needs to a much greater degree than would apply to a similar industrial setting onshore," therefore, mandatory personal safety courses such as a Basic Survival Training (BST) and subsequent recurrent training (BST/R) are required (pg. 409). Within these guidelines, the BST and other mandatory courses require HUET exercises including emergency breathing systems; however, no description of the actual skill set is outlined. Therefore, the following sections identify which HUET skills appear to be most beneficial to the process of transferring information gained during training to a real-world situation.

3.2 HUET Skill Requirements

The explicit purpose of HUET is to ensure that individuals understand both what to do (declarative knowledge) in the event that a helicopter ditching is about to take place and what tasks (procedural knowledge) needed to be performed to successfully escape after the initial impact with the water. The division of these two types of knowledge is crucial to the development of a HUET standard as it bears directly on the approach taken during the design and implementation of training as well as the operational approach used by helicopter manufacturers and offshore operators. If for instance, declarative knowledge (information in memory that relates to facts and experiences) is seen as the most important aspect of training for underwater escape, the need to demonstrate practical skills warrants less emphasis. If however, procedural knowledge (information in memory related to the performance of skills) is considered to be more important to preparation of the individual, the ability to declare what skills need to be performed is deemphasized.

Still others suggest that the only way to measure the level of skill acquisition is by examining the amount of retention displayed at some later date (Schmidt & Bjork, 1992). Simply training an individual to escape a generic underwater egress simulator does not necessarily guarantee that the person will be able to generalize that information to a different environment (i.e. different emergency exits, sitting in an aisle versus a window, or one row back from an exit). In fact, it could be argued

that a person can be trained to escape a specific underwater egress simulator perfectly every time and still not be able to perform these skills in a more stressful unfamiliar environment such as a real helicopter in a ditching. Schmidt and Bjork (1992) suggest that if a generic environment has to be used, it is best to include effortful practice trials that may not be easy for the individuals to perform. That is, if a skill does not require the individual to allocate a considerable amount of attention to ensuring an acceptable level performance is achieved, it is unlikely that the skill will be recalled at a later date.

It is further suggested that random practice (varied performance of different skills) is better for retention (Schmidt & Bjork, 1992; see also Perez, Meira, & Tani, 2005). These findings have been also been supported by Stokes, Lai, Holtz, Rigsbee, & Cherrick (2008) who suggest that during early learning, high variability facilitates skill acquisition, retention, and transfer as well as improving an individual's capability to adapt skill performance to changing conditions. By increasing the variability and difficulty during the learning process, there may also be an increase in the level of stress and anxiety experienced by the individual. Coleshaw (2006a) indicates however, that individuals having completed HUET requiring underwater exit removal suggested that they had a higher level of confidence and that removal of the exits was not seen as a major problem during training. This higher level of confidence would presumably decrease the levels of stress associated with increased difficulty of required skill sets.

From the survival rates shown in Table 2 (above), it is clear that military personnel are more likely to survive a helicopter ditching that their civilian counterparts (83% versus 70% respectively). It may be argued that military personnel need to be trained to a higher standard due to the fact they are placed in a more hostile environment on a more regular basis. Although this may be true, training of basic HUET skill sets should not be reduced merely because the likelihood of using the skills is less. In fact, egressing from a capsized and flooded helicopter that has 16 to 18 other people (offshore configuration) may be more difficult than one that has only 3 to 5 people trying to escape (typical military helicopter crew). Therefore, HUET course providers should consider the fact that

performance of a skill set requires the same level of training regardless of whether it is in a military or civilian environment.

Clearly, a holistic approach is most beneficial to the offshore workforce as it allows for consideration of the different possible situations that might be faced during a ditching (i.e. controlled landing on the surface of the water versus uncontrolled impact in which the helicopter inverts immediately). Therefore, declarative and procedural knowledge aspects are discussed in order to identify their inclusion in existing HUET course information.

3.2.1 Declarative HUET Knowledge

Declarative knowledge related to HUET includes an understanding of the difference between pre- and post-impact skill requirements. For example, emergency breathing systems incorporated into the standardized personal protective equipment should not be used prior to water impact as potentially serious injury may occur if an individual inserts the air delivery valve into their mouth before impact has occurred. Pre-impact information (usually delivered in a classroom setting) should address past ditching results to ensure that individuals understand the importance of performing specific skills that will increase survival. This information should be used to identify hazards (i.e. poor brace position during impact, consequences of releasing a seat harness too early, hazards of loose ends of seat harness) that are known to reduce survival rates. The declarative knowledge covered during the theory portion of a HUET course should be designed to increase the possibility that individuals are able to create a beneficial survival plan regardless of the helicopter configuration used for offshore travel. That is, HUET course theory should ensure that pre-flight preparations (safety briefing, stowage of loose articles, checking primary and secondary emergency exit operation, and mental rehearsal of escape plan) become automatic regardless of helicopter type used for transport. After completing HUET theory requirements, individuals should be able to quickly identify ditching related hazards within an interior configuration and make appropriate changes to a pre- and post-ditching plan.

3.2.2 Procedural HUET Knowledge

Procedural HUET knowledge should include physical performance of the required skill set. This includes the proper brace position depending on the style of seat and harness, physical motor skills necessary to open an exit in air and inverted underwater, as well as the physical requirements to function all supplementary survival equipment (i.e. personal locator beacon, lifevest, survival mitts, strobe light, and splashguard). In order to identify differences in skill performance requirements used to obtain certification, Table 3 outlines the HUET course requirements from the two CAPP approved course providers. Table 3 clearly identifies that there are a number of task requirement differences even though certification is recognized by CAPP and other offshore operators as being the same.

Table 3. Comparison of Basic Survival HUET skill set requirements from MI and SSTL. (Note: These numbers represent the minimum sequences conducted at each training facility. Additional exercises are conducted if required to demonstrate competency).

HUET Skill Set Requirements	Seat Position and Number of Sequences Performed	
	Marine Institute (MI)	Survival Systems Training Limited (SSTL)
Classroom Theory	Approximately 4 hours	Approximately 4 hours
Surface Evacuation and liferaft operation	1	1
Surface Evacuation with partial upright immersions	1	
Controlled ditching to surface including exit jettison procedures and subsequent immersion (no inversion)	1	
Total Number of Underwater Escapes	3	4
Number of Different Emergency Exits Used	1	2
Number of 180° Inversions Required	2	4
Number of Times Exit is Jettisoned Underwater	0	2
Number of Escapes from an Aisle Seat Position	0	2

As an extension of the diversity of simulation environment fidelity, differences in training methodology begin to emerge when an examination of skill requirement is completed. At a basic level, OPITO HUET certification requires an individual to demonstrate the ability to egress from an inverted HUET simulator while breath-holding once during initial training and once during recurrent training (every 4 years). Marine Institute (MI) carries out similar HUET programs and requires 2 inversion egresses during basic training and 1 during recurrent course training (every 3 years). In contrast, Survival Systems Training Limited (SSTL) requires HUET course participants to complete at least 4 breath-hold escapes from an inverted simulator during both initial and subsequent certification (every 3 years). Based on the training schedule minimums, trainees attending an OPITO HUET program would need to complete at least 4 courses (equivalent to 12 years offshore – assuming a 4 year recurrent requirement) in order to gain the same experience as those completing one course at SSTL. Similarly, trainees attending an MI HUET program would need to attend 1 basic and 3 recurrent courses (equivalent to 6 years offshore) before they would gain the same amount of inverted underwater egress experience as an individual attending one basic HUET course at SSTL.

Additionally, the discrepancy between which skills need to be demonstrated is of particular interest. Hart (2008) suggests, "training works best when the HUET trainer simulates the actual passenger environment as closely as possible. Ideally passengers practice rolling inverted, pushing out windows and evacuating as first and second out the exit" (http://hartaviation.com/content.php?region=200). This suggests that individuals demonstrate their ability to jettison an exit from an inverted position at both the window and aisle seat. However, despite overwhelming evidence that helicopters typically invert rapidly after water impact, some of the offshore HUET certified workforce might never have been required to successfully jettison an exit while inverted underwater because, until recently, OPITO certification did not require trainees to open an emergency exit while underwater. In fact, the most recent gap analysis conducted by OPITO (2009) indicates that, although assessment during HUET skill performance requires that "push out windows are to be fitted for the capsize exercise, competence in the operation of these should be assessed during the partial submersion exercise" (pg 9). This statement

suggests that although the push-out exits are installed during the HUET exercises that involve a 180° inversion of the simulator, trainees are not required to demonstrate their competency of exit removal skills from this position. Given the fact that "more than 120,000 people across 30 countries are trained to OPITO standards every year", a considerable number of individuals may not have the skill set required to perform one of the most basic tasks necessary to survive an underwater escape (http://www.opito.com/international/about-us/news.html). Additionally, MI does not require an individual to demonstrate the ability to jettison an exit while inverted underwater on a breath-hold. Therefore, although SSTL and MI trainees receive identical HUET certification, the level of inverted exit experience is vastly different.

The opportunity to perform an exit removal underwater from an inverted position has been reported to improve confidence in skill performance (Coleshaw 2006b) and capability to perform the skill after a delay period (Kozey, McCabe, & Jenkins, 2006). In one of the first examinations of skill performance based on retention of HUET skills, Mills and Muir (1999) documented HUET skill performance of OPITO-certified personnel who had completed training 6 months, 12 months, 18 months, 2 years, 3 years, and 4 years prior to testing. It was found that over a third of the individuals failed to meet the minimum performance criteria that "required trainees to demonstrate the ability, underwater in an inverted HUET, to release a representative seat restraint and escape exit mechanism, and effect an escape unaided" (Mills & Muir, 1999, section 3). It was noted, however, that the training environment was not the same for all of the participants and it was suggested that future studies should examine HUET performance of individuals having similar experience from the same training environment (Mills & Muir, 1999). It was also noted that the test individuals were considered to be a self-selected group that did not have an aversion to completing the HUET skill requirements. As all of the tested individuals were volunteers, it could be argued that a more representative offshore population might include a number of individuals who are extremely anxious about completing the required HUET skill set and performance levels may decrease.

In order to address the differences in HUET skill performance from a similar course population and training environment, Taber (2005)

collected underwater escape performance from BST and BST/R personnel attending survival training courses at SSTL over a period of 11 months. The 277 course trainees were informed that HUET instructors would record if assistance was provided during the first two underwater inverted egress trials required for certification. Only one of the two HUET trials required the removal of an exit in an inverted position. It was noted that BST trainees were more likely to require assistance during their first training exercise (no window during inversion) than those attending a BST/R program (Taber, 2005). These results were not found to be surprising given the fact that the majority of individuals attending the BST were completing the HUET skill set for the first time and did not really know what to expect. Of greater interest was the performance of individuals who had completed HUET training prior to the collection of the test data. Taber (2005) reported that BST/R trainees required more assistance and committed greater numbers of procedural errors during their second escape trial (jettison exit underwater) than the BST group. Similar to the results reported Mills and Muir (1999), it was noted that 34.7% of those completing the BST/R required some form of assistance despite having gained HUET certification 3 years earlier (Table 4) (Taber, 2005).

Table 4. HUET performance and assistance required for BST and BST/R trainees. (from Taber 2005 with permission).

Assistance Provided	Courses			
	BST		BST/R	
	No. of individuals	No. of exercises	No. of individuals	No. of exercises
A (no assistance)	114 (74.5%)	554 (90.5%)	81 (65.3%)	434 (87.5%)
B (mild to moderate assistance)	28 (18.3%)	39 (6.3%)	39 (31.5%)	57 (11.5%)
C (emergency assistance)	11 (7.2%)	19 (3.1%)	4 (3.2%)	5 (1%)
Total	**153**	**612**	**124**	**496**

In order to examine the training environment associated with HUET experience, it is important to further consider the combined influence of both practice and simulator fidelity. Therefore, the next section addressed the level of physical fidelity associated with the HUET environment

provided to the Atlantic Canadian offshore workforce. The differences in fidelity are then discussed in order to identify the implications of training in generic environments.

3.2.3 Fidelity of the Training Environment

Clearly, the procedural knowledge gained from the Canadian CAPP-approved HUET providers are different, as is the environment in which the skill acquisition takes place. For example, MI uses a retrofit dunker manufactured by McLean and Gibson International during the mid- to late 80s (Flight International, 1984) (Figure 7). The interior cabin contains low-back seats that are fitted with over-center lap belt seat harnesses. The MI dunker can be fitted with two types of emergency exits (push-out and mechanical); however, these are not used while in an inverted position.

A

B

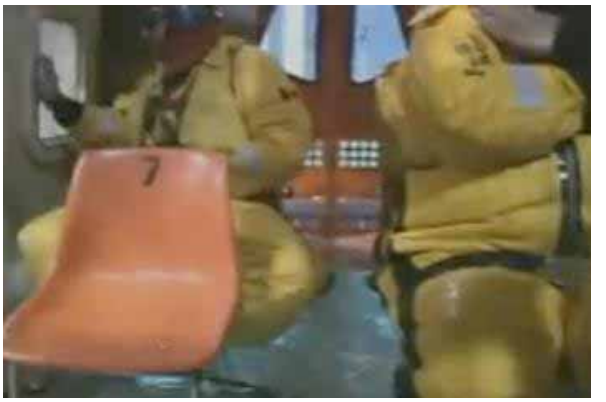


Figure 7. Retrofit McLean and Gibson International dunker located at MI in Newfoundland (Panel A). Interior of the dunker during simulated impact (Panel B). *Note: images retrieved from http://www.mi.mun.ca/.*

Survival Systems Training Limited (SSTL), on the other hand, uses a Modular Egress Training Simulator (METS™) manufactured by Survival Systems Limited (Figure 8). The METS™ can be configured to resemble numerous helicopters currently used for offshore and military operations (http://www.survivalsystemsgroup.com/index.html?pg=25). More than 140 different exits have been manufactured for the METS™ and the interior of the cabin can be configured to the exact specification of the helicopter being used for flight operations. SSTL has a complete simulation of an S61N, AS332L (Super Puma), and S92, which includes high-back seats that are fitted with four-point seat harnesses. Additionally, the S92 configuration is equipped with crashworthy seats manufactured to the specifications outlined by the helicopter manufacturer.

A

B

Figure 8. METS™ model 40 showing 4 different exit types (Panel A). Interior of METS™ showing high-back crashworthy seats fully compressed and 4-point harnesses (Panel B).

Figure 9 further shows the fidelity of the METS™ as it relates specifically to an S92. Panel A shows the forward port emergency exit and push-out window in the actual helicopter. Panel B shows the interior configuration of the METS™ to identify the level of physical fidelity available for offshore workforce HUET courses. This level of physical fidelity allows for identification of skill deficiencies during training as well as clearly defined guidelines of both instructional delivery methods and offshore operator configuration approval.

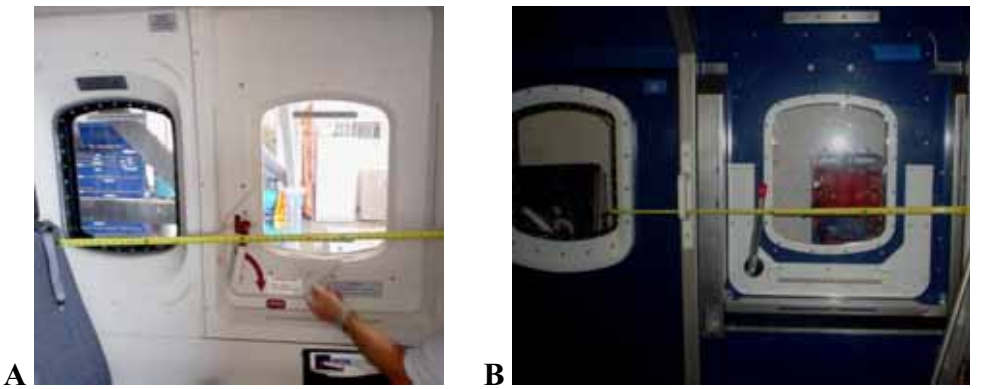


Figure 9. S92 helicopter interior (Panel A) and METS™ simulation (Panel B).

Research conducted by Coleshaw (2006b), Kozey et al. (2006), Mills and Muir (1999), and Taber and McCabe (2007, 2008, 2009) suggest that physical fidelity is necessary during HUET skill acquisition and indicate that it is a fundamental requirement to ensure the transfer of procedural knowledge. Additionally, Kozey et al. (2006) demonstrated that the fidelity (requirement of exit functioning while inverted underwater) of HUET training provided to individuals has a significant impact on their ability to perform skills that may be necessary in a real-world ditching. Specifically, it was shown that individuals having received more practice (4 versus 1 or 0 trials) opening an exit while inverted underwater performed better than those who had limited or no practical experience six months prior to a testing session. Kozey et al. (2006), therefore, concluded that "The results clearly demonstrate that the success rate from a single METS egress 6 months post training is greatest for individuals who receive trials with the greatest physical fidelity and extensive practice" (pg. 110).

As a further example of physical fidelity importance, every federal aviation administration (i.e. CAA, EASA, FAA, TC) requires pilots of large passenger aircraft to successfully complete *type- specific* flight simulation once every 12 months (see CAR 2009-2, standard 723.98 for air taxi-helicopters). It would be unimaginable for an airline pilot to be tested on a small Beaver- or Cessna-type aircraft and be expected to perform emergency duties on an Airbus A320 or Boeing 767. Without

having the experience of performing a skill set in an environment that closely matches that which would be experienced in a real-world situation, it is difficult to predict performance in the real situation. This is precisely why military and emergency response training is conducted under realistic conditions.

3.3 Research Identifying HUET Skill Proficiency

Before identifying specific HUET research related to skill proficiency, it is important to briefly outline skill acquisition. Stothart and Nicholos (2001) report "In order to learn and use a skill, or information, a learner needs to understand how it occurs and when to apply the skill. These only come with practice and experience; as the learner becomes an expert, they can apply their understanding to other situations, while also evaluating its appropriateness" (pg. 9). Research has shown that learning a skill typically shows a steep increase during the first few attempts and then begins to plateau as experience is gained and eventually performance becomes automatic (Schmidt & Lee, 2005). Generally speaking, performance curves typically follow what is referred to as the *power law of practice*, in which the more times a skill is practiced, the better the performance of that skill becomes until such a point that no further improvements are detectable (Schmidt & Lee, 2005). Performance of the skill can later be influenced by level of arousal and environmental conditions; however, the acquisition of the skill requires that it be deliberately practiced until it becomes automatic (Feltovich, Prietula, & Ericsson, 2006).

3.3.1 HUET Proficiency Requirements

Clearly then, HUET skills that will be needed during a real-world ditching should be practiced as often as possible if they are to be performed an expert level. Hart (2008) writes "The operation of emergency exits, doors, seat belts and survival equipment should be standardised between aircraft to the extent possible if more than one type is being flown on a contract, and the training should be such that operation of this equipment is second nature to passengers. In a ditching situation events happen quickly and well taught survival lessons can make a critical difference" (http://hartaviation.com/content.php?region=200, see also Hart, 2004). Benham, Redman, and Haywood (1995) also suggest that "more realistic

training" would benefit those trying to escape and survive from a ditched helicopter (pg. 11). These statements are reiterated by Kozey et al. (2006), Mills and Muir (1999), and Taber, (2005), who found similar levels of HUET skill retention and suggest that a longitudinal study should be conducted to ensure the current training schedule ensures optimal survival rates if a ditching occurs. Learning research indicates that one of the best ways to increase retention of a procedural skill is by overlearning the task during initial acquisition (Driskell, Willis, & Copper, 1992). In other words, the task is practiced beyond the point that it is mastered. However, most civilian HUET course standards only require trainees to perform one errorless underwater inverted egress and do not request individuals to provide further evidence of their procedural knowledge. Therefore, it is difficult to identify whether the HUET skills will be integrated into long-term memory and be recalled during an emergency.

3.3.2 Proposed HUET Proficiency Requirements

Based on the research and anecdotal evidence related to ditching survival rates presented to this point, a HUET standard that requires individuals to perform *one* underwater egress with an exit installed every 3 to 4 years is not sufficient to ensure that the skill will be recalled in the event of a real emergency. Although the offshore workforce may be *current* under the existing guidelines, they are not necessarily *proficient*. Kozey et al. (2006) clearly showed that nearly 20% of the individuals given only one egress training trial in which they had to remove the exit while in an inverted and submerged position could not perform the task six months later. It was further shown that 46% of those who had not had the same opportunity to jettison an exit underwater failed in their attempt to egress (Kozey et al., 2006). This suggests that nearly half of the individuals completing a HUET course that does not require the removal of an exit inverted underwater would not survive a ditching that resulted in a rapid capsizing, just six months after gaining certification. These results closely match the survival rates cited by previous research (Table 2 above) and suggest that training may play as great a role in survival as structural crashworthiness factors.

With this in mind, it is proposed that in addition to the standard protocol for offshore operational requirements (i.e. weather limitations, helideck

and refueling standard procedures, flight following), HUET course providers and offshore operators should:

1. Identify what HUET skills are required to egress from the existing helicopter interior cabin configurations (i.e. do current AS332L and S92 configurations influence overall survival rates and if so can they be mitigated through training or repositioning of seats and auxiliary equipment such as fuel tanks).

2. Ensure that representative exits (same overall dimensions, operating mechanisms and forces required to open them), positioned in representative locations (same distance from seats and height from floor), for those types of helicopters used in offshore operations be installed and used for training within the HUET simulator.

3. Ensure that representative seats (i.e. high-back, crashworthy, forward/rear facing, bench style) similar to those used in offshore helicopter operations be installed for training within the HUET simulator.

4. Identify the level of initial HUET proficiency that will not degrade to a point that becomes problematic before recurrent training.

Despite considerable effort to mitigate risks associated with a helicopter ditching/crash, changes to survival rates have not been realized and until underwater escape skill performance is fully understood, it is difficult to identify interventions that may aid in survival. For example, the addition of mandatory external flotation systems does not appear to have a significant affect on overall survival rates due primarily to the fact that floats may not have been deployed as a result of minimal warning or may be damaged during impact; therefore, they do not aid in keeping the helicopter upright on the surface (Taber & McCabe, 2007, see also CAA, 2005). Moreover, supplying EBS to passengers without training in the realistic conditions expected during a ditching may not by itself be the answer to increasing survival rates. Changing one aspect of a complex system rarely ameliorates all difficulties as was pointed out in the most recent ditching report of the Search and Rescue (SAR) Cormorant helicopter (Canadian Forces FSIR, 2008b). In their report, it was noted

that all crew members survived the initial impact forces; however, several personnel did not use the EBS that was available due to an inability to find it on their vest and the speed with which they made their escape. It was also reported that two of the crew members in the cabin of the helicopter were able to use EBS, but were unable to escape due to disorientation, debris, loose equipment, and blocked exits, before depleting the supplementary air (Canadian Forces FSIR, 2008b). Based on the findings from the ditching report, it is apparent that a holistic approach, which includes a detailed investigation of human factors, environmental conditions, and available technology is needed before specific answers that address survival rates should be expected.

4. PERSONAL PROTECTIVE EQUIPMENT ASSOCIATED WITH HELICOPTER TRANSPORT OVER WATER

As outlined in the previous sections, helicopter transport over water (particularly cold water) requires an understanding of the interrelated aspects of several components. Of particular importance is the integration of personal protective equipment (PPE) with regard to the overall survivability of passengers and crew during and immediately following a ditching/crash. Therefore, the following sections address the current PPE requirements and standards and suggest a guideline for system safety integration.

4.1 Helicopter Passenger Transportation Suit (HPTS) Requirements

Although the benefits of wearing personal protective equipment (PPE) to prevent cold water- related injury are well documented, Transport Canada's operating manual (OM) does not require the use of an immersion suit within 15 nautical miles (nm) of shore (TSBC, 2006). In addition, Moorman (2005) writes "in Canada, there is not a regulatory requirement that helicopter pilots wear immersion suits during offshore operations" (http://www.aviationtoday.com/rw/commercial/offshore/1541.html).
However, due to the harsh North Atlantic environmental conditions present during most of the year, thermal protective equipment has been mandated for all personnel if the potential of accidental immersion exists. For example, Transport Canada (TC) indicates that "no person shall operate the helicopter over water having a temperature of less than 10°C

unless:"

- a helicopter passenger transportation suit system is provided for the use of each person on board; and

- the pilot-in-command directs each person on board to wear the helicopter passenger transportation suit system (CAR 602.63).

The regulation further states, "Every person who has been directed to wear a helicopter passenger transportation suit system…. shall wear that suit system."

Helicopter Passenger Transportation Suits (HPTS) can be approved for use in two distinct variations. An integrated HPTS incorporates the functionality of a lifejacket (FAA, Technical Standing Order-C13f) and does not need a separate lifejacket to be worn over the suit, whereas a basic HPTS requires the use of an additional lifejacket. This distinction is important in that an integrated HPTS does not require the user to don additional equipment that has been separately manufactured and may not integrate particularly well. This reduces the need to ensure the lifejacket is fitted for the individual and there are fewer compatibility issues with regard to inflation toggles, connection straps, and zippers.

HPTS suits must meet current Transport Canada Airworthiness Manual (AWM 551.407) and Canadian General Standards Board (CAN/CGSB-65.17-99) standards which require the integration of head and hand coverings, and must meet specific requirements for performance tests such as a jumping into water, righting (turning a person from a face-down to a face-up position), underwater escape, swimming ability, freeboard, flotation position, and field of vision. At a fundamental level the HPTS must meet the following CAN/CGSB-65.17-99 standards:

4.1.1 Performance Requirements

- ***Maximum Escape Buoyancy*** - shall not be more than 175 N (17.85 kg/39.35 lbs).

- ***Minimum Flotation Buoyancy*** – shall not be less than 156 N (16.83 kg/37.10 lbs).

- ***Donning Time*** – must be able to don the suit system completely within 2 min. However, the "Life Preserving Helicopter Passenger Transportation Suit System" is exempt from the requirement as the suit is donned by all passengers prior to departure (Transport Canada 2006, SCA 2006-07).

- ***Floating Characteristics*** - suit system shall provide a stable floating position, with a face plane angle between 30º and 80º to the horizontal, in which the subject is face-up with the mouth and nose at least 120 mm above the surface of the water.

- ***Righting*** - suit system shall turn the wearer from a face-down position to a face-up position within 5 seconds or allow the wearer without assistance to turn himself or herself from a face-down position to a face-up position within 5 seconds. If a suit system has auxiliary buoyancy, the suit system shall be designed to meet these requirements when the auxiliary means of buoyancy is used as well as when it is not used.

- ***Thermal Protection*** - must not be less than $0.116°C \cdot m^2 \cdot W^{-1}$ (0.75 immersed Clo). Using this test method, the hands shall have a minimum thermal protection value of 0.6 $K \cdot m^2 \cdot W^{-1}$ (0.5 immersed Clo). The suit system shall provide thermal protection such that the average body core (rectal) temperature of persons wearing the suit system for 6 hours in calm circulating water that is between 0 and 2°C shall not drop more than 2°C and the finger, toe or buttock temperature of the wearers shall never drop below 5% and never below 8°C for more than 15 minutes for an entire immersion.

- ***Suit Sizing*** – sizes shall be classified by the maximum girth and height of the intended wearer. This standard also allows for suits to be sized to individual wearers.

- ***Survival Aids Attached to outside of Suit*** - allow for easy use, are visually and physically accessible and operable, do not attain a position that either degrades the function of the fittings or reduces the wearer's ability to escape or survive.

- ***Buddy Line***
- ***Personal Locator Light***
- ***Personal Whistle***
- ***Splashguard***

4.1.2 Interpretation of the HPTS Standards

For clarification, the unit of thermal protection described in the standard refers to "1 clo for the insulation of a clothing system that maintained a sitting–resting average man comfortable in a normally ventilated room (0.1 m/s air velocity) at the air temperature of 21ºC and relative humidity less than 50%" (Gagge, Burton, & Bazett, 1941 as cited by Huang, & Xu, 2006, p. 318). The requirement of .75 Clo for passenger survival suits does not include thermal insulation gained from personal clothing. However, in an effort to approximate typical offshore workforce attire, the CGSB requires that HPTS thermal protection testing is completed in "A long-sleeved cotton shirt, denim trousers, underwear (briefs) and medium-weight dress socks for wear by the subject and by the manikin during the testing procedures" (CAN/CGSB-65.17-99). As there is no specific C-NLOPB guideline on required clothing for helicopter flights, passengers are permitted to wear a wide range of clothing under the suit while traveling offshore. The personal decision of what to wear under the suit is presumably based on environmental conditions such as the ambient air temperature. As there is no specific standard for required clothing, this issue will be addressed in further detail in Section 6.3.2 (below).

As with several of the previous sections, maximum allowable buoyancy does not appear to have an internationally recognized standard. For example, Brooks (2008) indicates that, after extensive underwater escape buoyancy testing, "a decision was made to establish a standard maximum of 42 pounds (175 Newtons) of added inherent buoyancy. A compromise had to be made in order to achieve the required 0.75 immersed Clo of thermal insulation. This could not be practically done if the inherent buoyancy was less than 175 N. Subsequent tests in the helicopter underwater escape trainers worldwide have shown that this appears to be a reasonable compromise – but ideally, in the concept for new suits the less inherent buoyancy the better" (RTO-AG-HFM-152, pg. 9C – 9). Interestingly, however, after investigating the post-crash conditions experienced by crewmembers of a Search and Rescue Cormorant, the

Canadian Forces (2008b) indicate that a maximum allowable buoyancy for thermal protective suits is 35lbs. Additionally, the European Aviation Safety Agency - Technical Standard Order (2006) identifies that the "the trapped buoyancy due to the suit and recommended clothing, with the suit fully vented, shall be no more than 150N (33.7lbs)" (ETSO-2C502, Section 9.1).

Similar to many of the components discussed thus far, maximum allowable water ingress does not have one recognized standard. For example, CGSB water ingress standards for the testing of HPTS requires a jump into water of not less than 3 meters and a swim test in calm water (CAN/CGSB-65.17-99), after which the combined ingress in grams from the jump and swim of not less than 60 minutes are used to calculate total accumulations of water. The CAN/CGSB-65.17-99 does not specify a maximum allowable limit for water ingress, whereas the CAA (1991) regulation indicates that the maximum allowable water ingress value shall not exceed 200g after a jump and swim test of not less than 30 minutes. The differences in swim time suggest that the CGSB are more stringent that those required by CAA regulations.

In order to examine the effects of water ingress on thermal protection, Tipton and Balmi (1995) collected rectal and skin temperatures from participants wearing immersion suits that had 0, 200, 500, and 1000ml of water ingress over a period of 70 minutes in water temperature of 5°C. Results of their study indicated that 200ml (200g) of water ingress at the torso should be the maximum allowable limit (Tipton & Balmi, 1995). These water ingress tests are designed to ensure proper fitting of the immersion suit so that water seeping in through face, neck, or wrist seals does not compromise the individual's chances of survival while waiting for rescue. However, recent reports have questioned the water ingress tests, suggesting that the jump and swim requirements lack ecological validity. Specifically, in a Transportation Safety Board of Canada (2004) occurrence report, investigators indicate, "because the swim test [CGSB]- an integral part of the standard - must be conducted in controlled facilities, the test has never been validated against realistic conditions" (p.15). In an examination of HPTS water ingress conducted by the CORD Group Limited (2009), it was recommended that, in addition to the current jump and swim test, there should be a requirement for testing to be completed

after underwater egress from an inverted position with a window, as well as liferaft boarding with wind and waves. These suggested changes further highlight the need for international standardization for testing the HPTS.

4.2 Aircrew Immersion Suit Requirements

In a review of cold water survival needs, Brooks (Transport Canada, 2003) indicates that, while offshore passengers should wear a "Group II - .75 immersed Clo" immersion suit, aircrew should be thermally protected by a suit ranging from .25 to .75 Clo – "Group I" (pg. 65). This recognition of integrated hazards (i.e. hot environment in cockpit and cold water) is important to ensure that the effect of heat stress does not compromise flight safety. The thermal conditions experienced by the pilots are influenced by what is known as a "greenhouse effect" created by the sun streaming in through the cockpit windows. In the Transport Canada (2003) report, Brooks identifies a number of aircrew immersion suits that meet the .25 Clo rating. However, similar to the passenger immersion suit requirements, there is no specific standard or guideline that suggests the options for pilot clothing requirements to be worn under the immersion suit.

4.2.1 Thermal Loading and Heat Stress for Aircrew

Prolonged exposure to high ambient temperatures is generally linked to reduced cognitive functioning (Cheung, 2010; Pilcher, Nadler, & Busch, 2002) and decreases in working memory and information retention (Hocking, Silberstein, Man Lau, Stough, & Roberts, 2001). Ducharme (2006) indicates that, at ambient temperatures above 18°C, aircrew dressed in thermal protective clothing "will likely be affected by heat stress during flight operations" (p. 439). As evidence of thermal loading affecting performance, reported increases in core and skin temperature have been found to significantly increase the number of incorrect reactions individuals make when tested on an aircrew-related vigilance task (Færevik and Reinertsen, 2003). The relationship between cognitive impairment and heat has also been supported by reports of decreased mental arousal and perceived increases in exertion during exercise-heat stress (Castellani, Young, Kain, Rouse, & Sawka, 1999; Nybo & Nielsen, 2001). However, Hancock, Ross, and Szalma (2007) purport that

performance effects are linked to a complex interaction of duration and intensity of the heat stressor. Therefore, it is important to consider the amount of solar loading of aircrew when addressing thermal protective garments. As a guideline to protect against the harmful effects of thermal loading, the U.S. Military Standard Operating Procedures for Overwater Operations (n.d.) has suggested that immersion suits need to be worn during overwater operations if the water temperature is below 60 degrees Fahrenheit (15ºC); however, "when the water temperature is between 61 and 70 degrees Fahrenheit [15-20ºC], the unit commander or his designated representative may waive the wearing of the immersion suit. When the water temperature is above 71 degrees Fahrenheit, the wearing of the immersion suit is at the discretion of the individual pilot" (http://www.globalsecurity.org/military/library/policy/army/fm/1-564/AE.HTM).

4.2.2 Aircrew Immersion Suit Standards

Similar to those standards set out for passenger immersion suits, aircrew constant wear suits must meet specific performance and design standards. However, minor differences in suit design allowances are found and the CAA (1991) indicates that:

> The design of the immersion suit shall allow tailoring to fit the individual wearer or, where suits are not individually tailored, the size range must be fully satisfactory for all wearers whose significant body dimensions range from the 5th percentile female to the 95th percentile male and adequate for most of the 5% at each extreme. The significant body dimensions to be taken into account shall include at least the following:
>
> Total Height: from ground to top of head
> Sitting height: neck seam to crotch seam
> Inner leg: crotch seam to normal length of trouser
> Sleeve length: shoulder seam over elbow to cuff (arm bent at 90º)
> (Specification 19 – Section 3.6).

In addition to thermal protection and fitting, specifications related to the colour of the aircrew suit differ from those for passenger suits. For example, in a safety recommendation from the Australian Aviation

Investigation Bureau (AAIB) (2008), it is recommended "that the European Aviation Safety Agency (EASA) investigate methods to increase the conspicuity of immersion suits worn by the flight crew, in order to improve the location of incapacitated survivors of a helicopter ditching. The yellow immersion suits worn by the passengers were noticeably more conspicuous in the dark than the blue immersion suits worn by the pilots when illuminated by a helicopter's searchlight" (Safety Recommendation 2008-036 AAIB). And the CAA suggests, "the choice of suit colour may vary to minimise the risk of the suit reflecting on surfaces within the flight deck" (p. 4).

As there is no standard requirement outlined by the TC, CAA, or FAA regarding clothing to be worn under the constant wear suits for aircrew, a guideline of thermal comfort zone with respect to protection in both hot and cold conditions should be developed. A discussion of suggested clothing is outline in Section 6.3.2 (below).

4.3 Additional Survival Equipment

Although specific standards exist for the design and testing of HPTS and aircrew constant wear immersion suits, there is no specific regulation that mandates the inclusion of additional or supplementary survival equipment. Additional equipment is typically included as standard issue at the request of offshore operators to aid in post-event survival and rescue. For example, OLF (n.d.) standards require that the immersion suits are fitted with a pocket for a personal locator beacon (PLB) and must have an integrated breathing system that "provides more time for underwater evacuation than what is possible when that time is limited to each individual's capacity to hold his/her breath. The breathing system must be compatible with the survival suit and must not reduce the suit's efficiency. The breathing system shall be automatically activated when submerged" (section 4). This statement regarding integration is repeated by CAA (1991) in that "any attached equipment shall not compromise the basic survival function of the immersion suit by causing puncturing, fretting or distortion of the material, or changes in its mechanical properties" (Specification No. 19, section 3.4). Operators in Atlantic Canada also require PLBs and more recently emergency breathing systems.

The addition of supplementary equipment is often not integrated into the original design of the immersion suit system; therefore, not always integrated in such a way that it will not snag during underwater egress. Taber (2007) and Taber and McCabe (2009) indicated that snags identified during underwater egress task analysis trials in an AS332L and Sea King configuration were not apparent during dry testing in the actual helicopter and recommend that a full wet snag test analysis be carried out prior to implementation of new equipment or configuration change. As an example of this application of snag testing, Mills (2003) suggests that new military uniforms for the U.S. Army will be designed to decrease the amount of weight that each person is carrying as well as reduce what is termed "the Christmas tree effect" (http://usmilitary.about.com/cs/genweapons/a/futureuniforms.htm). The Christmas tree effect refers to the additional equipment being hung on individuals with little regard for how the items may impact safety. Currently, the offshore workforce wears a strobe light, emergency breathing system, and personal locator beacon in addition to an approved immersion suit which incorporates at least one pull toggle for vest inflation, a buddy line, whistle, thermal protective mitts (usually stored in a pocket), splash guard, and nose clip. Without ensuring that all of these items work together as one integrated system that will not create snag hazards during egress, it is difficult to predict how one single item or the combination of items might affect survival rates. Therefore, a full underwater egress task analysis should be carried out in each of the existing helicopter interior configurations to ensure that snagging of equipment does not impede escape procedures.

5. COLLABORATIVE APPROACH TO THE IMPLEMENTATION AND MONITORING OF HELICOPTER SAFETY INITIATIVES.

This section of the report addresses aspects of helicopter safety initiatives and how they are implemented within the offshore safety culture. In order to address the implementation and monitoring of these initiatives, this section discusses safety management systems, safety climate, and safety culture. The last portion of this section identifies possible additions to the current process of dissemination of safety initiative information.

5.1 Safety Management System (SMS)

McDonald, Corrigan, Daly, and Cromie (2000) suggested that, in order to examine organizational safety, it is important to consider the influence of a safety management system, safety climate, and safety culture. By addressing the various factors of the overarching macro-environment within a particular organization that influence safety, it is possible to identify specific interventions that will aid in mitigating risk. As an example of the importance of risk mitigation, Transport Canada requires all aviation operators to have a Safety Management System (SMS) in place (CAR 107, T51-15/107-2008E-R). An SMS has been described as "an explicit, comprehensive and proactive process for managing risks that integrates operations and technical systems with financial and human resource management" and "provides for goal setting, planning, and measuring performance" (Transport Canada, 2008, section 3.2). The International Civil Aviation Organization (ICAO) also requires an SMS process to be in place for all aviation operators as of 2010.

The basic requirement of incident reporting and dissemination of information related to helicopter safety initiatives and activities is well documented and both Cougar Helicopters and CHC Helicopter Corporation (CHC) currently have extensive SMS procedures in place. Similar to the aviation safety reporting system (ASRS) developed by the National Aeronautics and Space Administration (NASA) in order to increase aviation safety (http://asrs.arc.nasa.gov/), CHC has a "Confidential and Anonymous Concern Hotline" where individuals can use a secure web form, email, or voicemail to report their concerns regarding operational issues related to financial or safety and quality procedures (https://www.openboard.info/chc/index.cfm). The importance of having a system like the ASRS cannot be overstated and this type of system has been cited as being one of the main reasons that the commercial airline industry has been able to reduce the number of reportable events and fatal accidents (Helmreich, 2000). In an effort to improve patient safety to reduce health care errors, a similar technique is being employed in medicine (Sexton**,** Thomas**,** & Helmreich**,** 2010). By creating not only an environment in which personnel feel comfortable discussing safety issues, but also one in which it is expected, the offshore work force and helicopter crews can work toward increased safety.

5.2 Safety Climate

Safety climate differs from a safety management system in that it is sensitive to the changes that occur within the organizational environment. Mearns, Whitaker, and Flin (2003) suggest that safety climate is "a manifestation of safety culture in the behaviour and expressed attitude of employees" (p. 642, see also Cox, & Flin, 1998). For example, the explicit identification of growing concerns about maintenance practices or safety operations typically increases after a major event has taken place and the climate of the environment shifts from a level of general dissatisfaction that remains unspoken to one of formal action involving written complains. For example, the shift from internal to external exposure of safety concerns can be seen immediately after the British Petroleum (BP) Texas oil refinery disaster in March of 2005. When reporting details of the event, the U.S. Chemical Safety and Hazards Investigation Board (CSB) (2007) cited issues related to poor communication among operators, malfunctioning instrumentation, poor computerized control displays, ineffective supervision, insufficient staff, operator fatigue, and inadequate training. It was further noted that the lack of response to previous incidents (considered to be of a serious nature) at the refinery might have created an environment in which the safety management system did not appear to be supported by BP's upper management. The apparent lack of support from upper management as well as inability to learn from past incidents, perhaps due to the complexity of the reporting system, undoubtedly influenced decisions made by key individuals prior to and during the event. The formal identification of safety concerns does not necessarily indicate that the safety culture or SMS of the organization is deficient; it does however identify that a change in observable workforce behaviour is reactive to recent events and, as Reason (1997) points out, these changes are often "shortlived" (pg. 192).

5.3 Safety Culture

Finally, safety culture has been defined as "the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour, that determine the commitment to, and the style and proficiency of, an organization's health and safety management" (Transport Canada, 2008, section 3.5.2). Taken together, SMS, climate,

and culture represent the collective aspects of the offshore workforce, the pilots that transport them to their destinations, the organizational structure in which they work, the environmental factors of their geographical location, and the technology of the equipment used to keep the system operating in an effective, efficient, and safe manner. Reason (1997) suggests "an ideal safety culture is the engine that continues to propel the system towards the goal of maximum safety health, regardless of the leadership's personality or current commercial concerns" (pg.195). Therefore, it is the responsibility of all personnel within the system to ensure that safety initiatives are maintained and updated as issues arise. In other words, if a risk is not identified through a formal reporting system that is recognized and valued by all members of an organization, it is difficult to develop a strategy of mitigation.

5.4 Possible Additions to Safety Initiative Process

The global offshore helicopter safety culture will undoubtedly change in response to current events and a collaborative effort from industry workforce members, organizational management, offshore operators, applied research and development, and governmental institutions will be needed to ensure all aspects are addressed. At a basic level, safety concerns related to offshore helicopter travel should have a clear mechanism of reporting such as the ASRS or a quarterly safety survey. However, this mechanism must have a definitive purpose with regard to implementation of future safety initiatives. For instance, if anonymous reporting or survey results identify that workers are concerned about safety implications of a particular passenger seat or a configuration within the helicopter, there needs to be a process by which workers can see the efforts being put forth by operators to rectify the issue; otherwise, the system will not be considered a viable option for voicing concerns. The managerial commitment to this process must be seen as a clear sign of safety over productivity (Mearns et al., 2003). Furthermore, all members of a safety system need to consider the consequences of particular initiatives in a proactive manner rather than waiting for an event to occur.

6. PERSONAL ACCOUNTABILITY WITH REGARD TO HELICOPTER TRAVEL SAFETY

As part of an overarching safety management system, personal accountability plays a critical role in identifying where rules and procedures are lacking. In sections 2 through 5 of this report, it was identified that several regulations and guidelines exist with regard to HUET course requirements, crashworthiness, emergency exit size and design, personal protective equipment, and the monitoring of helicopter safety initiatives. Additionally, benefits of these rules and regulations were discussed; this section of the report identifies some of the difficulties faced by operators and offshore helicopter transport suppliers when addressing personal accountability.

6.1 Operating within the Boundaries of System Safety Limits

A main component of identifying limits to personal accountability stems from the ability of a safety system to tolerate violations such as operating outside established safety boundaries (Busby & Bennett, 2008). Organizational safety research has clearly shown that individuals often work outside safety boundaries set by industry and equipment manufacturers due to a lack of system feedback and understanding of the consequences resulting from these minor violations (Vincente, 2003; Rasmussen, 1997). The fact that there are no negative consequences for operating outside these limits provides positive reinforcement that the system can tolerate small deviations. Operations conducted outside the prescribed limits slowly become normalized and the system is incrementally pushed further until a catastrophic event occurs. Reason (1997) suggests that it is difficult to maintain a level of vigilance that assumes everyday "will be a bad day," which might explain why individuals let their guard down (intentionally or not) when considering the consequences of violating safety protocols (pg. 37).

With regard to helicopter safety and personal accountability, it is important that individuals can readily identify these invisible safety boundaries (Vincente, 2003) in order to develop an understanding of how their actions may circumvent the defences implemented by organizational safety standards. Unfortunately, minor safety violations that do not result

in a negative outcome are then used as a new benchmark by which limits are slowly adjusted. Only after an event has occurred is it obvious that systems had been pushed well beyond the original design. Issues such as moving a helicopter passenger seat to a particular position or placement of auxiliary equipment without considering the consequences as they relate to underwater egress may initially be addressed as a safety concern when they are first implemented, but slowly become the norm as each uneventful flight occurs. It is only after an undesirable event has occurred that these changes are again identified as a concern in which safety has been compromised and holes in the safety management system are identified.

Busby and Bennett (2008) suggest that, simply by identifying a risk, there is an obligation to mitigate the associated hazards. However, sections 2, 3, and 4 of this report clearly identify that information regarding personal accountability and helicopter safety is limited to the "shall be," "shall meet," or "shall not" prescriptive regulations. And although the risks associated with thermal protection, heat stress, and thermal loading are known, the current rules and regulations do not set guidelines that indicate what clothing should be worn under an immersion suit, nor are there detailed lists of what clothing is appropriate given a specific set of environmental conditions, physical fitness level, sex, or age. Offshore personnel are therefore left to make a decision based on instructions given to them at a basic level and it is assumed that there is an understanding of the hazards associated with offshore helicopter travel. However, there does not appear to be a mechanism in place that allows for further development of this understanding. Personal accountability requires that individuals take the time and initiative to explore available information in order to develop a clear guideline by which to judge the behaviour of their own actions as well as those of others. If there are no suggested guidelines available, individuals often look to those who have the most experience even if there is no indication that they have a superior understanding of the hazards.

6.2 Quality Management System and Safety Culture

Turnusbekova, Broekhuis, Emans, and Molleman (2007) report that a critical first step in the development of a Quality Management System

(QMS) is the clarity of standards and expectations. Without this fundamental level of agreement, it is difficult to establish an acceptable level of accountability. For example, the BST and recurrent training provided in both of the CAPP-approved HUET organizations clearly outline the benefits of wearing thermal protective clothing next-to-skin; however, when newly trained offshore employees arrive at the heliport for their first offshore helicopter flight, they are not required to follow any of the suggestions pointed out during their training (anecdotal evidence). This first trip is the beginning of their indoctrination into the offshore helicopter safety system. Conflicting signs of standardization such as the requirement of next-to-skin thermal protection make it difficult for the new employee to transfer the knowledge gained on a safety course to the real world.

Similar to the points made in Section 5 of this report, Rao (2007) suggests that organizational safety culture is based on norms, networks, and trust that need to be considered when analyzing occupational risk assessments. Likewise, personal accountability relies on the social support of others (Turnusbekova et al., 2007). If, for instance, one's peers continually arrive at the heliport in a pair of shorts, a T-shirt, sandals, and socks, social desirability theories (Adams, Matthews, Ebbeling, Moore, Cunningham, Fulton, & Herbert, 2005) would suggest that conforming to the group norms and expectations is the best course of action, even if it is known that these actions are contrary to previous experience (i.e. HUET instruction). Reason, Parker, and Lawton (1998) suggest that, for organizations that operate within hazardous environments, it is important that there is a "requirement to limit human actions to pathways that are not only efficient and productive, but also safe" (pg. 289). Reason et al. (1998) further argue that organizational safety is measured by the absence of incidents, thereby making it difficult to identify the true state of the organizational safety. Therefore, a lack of incidents in which wearing minimal thermal protection or an immersion suit that is too large results in fatalities that could be construed by a new employee as a valid reason for not properly preparing for an offshore flight.

6.3 Personal Accountability of Offshore Workforce for Pre-flight Preparation

6.3.1 Hydration and Pre-flight Diet

In order to reduce the gap between basic helicopter safety training and pre-flight briefings, the following information suggests some of the preliminary preparation that should be taken before take-off. One of the fundamental factors of thermal regulation is hydration. Research has shown that dehydration and poor caloric intake are considered aggravating factors of hypothermia (Armstrong, 2005; Nagpal, & Sharma, 2004). It has also been reported that dehydration affects cognitive performance in hot environments similar to those found inside the helicopter (Cian, Barraud, Melin, Raphel, 2001; Sharma, Sridharian, Pichan, & Panwar, 1986; Gopinathan, Pichan, & Sharma, 1988). Therefore, it is recommended that individuals have a good meal and are well hydrated prior to an offshore flight. As a simplified way of subjectively judging hydration levels, Young, Sawka, Epstein, Decristofano, & Pandolf (1987) suggest that an estimate can be made on a scale from 1 (not at all thirsty) to 9 (very thirsty) and that a score between 3 (somewhat thirsty) and 5 (moderately thirsty) indicates mild levels of dehydration. Avoiding caffeine is also advisable as this is a diuretic and can reduce hydration levels (see also Armstrong, 2005). Being well hydrated is an important part of pre-flight preparation in that it accomplishes two goals. First, it ensures that thermal performance deficits will be minimized. Second, and more importantly, it begins the psychological preparation for the offshore flight.

6.3.2 Clothing

Although thermal protection of offshore personnel is considered during the development, design, and implementation of helicopter passenger transportation suits, it is advisable to take into account the benefits of additional thermal protection next-to-skin. The microclimate between the skin and first layer of clothing may affect performance and comfort during routine flights as well as those involving accidental immersion. Sweat that accumulates between this layer of clothing and the individual's skin may influence the sense of comfort as well as reduce the effectiveness of the body's attempt to thermal regulate when wearing the impermeable layer of

the immersion suit. For example, Yoo and Baker (2005) reported that 100% cotton was rated as being stiffer, had a higher level of clamminess, and retained a greater amount of moisture (i.e. sweat) than other heat-resistant protective workwear. Golden and Tipton (2002) suggest that multiple layers of clothing are more effective than one single thick layer in maintaining thermal properties. Havenith (1999) also reports that wearing clothing that retains sweat close to the skin's surface increases the likelihood of excessive cooling if the person is placed in a cold environment (i.e. sudden cold water immersion). Given that research clearly shows that some materials are ineffective for thermal regulation, it is advisable for individuals to wear clothing that is designed to wick sweat away from the surface of the skin. It is also advisable to wear clothing in layers with respect to the environmental conditions. For example, wearing one or two layers of thin wick-away clothing (long sleeve and full length pants) during summer months and three to four layers during colder winter months may increase the chances of survival after a ditching.

Wearing the extra thermal protection may increase thermal loading and the chance of heat strain, particularly during warmer months of the year; however, with proper hydration these effects are outweighed by the benefits that would be gained in the case of accidental cold water immersion. Windle, Hampton, Hardcastle, and Tipton (1994) clearly demonstrated that passive heating similar to that experienced while wearing an immersion suit during an offshore helicopter flight had no effect on short or long term survival in cold water. Furthermore, in an ongoing study of heat stress related to the performance of HUET skill set, Taber, Dies, and Cheung noted that, even after 90 minutes of exposure to 34°C, there were no decrements in task performance. Therefore, although the sensation of being hot and uncomfortable due to increased skin temperature may be perceived as a hazard in the event of a helicopter ditching, none have been reported.

6.3.3 Physical and Psychological Preparation

The physical and psychological preparation as well as the pre-flight video briefing is designed primarily to start the process of identifying what skills are needed if a worst case scenario arises. Without considering the possibility of a ditching, it may be difficult to shift one's mental schema

from that of a routine flight offshore to an emergency response mode in under 15 seconds (Brooks et al. 2008). It has been demonstrated that practice of a discrete motor skill is beneficial for physical preparation of future task performance (Schmidt, 2003). Therefore, it is advisable to mentally and physically rehearse the steps that would be needed to survive a possible ditching.

Physical preparation could be completed immediately following a pre-flight video briefing if a full-scale simulation of the helicopter interior were located at the heliport. Although not inverted and submerged underwater, practicing the actual steps that might be required during a ditching prior to boarding the helicopter might refresh aspects of the procedure critical to survival while providing the physical reinforcement needed to ensure that steps are carried out correctly. Furthermore, if all passengers were required to physically perform the required procedures prior to boarding the helicopter, any difficulties associated with suit sizing or equipment placement could be addressed prior to the flight.

As no such simulation is available at the heliport, offshore personnel, while watching the pre-flight video and then once inside the helicopter, should perform the following steps:

- Once seated in the helicopter, check primary and secondary escape routes to confirm exit jettison procedures (i.e. pull tab and push at corner, or rotate handle and push, etc…).

- Check that loose items are stored securely after use (i.e. book or magazine, safety card, ear defenders, water bottles, etc…) to ensure that these items will not cause impact injury or impede egress.

- Ensure that the seat harness is securely fastened and loose ends of the strap are tucked away (seat harness should first be made tight at the waist and then shoulders to ensure that the release mechanism remains on the pelvis and not mid-abdominal region).

- Ensure all supplementary survival equipment (i.e. strobe light, personal locating beacon, EBS hose and cylinder, EBS demand valve, whistle, buddy line, vest inflation toggle, splash guard pull

tabs, etc…) is secured in such a manner that it is easily accessible and will not impede egress.

- Ensure proper brace position can be obtained prior to take-off.

- Ensure physical reference point can be located with seat harness fully secured and locked.

- Physically perform the movements that would be necessary to egress underwater (minus jettisoning the exit) which include:

    - Brace position
    - Simulate deployment of emergency breathing system including clearing procedures
    - Physically locate reference point
    - Simulate window jettison
    - Simulate relocation of exterior reference point by holding the interior edge of window frame
    - Release seat harness
    - Simulate egress by moving head and body in the direction of escape
    - Repeat steps for secondary exit

This preparation is not to suggest that the every flight will result in an emergency. Nor is this suggested preparation intended to raise anxiety and stress about flying. It is intended as a proactive state of readiness whereby individuals understand the possibilities of risk and, more importantly, the actions necessary to mitigate some of those risks. Being proactive as opposed to reactive to a potential threat is a far more desirable position when safety is concerned.

7.0 CONCLUSIONS

Based on the information presented in this report, offshore helicopter travel in Canada is at or above safety levels in other regions around the world. There appears to be a well-organized process of identifying hazards

and risks as well as a clearly-defined mechanism to mitigate risks. Supplementary survival equipment such as state-of-the-art personal locater beacons, emergency breathing systems, and strobe lights are well above the standards set by Transport Canada, Civil Aviation and Federal Aviation Authorities. Moreover, thermal protective transportation suits meet and exceed Canadian General Standards Board requirements.

With this in mind, the final section of the report is designed to consolidate known and unknown aspects of helicopter safety in an effort to draw attention to the gaps in the collective understanding of offshore helicopter safety. By identifying the gaps in knowledge, future research may be better focused on improving factors that influence overall survival rates as well as routine flights. Furthermore, the following list helps to identify the interactive nature of the multiple factors associated with offshore helicopter travel.

CURRENT KNOWLEDGE REGARDING OFFSHORE HELICOPTER SAFETY

- Overall reported survival rate for helicopter ditching is approximately 72%.
- Approximately 85% of all aircraft accidents are considered survivable.
- Little warning is given prior to ditching.
- Majority of helicopters invert shortly after impact.
- Majority of ditching fatalities are from drowning.
- HUET improves survival rate.
- EBS improves survival rate.
- Practice with realistic exits improves HUET performance.
- There are several types of emergency exit designs and no regulation to ensure conformity of function.

- There are differences in what HUET skills are required.
- There are significant differences in HUET skill refresher schedules.
- Current testing guidelines for HPTS need to reflect a more realistic environment.
- Next-to-skin clothing material affects thermal regulatory properties of the overall HPTS system.
- Pre-warming before cold water immersion does not affect short or long term survival.
- There is no federal regulation regarding the required placement of helicopter supplementary survival suit equipment.
- Current SMS helicopter safety initiatives are available.
- Hydration and caloric intake (diet) influence cognitive performance and thermal regulation.
- Personal accountability plays a role in pre-flight preparations.

REQUIRED KNOWLEDGE REGARDING OFFSHORE HELICOPTER SAFETY

- What are the optimal HUET skills that should be demonstrated to gain certification?
- How many times should an individual demonstrate exit removal proficiency underwater?
- How often should HUET be refreshed?
- Should HUET be conducted in more realistic environmental conditions?

- Should crashworthy seats be incorporated into HUET performance requirements?

- What is the minimum force required to jettison an S92, AS332L, or S61N push-out window underwater?

- What are the egress implications of having an auxiliary fuel cell installed inside an offshore helicopter?

- Will individuals have difficulty finding a seat harness release mechanism if a crashworthy seat is lowered during impact?

- What clothing should be worn under the helicopter transportation suits of passengers and crew to aid in thermal regulation?

- What tests should be performed to ensure an HPTS or constant wear immersion suit is properly fitted?

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Appendix A

Helicopter Underwater Escape Training Simulators

(*note: images were gathered from Google™ image search engine*)

WLL 800Kg

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AEROSAFE
RISK MANAGEMENT

Offshore
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Safety Inquiry
Newfoundland and Labrador • Canada

MAY 2010

Offshore Helicopter Safety Inquiry

Passenger Survey Report

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About Aerosafe Risk Management

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MAY 2010

Offshore Helicopter Safety Inquiry

Passenger Survey Report

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This foreword introduces the completed offshore worker survey, which was carried out by Aerosafe Risk Management (Aerosafe) at the request of the Commissioner of the Offshore Helicopter Safety Inquiry.

The workforce participation was very high and in fact the survey was completed by a significant majority of the passengers who travel by helicopter to the Canada-Newfoundland and Labrador offshore oil installations.

Of particular significance are the survey results, which show a thoughtfulness and balance that I trust will be a helpful addition to the Inquiry's work.

I wish to express the thanks of Aerosafe to all of the workers, companies and organizations whose cooperation made the survey possible.

Yours sincerely,

Kimberley Turner
Chief Executive Officer

31st May 2010

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March 30, 2010

Dear Helicopter Passenger:

As part of the Inquiry process I have engaged a company called Aerosafe Risk Management to conduct a survey of offshore workers' opinions on helicopter travel safety issues. The survey will be conducted over a six-week period commencing in early April. The oil operators and Cougar have agreed that the survey may be conducted as the helicopter passengers prepare to take flights to the offshore installations. When you check in at Cougar Helicopters you will be given an envelope containing the survey and a cover letter from me. The survey can be completed in about ten minutes. Once the survey is completed it can be placed in a secure box at Cougar's heliport.

It is important for the Inquiry to have your cooperation in this survey because it is important that I know what you think.

Yours sincerely,

Robert Wells
Commissioner

Note: If you have any questions regarding the survey please contact Aerosafe by Phone 202 449 7693 or email oshsi-survey@aerosafe.com.au

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EXECUTIVE SUMMARY

This Report was commissioned in 2010 by the Commissioner, Offshore Helicopter Safety Inquiry (OSHSI), Newfoundland and Labrador, Canada, the Honourable Robert Wells Q.C. This Report presents the information and viewpoints gathered by means of a survey about helicopter safety matters from offshore oil workers who were passengers to offshore oil installations in the Newfoundland Labrador offshore area between April 1, 2010 and May 17, 2010.

The survey was qualitative in nature and was given to passengers to complete voluntarily. Direct encouragement to participate was offered by the Commissioner in a letter which accompanied each survey. Similarly, the oil Operators sent messages to their workers and contractors supporting passenger participation. All messages were on display at the survey distribution point (Cougar Helicopters Inc. heliport St. John's, Newfoundland).

There was a very high response rate to this voluntary survey over a relatively short period of six weeks. The level of worker participation in this survey indicates there is a strong voice and interest in helicopter safety. Several key issues have been identified through the survey results outlined in this Report. Overall the survey results are balanced and do not highlight any extreme safety issues that have not already been the subject of the Offshore Helicopter Safety Inquiry. Thirty-six questions were asked of passengers. In total 991 surveys were received by Aerosafe.

The survey results can be classified into two primary categories, helicopter operations and survivability. Survivability only becomes an issue when an aircraft accident occurs; however, it is extremely important that passengers have confidence in this aspect of transportation. A high percentage of comments in the open free field part of the survey (Q35 and Q36) fell into this survivability category. Although there were a high percentage of responses with respect to helicopter operations, many of these responses indicated limited knowledge of aviation practices on the part of the passengers. It is difficult for non aviation specialists to appreciate the rigor and effort that go into safe helicopter operations and provide comment with the appropriate level of technical integrity.

Responses to the survey were balanced and where concern was raised, it was raised by approximately 20% to 30% of respondents. This in itself is significant. 20% to 30% of survey participants is a noteworthy portion of the workforce and certainly enough to affect the centre of gravity for satisfaction in the workplace.

Many could argue that the offshore industry of Newfoundland and Labrador has a good safety culture and has good safety practices. Regardless of this, there is a current and notable lack of confidence in a large percentage of the workforce on a range of issues under the safety umbrella. Whether the issues are real or perceived, proactive management of these issues is required.

One of the key underlying issues that permeate many of the responses is whether the level and type of communications among this workforce are adequate. Achieving the right level of communication and information flow will increase confidence around safety.

A summation of results is detailed in the conclusion to this Report on page 39.

Overall the offshore helicopter passenger survey received a very high level of participation with just under 1000 workers responding, thus enabling this Report. In the interest of transparency, full disclosure of the raw data submitted by survey participants can be found in the annexes to this Report. The survey results contained in this Report provide an excellent foundation for the Inquiry, Regulator and Operators alike to address the concerns and take on board the ideas of the offshore workers. The building blocks are there but, as always in the "science" of safety management, more can be done.

Accord Act	The Canada-Newfoundland Atlantic Accord Implementation Act and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act.
Newfoundland and Labrador Offshore Area	The offshore area as defined in the Accord Act.
Operator	A company which have been issued an authorization pursuant to the Accord Act to conduct work or activity within the Newfoundland and Labrador Offshore Area.

Acronyms and Abbreviations

ASFQ	Unknown
BST	Basic Survival Training
CCR	Central Control Room
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
ECC	Emergency Coordination Center / Emergency Control Center
EHIS	Environmental Health Information Services
ERT	Emergency Response Team
HSE	Health, Safety and Environment
HSEQ	Health, Safety, Environment and Quality
HUEBA	Helicopter Underwater Emergency Breathing Apparatus
HUET	Helicopter Underwater Escape Training
IR	Infrared
IRP	Industry Risk Profile
JOSHC	Joint Occupation Safety and Health Committ**ee**
OSHSI	Offshore Helicopter Safety Inquiry
PLB	Personal Locator Beacon
SAR	Search and Rescue
SHTR	Unknown
SMS	Safety Management System

MAY 2010

Offshore Helicopter Safety Inquiry

Introduction

Following the fatal accident of Cougar Flight 491 on March 12, 2009 off the coast of St. John's, Newfoundland, the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) established the Offshore Helicopter Safety Inquiry (OSHSI). The purpose of the Inquiry is to

> *"determine what improvements can be made so that [C-NLOPB] can determine that the risks of helicopter transportation of offshore workers is as low as is reasonably practicable in the Newfoundland and Labrador Offshore Area." [Commissioner's Terms of Reference]*

In order to solicit the views of the offshore helicopter passengers with respect to practices which may reduce the risks of helicopter transportation, a survey was carried out. It was made available to all passengers who travelled to offshore installations by helicopter in the Newfoundland and Labrador area of Canada. This report presents the results of the survey.

Overview

The Passenger Survey was conducted from April 1, 2010 to May 17, 2010 inclusive. At the time of the survey there were approximately 1,800 persons involved in working in the Newfoundland and Labrador offshore area requiring helicopter transportation. The total potential workforce number of 1800 was based upon total available persons on board all six installations for two shifts. The timeframe was considered adequate to maximize participation and comment. The survey was conducted by Aerosafe Risk Management, a leading private sector firm, engaged by the Commissioner as an independent specialist in the field of aviation risk and safety management.

The aim of the survey was to provide an opportunity for the helicopter passengers to assist in identifying possible risks associated with transit offshore, as well to provide insight in to the existing conditions and perceived safety of helicopter transportation. The results from the survey are provided to enable the Commissioner to "report on and make recommendations in respect of matters relating to the safety of offshore workers in the context of the accountability which employers have for the escape, evacuation and rescue procedures while travelling to and from work by helicopter." [Commissioner's Terms of Reference]

Survey Background

The Cougar Flight 491 crash on March 12, 2009 killed 17 people on board and seriously injured the sole survivor. This crash constituted a serious accident. The Canada-Newfoundland Atlantic Accord Implementation Act and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act require that if a serious accident occurs, an inquiry is mandatory. The C-NLOPB determined that an inquiry into the safety of helicopter transportation in the Newfoundland and Labrador offshore area was necessary for the C-NLOPB to carry out its mandate of safety oversight. [Commissioner's Terms of Reference]

The Commissioner's Terms of Reference allows for the use of a survey as an instrument by which information can be gathered.

The survey is intended to identify any concerns or risks associated with offshore helicopter travel as well as any practices which may reduce or eliminate the risks. It is intended that the survey gather information which depicts the safety culture of the Operators and the safe operations of the helicopter, particularly with respect to escape, evacuation and rescue procedures when travelling by helicopter.

A survey is a method of gathering information from a population. The Aerosafe survey was available

to all the offshore population. It provides a simple means for the population to contribute to the Inquiry and the improvement of helicopter safety when travelling offshore.

Survey Objectives

The primary objective of the survey is to contribute to the Commissioner's report in respect of the Offshore Helicopter Safety Inquiry's Terms of Reference:

(a) Safety plan requirements for Operators and the role that Operators play in ensuring that their safety plans, as represented to and approved by the Board are maintained by helicopter operators,

(b) Search and rescue obligations of helicopters by way of contractual undertakings or legislative or regulatory requirements,

(c) The role of the C-NLOPB and other regulators in ensuring compliance with legislative requirements in respect of worker safety.

Aerosafe Risk Management constructed a survey which is designed to address these requirements by:

1. Collating information about helicopter operations and the safety of helicopter operations, particularly training for emergency situations and safety equipment, and

2. Collating information about Operators' safety culture, including risk assessments and safety management systems, and

3. Collating risks and risk reducing practices which have been identified by passengers.

Answers to these three requirements will contribute to the Commissioner's investigation to comprehend the existing safety regime in place within the Newfoundland and Labrador offshore oil and gas industry as well as identify practices which may reduce the risks of helicopter transportation.

A second objective of the survey is to establish a means for those who travel to offshore installations by helicopter to have their opinions recognized. Phase I of the Inquiry included a public hearing involving a number of Parties with standing. However, this Passenger Survey specifically allows all those people who are flying to and from the offshore installations to have a direct way of communicating any risks concerning the safety of helicopter travel, perceived or otherwise, recorded. It also contributes to completing a picture of the safety culture and regime existing in the industry.

Assumptions & Limitations

This survey was developed within the context of the following assumptions:

1. The survey was done at the request of the Commissioner, Offshore Helicopter Safety Inquiry, Newfoundland and Labrador, Canada and addresses the requirements of the Inquiry.

2. The survey was independently developed and administered. The survey results were compiled independently and this process was free of any external influence.

3. There was regular liaison between the Commissioner, Inquiry Counsel and Aerosafe during all stages of survey development and administration.

4. It is assumed that all offshore oil workers received notice advice of the survey from their employer or organisation they are contracted to.

5. It is assumed that the information entered onto the survey was freely given, voluntary and supplied without coercion of any kind.

6. It is assumed that the information provided by survey participants is complete, true and correct.

7. The information is a true reflection of the eligible respondent's point of view at a particular time to the set of questions asked on the survey.

8. There has been no disclosure of survey results by Aerosafe prior to the date of submission to the Commissioner.

9. It is assumed that the Report once submitted to the Commissioner will be made publicly available on the Inquiry website.

10. The original surveys are safely stored until direction is given to Aerosafe by the Commissioner for their complete destruction.

This OSHSI survey is subject to the following limitations:

1. The survey was made available to offshore oil workers travelling to installations over a six week period being the April 1, 2010 to May 17, 2010.

2. It is acknowledged that every single worker may not have been travelling offshore during this six week period.

3. Workers were requested to arrive at the heliport 10 minutes before normal check in time to complete the voluntary survey.

4. There was a slightly lower response rate for those passengers who took the first flight of the day owing to the early departure.

5. The definition of "Passenger" is that which is given to a employee or contractor of an offshore installation approved to be a passenger entitled to fly on a helicopter operated by Cougar Helicopters Inc. to their place of employment in the Newfoundland and Labrador offshore area.

6. Aerosafe would not accept any surveys beyond the cut off date of May 17, 2010.

Survey Structure

In order to address the objectives, the Passenger Survey was constructed using a number of established Industry Risk Profile (IRP) techniques to identify risks in the offshore oil and gas industry.

The survey was divided into the following five parts:

1. General Information

2. Helicopter Transportation and Operations

3. Employer's Safety Culture
4. Additional Information
5. Opportunities for Improvement

Each of these parts allows a specific aspect of the survey objectives to be achieved e.g. the opening General Information captures demographic information about participants. A cross tabulation of these results may then identify emergent trends which are specific to one or more group, whether it be by age, job role, offshore installation and so on.

In constructing the survey, the usual technique of a test group was not available to allow further development. However by identifying a number of other surveys and similar resources it was possible to create a survey based on past successes and industry recognized techniques.

Survey Administration

The Passenger Survey was available from April 1, 2010 to May 17, 2010, from the Cougar Helicopters Inc. heliport at St. John's, Newfoundland. The survey, comprising four pages, was handed to passengers only as they checked in for a flight to one of the offshore installations. Cougar Helicopters Inc. facilitated the survey distributions. The completed surveys were deposited by the passengers into a secure box at Cougar heliport and the surveys were collected by Inquiry staff and forwarded to Aerosafe Risk Management (in Washington D.C.) for tabulation. The time window selected for the survey was large enough so that each employee of the installations would have an opportunity during their work rotation stints offshore to pass through the airport and receive a survey. A number of employees who, for various reasons, would not be able to attend the airport to participate in the survey were able to respond by mail.

An Aerosafe contact website address and direct contact phone number were also made available to survey participants.

The survey was undertaken in a quiet part of the airport, and took between 10 and 15 minutes for respondents to fill out. The timing of the survey distribution before each flight meant that there was no rush for participants to complete the survey. All passengers were made aware of the survey distribution details and timing through their worksite. This meant that respondents were able to prepare for the survey, as well as ensure sufficient time to complete the survey.

This method of survey delivery and the timeframe chosen enabled nearly all the population of the Newfoundland and Labrador offshore oil and gas industry to participate in the survey. This potential sample size allows a highly accurate survey result. A participation rate of 51% or greater will allow a margin of error of 3% with a 99% confidence interval. The final response was 991 surveys lodged out of a population of 1800. This response rate enables reliable and accurate conclusions to be drawn from the survey.

About this Report

The intention of this survey report is not to interpret the results nor to draw conclusions. The report is intended to present the results in summarized form, which may allow conclusions to be drawn. The results for each question are provided as a percentage of the overall number of completed surveys. This enables the reader to comprehend the overall response, and may lead to future analysis of the results to identify trends or draw comparisons.

While the objective of the survey is to assist the Commissioner to report on the specific mandate of the Inquiry, the purpose of this report is not to provide an answer to each of the aspects. Rather this report will summarize the responses to each question and empower the audience to make an assessment of the helicopter transportation operations and the safety culture of the Operators.

Report Structure

The results for each question are contained in the following section and are tabulated. A number of Appendices are attached to provide a record of the responses to the "free text" questions.

In the case of Question 3 participants are asked to specify their job role if not listed in the range of options. A frequency count of each of the answers is included.

If respondents indicated in Question 6 that they hold a safety specific appointment, they were asked to specify their position. A frequency count is included in the body of the report.

Question 10 asks passengers to identify any changes they have noticed in the safety practices of helicopter operations. If they selected 'Yes', then a further question was asked. These extended answers were then broadly categorized. A frequency response for each category is included in the report. Individual responses are contained in Appendix B.

The number of respondents who explained their answer to Question 25 was 73. Each of these responses is included in Appendix C.

The responses for Questions 35 and 36 form a significant segment of the survey. In order to present the data without alterations, each of the responses, as written on the surveys, is contained in Appendices D and E for Questions 35 and 36 respectively. Each response was entered into broad categories and a frequency count was taken. The count is contained in the Survey Results. In the case of Question 35 specifically, it is asked that each of the concerns is rated for how significant the concern is on a scale of 1 to 5. This rating is included in Appendix D.

Analysis Techniques

The results from the surveys were first compiled into a number of datasheets. In order to maintain consistency of technique and quality control, one person was responsible for data entry with two people conducting periodic 'checks' of the data entry.

Where more than one response was given to a question requiring only a single answer, the responses were recorded but the answer was declared "invalid". Similarly if the respondent had marked an answer which was not applicable, for example Question 17 which was only to be answered if the answer to Question 16 was 'Yes', the response was recorded as "invalid".

The analysis of the results is primarily descriptive in order to avoid data manipulation and drawing potentially misleading conclusions. The results illustrate both frequency of response and percentage of response. The combined number of unanswered questions and invalid responses are recorded for each question.

Survey Results

The overall survey participation rate was excellent given that the survey was voluntary. Survey responses from the passengers appeared open and honest about both helicopter transportation and operation and the safety climate in the Newfoundland and Labrador offshore petroleum industry. The opportunity for passengers to identify "concerns" about helicopter transportation and any "suggestions" for improvement had a good response rate. There was much consistency in information provided in the open text section of the survey (Q35 and Q36). This enabled some overall grouping of the concerns and suggestions in order to provide an overview of topics arising.

The results are presented to enable a summary of the passengers' opinions. Conclusions regarding the workers' opinions were not analyzed in detail, yet rather collated so that the readership of this survey report can draw their own conclusions. Some description of the results is included in order to provide a method of comparison of responses between questions. In the case of presenting the overview of results from free text questions, the general grouping of responses is intended only to provide an indication of the types and numbers of answers, not a definitive frequency count.

Response Rate

Information provided by C-NLOPB indicates that the total workforce size at the time of the survey was 1800. Based upon this, the total survey participation rate was 55%. This sample size of 991 replies allowed a high degree of accuracy and reliability to be given to the results.The response rate for each of the questions varied between 57% and 99.9%.

Due to the nature of the first three parts of the survey, a high response rate among those who chose to participate in the survey was expected. The actual average response rate for Parts One to Three was 96.65%. This is a very high rate of response and allows for precise results as well as accurate observations to be made.

Parts Four and Five, the free text questions, were expected to have a lower response rate. The extra time required for identifying "concerns" and "suggestions" means that the final response rate was 54% and 60% for Parts Four and Five respectively. The number of people who identified three concerns was 36% of the total number of respondents. Most people identified at least one concern, 77%, while some respondents identified concerns but did not rate them.

The response to Part Five, "Opportunities for Improvement", was 60% of all respondents. This is approximately 37% of the total offshore helicopter passenger population. The proportion of people who recorded 3 suggestions (25%) compared to the number of people who recorded one suggestion (55%) indicates that time or interest in the final part of the survey may have been contributing factors to the response rate.

The overall response rate was high for the survey. The large number of results not only indicates the keenness of passengers to play an active role in improving the safety of offshore helicopter transportation, but it also enables accurate conclusions and observations to be made from the survey results.

Part 1 of the survey provides an overview of the demographic breakdown of the respondents. Although an analysis of the demographic results is not included in this report, future evaluations may choose to undertake this task.

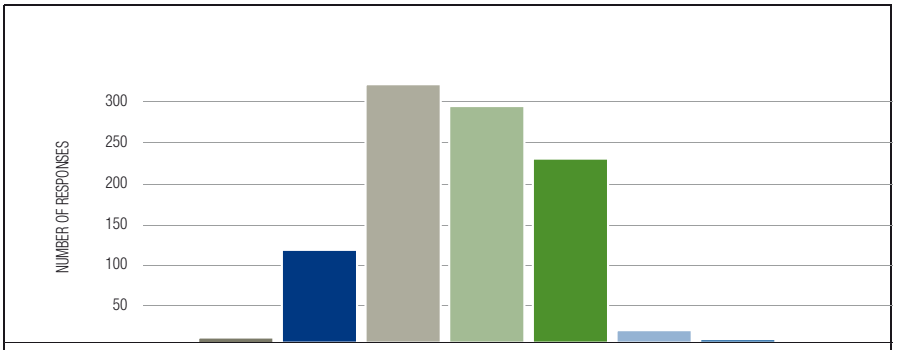
MAY 2010

Offshore Helicopter Safety Inquiry

Responses

Q1: Age

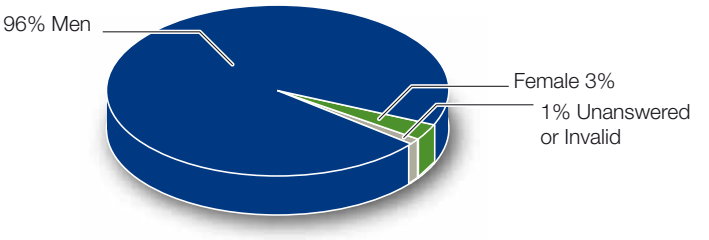
Thirty-two percent (32%) of people traveling offshore are aged between 30 and 39. This is closely followed by passengers (30%) aged between 40 and 49. The median age range was 40-49.



ANSWER	TOTAL	<20	20-29	30-39	40-49	50-59	60+	UNANSWERED OR INVALID
Number of Responses	**991**	1	122	315	298	236	18	1

Q2 : Sex

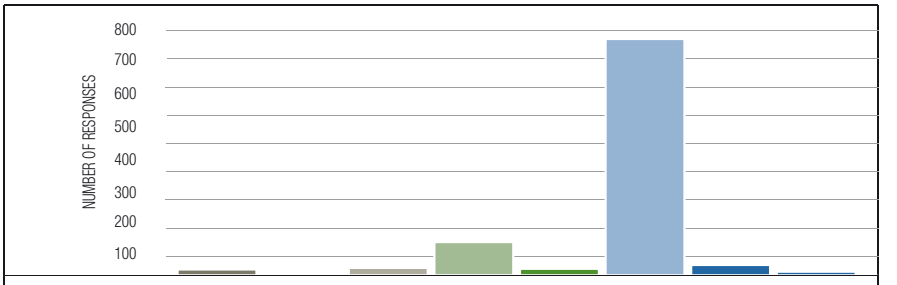
Of the 991 respondents, 96% were male, 3% were female and 1% of passengers did not answer the question.



ANSWER	TOTAL	MALE	FEMALE	UNANSWERED OR INVALID
Number of Responses	**991**	954	27	10

Q3: Job Role

Seven hundred and fifty (750) respondents identified their job role as “worker”. This constitutes 76% of all respondents. The number of people in “manager” or “supervisor” roles constituted 2% and 16% of respondents respectively.



ANSWER	TOTAL	AIRCREW	EXECU-TIVE	MAN-AGER	SUPERVI-SOR	VISITOR	WORKER	OTHER	UNANSWERED OR INVALID
Number of Responses	**991**	2	0	21	154	9	750	43	12

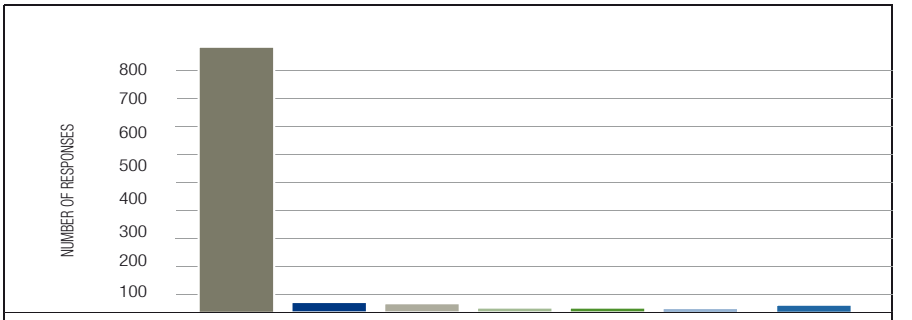
Four percent (4%) of respondents selected “Other”. The following is a list of the positions recorded as “Other”.

JOB ROLE	NUMBER OF TIMES IDENTIFIED
Field Service Engineer/Specialist	6
Contractor/Third party	4
Medic	4
Offshore Worker	4
Safety	3
Surveyor	3
Electrician	2
Inspector	2
Service Representative/Contractor	2
Weather/Ice Observer/Radio Operator	2
Advisor	1
Catering	1
Coach	1
Coordinator	1
Deck Operative	1
Elevator Technician	1
Engineer	1
Photographer	1
Security Advisor	1
Subsea	1
Towmaster	1
TOTAL	**43**

Identifying the position of the passenger within the organization and whether there is any correlation between results as dependent on varying perceptions may be a topic of further investigation.

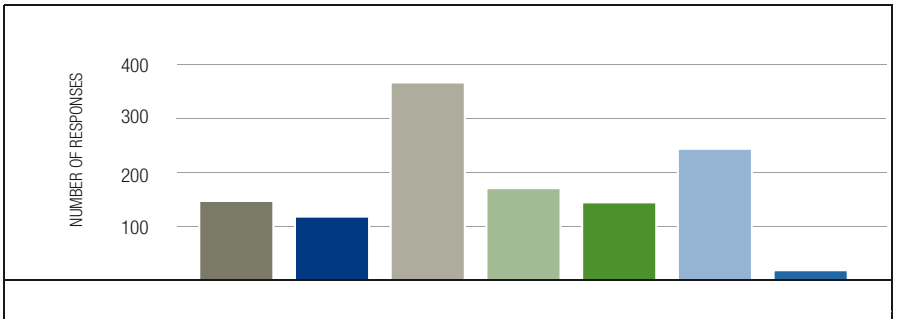
Q4: Which rig/platform do you work on?

There are six offshore installations currently operating in the Newfoundland and Labrador Offshore Area: GSF Grand Banks, Henry Goodrich, Hibernia, Sea Rose FPSO, Stena Carron, Terra Nova FPSO. 85% of respondents indicated they worked at one location. 5% and 5% of respondents worked and two and three sites respectively.



ANSWER	TOTAL	1 SITE	2 SITES	3 SITES	4 SITES	5 SITES	6 SITES	UNANSWERED OR INVALID
Number of Responses	**991**	846	48	46	13	7	7	24

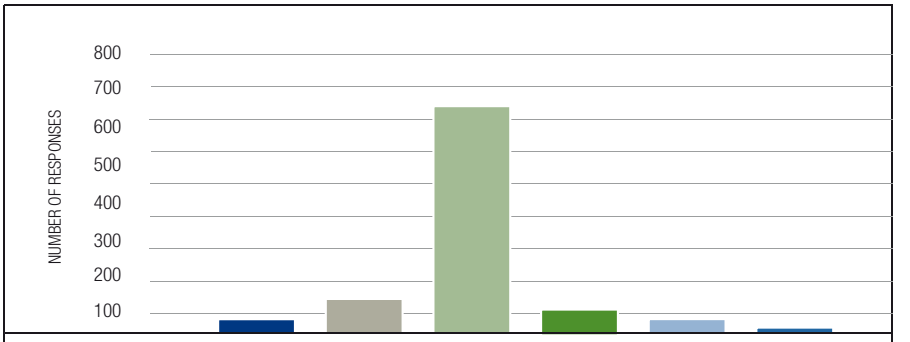
Collating the results of rig/platform location gave 1224 results. Of this the majority of passengers indicated they worked at Hibernia. Responding to this question was clearly marked as optional, and 2% of respondents did not answer this question.



ANSWER	TOTAL	GSF GRAND BANKS	HENRY GO-ODRICH	HIBERNIA	SEA ROSE FPSO	STENA CARRON	TERRA NOVA FPSO	UNANSWERED OR INVALID
Number of Responses	**1224**	145	108	377	181	148	241	24

Q5: How many trips to the rig/platform would you make each year?

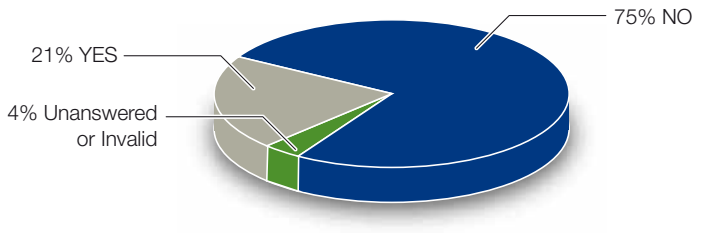
Sixty-five percent (65%) of passengers make between 7 and 9 trips to the offshore installations each year. Nearly equal numbers of respondents take 4-6, and 10-12 trips per year.



ANSWER	TOTAL	1-3	4-6	7-9	10-12	>12	UNANSWERED OR INVALID
Number of Responses	**991**	41	106	647	101	90	6

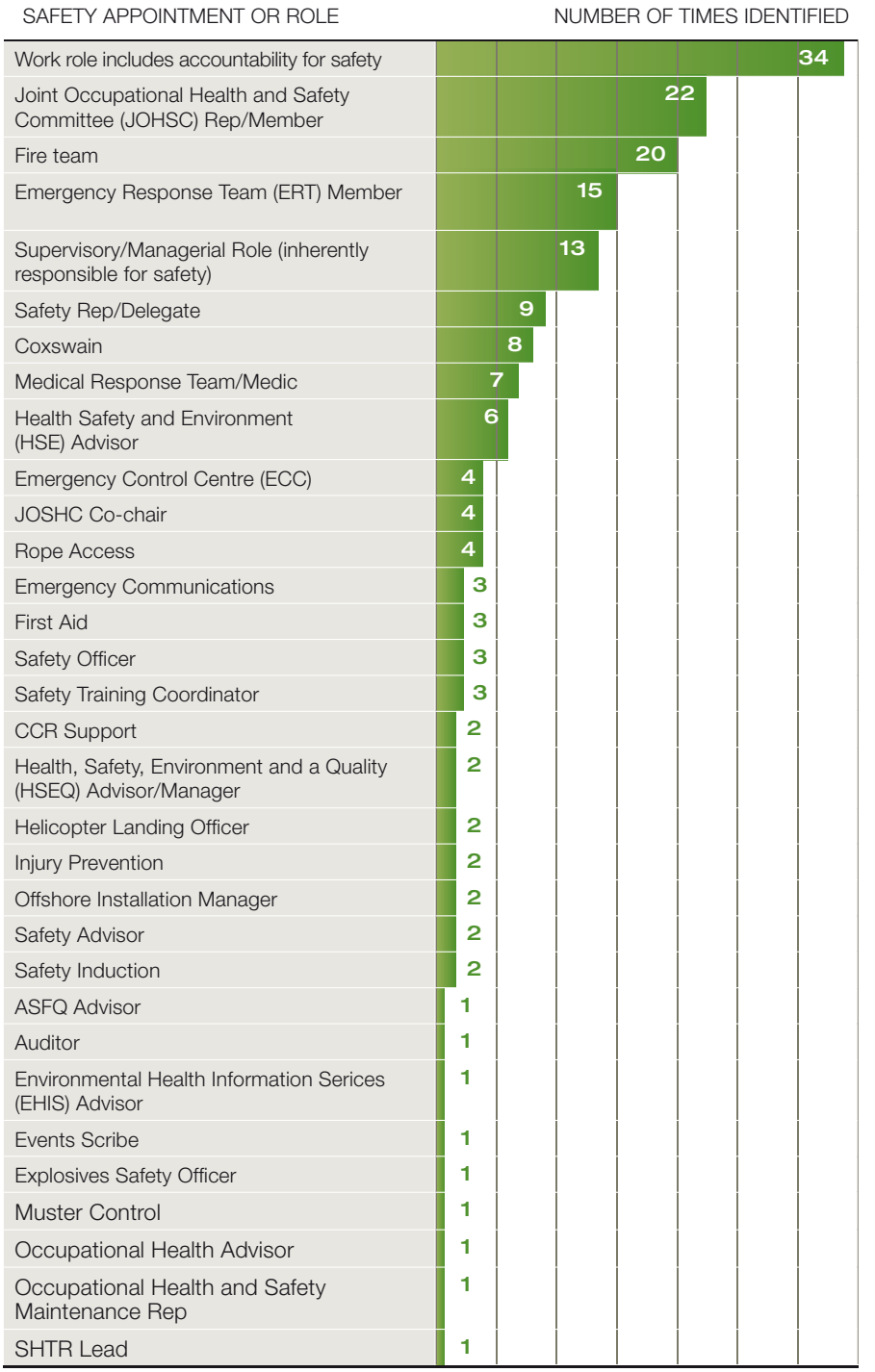
Q6: Do you hold a specific safety appointment or role with your employer?

Two hundred and eight (208) participants indicated that they held a specific safety appointment, of which 174 specified their position. Of the passengers who specified their position, 9 passengers identified two safety roles in their response; 34 passengers identified their job as having a safety role that is an integrated part of their everyday activities; 13 passengers in supervisory roles indicated that they have a responsibility for safety as a part of their job. Two descriptions were illegible.



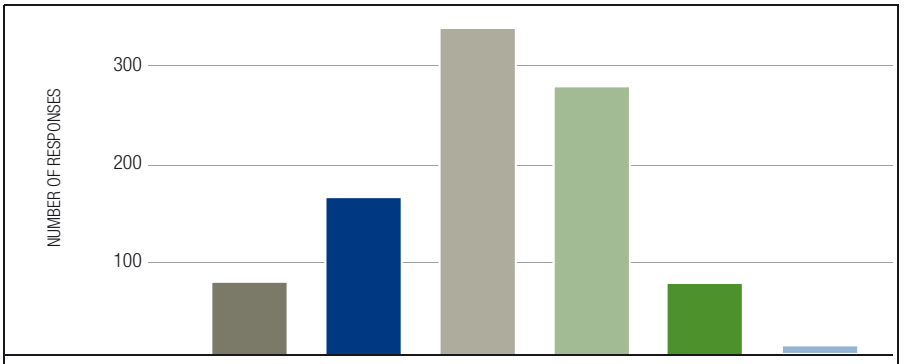
ANSWER	TOTAL	YES	NO	UNANSWERED OR INVALID
Number of Responses	**991**	208	748	35

GENERAL INFORMATION: QUESTIONS 1-6



Q7: What is your confidence level in respect to the safety of helicopter transportation?

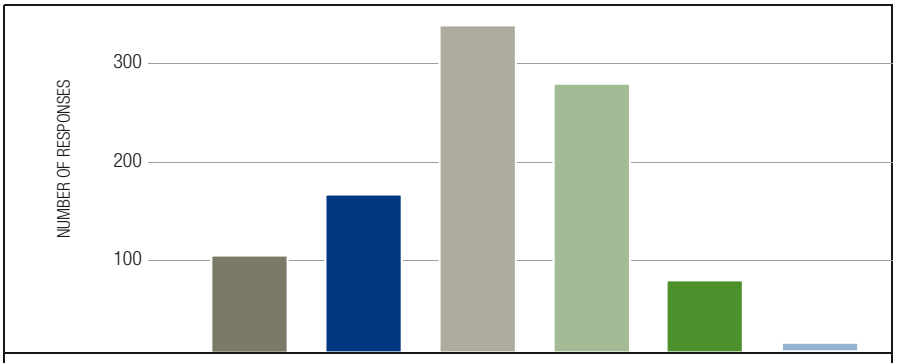
Of the respondents, 29% and 8% felt "confident" or "very confident" about the safety of helicopter transportation. This total, 37%, indicates an overall confidence in helicopter travel safety. However 35% of people indicated 3 out of 5, a middle response, to the confidence level. In total 27% of respondents scored 1 or 2 out of 5, where 1 indicated "not confident".



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	86	174	350	288	87	6

Q8: Do you feel safe when travelling in helicopters to and from the rig/platform?

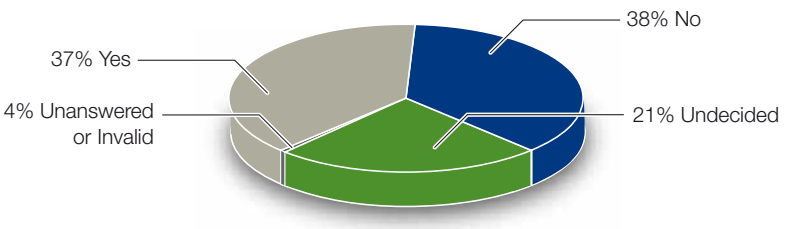
The most commonly identified response to this question was 3 out of 5, constituting 35% of participants. 29% marked 4 out of a possible 5, indicating they felt safe when travelling via helicopter.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	101	178	344	283	76	9

Q9: Would you prefer to travel to the rig/platform via an alternate means of transport (eg boat)?

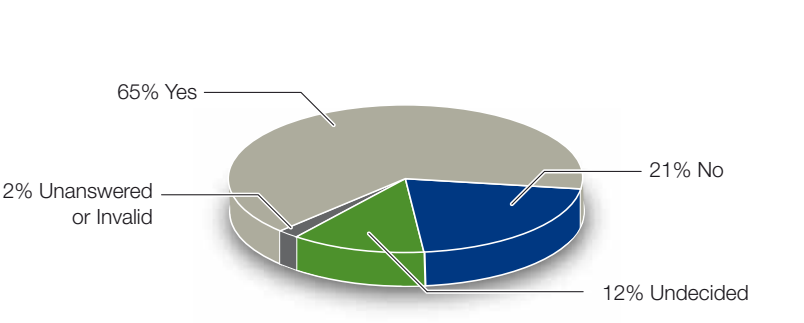
Thirty-eight percent (38%) of passengers answered 'Yes' to this question, with 37% answering 'No'. As the difference between these results is smaller than the margin of error, which is 2.5%, the results can be considered equal. A quarter of respondents, 25%, indicated they were undecided about an alternate means of transportation to and from work.



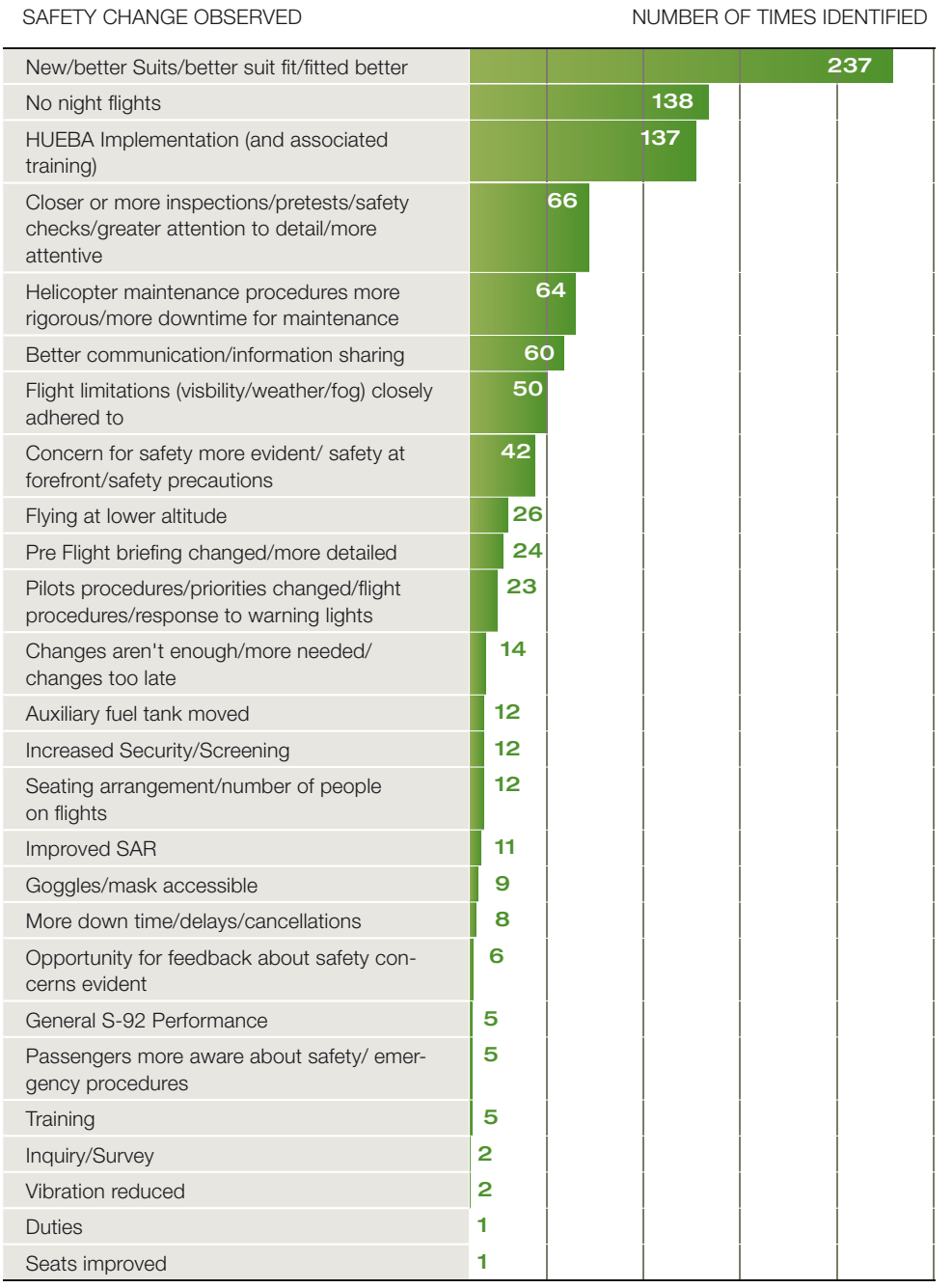
ANSWER	TOTAL	YES	NO	UNDECIDED	UNANSWERED OR INVALID
Number of Responses	**991**	381	363	244	3

Q10: Following the Flight 491 accident, have you noticed any changes in safety practices of helicopter transportation?

Six hundred and forty-three (643) people, or 65% of respondents, indicated that they had noticed changes in the safety practices of helicopter transportation since the Flight 491 accident. 21% of passengers had not noticed any changes. 552 respondents described the changes they had noticed, see Appendix B for recorded responses.

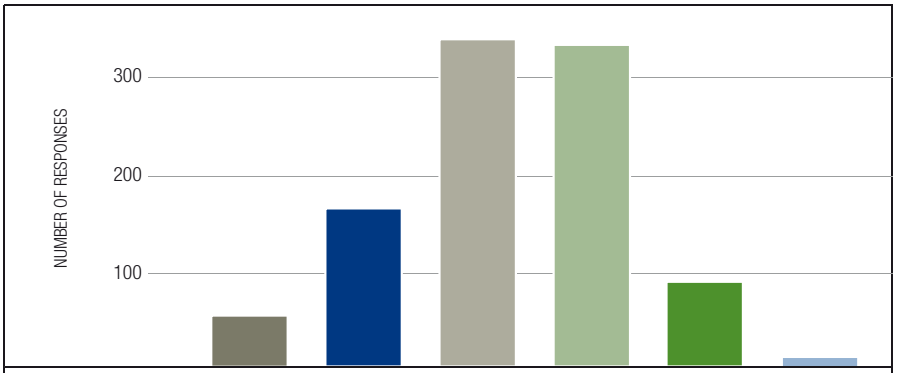


ANSWER	TOTAL	YES	NO	UNDECIDED	UNANSWERED OR INVALID
Number of Responses	**991**	643	208	121	19


SAFETY CHANGE OBSERVED
NUMBER OF TIMES IDENTIFIED
New/better Suits/better suit fit/fitted better
237
No night flights
138
HUEBA Implementation (and associated training)
137
Closer or more inspections/pretests/safety checks/greater attention to detail/more attentive
66
Helicopter maintenance procedures more rigorous/more downtime for maintenance
64
Better communication/information sharing
60
Flight limitations (visbility/weather/fog) closely adhered to
50
Concern for safety more evident/ safety at forefront/safety precautions
42
Flying at lower altitude
26
Pre Flight briefing changed/more detailed
24
Pilots procedures/priorities changed/flight procedures/response to warning lights
23
Changes aren't enough/more needed/ changes too late
14
Auxiliary fuel tank moved
12
Increased Security/Screening
12
Seating arrangement/number of people on flights
12
Improved SAR
11
Goggles/mask accessible
9
More down time/delays/cancellations
8
Opportunity for feedback about safety concerns evident
6
General S-92 Performance
5
Passengers more aware about safety/ emergency procedures
5
Training
5
Inquiry/Survey
2
Vibration reduced
2
Duties
1
Seats improved
1
TOTAL
972

Q11: How capable do you feel to respond to an emergency situation in a helicopter?

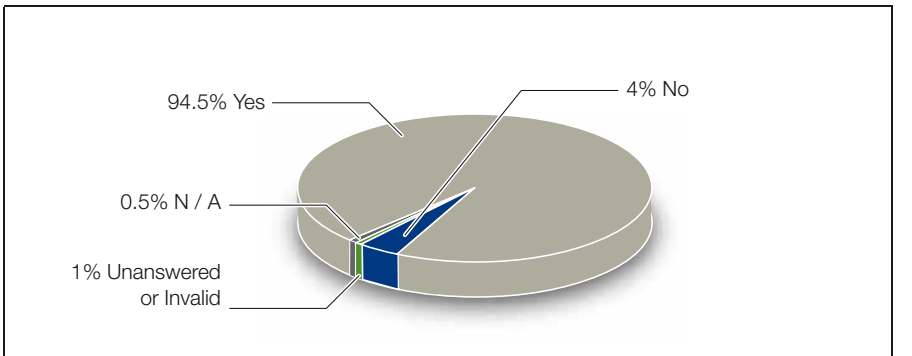
An equal percentage of passengers, 33%, indicated 3 or 4 on the scale of 5, where 5 represented "very capable" to respond to an emergency situation in a helicopter. 5% indicated they felt incapable to respond in an emergency.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	53	166	329	327	99	17

Q12: Have you received training for emergency situations in helicopter operations?

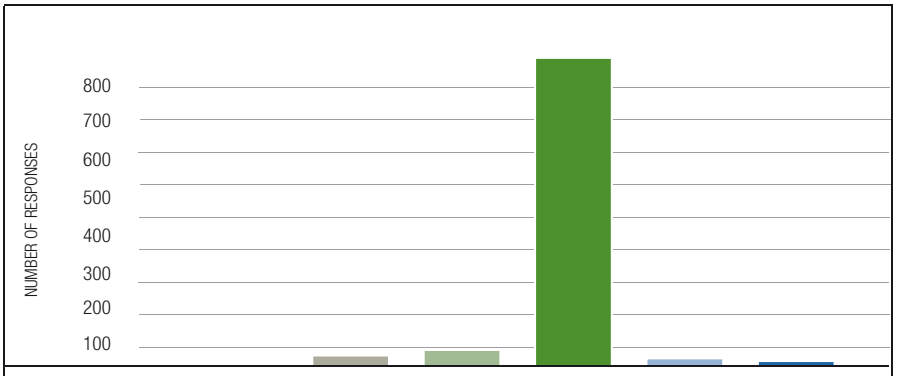
Nine hundred and forty-one (941) passengers indicated that they had received training for emergency situations in helicopter operations. This accounts for 94.5% of participants, with 4% of participants indicating 'No'.



ANSWER	TOTAL	YES	NO	N / A	UNANSWERED OR INVALID
Number of Responses	**991**	941	38	4	8

Q13: How often do you receive recurrent/refresher helicopter safety training?

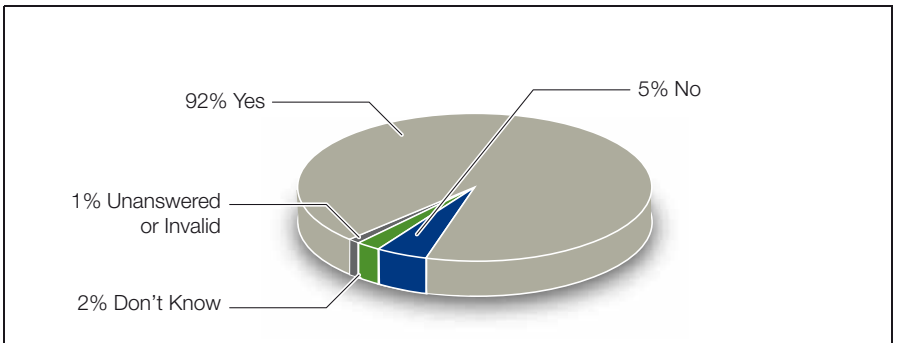
Eighty-eight percent (88%) of passengers indicated they received recurrent or refresher training for helicopter safety every three years.



ANSWER	TOTAL	TWICE A YEAR	ONCE A YEAR	EVERY TWO YEARS	EVERY THREE YEARS	CAN'T REMEMBER	UNANSWERED OR INVALID
Number of Responses	**991**	0	12	74	877	16	12

Q14: Did the helicopter safety training involve physical drills or exercise?

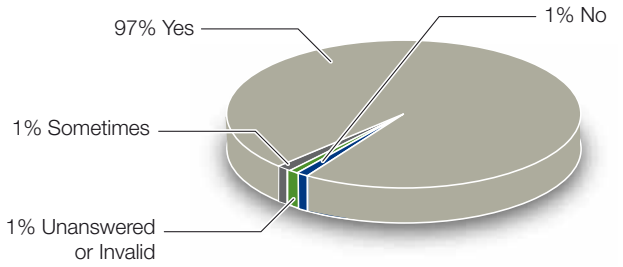
The majority of respondents, 92%, indicated that the helicopter safety training involved physical drills or exercises.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	913	47	20	11

Q15: Are you given a helicopter safety briefing prior to each flight?

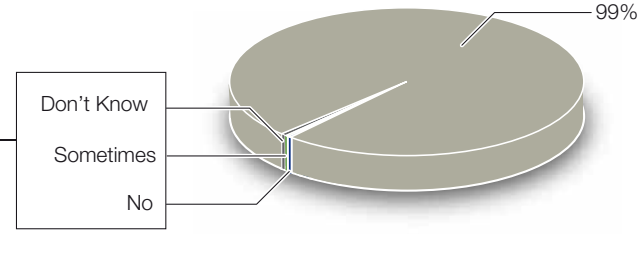
Nine hundred and fifty-nine (959) passengers, or 97%, confirmed that they receive a safety briefing before each flight offshore. 1% of respondents indicated that they did not, but this is smaller than the margin of error for the survey.



ANSWER	TOTAL	YES	NO	SOMETIMES	UNANSWERED OR INVALID
Number of Responses	**991**	959	12	7	13

Q16: Have you undertaken Helicopter Underwater Escape Training (HUET) training?

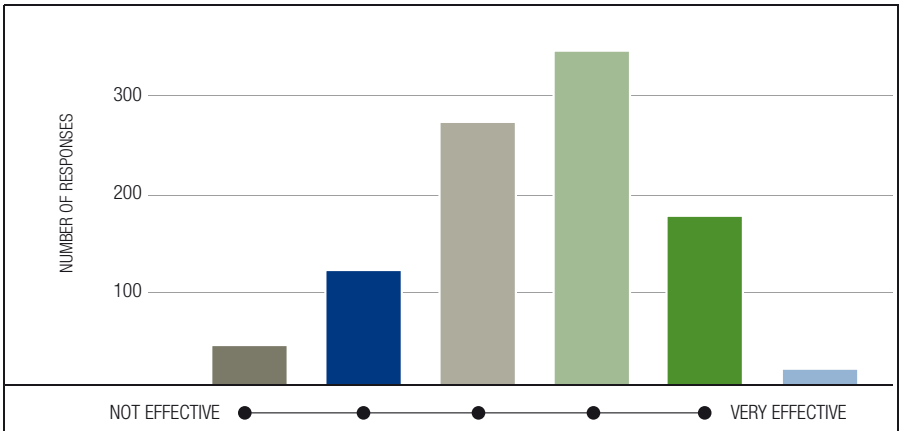
Nine hundred and eighty-two (982) passengers, 99% of respondents, have undertaken HUET training.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	982	3	1	5

Q17: How effective is the HUET training?

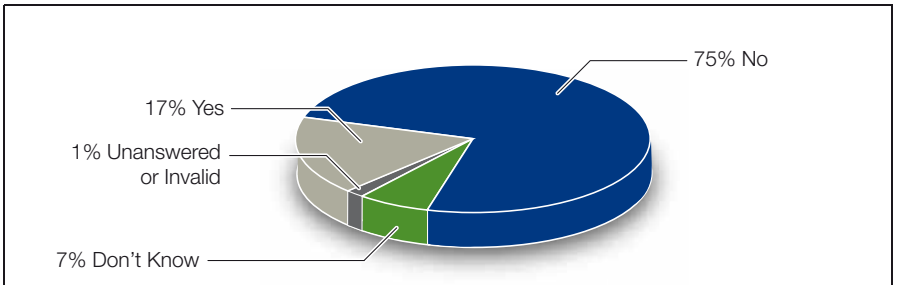
When asked to rate the effectiveness of the HUET training on a scale of 1 to 5, with 5 being very effective, 36% of passengers scored it as 4; 54% of passengers rated the HUET training as 4 or 5 out of 5; 28% of respondents indicated 3 out of 5.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	38	113	279	361	176	24

Q18: Do you have any concerns with the breathing device, PLB or other personal safety equipment issued to you at the heliport?

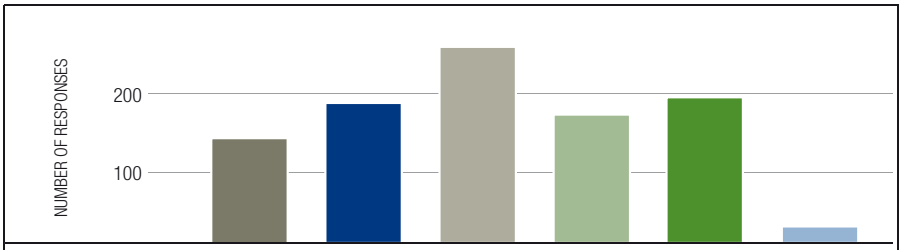
The most frequently identified response to this question was 'No' with 75% of participants indicating that they are not concerned with the safety equipment issued to them. 17% of respondents indicated 'Yes' to this question.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	171	738	68	14

Q19: Do you have any concerns with your survival suit?

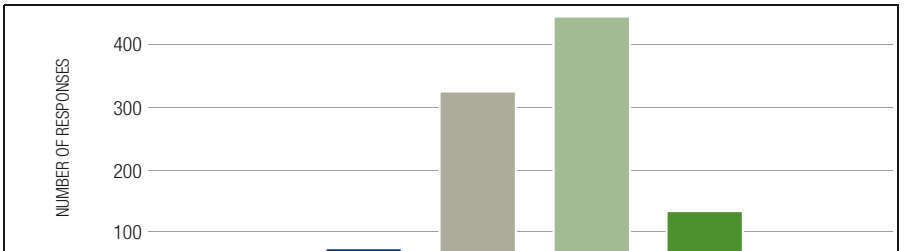
The most commonly identified response was 3 out of 5. This response was selected by 26% of passengers. Combining the responses for 1 and 2, i.e. not concerned, comprises 34% of responses. Similarly combining responses at the other end of the scale, indicated by 4 or 5 out of 5, constitute 38% of respondents. A number of surveys had many written comments in addition to answering this question, indicating that the suit used had been changed.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	140	192	258	185	194	22

Q20: How satisfied are you with the adequacy of the training and procedures on how to use the safety equipment?

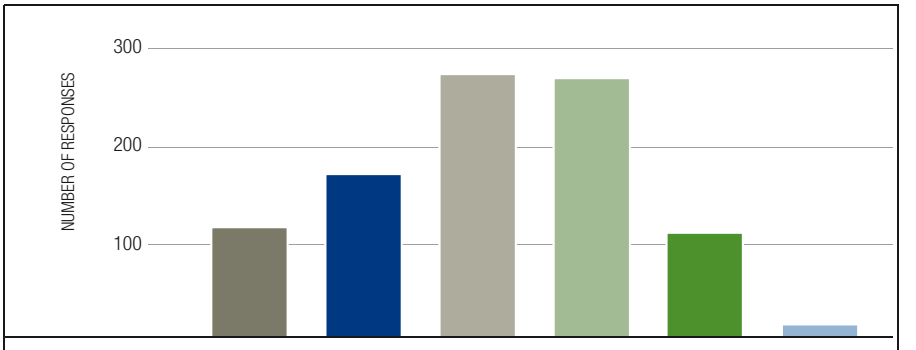
Forty-three percent (43%) of passengers indicated that they are satisfied with the adequacy of training and procedures on how to use safety equipment, scoring 4 out of 5 for this question, where 5 corresponds to “very satisfied”. The second most frequently identified response is 3 out of 5, comprising 32% of all respondents.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	22	75	318	429	137	10

Q21: When you are travelling by the helicopter how satisfied are you that you get the right amount of information about helicopter operations?

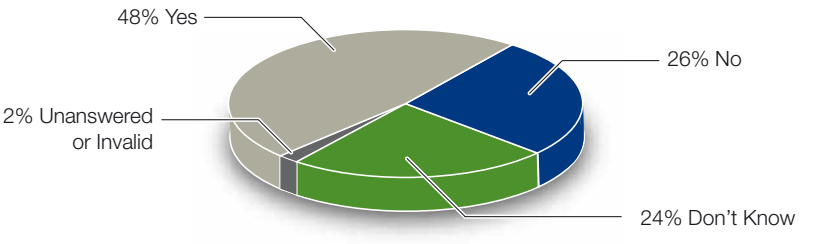
Forty percent (40%) of respondents selected 4 or 5 on the scale, where 5 corresponds to "very satisfied". 29% of participants indicated 1 or 2 on the scale, where 1 corresponds to "not satisfied".



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	116	177	288	287	110	13

Q22: Do you believe there is an adequate level of overseeing of safety (safety oversight) for helicopter transportation?

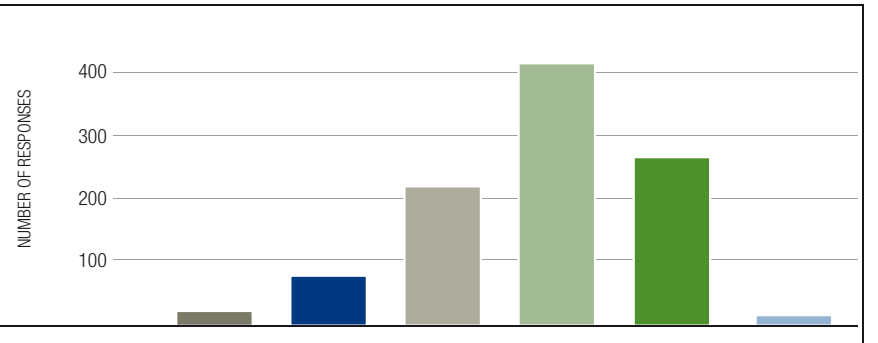
Four hundred and seventy-five (475) passengers, 48% of respondents, indicated that they believed there is a sufficient level of safety oversight for helicopter transportation. 26% of participants indicated that there was not an adequate level of overseeing of safety for helicopter transportation. 24% of participants selected 'Don't Know'.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	475	261	236	19

Q23: Please rate your organization's safety culture?

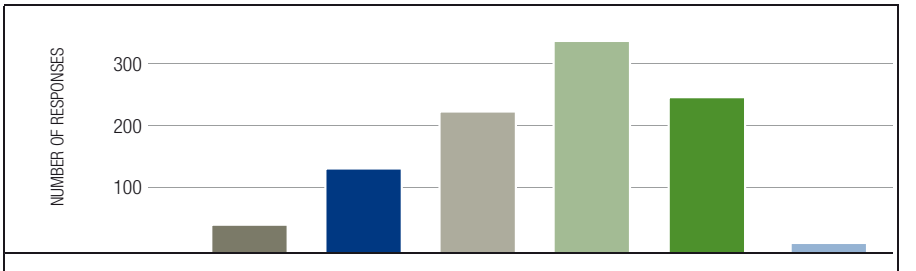
The most frequently identified rating of their organization's safety culture is 4 out of 5, where 5 indicated an excellent safety culture. 22% indicated 3 out 5 when rating the safety culture. The average response was 3.85, which is the highest average for any of the 'scale' questions in the survey.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	19	71	215	403	269	14

Q24: Do your consider your organization/employer to have an open reporting culture?

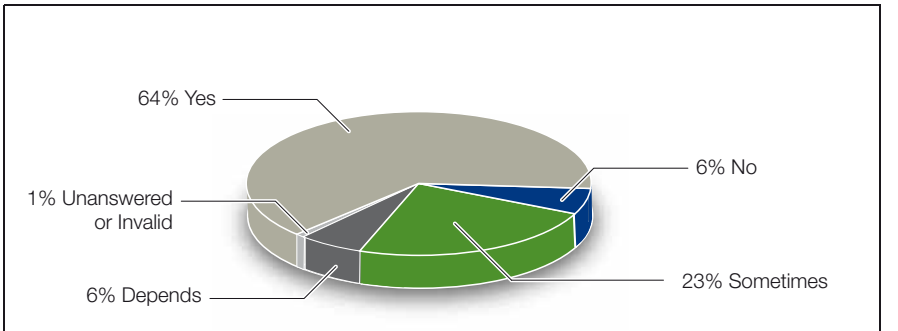
Sixteen percent (16%) of respondents selected a 1 or 2 on the scale that indicated they believed the reporting culture was closed.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	40	122	217	338	257	17

Q25: Are you comfortable that you are able to personally raise your safety concerns?

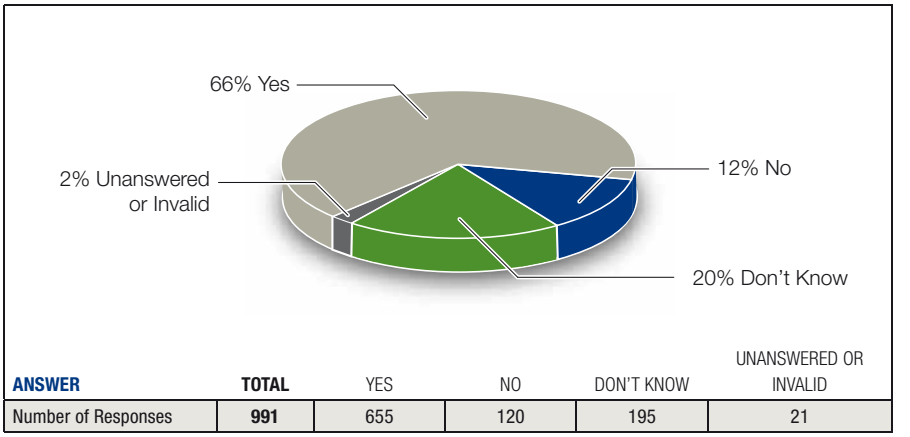
Sixty-four percent (64%) of respondents indicated they felt comfortable to raise their safety concerns. 23% of respondents said "sometimes". When asked to explain their answer, 73 people did so. The explanations are included in Appendix C, as well as the response given.



ANSWER	TOTAL	YES	NO	SOMETIMES	DEPENDS	UNANSWERED OR INVALID
Number of Responses	**991**	631	57	234	60	9

Q26: Does your organization/employer have a confidential reporting system for safety?

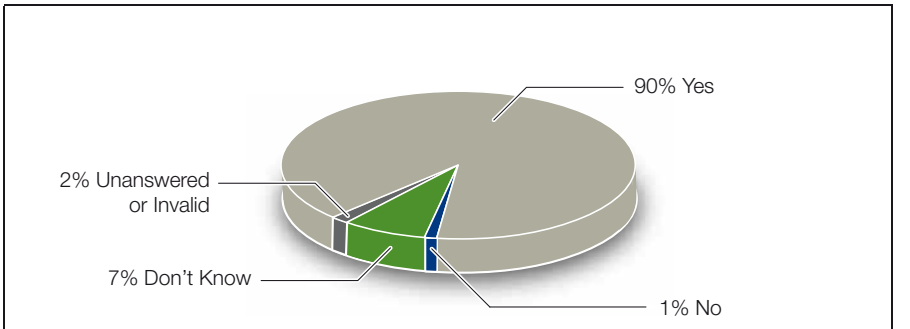
Sixty-six percent (66%) of respondents said they were aware of their organization's confidential reporting system; 20% of respondents indicated that they didn't know whether there was such a system, and 12% said that their organization did not.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	655	120	195	21

Q27: Does your organization/employer have a Safety Management System?

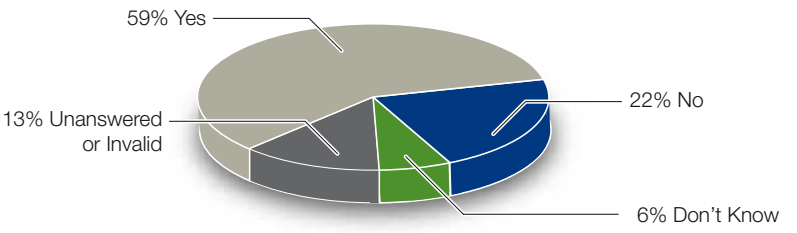
Ninety percent (90%) of passengers were able to confirm that their organization or employer has a Safety Management System (SMS). One percent (1%) indicated their organization did not have an SMS. Seven percent (7%) of respondents did not know whether their organization had an SMS.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	889	11	76	15

Q28: Have you received training on the Safety Management System?

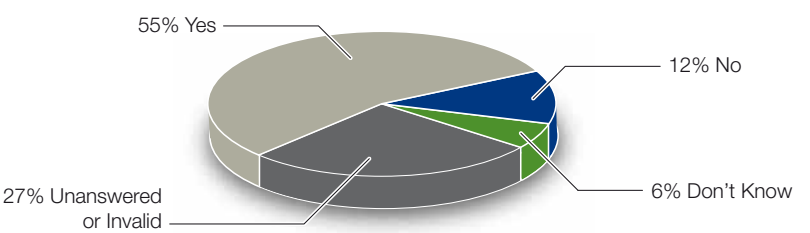
Fifty-nine percent (59%) of respondents have received training on their organization's SMS. This is equivalent to 66% of people who indicated in the Question 27, that their organization had an SMS. 22% indicated they had not received training on the SMS and 6% indicated they were not sure.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	583	215	65	128

Q29: Do you regularly use the Safety Management System?

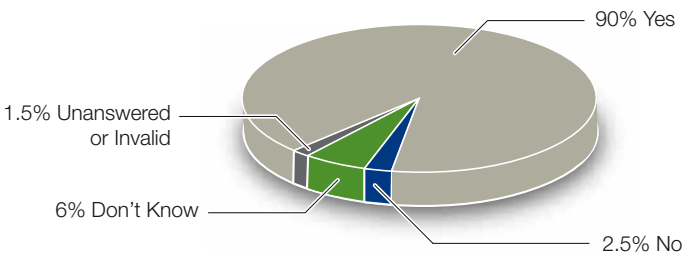
Fifty-five percent (55%) of respondents indicated that they regularly used the SMS. This is equivalent to 62% of those people who are aware of the SMS, and 94% of those people who indicated that they have received training in the SMS. Of the people who indicated that they had received training in the SMS, 20% responded that they didn't regularly use the SMS. The figure below represents the responses as a percentage of the total number of respondents.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	547	117	58	269

Q30: Does your organization/employer do risk assessments?

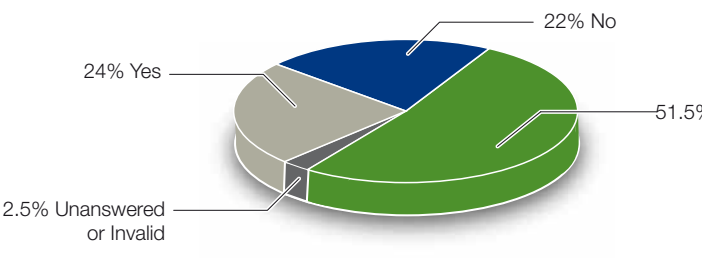
Ninety percent (90%) of passengers indicated that their employer or organization undertook risk assessments. 6% did not know if their organization undertook risk assessments and 3% indicated their organization did not do risk assessments.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	894	25	57	15

Q31: Does your organization/employer have a risk assessment on helicopter transportation?

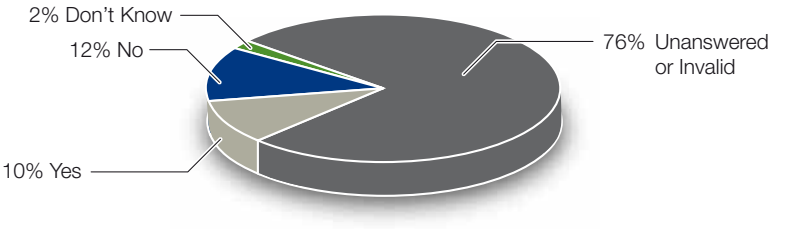
More than 50% of participants, 511 people, did not know if their employer or organization had a risk assessment on helicopter transportation. Nearly equal numbers of respondents answered 'Yes' and 'No' to this question, with 24% and 22% indicating 'Yes' and 'No' respectively.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	239	214	511	27

Q32: Have you seen a copy of the risk assessment on helicopter transportation?

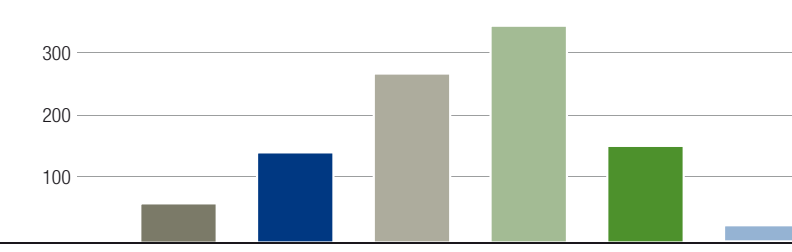
Ninety-nine (99) passengers have seen a copy of the risk assessment on helicopter transportation. This is 10% of the respondents. From the group of respondents who indicated "yes" in Q31, 41% indicated that they had seen the risk assessment on helicopter transportation.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**991**	99	118	19	755

Q33: How effective do you believe your safety committee is in addressing safety concerns?

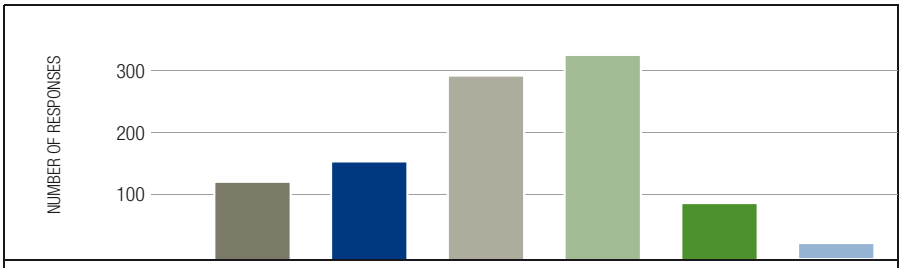
When asked to rate the effectiveness of the organization's safety committee, 36% selected 4 out of 5 on the scale, where 5 indicated "very effective." The total number of people who indicated either 4 or 5 was 508, or 51% of all respondents. 28% selected 3 out of 5, and 19% answered either 1 or 2 on the scale.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	54	135	275	355	153	19

Q34: How satisfied are you with the level and amount of information regarding helicopter safety available to you?

The most frequently identified response to this question is 4 out of 5, which 31% of respondents selected. 30% of passengers selected 3 on the scale. In total, 40% of respondents selected 4 or 5, where 5 indicates very satisfied; and 27% selected 1 or 2, where 1 indicated not satisfied.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**991**	118	153	297	307	94	22

Q35: Additional Information

Seven hundred and forty-six (746) respondents identified at least one concern in this part of the survey. In total 1917 concerns were identified. These were broadly grouped in 32 fields in order to provide an indication of how frequently similar concerns were identified. The frequency is shown below. Each individual response is contained in Appendix D. Respondents were asked to identify how significant each concern is, with 5 indicating they are "extremely concerned" and 1 indicating "not a big concern".

		FREQUENCY						
		TOTAL FREQUENCY AS CONCERN SIGNIFICANCE						
		EXTREMELY CONCERNED						NOT A BIG CONCERN
	CONCERN GROUP	TOTAL	5	4	3	2	1	CONCERN NOT RATED
1	Suits	204	100	45	35	9	5	10
2	Helicopter maintenance/ mechanical failure/equipment failure/inspection/ reliability	190	92	48	28	8	5	9
3	Number of passengers on board/seating arrangement/loading/ability to egress	172	102	42	12	3	4	9
4	Auxiliary fuel tank location	164	113	27	9	3	2	10
5	SAR (location, rescue response time, availability)	129	73	27	15	3	3	8
6	Flying in bad weather/ visibility/sea states/proper limitations in place for these	126	54	24	30	6	2	10
7	Amount and level of information/transparency/ communication about helicopter operations	111	58	27	15	3	1	7
8	S-92A performance/ choice of helicopter	105	62	18	12	3	1	9
9	Gearbox	104	69	21	4	2	4	4
10	Number of helicopters	72	33	20	9	2	1	7
11	Safety generally	71	39	10	11	3	3	5
12	Training	67	37	15	8	0	4	3
13	Ditching (including flotation)	62	35	14	5	5	1	2
14	Night flying	52	27	17	4	2	1	1

ADDITIONAL INFORMATION: QUESTION 35

			FREQUENCY					
			TOTAL FREQUENCY AS CONCERN SIGNIFICANCE					
			EXTREMELY CONCERNED					NOT A BIG CONCERN
	CONCERN GROUP	TOTAL	5	4	3	2	1	CONCERN NOT RATED
15	Pilot and crew procedures, experience and decision making skills/ response in emergency	49	28	13	4	0	1	3
16	Vibration/noise/cabin comfort	43	16	14	5	4	2	2
17	Delays	20	4	6	5	0	2	3
18	Communication within helicopter	20	7	8	2	1	0	2
19	Offshore location	20	5	4	5	3	2	1
20	Cougar performance and service	19	10	2	2	3	1	1
21	General helicopter characteristics	18	10	4	2	1	0	1
22	Oversight of safety/regulations/safety enforcement	15	9	2	2	0	1	1
23	Safety as a priority/timely implementation of safety measures	14	9	1	0	0	2	2
24	Cruising altitude	12	4	3	3	0	1	1
25	Human factors (size/reaction)	11	7	1	1	1	0	1
26	HUEBA	9	4	2	1	0	0	2
27	Number of flights for each passenger	8	5	0	1	1	0	1
28	Approach/landing technique	7	1	3	2	1	0	0
29	Personal Locator Beacon (PLB)	6	2	2	2	0	0	0
30	Pooling arrangement	6	4	2	0	0	0	0
31	Fire	2	0	1	0	1	0	0
32	Lack of resources	2	1	1	0	0	0	0
—	Illegibile	6	3	0	1	0	1	1

Q36: Opportunities for Improvement

The final part of the survey asked respondents to suggest three opportunities for improvement in helicopter transportation. A summary of the results is included below. Each individual response is contained in Appendix E. The frequency column in the table below indicates the total number of times each suggestion topic was identified.

	SUGGESTION FOR IMPROVEMENT	NUMBER OF TIMES IDENTIFIED
1	Additional helicopter(s)	124
2	Improved communication frequency/level/ amount between Cougar and Operators to passengers regarding all aspects of helicop- ter operations (including flight line)	122
3	Improved suits - fit/thermal protection/ gloves/hood/seal/mobility/comfort/ customized	121
4	Improved SAR (location/response time/ availability)	104
5	Remove auxiliary fuel tank from inside cabin	101
6	Seating arrangement different/fewer people on aircraft/window for everyone/more or improved emergency exits	101
7	Training/training updated/more frequent/ more realistic	69
8	Use different helicopter model	66
9	Improved or replaced main gear box	47
10	Boat transfer as alternative	43
11	Fly only in limited sea states/weather/ visibility/strict limitations for these	37
12	Resolve all mechanical problems/reliability	36
13	Better service (punctual/comfort/space/ airport operations)	35
14	Improved maintenance/inspections procedures	33
15	General improvement to safety	23
16	Improved aircraft capabilities (flotation/au- tohover/IR/approach technique)	23
17	No night flights	20
18	Improved communications within cabin	20
19	Bring back night flying (with appropriate measures in place)	18
20	Improved/timely response to safety concerns	17

OPPORTUNITIES FOR IMPROVEMENT: QUESTION 36

	SUGGESTION FOR IMPROVEMENT	NUMBER OF TIMES IDENTIFIED
21	Pilots well trained/correct emergency procedures in place	11
22	Safety regulations/regulator improved	10
23	HUEBA	8
24	Reduce noise/vibration	8
25	Act on alert service bulletins/airworthiness directivess immediately	6
26	Additional aircraft operator - remove monopoly	5
27	Assigned seats	5
28	Dedicated helideck half way to installations (emergenecy landing/crew change)	5
29	Different offshore shift rotations	4
30	Overall Cougar performance/accountability	4
31	Lower cruise altitude	2
—	Illegibile	7

Review of Survey

The survey of offshore workers provides an insight into their concerns, understanding and perceptions of helicopter transportation. Several key issues have been identified through the survey results outlined in this Report. Overall the survey results are balanced and do not highlight any extreme safety issues. Participation in this voluntary survey was extremely high with 991 responses.

The survey results can be classified into two primary categories, helicopter operations and survivability. Survivability only becomes an issue when an accident occurs; however, it is extremely important that passengers have confidence in this aspect of transportation. Also, it is difficult for non aviation specialists to appreciate the rigor and effort that go into safe helicopter operations.

Responses to the survey were balanced and approximately 20% to 30% of respondents expressed concerns with aspects of helicopter transportation and supporting systems and arrangements. While it is encouraging that the majority of respondents expressed varying degrees of confidence in the system, the concerns of the minority should be respected and addressed. It could be questioned whether 20% to 30% of a workforce is a minority. Whether the issues are real or perceived, the proactive management of perceptions is also important. A recurring theme is the need to involve workers and communicate effectively.

The observations below are made specifically to helicopter offshore transportation to comply with the scope of the Inquiry and the terms of Aerosafe's engagement.

Safety oversight was not the issue which raised most comment in the survey; however, it is one of the overarching strategic considerations of particular significance in establishing an environment which allows passengers to have confidence in the transportation system as a whole. Canada is regarded as a leading aviation Member State of ICAO and its aviation regulator (Transport Canada) is held in high regard internationally. In question 22 on the effectiveness of safety oversight, 22% answered "no" to this question and 24% of respondents indicated they "don't know". This is probably a fair result given the components of safety oversight may not be widely defined or known by operational employees.

Issues of personal protection, egress from a helicopter after an accident and survival figured prominently as major concerns of respondents (Q35). Suits, training, HUET, breathing apparatus and internal helicopter configuration emerged as significant issues. Question 18 on the other hand showed that 75% of respondents did not have concerns with their equipment whereas question 19 indicated that 38% respondents have concerns with suits. The issue of equipment and suits needs to be further examined so that the appropriate items can be addressed as not all equipment issues have concern.

Most respondents indicated that they felt capable of responding to an emergency situation in a helicopter (Q11, Q12).

Responses to questions 7 and 8 provide an insight to the confidence employees have in helicopter transportation. The diagram approximates to a normal distribution though it is slightly skewed towards those with confidence in the safety of the system. That being said the 27% of survey respondents who indicated they were "not confident" is of concern as this is not a small percentage of those surveyed. It would be interesting to compare these results with the concerns of the overall population with flying in general or with an organization that has recently experienced a significant accident.

Other key concerns included maintenance, night flying, bad sea states and aviation procedures.

Questions 26 to 29 examine safety management and safety management systems. The results indicate that such systems are in place and that a majority of workers know about them. Reponses to questions 28 and 29 indicate that just over one-half of workers either are trained in or use the systems. The issue of the effectiveness of the systems should therefore be addressed at the individual worker level and the difference between a safety regime and a safety system should be examined.

Differentiation between the use of the safety management system for normal offshore installation activities and aviation or helicopter activities was not identified in the open responses at question 36.

Question 30 asks whether the survey participant was aware that their organization uses risk assessments and 90% of respondents confirm that these are done. However, when question 31 asks about risk assessments on helicopter operations, over 79% say that either they are "not done" or that they "don't know". In answering question 32, only 10% of respondents indicate that they have seen the risk assessment for helicopter operations. This indicates that there is not a clear delineation between 'general safety' and 'aviation or helicopter safety'.

Questions 23 to 26 ask about organizational culture and open reporting. There was a very positive response to the rating of safety culture which suggests that there is a firm basis upon which to build. A primary attribute of an effective safety culture is demonstrated by an openness and a willingness to listen to the "bad news". Question 24 indicates that a sizable number of respondents think that there is an open reporting culture, while question 25 establishes that 64% are comfortable personally raising safety concerns. Interestingly, 29% answered "sometimes" or "depends". While some anomalies might be attributed to the attitudes of individuals, this result indicates that, while the companies are well on the road to an effective safety culture, more work remains to be done.

Communication was highlighted as both an issue and a potential opportunity for improvement. Effective communication is important in any organization and especially so where safety or other high consequence risks (such as environmental issues) are involved. Question 34 again demonstrated a high level of satisfaction with the amount of helicopter information available; however, 27% expressed dissatisfaction. This result, along with the results discussed above, indicates a potential for further improvement.

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MAY 2010

Offshore Helicopter Safety Inquiry

Appendices

The contents of the following Appendices are a presentation of the raw data submitted by survey respondents. In the interest of full transparency, comments made by survey participants were transcribed as submitted. Typographical errors have not been amended in the interest of maintaining accuracy of comment.

Offshore Helicopter Safety Inquiry
Passenger Survey

AEROSAFE RISK MANAGEMENT

WORKER CONFIDENTIALITY:
Your responses will be kept strictly confidential and no information released will identify individual respondents.

Aerosafe Risk Management has been engaged by the Commissioner of the Offshore Helicopter Safety Inquiry to conduct an independent worker survey of helicopter transportation. This survey is your opportunity to provide direct input into the Inquiry process – your voice will be heard!

We expect that this survey should take 10-15 minutes and we look forward to your response. The results of the survey will be available on the inquiry website **www.oshsi.nl.ca** from June 1, 2010. If you have any questions regarding the survey please contact Aerosafe by phone 202 449 7693 or email oshsi-survey@aerosafe.com.au

Thank you for your time and participation in this extremely valuable activity.

PART 1: GENERAL INFORMATION

Q1 **Age** ☐ <20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

Q2 **Sex** ☐ Male ☐ Female

Q3 **Job Role** ☐ Aircrew ☐ Executive ☐ Manager ☐ Supervisor ☐ Visitor ☐ Worker ☐ Other

If "Other" checked above please specify: _____

Q4 Which rig/platform do you work on? ***(OPTIONAL)***

☐ GSF Grand Banks ☐ Henry Goodrich ☐ Hibernia ☐ Sea Rose FPSO ☐ Stena Carron ☐ Terra Nova FPSO

Q5 How many trips to the rig/platform would you make each year?

☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ 10-12 ☐ >12

Q6 Do you hold a specific safety appointment or role with your employer?

☐ Yes ☐ No If yes, please specify _____

PART 2: HELICOPTER TRANSPORTATION & OPERATIONS

Q7 On a scale of 1-5, what is your level of confidence in respect to the safety of helicopter transportation?

(not confident) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very confident)

Q8 On a scale of 1-5, do you feel safe when travelling in helicopters to and from the rig/platform?

(not safe) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very safe)

Q9 Would you prefer to travel to the rig/platform via an alternate means of transport? *(eg boat)*

☐ Yes ☐ No ☐ Undecided

Q10 Following the Flight 491 accident, have you noticed any changes in safety practices of helicopter transportation?

☐ Yes ☐ No ☐ N/A

If you answered yes, what have been the changes you have seen? _____

_____

_____

_____

1

continued on page 2

Q11 On a scale of 1-5, how capable do you feel to respond to an emergency situation in a helicopter?

(not capable) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very capable)

Q12 Have you received training for emergency situations in helicopter operations?

☐ Yes ☐ No ☐ N/A

Q13 How often do you receive recurrent/refresher helicopter safety training?

☐ Twice a Year ☐ Once a Year ☐ Every Two Years ☐ Every Three Years ☐ Can't Remember

Q14 Did the helicopter safety training involve physical drills or exercises?

☐ Yes ☐ No ☐ Don't Know

Q15 Are you given a helicopter passenger safety briefing prior to each flight?

☐ Yes ☐ No ☐ Sometimes

Q16 Have you undertaken Helicopter Underwater Escape Training (HUET) training?

☐ Yes ☐ No ☐ Don't Know

Q17 On a scale of 1 to 5, if you answered "Yes" to Q16, how effective is the HUET training? (If you answered 'No' in Q16, go straight to Q18)

(not effective) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very effective)

Q18 Do you have any concerns with the breathing device, PLB or other personal safety equipment issued to you at the heliport?

☐ Yes ☐ No ☐ Don't Know

Q19 On a scale of 1-5, do you have any concerns with your survival suit?

(not concerned) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very concerned)

Q20 On a scale of 1-5, how satisfied are you with the adequacy of the training and procedures on how to use the safety equipment?

(not satisfied) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very satisfied)

Q21 When you are travelling in the helicopter, on a scale of 1-5 rate how satisfied are you that you get the right amount of information about helicopter operations?

(not satisfied) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very satisfied)

PART 3: EMPLOYER'S SAFETY CULTURE

Q22 Do you believe there is an adequate level of overseeing of safety (safety oversight) for helicopter transportation?

☐ Yes ☐ No ☐ Don't Know

Q23 On a scale of 1 to 5, please rate your organization's safety culture?

(poor) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (excellent)

Q24 On a scale of 1 to 5, do you consider your employer's to have an open reporting culture?

(closed culture) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very open)

Q25 Are you comfortable that you are able to personally raise your safety concerns?

☐ Yes ☐ No ☐ Sometimes ☐ It depends *(explain below)*

_____

_____

continued on page 3

Q26 Does your organization/employer have a confidential reporting system for safety?

☐ Yes ☐ No ☐ Don't Know

Q27 Does your organization/employer have a Safety Management System?

☐ Yes ☐ No ☐ Don't Know

Q28 If you answered "yes" in the last question then have you received training on the Safety Management System? (If you answered "No" in Q27, go straight to Q29)

☐ Yes ☐ No ☐ Don't Know

Q29 If you answered "yes" to the last question, do you regularly use the Safety Management System?

☐ Yes ☐ No ☐ Don't Know

Q30 Does your organization/employer do risk assessments?

☐ Yes ☐ No ☐ Don't Know

Q31 Does your organization/employer have a risk assessment on helicopter transportation?

☐ Yes ☐ No ☐ Don't Know

Q32 If answered "yes" to Q31, have you seen a copy of the risk assessment on helicopter transportation?

☐ Yes ☐ No ☐ Don't Know

Q33 On a scale of 1-5, how effective do you believe your safety committee is in addressing safety concerns?

(not effective) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very effective)

Q34 On a scale of 1-5, how satisfied are you with the level and amount of information regarding helicopter safety available to you?

(not satisfied) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very satisfied)

PART 4: ADDITIONAL INFORMATION

Q35 What are your top 3 concerns with helicopter transportation?

Concern 1:

On a scale of 1-5, how significant is this concern? (not a big concern) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (extremely concerned)

Concern 2:

On a scale of 1-5, how significant is this concern? (not a big concern) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (extremely concerned)

continued on page 4

Concern 3:

On a scale of 1-5, how significant is this concern? (not a big concern) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (extremely concerned)

PART 5: OPPORTUNITIES FOR IMPROVEMENT

Q36 What improvements would you like to see in helicopter transportation?

Opportunity for improvement – Suggestion 1:

Opportunity for improvement – Suggestion 2:

Opportunity for improvement – Suggestion 3:

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	(very little) improved suits
Yes	*more information from pilots on lights *more emphasis on suit fitment
Yes	1) More disclosure from Cougar about maintenance issues 2) Huge improvement in suit
Yes	1) New HH suits; improved & long overdue (suit HTS1) 2) Improvement in information exchange
Yes	1) Nightime flying ceased 2) Boomerang flights lowered due to pushing the envelope & trying to land with heavy fog offshore, known to exist before departure from Cougar
Yes	1. Hueba 2. More attention to detail when boarding helicopter by those traveling and those conducting safety checks 3. People traveling wanting specific seats
Yes	1. More awarness on issues concerning choppers. 2. More safety conscience 3. Improvement on suits.and mabie search and rescue.
Yes	1. More suit checks 2. Boarding practice engines running/ not running3. HUEBA Initiation
Yes	1. Much longer delays 2. More excuses not to fly
Yes	1. No night flying 2. They are not flying when it is giving out for poor weather
Yes	1. Starting the helicopter prior to boarding, making sure everything is in proper working order. 2. Loading helicopter in a particular manner-ie certain seats to be occupied first.
Yes	1. Suit
Yes	A less casual approach in processing & boarding. This could indicate either an improved overall approach to safety & maintenance or simply window dressing, one hopes the former & not the latter is the case.
Yes	A lot more delays, no night flying
Yes	A lot more maintenace, and flight times
Yes	A lot more turn arounds if lights come on. Fog or rig, high seas, etc.
Yes	Added HUEBA, very few night flights, if any
Yes	Air bottle
Yes	Air supply
Yes	As was shown on survival training, the seats have been upgraded with hydraulic amortisators, reducing the impact during crash.
Yes	Asking more questions before flight equipment better if flight suits.
Yes	At Check-in workers verify equipment in more detail. Flight hights have changed.

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Attitude toward safety prcedures being followed with respect to flights? Gaining access to platform and weather conditions considered.
Yes	Been fitted with new flight suit, seems much better than the last one, however, not issued one yet at heliport.
Yes	Better briefing More attention paid to safety equipment Somewhat better communication wrt. Maintenance
Yes	Better communication
Yes	Better communication with workforce about issues
Yes	Better communication; suits fit better
Yes	Better communications Improvements to equipment
Yes	Better fitted flight suits HUEBA implementation
Yes	Better fitted suits, less people on helicopter going offshore per trip. HUBA installed or added to suits. NO night flying.
Yes	Better focus on safety
Yes	Better information share to passengers
Yes	Better maintenance
Yes	Better maintenance checks. Better ditching regs.
Yes	Better PM inspections on aircraft, lower altitude flying. HUEBA implimentation, dedicated rescue helicopter
Yes	Better safety video
Yes	Better safety video presentation. Better suit fittings. Better controls of baggage (weights/sizes). More aircraft maintenance times.
Yes	Better screening, more weather related decisions not to fly.
Yes	Better seat belt check, and more time spent on safety features
Yes	Better suit, flight restrictions on darkness
Yes	Better suits
Yes	Better suits
Yes	Better suits
Yes	Better suits & Hueba
Yes	Better suits HUEBA
Yes	Better suits Overall I feel more safe
Yes	Better suits, and breathing apparatus (I am from the north sea sector) in the UK
Yes	Better suits, Heuba No night flights
Yes	Better suits; HUEBA addition; people pay more attention to pre-boarding video

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Better video trg aids suits changes (for the better), HUEBA
Yes	Big difference to suits maintenance
Yes	But there is still room for imporvement. One of the seats in the back should be removed to improve the chances of donning your hood safely due to it being really congested
Yes	Cannot fly in seas over 6m. No night flights. Seems to be more down time due to maintenance issues.
Yes	Caution with everything, maintenance, safety changes ie night flights, 700' ceiling although I feel safe the thought is always in my mind and makes me nervous when travelling via helicopter
Yes	Change in prep for flight more open to passengers.
Yes	Change suits, no night flights
Yes	Changed to flight criteria (weather,?, etc)
Yes	Changes I have seen, there's seems to be more maintenance on helicopter
Yes	Changes in suits, no night flights
Yes	Changes to night time flying
Yes	Changes to suits more checks of helicopters no flying after dark.
Yes	Changes to training (i.e. HUEBA) was added.
Yes	Chang's in suits
Yes	Chaning at suits, HUEBA
Yes	Checking choppers beteween flgiths. But…usually the choppers are always late and when there are a flight backlog, how can choppers be inspected when they are trying to 12 or 15 flights out.
Yes	Chopper cannot leave until wheels down on inbound flight
Yes	Chopper designated as rescue chopper. Returing heli had to have wheels down before the next flight could depart. Flight hours reduced.
Yes	Choppers are down for maintenance more often Suit changes
Yes	Choppers are down more for maintenance
Yes	Clear announcements, suits
Yes	Closer attention to detail
Yes	Cougar does an exceptional job. The S-92 units are too "fragile" & not proven in the industry. Too many brakedowns/ unservicible units in the (run of 1 week)
Yes	Cougar is more cautious when there are weather conditions that may hinger the safety of our arrival. They seem to take more preventative measures to allow for the most safety transfer possible.
Yes	Cougar is more informative on the chopper issues
Yes	Cougar seems to be quicker with regards to reporting incidents that occur which require choppers to turn back or to be replaced

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Crew checking suits more completely
Yes	Crew more diligetn when checking suits
Yes	Cruising altitude Suit modifications (ie HEUBA)
Yes	Daylight flights
Yes	Different suits being implemented shortly
Yes	Don't know if safety practices is the correct term but it appears the choppers are unavailable due to maintenance more often. This may be an overkill due to 491. This is not a complaint but an observation.
Yes	Duties
Yes	Elimination of night flights Seemingly more maintenance? Better flight suits
Yes	Emphasis placed on suit fitting
Yes	Escape (Hueba) trained Survival suits upgraded
Yes	Even more heightened safety awareness. Highest priority should be provided for airframe and aero engine Transport Canada and FAA Airworthiness Directions (AD's)
Yes	Everyone involved is more conscious when flying
Yes	Everyone more aware of personal responsibilities-suits checked, more serious
Yes	Extra precautions via not traveling at night and modifications due the flight suits to make them more comfortable and ensure more confidenc in survival situation.
Yes	Finally a suit that fits. Finally HUBEA. Less people on choppers. NO night flights.
Yes	Flight height, choppers staited before entering
Yes	Flight indicator alarm reporting (ex-chip indicators,etc) are less frequent or not at all. Suit checks seem to be the main issue. Focus on suits. More focus on helicopters req. (ie change out s-91 with safer model)
Yes	Flight suit
Yes	Flight suit
Yes	Flight suit fit awareness
Yes	Flight suit
Yes	Flight suits
Yes	Flight suits + information
Yes	Flight suits revisions, HEUBA, no night flights
Yes	Flight suits, changes training, altitude.
Yes	Flight suits, night flying, more maintenance
Yes	Flight suits, procedures for Helicopter flight.
Yes	Flights are backed up for pending weather

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Flights do not leave if there is something wrong with helicopter's
Yes	Fly at lower altitude
Yes	Fly closer to the water..more flights interrupted for weather and repairs
Yes	Flying 3 years + took my BST Renewal to make me aware of collapsible seats
Yes	Flying at a lower altitude not flying after dark.
Yes	Flying at lower level, no night flying.
Yes	Flying at night, hight of flying
Yes	Flying is much safer conditions
Yes	Flying lower
Yes	Fog and wind, unexpected trouble
Yes	Fuel Tank moved.
Yes	Goggles attached to seat belts More attention by HLO & crew for travelling personnel
Yes	Great concern for safe operation at BST New flight suit from Helly Hanson This survey
Yes	Greater attention to suits/flights/any issues brought forward and communicated an resolved A lot of communication re aircraft issues
Yes	Greater emphasis on suit fitting chk.
Yes	Greater infacis on suits. Proper fitting The use of the hueba makes me feel a lot better about getting in an helicopter
Yes	Gronds crew making sure passengers are safely buckled suit fittings.
Yes	ground choppers easier to investigate for mechanical problems
Yes	Harder to get to and from with 700 ft of ceiling.
Yes	Have more checks Follow more rules
Yes	Helicopter are inspected more often.
Yes	Helicopter suits are better Hueba training no night flying
Yes	Helicopters seem to be down more often due to repair, etc.
Yes	Helisuit fitting and HUEBA More frequent grouded helicopters due to warning signals
Yes	Helisuits and HUEBA
Yes	HEUBA
Yes	Heuba
Yes	Heuba introduced New suits
Yes	HEUBA, more checks

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Hightened safety awareness
Yes	Hopefully the choise to land on water
Yes	HTS-1 suits and Hueba
Yes	HTSI suits fit better
Yes	Huba
Yes	Huba
Yes	HUBA
Yes	HUBA addition and location of fuel tank
Yes	Huba Suits
Yes	Huba, suit test
Yes	Huba/new suits, no night flights
Yes	Hubba training Flight suits fit test
Yes	Hubbea was introduced here and in NOVA Sctoia
Yes	Hueba
Yes	HUEBA
Yes	Hueba
Yes	Hueba
Yes	HUEBA
Yes	HUEBA
Yes	HUEBA & suit changes
Yes	HUEBA + suits fittings
Yes	HUEBA added to suits, suits changed and sizes redone, more attention payed to safety feature during travel
Yes	Hueba bottles and training Better suits
Yes	HUEBA- But level of Cert. not comfortable
Yes	Hueba course
Yes	Hueba implementation, SAR requirements, seating arrangements
Yes	HUEBA implimation HTS1 Suit
Yes	HUEBA introduced
Yes	HUEBA new suits both of which we required before the accident
Yes	HUEBA stricter on flying conditions
Yes	HUEBA training + update video briefings
Yes	Hueba under water breathing

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Hueba Heliport personell boardiong chopper to assign seating and check seat belts. Goggle more accessable. Emergency cards updated.
Yes	HUEBA Improved HTS-1 suits
Yes	Hueba More attention to suit fit
Yes	Hueba New flight suit
Yes	Hueba SAR coverage Lack of night flights
Yes	HUEBA Seating Aux tank on other side of chopper
Yes	HUEBA Suit fitting
Yes	HUEBA, changes in suits
Yes	HUEBA, Changes to the suits
Yes	Hueba, flight suits, location of aux fuel tank, no night fligthts until dedicated SAR in place.
Yes	Hueba, general attitude, suit fitment, seating assignments
Yes	HUEBA, HTS-1 suit, lower flight altitude
Yes	Hueba, increased attention to worker safety and keeping workforce informed of events.
Yes	Hueba, new suits better fit
Yes	HUEBA, no night flights
Yes	HUEBA, Suites
Yes	HUEBA. New flight suits, lower altitude during the flights.
Yes	Hueba. Safety Video Changes
Yes	HUEBA-fewer flights-nights
Yes	HUEBA's are now used, more communication between cougar/ operators on mechanical issues/ check-in @ cougar more detailed during briefings
Yes	I am in a smaller, even more restrictive suit. The gogles are in front of me. Instead of under my seat. I have a HUEBA on my suit, but I cannot practice getting out of helicopter with it on my suite. There is no more mention of ship indicator sights or pussance alarms. NOw we are told there was an alarm with no details.
Yes	I believe problems are reported, now: and we have lots of problems with these choppers
Yes	I don't agree with fuel tank near windows All passengers should have window seat

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	I feel everything gets triple checked by Cougar mechanics which gives me confidence to fly and I am pleased about that. But I often think about the filter bowl assembly still.
Yes	Immediate response to supplying air breathing apparatus. New improved survival suits. Flying @ lower altitude to allow time to land if problem roccurs. NO night flying.
Yes	implementation of HTS-1 suit, HUEBA, Also some issues regarding the standby helicopter were rectified
Yes	Imporved suits
Yes	improve suits, more information on problem with choppers is not working. Not so eager to fly in bad weather.
Yes	Improved ditching criteria, increased inspection frequency, no night time flying until mods are complete, HUEBA
Yes	Improved suits
Yes	improved suits HUEBA change in procedures
Yes	Improved suits, Hueba, Fuel Tank moved
Yes	Improved survival suits Mechanical changes to helicoopter gear box
Yes	Improvement in Suit
Yes	Improvement on suits. More information
Yes	Improvement on survival suits Limited flying to daylight hours
Yes	Improvement s in egress equipment- eg HUEBA, suit changes, suit fittings
Yes	Improvement suit fitness
Yes	Improvement to flight suits
Yes	Improvements in suits, and HUBA
Yes	Improvements in suits. Survival suits have been modified for better fit. Along with breathing apparatus have been added.
Yes	Incidents to be reported a little quicker than before
Yes	Increase awareness & PM
Yes	Increased delays due to safety checks. No night flights
Yes	Increased focus on helicopter survival suit fitting
Yes	Increased inspections, maintenace focus on passengers, their safety; concerns.
Yes	Increased restrictions on flights (weather, time of day, etc)
Yes	Increased safety checks
Yes	Increased security, detailed video, more detailed suit inspection

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Increased vigilance checking suit fit No night flights HUEBA implemented Started use of HTS-1 suit
Yes	Information Sessions are more intense, suit changes
Yes	Informing persons of any safety changes to be carried out to air craft.
Yes	Inspections of equip. prior to each flight, changes to night flights altitudes at which we fly
Yes	Introduced the heuba since accident made changes to suits ex hoods, gloves.
Yes	Introduction of HUEBA and associated training Design changes to survival suits Much more emphasis on pesonell safety at briefings - pre flight
Yes	It appears there is more visual inspections carried out on the tarmat
Yes	It looks like saftey is there #1 concern
Yes	It seems that now flights are delayed/ cancelled at any glitch with the helicopters. I believe that cougar is doing a very good job in checking and maintaining the helicopters. My confidence in the helicopters (Sikorsky) is middle of the road- not bad, not great.
Yes	Less flights, no night flights
Yes	Less people on each flight Introduction of HUEBA's More Inspections on helicopters with so mnay flight time hours New suits being introduced
Yes	Less sttempt
Yes	Less vibrations in choppers, end of night flights
Yes	Longer video to watch
Yes	Longer waits suits still don't fit. Flights are delayed more.
Yes	Lower altitude No nite flights
Yes	Made the suits more comfortable
Yes	Maintenance
Yes	Maintenance frequency Communications to passengers about issues
Yes	Manidatory helicopter for Stand-by and new survival suits (the should invest in a new helicopter model, not spend large amounts of money on substandard ones.)
Yes	Mask on arm during flight HUEBA implementation New flight suits
Yes	Masks inside helicopter are now accessable Better flight suits of course
Yes	Minimal night flights

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Modifications to flight suits different procedures during emergency situations (i.e. forward facing seat to lean forwards during bracing)
Yes	More along the lines of security
Yes	More aparent checks. Things seem more scrunitized
Yes	More att to detal
Yes	More attention paid to instruction
Yes	More attention paid to suit fix and seal
Yes	More attention paid to suits and their fitment. Hueba is checked and donning is observed
Yes	More attention to detail
Yes	More attention to detail payed by helideck crews and arrival/ departure crews.
Yes	More attention to helicopter maintenance. No night flights. Better suits to be introduced. Dedicated rescue chopper coming.
Yes	More attentions to suits and not thinking we are complaining when bringing up safety issues! Not being so arogant when asked questions or when held for fog, weather!
Yes	More attion to maintenance No nite flights
Yes	More attn to detail
Yes	More awareness of safety no helicopter fly if there is issues, the use of the HUEBA and HUEBA training.
Yes	More awareness Better maintenance scheduled
Yes	More bull shit stuff at departure
Yes	More care taken with suit usage use of Hueba
Yes	More causious about the flight suits and maientence with the helicopters.
Yes	More caution
Yes	More cautious. More involvement in getting to and from the platform
Yes	More checks
Yes	More checks after each flight. HUBA training
Yes	More checks done on helicopters
Yes	More checks of helicopter Suit sizing
Yes	More checks, but still not enough
Yes	More communication re: problems in helicopters . Appears to be more inspections.
Yes	More communication. Greater maintenance checking schedule
Yes	More delays, no night flying
Yes	More detail given to safety. Better explaination on procedures.
Yes	More detail to maintenance HUEBA More attention to weather conditions

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	More detailed safety orientaiton. Level of transperency ie. Sharing info
Yes	More dilagence with regard to weather More security New suites
Yes	More down time for inspections checking every little noise etc.
Yes	More down time for maintenance issues
Yes	More downtime for maintenance
Yes	More emphasis put on safety features and video and suit fitting.
Yes	More flight delays due to more mech. Issues. Wheater and no night flying.
Yes	More flight delays, dut to maintenance issues ex. Warning lights “based on info received from staff”
Yes	More flight restrictions based on weather/night/icing
Yes	More focus on safety Better communication
Yes	More focus on seatbelts Video is modified Emergency response plans are updated Flying at a lower elevation
Yes	More focus on suits Cougar more proactive in letting personnel know issues or problem with aircraft.
Yes	More frequent checks, maintenance, which sometimes takes a chopper out of service. Need more choppers so as to maintain a minimum fleet
Yes	More frequent heli checks/maintenance
Yes	More frequent maintenance checks HUEBA New flight suits/new procedures
Yes	More frequent updates regarding travelling.
Yes	More helicopter checks
Yes	More helicopters
Yes	More helicopters down dew to maintenance
Yes	More in debt to proper procedures
Yes	More in place with regard to security More info @ briefings More infor on helicopter maintenance
Yes	More info
Yes	More info is made public
Yes	More info to passangers about maintenance
Yes	More information
Yes	More information is provided to you.
Yes	More information.

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	More informmative-suit changes- HEUBA
Yes	More input into safety Safety changes. Helicopter personnel more. Concince of weather
Yes	More inspection and things being picked up that probably might have been missed before. Thanks to the people doing the pre flights checks.
Yes	More inspections on helicopters
Yes	More maint More response to minor problems.
Yes	More maintenance
Yes	More maintenance Better comms
Yes	More maintenance, less flights in fog
Yes	More media/updates and coverage HUEBA Trg for all BST participants Public inquiry will be interesting to follow up info Flight suit fitting and competency
Yes	More MTC downtime. Seems like issues are looked after in a more timely manner
Yes	More noticable checks before helicopter leaving
Yes	More open communication
Yes	More precaustions to weather and of course flying times restricted to daylight
Yes	More precautions have been taken since 491
Yes	More regular safety checks/inspections
Yes	More restriction on night flights Differents suits have came out More choppers down for maintanence which tells me less things are getting over-looked
Yes	More safety awareness by passengers more attention to better fitting suits.
Yes	More safety checks being done
Yes	More safety concience
Yes	More safety concious on suits. Unfortunately many of the suit issues were mentioned by workers before the 491 incident but were not considered legimate until 17 lives were lost. Less chances taken now with flyig in poor weather.
Yes	More safety percautions
Yes	More saftey feathers in place
Yes	More scrutiny to mechancial issues on helicopters. Implementation of HUEBA. More emphasis on preflight briefings.
Yes	More strict on weather conditions (ie sea state, fog, freezing rain, etc.)
Yes	More stringent about personell safety.
Yes	More suit inspections, fittings and new suits to come.

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	More time put in to pretests on helicopters
Yes	More time spent on repairs
Yes	More training @ heliport
Yes	More transparency of safety issues
Yes	More verbal and all information gets relayed to passengers. Should always be open communication
Yes	More vigilant in all areas
Yes	More weather delays
Yes	New [UNREADABLE] New suits
Yes	New and better fitting flight suits
Yes	new flights suits being emplemented
Yes	New suit, and HUEBA implemented
Yes	New suit, no night flying
Yes	New suites (still garbage) Hueba
Yes	New suits
Yes	New suits
Yes	New suits and HEUBA training
Yes	New suits and Hueba
Yes	New suits and Huet
Yes	New suits implemented NO ngiht flying
Yes	New suits HEUBA
Yes	New suits!
Yes	New suits, hueba
Yes	New suits, HUEBA
Yes	New suits, HUEBA, training
Yes	New suits, more safety oriented
Yes	New suits, not flying in 0 visibility
Yes	New suits. More cancelled flights for maintaince.
Yes	New suits/suit fitting, goggles on seat, HEUBA implementation, SAR response time reduced// dedicated helicopter
Yes	New survival suits
Yes	Night flight flight restrictions
Yes	Night flights cancelled. HUEBA.
Yes	Night flights, risk of helicopter taken to fly

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Night flights, suits
Yes	Night flights. Suits little, better update on chopper issues, still room for improvement
Yes	Night flying has halted, modification to survival suits. But the focus should be on the mechanical aspects also.
Yes	Night flying better updates Better review of flight suits prior to departure
Yes	Night flying Loading arrangements
Yes	Night restrictions - no night flight
Yes	No flight at night
Yes	No flights in the dark
Yes	No flying @ night, introduction of HUEBA
Yes	No helicopters flights at night/low visability helicopter loading procedures.
Yes	No longer night flights, lower flying altitude.
Yes	No more night flts until helicopter eq'ment upgrades
Yes	NO more night time flying
Yes	No ngiht flights suit improvements huba
Yes	NO night flight
Yes	No night flight and weather limits.
Yes	No night flight flying lower
Yes	No night flights
Yes	No night flights
Yes	No night flights
Yes	No night flights
Yes	No night flights
Yes	No night flights
Yes	NO night flights
Yes	No night flights
Yes	No night flights
Yes	No night flights
Yes	No night flights
Yes	No night flights

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	No night flights and required SAR A/C on ground at all times
Yes	No night flights new suits
Yes	No night flights stricter criteria for flights to depart.
Yes	No night flights Better survival suits
Yes	No night flights Directly after the incident notificiation when made available.
Yes	No night flights HUEBA training More information received regarding delays
Yes	No night flights New suits Hueba
Yes	NO night flights Remonal of auxillary tank cover
Yes	No night flights Suits changed, etc
Yes	No night flights, changes in survival suits
Yes	No night flights, HUEBA used now.
Yes	No night flights, improvements to suits
Yes	No night flights, more cautious when it comes to poor weather conditions, revised briefings
Yes	No night flights, security boosted up.
Yes	No night flights, which should never been anyway when they knew they had no rescue plan in place (ie. no auto hover on Cougar choppers)
Yes	No night flights.
Yes	No night flights.
Yes	No night flights.
Yes	No night flights. Improvements in survival suits. HUBA training.
Yes	No night flights. This is a big improvement. You need to remember that the statistics of surviving a ditching at night are far less than in daylight. Even with full SAR capabilities you need to survive to be rescued.
Yes	No night flights. Improvement? To suit, more attention to detail by cougar attendants.
Yes	No night flights. More flights cancelled due to inclement weather.
Yes	No night flights/ More helicopter breakdowns
Yes	No night flihgts, flying at lower altitudes, new flight suits, goggles not under seats
Yes	No night flying
Yes	No night flying
Yes	No night flying

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	NO night flying auxillary fuel tank moved to starboard sink, HUEBA finally incorporated.
Yes	No night flying
Yes	No night flying More attention to suit fitting
Yes	No night flying More checks on helicopters
Yes	No night flying More weather consideration
Yes	NO night flying move down time due to weather and maintaince
Yes	No night flying NO flights in reduced visibility
Yes	No Night flying, flying in low visability conditions. Replacement of fuel tank.
Yes	No night flying.
Yes	No night time Flights Strick rules on weather
Yes	No night time flying
Yes	No night time flying
Yes	No nighttime flying until a SAR helicopter is stationed in St. John's.
Yes	Not fling in questionable weather
Yes	Not flying after dark. Appears to be more maintenance checks. Less vibrations on helicopter.
Yes	Not flying at night or bad weather or fog.
Yes	Not flying outside of safety limits weaks etc.
Yes	Noticed picking up on little things Don't fly at night Upgraded suits
Yes	Noticied more safety procautions ie: Night flights.
Yes	Operator seems to be more aware of weather conditions, there seems to be more "down" time for maintenance issues. New suits
Yes	Overall, all personnel involved seem to be more safety conscious.
Yes	Passengers are more informed of issues with helicopters. However before 491 it was common for issues to occur like (i.e. gearbox indicator chip sensor) Would cause the helicopter to return, now this never happens. It seems the issues are always minor issues, none are main engine or geart-box related
Yes	Paying more attention to detail with regards to procedure. Staying by the reg's as far as I can see it
Yes	Pilots are more concerned and less willing to fly when warning lights come on
Yes	Pilots err on the side of caution regarding warning lights, etc.

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Preflight briefings Suit improvements Communication
Yes	Prior to the accident, it seemed that worker complaints about the flight suit went without any attention being paid to them. Immediately after, the newest revisions, including the HUEBA introduction, were implemented.
Yes	Proper suit fittings have been carried out for workers. Cougar crew ensure that you are seated and belted prior to departure
Yes	Reduced altitude, better suits, pilots now more aware of problem, better information to passengers, not flying in darkness and poor visibility.
Yes	Reduced/eliminated night flights Better suit fit and attention
Yes	Removal of Gas tank seating
Yes	Renewed safety culture. More questions= more answers. Improvement ideas taken more seriously.
Yes	Respect to weather Suit issues are being addressed More open
Yes	Review of flight suits and changes made
Yes	Safer flying practices.
Yes	Safety briefings more extensive
Yes	Safety check on helicopters more effective
Yes	Safety has been highlighted. Still hasn't gone far enough. Every passanger should have their own Bait. NO on should sit in middle seats by ax tank. If accident occurs it is a death sentence.
Yes	SCBA (HUEBA)
Yes	Scuba Huet
Yes	Seating
Yes	Seating arrangement
Yes	Seating arrangements and the introduction of the HUEBA
Yes	Seating next to fuel tank mask in back of seat pouch not under seat
Yes	Security and flying in better conditions
Yes	Security/Safety screening process
Yes	Security; tighter maintenance; suit inspections;
Yes	Seems like the helicopters are grounded a lot more often due to mechanical problems. The fact that they are being grounded more now raises a some question in my mind on what was being done before.
Yes	Seems to be more flights on hold due to Maintenance where their was not many helicoptors on hold before.

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Sharing of information between cougar and offshore workers concerning and mechanics issues with choppers
Yes	Shorter hours in between maintanence
Yes	Small changes to the pre flight video
Yes	Small items are now getting more attention
Yes	Some loose attitude has tightened but nothing of considerable worth
Yes	Specific to my travels, yes, my flight was shut down when rotors running and due to de-ice alarm?
Yes	Still not comfortable with the helicopters, but now they don't fly in the dark which is a bonus until they get the IR and auto hover.
Yes	Stopped night flying. Appear to be more delays due to mechanical and weather issues.
Yes	Stopping night flights until Sar is better for us. Other then that, I don't think anything has changed. When for some reason choppers aren't flying, we should be told why thay aren't in the air. Everyone would feel better knowing.
Yes	Strickter with suit "fitting"
Yes	Strict check in policy, more training, new suits
Yes	Stricter weather flying conditions
Yes	Suit
Yes	Suit changes
Yes	Suit changes- but this si not the real issue inspection of helicopter after flight (ie bolts for gearbox) I feel these gearbox and bowl assemble should be changed out.
Yes	Suit changes, HUBA
Yes	Suit changes-goggle location-heightened awareness of emergency/ egress procedures by passengers- increased information re: helicopter maintenance issues
Yes	Suit donning. Proper suit fitting
Yes	Suit Fitting Hueba
Yes	Suit fitting HUEBA
Yes	Suit fittings
Yes	Suit fittings before flights.
Yes	Suit fittings Weather watch
Yes	Suit information. Heli " and procedures.
Yes	Suit Lhings HUEBA
Yes	Suit modifications
Yes	Suit particulars!
Yes	Suits

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Suits
Yes	Suits
Yes	Suits
Yes	Suits
Yes	Suits
Yes	Suits & fuel tank
Yes	Suits & UWBA
Yes	Suits are being fitted/ checked HUEBA introduced, no night flying
Yes	Suits only. No confidence in the s-92
Yes	Suits Daylight hour only
Yes	Suits, attention to detail when loading choppers
Yes	Suits, etc
Yes	Suits, Heuba
Yes	suits, HUEBA training
Yes	suits, no nite flying
Yes	suits, underwater breathing gear, sutis are checked on platform prior to depart for home by helo admin staff stiting down dna putting up hooks on both ends.
Yes	Suits, weather tolerences
Yes	Survival suit improvement, better ?brelys?, higher guard awareness.
Yes	Survival suits
Yes	The altitude we fly now.
Yes	The choppers are being inspected more often & more problems are being found quicker than before, (there are still problems with the choppers)
Yes	The elimination of night flights
Yes	The fuel tank moved to opposite side. “How we were allowed to fly with that fuel tank on the other side I don’t think anyone can explain that”. Ed Hodder
Yes	The implementation of Hueba! Changes in suit
Yes	The only changes are more security at cougar for check in. After 10 years having to show ID at main counter and then at baddge checkin 10 feet away. NO more safe!!
Yes	The seats and every safety issue with the suits.
Yes	The suit seem to be a lot better Huba bottle good
Yes	Their trying to improve the survival suits
Yes	There hace been many-HUEBA, upgrades to flight suits, ditching procedures, max flying altitude, more rigorous maintenance and checks for helicopter.
Yes	There is always a flight on the ground ready for SAR

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	There is better communication between Cougar and the passengedrs. The night flight restrictions and the new HTSI suits.
Yes	There is more down time for maintance
Yes	There seems to be a greater sense of safety awareness.
Yes	There seems to be more information transfer
Yes	There seems to be more inspections of chopper. Now survivcal suits that are coming are way more comfortable.
Yes	They are checked more often.
Yes	They are checked out more.
Yes	They are checking the helicopters after every flight On the other hand if I had a car that I had to return to the dealer for a check every time I wen around the bay I wouldn't have it very long
Yes	They are showing concern more for weather issues offshore and taking less chances landing on offshore installations. They are showing dilegence with inspection of the Geare box foot assembly.
Yes	They let themen know more about what is going on
Yes	They seem not to fly if there is any problem. But, before they would probably chance it. There needs to be more open communication to the workers offshore as to why the choppers are not flying. Not just put in a book but an announcement or some-thing.
Yes	They seem to be more meticulous with inspections, maintenance, etc.
Yes	They seem to inspect them a lot more
Yes	They seem to pay more attention to safty checks and adverse weather conditions
Yes	Time taken to explain delays or other issues
Yes	Times of flight, no night flying HUEBA New suits ordered
Yes	Took an accident to get stuff done. As a norm.
Yes	Trying to improve everything
Yes	Updates are given when defects are found
Yes	upgrades to the suits
Yes	Upgrading of the fight suits, introduction of the HUEBA etc.
Yes	video
Yes	Video has more info/ suits will be more comfortable
Yes	We are always notified right away what the cause of delay maybe. If there's any question of flying safetly (weather wise) always on the side of caution.
Yes	We are made more aware of helicopter maintenace issues.
Yes	We have become aware of how many problems are actually associated with these machines. Most days there are only 1-2 helicopters operating because of mechani-cal or other issues.

APPENDIX B: QUESTION 10 RESPONSES

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	We jave beem [UNREADABLE ftted fr the E452 suit and now the H751 suit. Night flights (except for emergency purposes) have ceased until a full time S-92 with proper/permanent rescue is available
Yes	workers are given more feedback on issues with the choppers, mechanical issues
Yes	Yea more attention to the minor details and inspection as per many recomendations.
Yes	Yes they are trying ot make flight suits more comfortable, but my personal opinion is that we should be wearing ocean survival suits not flight suits.
No Response	More professional; like at airport security
No Response	New improved flight suit
No Reponse	Lower flying height is about all.
No Reponse	no night flights- helo maintenance still bad to worse
No	Aux tank moved to other side of helicopter.
No	Helicopter is still turning around because of lights coming on and very high vibration while en-route
No	Helicopter updates as to why helicopters were turned around, whether mechanical or weather reasons are not relayed to passengers and offshore workers just enough.
No	still flying with broken/cracked motor mounts and don't know why it was happend-ing but telling me it's completely safe to fly on 3 legs.
No	suits only change noticed
No	They have changed some of the suits and changed the bolts in the transmission housing; that's it. Night flights will resume with auto hover
N/A	Haven't flown since. Suit issues and lack of work.
N/A	Only the night flights. Not very much has changed!
N/A	Suit- have seen some of the changes made to suit issues and these have been well regarded by the personnel who have these suits.

APPENDIX C: QUESTION 25 RESPONSES

SURVEY ANSWER	EXPLANATION
It Depends	All deponds on who you are working with and what work is being done at the time
It Depends	As a contractor, not full time, still the uncertainity that it will be held against you if you bring up something (especially if you are looking for a full time jor or you might lose your job.
It Depends	As long as it doesn't hinder operations
It Depends	Being up safety concerns as long as it doesn't cost money!!
It Depends	Bring up issues yet there is no way of knowing how far the concerns track ujp the line.
It Depends	Concerns are often overshadowed by production performance, money, etc.
It Depends	Contractors would be put between rock and hard place. They don't have to call you back.
It Depends	Depending on concern and if will offset oil production
It Depends	Depends on if it is a easy fix on or one that will take some thinking and money.
It Depends	Depends on who the installation manager is.
It Depends	Depends who is on shifts and if the concern is has for reaching implications.
It Depends	I always raise my concerns, though, it is known that by doing so, sometime, it black marks you as an individual for promotions, kinda considered a trouble maker, but, that's fine with me, my safety is more important than promotions but , others won't raise concerns for this reason.
It Depends	I would like to have more practice with the Huet an use it in the helicopter under water.
It Depends	If involves a mistake or slandering a mgmt decision, employees are spoken to privately concerning it
It Depends	If it costs the company it is usually ignored or the answer is no.
It Depends	If it is of a minor nature, yes speak. Anything major they don't want to hear of it. If it is going to be documented
It Depends	If it's a small concern, you might get "Action", if it's larger…forget it. The people are able to listen, but that's as far as it gets.
It Depends	If it's complicated they don't want to hear it. Or if it will incure significant cost they don't want to hear/resolve it.
It Depends	If oil production is impacted by my safety concern than it's hard to make your point heard.
It Depends	If you raise safety concerns, it dosen't mean that they will action your concern and sometimes they are considered to be low prority or throw out.
It Depends	If your safety concern costs the company money and slows things down they will cut corners
It Depends	Issue raised but not much done about it. Told that everything is according to regulations
It Depends	It depends how far you want to take it.
It Depends	It depends if it is a easy fix and that is don't cost any money

APPENDIX C: QUESTION 25 RESPONSES

SURVEY ANSWER	EXPLANATION
It Depends	It depends on if the safety concerns will impact on production and concerns about the helicopters being used are not opened to discussion. These helicopters are the greatest safety concern in the offshore today.
It Depends	It depends on the the severty of the concern. If it is going to cost money then I feel it is looked at negatively or you get a political answer.
It Depends	my believe is they only listen to what they want to company and oil company
It Depends	Not an issue to raise safety concerns, but having them actioned is an issue.
It Depends	On the manager/supervisor, who the safety concern is going to affect ie:company
It Depends	On what the situation is about. If it interferes with production on the rig, then the answer is no.
It Depends	Only if it is what they want to hear
It Depends	People will preach safety but sometimes don't practice it, this happens a fair bit
It Depends	Provided it does not interfere with production/operation
It Depends	Safety concerns about incidents with helicopter, have been address with employee to supervisors offshore and at JOSH meetings. But that's were it stayed (offshore.)
It Depends	Slow moving to get answers. $ sometimes determines the outcome.
It Depends	Small safety concerns are easy to report larger more important concerns, often insult the company when reported.
It Depends	Sometimes controversial topics are not addressed properly. As well; sometimes safety reps or union reps are viewed as trouble makers by supervisors when they voice or raise workers concerns. This is a fact!! I am not with rep.
It Depends	Sometimes it seems as was the case with the flight suits that there is no consultation with the worder population bfroe we are issued a safety device. Once we were told that we had new suits there were immediate concerns with mobility but no one listened. We were told it was normal and the suits needed to be broke in. It seems this has been addressed with the Ht-Yes but the practice still stands.
It Depends	Sometimes they just don't want to hear concerns. They treat it as complaints
It Depends	Touchy subject, lots of politics, more "behind closed doors" conversations taking place than up front talk. Suits are major concern for most people.
It Depends	Unfortuanately those in the corporate offices are in my opinion most concerned with profit. A platform/oil rig are simply assets. Far too often a situation is "managed" rather than to do the right thing. Corporations only react.
It Depends	We get "politically correct" answers and we are "told that we need to know" I do not think suncol is any different than any other. It is cost effective safety. This only changes after a tragedy. Even then, improvement, are based on cost. Ex/ not enough helicopters to allow reliability of service.

APPENDIX C: QUESTION 25 RESPONSES

SURVEY ANSWER	EXPLANATION
It Depends	What they are and if it will involved production of oil
It Depends	When concerns are raised they are not dealt with.
It Depends	You are free to raise concerns as long as they are easy fixes and don't affect production.
It Depends	You can bring up minor concers, but major with regards to the platform, but if it interferes with production and they view it as minor its frowned up eg. The life boats -down manning.
It Depends	You can comfortably raise your concerns in weekly safety meetings but they typically fall on deaf ears, unless the problem is easily fixable.
No	Afraid of loosing job
No	Always depends on the cost
No	Because you are remembered not for the safety concern but speaking your mind
No	Companies do not want to hear anything negative, if anything is put into safety cars it is passed on and told that inquiry is looking after it
No	I have raised safety concerns in the past, and like all oil companies, they are addressed if it doesn't impact production or if the dollar figure is not to high to fix it. I have always said, safety is spelled with a $, $afety.
No	The person/persons to whom you raise your concerns will all most always come back with some sort of statement to try and intimidate you.
Sometimes	A lot of times it boils down to work schedules. How many times has a safety meeting been put off due to work I have never had a a safety standown
Sometimes	Depends on the mgmt personnel. They can be very condensending and try to make it seem like you don't know what your talking about.
Sometimes	I feel sometimes concerns are not addressed
Sometimes	I think that some selected items are not addressed properly
Sometimes	I would not refuse to fly because of possible job loss, but if I had a choice, I would not fly at all
Sometimes	if it does not cost too much or if it does not effect production or drilling operations.
Sometimes	It depends on issues raised
Sometimes	Sometime afraid it will come back on us. These are hidden safety is a numbers game. They can make concerns disappear.
Sometimes	Sometimes it feels that regarless certain issues are not changeable & money makes a big impact on certain things
Yes	At Hibernia safety concerns are mostly concidered complaints and not taken seriously. Safety meetings are held once per rotation more as a formality than an actual forum to openly discuss safety concerns or issues.
Yes	But I feel that if you are outspoken the employer doesn't respect your opinion
Yes	But there are times the questions are picked apart
Yes	Concerns take a long time to be addressed

APPENDIX C: QUESTION 25 RESPONSES

SURVEY ANSWER	EXPLANATION
Yes	However if a concern is not minor or an easy fix, it may not get the attention required. An example would be the concerns raised when the flight suits were introduced. It would have cost money to make the suits fit. After It Depends9Yes the issues were addressed.
Yes	I do raise safety concerns regarding personnel training however, it is often overlooked. Many time unqualified personnel work on equipment who not have the technical background. Ie: working in electrical panels It Depends60 vac- Sometimes000 vac.
Yes	I would raise safety concerns regardless of their willingness or lack there of.
Yes	No problem to raise safety concerns
Yes	Very comfortable
Yes	Yah but it won't matter

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Not enough helicopters in fleet	**5**
1	Number of helicopters Logisitics of sending flgihts out when weather permits Fairness to all installations with order of flights	**5**
1	#1 Helicopter Reliability. I always believed we had the best of everything available. But after the inquiry I learned we were sub standard in response time. What other areas do we not have the best of especially helicopters. I don't believe we know the root cuase of the Pstud failure. There has to be something else wrong with the helicopter if the mounting feet keep cracking. That should not happen.	**5**
1	The saving of the helicopter is more important than the lives of 491	**5**
1	Concern would be the footings in the chopper, & can they be fixed	**5**
1	Rushing for the best seats	**5**
1	Being able to get out of ditched chopper. Suit safety. Immediate rescue.	**5**
1	Ditching	**5**
1	Flights overcrowded. Each window is an emergency ext. There should be one person per window. 2. mobility in the sutis. I realize this is being addressed but it seems a long wait for changes to be made. Currently still using older suit and mobility is poor. 3. Aux fuel tank stored in cabin with passengers. Not rained to excape in this situation.	**5**
1	Fuel tank inside helicopter	**5**
1	Getting back to see my family	**5**
1	Helicopter Failing	**5**
1	I still believe there is a design flaw in the S92's that vibrate and crack bolts or legs on the main rotor. Why do you need to inspect these items are so little flight? If you had to inspect you wheel lugs on your car ever 50 miles, you' trade the car in or get the problem fixed?!	**5**
1	Maintenance issues	**5**
1	Maintenance issues on S-92 Travel time +Distance Weather	**5**
1	1. Mechanical Breakdown 2. Flying in High wind and seas 3. Flying at night	**5**
1	mechanical failure	**5**
1	Night flying	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Not enough helicopters	**5**
1	Recurring repairs that have to be made when it is know what they problems are. EG: Gearbox failure	**5**
1	Weather	**5**
1	Where I sit in the helicopter during transportation	**5**
1	1. Helicopters seem to be broke down more than they are working. I have been travelling offshore 10+ years and only noticied this since the S-92's where bought online. 2. Aux. fuel tank being used on Hibernia flights. It is not needed most of times. 3. Everyone should have a windown seat in case inevacuation in ditch.	**5**
1	A lot of maintenance issues	**5**
1	Adaquate Inspections Pilot readiness Weather	**5**
1	age of choppers amount of time down due to mechanical issues no new aircraft	**5**
1	Aircraft are "unservicable" a lot. NO details or reasons are given. You can be on a helicopter, flight is aborted and return to land on helideck. Then, something with no explaination on very little, personnel are expected to board the same helicopter and fly.	**5**
1	Aircraft not able to run 30 minutes w/o gear oil	**5**
1	Airworthiness of the helicopter	**5**
1	Always a problem whether it be large or small	**5**
1	Always havin trouble never feel safe on the now Auxuarly tanks	**5**
1	Amount of people on each flight (to many) each person should have there escpae window to tight for space in bad now of seats (not safe)	**5**
1	Are the choppers mechanically sound	**5**
1	Are we receiving the correct information about helicopter inspections	**5**
1	Arriving alive When the helicopter has to turn back no info given on reasons why Concerns of helicopter maintenance	**5**
1	Arriving safely	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	At no time are we in the ocean with our flight suit. The only time we use it is in the pool during our BST. At that time everyone gets completely soaked. When this is brought up, they say its due to the chemicals in the pool action on the suit. How can people feel comfortable when they have never used this suit??	**5**
1	Aux fuel tank	**5**
1	Aux fuel tank	**5**
1	Aux fuel tank in cabin	**5**
1	Aux fuel tank in passenger compartment	**5**
1	Aux fuel tank restricts access	**5**
1	Aux fuel tank should be removed. Gear box mounting pads. Should have new gearbox installed. Emmersion suits.	**5**
1	Aux fuel tanks inside the cabin	**5**
1	Aux tank in passenger compartment. Should not be permitted. Aircraft was not tested as to on water stability & it blocks access to windows. Not trained in HUET to egress over aux tanks	**5**
1	Aux tank should be removed from helicopter	**5**
1	Aux tank very unsafe no training with aux tanks in emergency escape.	**5**
1	Aux tank Suit No information on mech. Problems	**5**
1	Auxilary fuel tank	**5**
1	Auxilary fuel tank	**5**
1	Auxilary fuel tank in cabin with passengers need to be gone. Put larger fuel tanks on the outside if necessary.	**5**
1	Auxillary fuel tank in fuslage	**5**
1	Auxillary fuel tanks	**5**
1	Back row seat in helicopter, 5 people seating in that now is to many, 4 is acceptable (unsafe cannot prepare youself to get out in emergency.	**5**
1	Back seats in helicopter. Room should be available to move properly	**5**
1	Being cramped up because to many people flying at one time	**5**
1	Brackets Why they fly so high Communication in the chopper	**5**
1	Brand of helicopter!! There are better aircraft available. Doesn't have a good safety record. Should have dry run!!!	**5**
1	Break downs	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Briefing Sea state Cougar reporting	**5**
1	Canister for oil filter is still held in place by 3 studs. New material in studs does no eliminate the problem	**5**
1	Cannot hear announcements inside chopper	**5**
1	cheaper availabilty, weather conditions (flying), lock of information	**5**
1	Chopper break down. No info to workers (why?). Not enough training when doing BST we should have 16 workers in simulator chopper instead of 2-3 plus HEUBA bottle and see what and how fast can we get out of chopper. Still turning back and high vibration	**5**
1	Cold water	**5**
1	Comfort and fit of existing flight suit.	**5**
1	Constant flights returned/ due to a malfunction or “indicating light” identifiying an issue with this model of helicopter. Two were returned to base just two days ago, I for failed repari, 1 for an indicated landing gear issue.	**5**
1	Constant mechanical problems with these choppers	**5**
1	Continuous “problems” with aircraft	**5**
1	Cracks found in S92 Gearboxes	**5**
1	Cracks in the MGB feet	**5**
1	Crampled conditions, too many people at one time to safely evacuate	**5**
1	Crash	**5**
1	Crash/ overcrowding with trying to get out	**5**
1	Crashing	**5**
1	Crashing	**5**
1	Crashing in the water. Very, very hot in the chopper	**5**
1	Current helicopter reliability, this machine is seriously flawed	**5**
1	Deal with safety alerts immediately as opposed to the time frames given to deal with the problem. Even if the standby chopper is able to rescue in the dark I would still not feel comfortable flying at ngiht	**5**
1	Ditching	**5**
1	Ditching on water	**5**
1	Ditching, Ditching, Ditching	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Don't trust operator Safety does not come first You have no choice, ride helicopter or lose job, safety concerns or no.	**5**
1	Don't like sitting side by side in a helicopter. I feel everybody should have their own designated exit via window or door	**5**
1	Double row seating. HUET training does not include this in their training because someone may get kicked and injured. Then why is it okay to use this dangerous seating arrangement?	**5**
1	Double seating	**5**
1	Each passanger should have a single seat next to a window	**5**
1	egress inside heli	**5**
1	Emergency response time	**5**
1	Equipment failure	**5**
1	Equipment failure	**5**
1	Equipment intregrity	**5**
1	Escape during an emergency "ditching" situation and survival for a un extended period of time in the water	**5**
1	Escape from a ditched helicopter; upon helicopter turning over in the water	**5**
1	Escape in an emergency, ie panic inside the aircraft	**5**
1	escape thru the windows	**5**
1	Every employee should have a window seat. The main goal is to prevent fatality if we were to have a controlled landing on water. It looks much easier on the video to escape a helicopter than what it would be if you control landed on water. That is a real situation and people may not react quick enough because of shock and the inside person could be left with an obstacle or another person blocking there exit	**5**
1	Every individual does not have a window seat	**5**
1	Every passenger should be next to a window. Even Robert Decker stated this affected your survivability. When I did my HUEBA training, the instructor and a Husker rep. from the inquiry stated your survivability is drastically reduced if someone is between you and the window.	**5**
1	Everybody should have a window seat at all times	**5**
1	Everyone should have a window seat	**5**
1	Excisive vibration	**5**
1	extra fuel tank too many sitting in rear of chopper sommetimes hard to hear announcements	**5**
1	Extra fuel tank, the smell	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Extreme weather conditions	**5**
1	FAR 29 certification	**5**
1	Faulty mounting paws are cracking on S92s which will eventually lead to another crash	**5**
1	Feet still being found to be cracked	**5**
1	Flight suites Reliability of the helicopter S92	**5**
1	Flight suits	**5**
1	flight suits	**5**
1	Flight suits sizews and fit ground your face, wrists, and the stiff zipper pressing against your throat making it impossible to look (face) forward.	**5**
1	Flight suits fuel tank P.M.	**5**
1	Flight suits Landing on water ?go gesc in +out?	**5**
1	Flight Suits The aux fuel tank in the passenger cabin The possibility of night flights in the future.	**5**
1	Flotation device on helicopter not adequate for the sea states we encounter, therefore leaving pilots hesitant to land in water if needed	**5**
1	flotation of the helicopter Accessability to emergency exits for the number of people on the helicopter. Should be 1 escape route per person. How good actually are the suits, and how come we do not use these flight suits for training	**5**
1	Fly with mechanical sound equipment and a good maintenance plan.	**5**
1	Flying at night	**5**
1	flying at night flying in fog 2. Flying without new flotation system installed 3. Chopper vibration when flying	**5**
1	Flying in a sea state over 3 m. Flying foggy conditions flying in the dark	**5**
1	Flying in darkness	**5**
1	Flying in fog	**5**
1	Flying in inclememnt weather to deliver parts/ when passenger safety is at risk. Seems plant operation comes ahead of safety.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Flying in poor weather conditions, fog, freezing rain. The Aux tank in the cabin. Young inexperienced pilots. Pilot decision making skills need to be addressed.	**5**
1	Flying in poor weather, high winds, freezing rain, ect.	**5**
1	Flying in weather conditions that would gravely affect a ditching at sea. High winds & high sea states	**5**
1	Flying when sea states are above 3 Ms flying at night flying in very foggy conditions	**5**
1	Flying when sea states are high	**5**
1	Flying when sea states are too high for retrieval exi FRC launch Flying at night Flying when weather is bad. Sometimes when we leave town it is hit and miss whether we land due to fog	**5**
1	For some reason the first system on the helo is hard to hear and if were returning to cougar base, why would you not be concerned	**5**
1	Fuel tank	**5**
1	Fuel tank - restricted access to exit chopper will tip to other side & you will have to go up-over the tank	**5**
1	Fuel tank (internal	**5**
1	Fuel tank in cabin Weather condition sea states	**5**
1	Fuel tank in cabin.	**5**
1	Fuel tank in helicopter	**5**
1	Fuel tank in helicopter	**5**
1	Fuel tank in helicopter -High winds and sea states when flying	**5**
1	Fuel tank in with passengers Gear box problems (oil filter and crack in gearbox legs)	**5**
1	Fuel Tank inside cabin Survival suit's leaking	**5**
1	Fuel tank inside the aircraft should be moved back to its original positions thus giving more passengers cole access to a window instead of having to climb over another person to get ot the window.	**5**
1	Fuel Tank inside Fog Delays	**5**
1	Fuel tank travelling with passengers	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Fuel tank Two many people on the helicopter Gear Box	**5**
1	Gear boc run dry time to low Not enough time for pilots to react to a major gearbox failure	**5**
1	Gear box	**5**
1	Gear box failure only concern	**5**
1	Gear box trouble. They know about the problem but the only thing happening are visual inspections. Need to fix problem no matter what the cost	**5**
1	Gear Boxes should be replaed. Not proven to be safe.	**5**
1	Gearbox	**5**
1	Gearbox	**5**
1	Gearbox failures (failures of mounting feet) Ditching in cold rough waters Survival suit capabilities	**5**
1	Gearbox failures with many different brands of helicopter	**5**
1	Gearbox in helicopter Nothing else Nothing else	**5**
1	Gearbox problems. Would like to see true Run Dry. 2. More open reasons why helicopter is not flying 3. Need outside overseeing of safety concerns	**5**
1	Getting out in an emergency situation how hard it is to push out the windows. There is no training for the real helicopter windows.	**5**
1	Getting out of helicopter during emergency	**5**
1	getting out help in time Frequency in helo	**5**
1	Getting there safe!	**5**
1	Getting to the rig and back safely There should be more helicopters	**5**
1	Getting to work safely Helicopter staying in air Getting back on shore safely	**5**
1	going down	**5**
1	Having a very trustworthy/ reliable helicopter with any safety concerns taken care off immediately has they become known.	**5**
1	Having to ditch in the water somewhere offshore	**5**
1	Having to sit by someone and having to climb over them if they may be injured/unconscious	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Helicopter availability	**5**
1	Helicopter gear box dry run	**5**
1	Helicopter maintenance	**5**
1	Helicopter Maintenance (Not enough helicopters or pilots) concern 2- constant pressure to improve, tendency to bend to scrutiny concern 3- Pilot stress levels	**5**
1	Helicopter maintinence	**5**
1	Helicopter mechanical issues	**5**
1	Helicopter reliability	**5**
1	Helicopter suits	**5**
1	Helicopter vibration	**5**
1	Helicopters always having to be gounded more than normal. Glad it is being done but this is over the top. From what we've understood other helicopters are not having all these glitches.	**5**
1	Helicopters are excellent machines for crew change operations. So saying, they are critical for maintenance and flight ops. Tolerance for failure is zero. Achievement of Excellence is barely adequate. Top priority to aircrew decision making and mechanic training and support.	**5**
1	Helicopters rely on radar, should have GPS locator like transport truck fleets	**5**
1	Heli-suits	**5**
1	High vibration levels on S-92 airframe, due to 4 blade main rotor is at unacceptable levels. Long term levels of high level rodal vibration greatly increases mechanical failures	**5**
1	How high we fly seats are uncomfortable cant lean back at all	**5**
1	How much impact can a HUEBA with staw	**5**
1	HUET Training Doesn't involve flipping over in chopper in pool.	**5**
1	Hydraulics issues	**5**
1	I have to say the gear box mounting feet are the main concern I have.	**5**
1	I strongly feel that we should be wearing ovean survival suits and not flight suits.	**5**
1	If lights + whistles go off again will the choise be made.	**5**
1	If the helicopter crashes will I still be concious to escape the helicopter, will I survive the impact	**5**
1	If you go down. How long is it going to take to get rescue.	**5**
1	Inadequate survival suit, still not the best design. North Sea variations of the suit a lot more user friendly and greater movement.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Inboard fuel tank	**5**
1	increased probability of helicopter ditching after 491 incident. Changes to BST course could become more hazardous/ aggressive. Pressure on pilots	**5**
1	Indicator light coming on	**5**
1	Info being made available	**5**
1	Inside Fuel Tank, should be removed and external take installed.	**5**
1	It seem that Cougar in over caprity and don't have enough helicopters Poor planning regarding check in that leads to long wait times making workers tired before start of shift The choppers vibrate more than other models	**5**
1	Lack of 30 min drt FAR 29 cert not valid in my opinion Poor suits, soon to be changed to new	**5**
1	Lack of egress due to fuel tank 4 seats across back of helicopter should not be accepted. I personally will sit there	**5**
1	Lack of information on safety bullitins and those concerns not being acted on immediately	**5**
1	Lack of operational information at the heliport delays very often not explained ie - weather or equipment	**5**
1	Landing attemps in foggy conditions	**5**
1	Laning on the water, will the helicopter be: 1) able to land without turning bottom up 2) Not being able to sit by a window. I think that every person should have a window seat. Will be a lot easer to get out in an emergency situation. 3) Get the fuel tank out of the helicopter	**5**
1	Large Distance of open water between shortage and the platform. Response timein the event of an accident. Fuel tank in passenger compartment (Aux)	**5**
1	Level of info or quality of info supplied by Sikorsky regarding their helicopters	**5**
1	Life	**5**
1	Low visiability flights may be put on hold for now, but soon to be resumed again after chopper SAR modifications. The main weather issue that should be looked at is high seas flights	**5**
1	Maintance	**5**
1	Maintenance	**5**
1	Maintenance	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Maintenance??	**5**
1	Maintence of the helicopters	**5**
1	Makin it back and forth	**5**
1	Manantance	**5**
1	Mechanical	**5**
1	Mechanical failure	**5**
1	Mechanical Failure	**5**
1	Mechanical issues with helicopters number of helicopters in service for number of flights to complete Having a fuel tank in the passenger cabin	**5**
1	mechanical problems	**5**
1	mechanical problems (is everything being checked) surivival suits and training Flying in bad weather and bad seas (sea state si too high, 5 should be 3)	**5**
1	Mechanical problems Helicopter realibility inexperience of some pilots	**5**
1	Mechanical reliability	**5**
1	Mechanical safety of equipment Proper maintenance of equipments, and keeping up with Ads, ASBs & safety notices Pilot qualifications & emergency procedures	**5**
1	Mechanical sound tested all choppers should be grounded if there is any problems anywhere in the world	**5**
1	MGB failurs	**5**
1	More communication needed. Ie. why delays with choppers? Explain the maintenance. Better real tim explaination needed	**5**
1	More information given for why a helicopter that you are traveling on, or are goin on, may have problem, but you are not informed as to the reason why	**5**
1	More information should be given about the condition of the choppers. Seems to be kept in the dark about a lot of issues.	**5**
1	Motor concern. Gearbox concern.	**5**
1	My biggest concern is and continues to be the level of vibration and the subsequent hair line cracks in the gear box mounting brackets.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	My concern is with the S-9It's a new design of heavy lift helicopter. The 1st with 4 rotos instead of 5. All heacy lift helicopters have 5 bladed rotors. 4 blade procedure far to much vibration, therefore stress cracking issues.	**5**
1	My suit is going to be a modified/custom suit but will NOT be marine certified	**5**
1	Need a better response time in case of a helicopter incident	**5**
1	Need an update suit Need more choppers into the cycle Need SAR techs 24/7	**5**
1	Need one or two more coppers to take the load off of the other 2 to 3 choppers flying all the time.	**5**
1	Never knowing what is wrong when you hear that a helicopter is out of service for mechanical service. We should be told what is wrong	**5**
1	Night flight search & rescue	**5**
1	Night flight's Tank inside the helicopter Not be able to sit next to a window	**5**
1	Night flights, why can we fly safe in the day and not nights.	**5**
1	Night flying. Flying in bad weather (ie) freezing rain. How was this machine serviced & inspected	**5**
1	Nights flights	**5**
1	No feedback or updating given from or by cougar staff including pilots when there is a delay or other technical problem.	**5**
1	No flying in adverse weather conditions	**5**
1	No run dry capability on S-92	**5**
1	Not enough choppers	**5**
1	Not enough choppers in service to handle all the flights to different installations.	**5**
1	Not enough choppers Lack of information by cougar not enough choppers	**5**
1	Not enough flights Night flying needs to be implemented Dedicated helicopter for each installation with one shared helicopter	**5**
1	Not enough helicopters for all the assets offshore	**5**
1	Not enough helicopters flight suits Emergency response time	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Not enough information relayed to worker on reasons heli-copters are not flying ie, mechanical failures ects. This leaves workers wondering what went wrong & if the helicopter is fit to get on at all	**5**
1	Not enough information shared	**5**
1	Not enough space for 4 seats in back of chopper -Have to climb over a fuel tank to get out	**5**
1	Not every passenger will have a window exit when traveling offshore.	**5**
1	Not given all details on helicopter issues (mechanically)	**5**
1	Not knowing the problems with aircrafts	**5**
1	Not realistic Huet training. If you can't do more involved Huet evaluations in the pool you shouldn't go offshore	**5**
1	Number of helicopters	**5**
1	On board fuel tank	**5**
1	On board fuel tank -Does EPIRB for helicopter deploy automatically -Have issues with PLB's been addressed with regard to signal strength	**5**
1	On time maintenace	**5**
1	Ongoing mechanical issues (gearbox, etc)	**5**
1	Our employer does not give us enough info on the status of helicopters from day to day.	**5**
1	Overcrowding in an emergency 19 people is too many no more than 12 per chopper should fly the S92 has signifigant vibration and gearbox problems this has not been addressed	**5**
1	Overcrowding, everyone needs own window. When they say its not our main means of escape, please explain how we walk up the isle to the doors, when we are upside down. And if we do land on water, that's just where we are going-upside down	**5**
1	ox tank in the helicopter cabin 4 seats in the rear of the hiliicopter no dry run capability	**5**
1	Passenger info for delays	**5**
1	Pilot training with regards to auto-rotations and other emer-gency landings	**5**
1	Poor undering P.A. announcements while on chopper	**5**
1	Poorly fitted suits	**5**
1	Procedures for Ditching	**5**
1	Procedures when alarm level is raised- why fly so high when you know there is a problem.	**5**
1	Proper maintence on choppers (no time lines)	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Recue time if I had to ditch	**5**
1	Reliability - sometimes difficult to return onshore due to lack of helicoptors and/or maintenance issues	**5**
1	Reliability of airframes	**5**
1	Reliability of choppers Suits checked in cold water No flying in adverse weather conditions	**5**
1	Reliability of choppers Suits checked in cold water NO flying in adverse wheather can't	**5**
1	Reliability of the S92 (to date it hasn't proved a comfortable level of reliability) E452 suits Emergency response time	**5**
1	Reliability of the S92 helicopter. Is the excessive vibrations normal	**5**
1	Reliability of the S-92 Ability of the S-92 to ditch safely in seas over 3 meters Ability of 17 people to exit safely out of an overturned helicopter	**5**
1	Reliability, out of service to much	**5**
1	Reoccurring gearbox problem.	**5**
1	Rescue	**5**
1	Rescue [UNREADABLE] water	**5**
1	Rescue Time Keeping Dry Training	**5**
1	Response time I there is an incident	**5**
1	Response time in case of landing on water	**5**
1	Response time of coast guard or helicopter to get to me	**5**
1	Response time to accidents	**5**
1	S-92	**5**
1	S-92 helicopter S-92 helicopter Emergency response time	**5**
1	S-92 helicotper unsafe! Survival suits-both E452-HTS1 need to be replaced. "Open" disclosure from cougar and companies about helicopter issues	**5**
1	S92 I do not have very much faith if are the pilots are fully trained and understated all aspects of the chopper	**5**
1	S92 Not a reliable helicopter. CNOPB should be more proactive in looking out for my safety	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Safety	**5**
1	Safety	**5**
1	Safety training involving ditching of helicopter involving text-book situations. This could not be reality. Training should involve possible real life siutions involving possible injuries etc.	**5**
1	Safety video is to long and people lose concentration after first 5 min	**5**
1	Saftey being able to have training in a seat with someone next to me I never had traing before, with someone sitting next to me or had training with a fuel tank on board.	**5**
1	SAR capabilities	**5**
1	SAR response Time	**5**
1	SAR response time & equipment availability 24/7	**5**
1	SAR response time Older suits were very uncomfortable Suits did not fit properly	**5**
1	Search & Rescue response time	**5**
1	Seat seating seats no comfortable rush to get seat not ssued	**5**
1	Seating 4 people across the back row during flights. There isn't enough room in case of emergency	**5**
1	Seating- sitting next to a window is very important. I would not want to jump over a large man/woman that is unconcious and blocking a window.	**5**
1	Service every 10hrs flying. Should not be so weak.	**5**
1	Sever and immediate flight failure causing an unsurvivable crash	**5**
1	Should be search and rescue located in St. John's	**5**
1	Side by side seating	**5**
1	Since 491 I have a very hard time flying in either direction. Why not the option of boat transfer	**5**
1	Size of escape windows with suits on.	**5**
1	Size of winds to small.	**5**
1	Space with fuel tank in helicopter. Sometime hard to under-stand ann. Made.	**5**
1	Staing in the air	**5**
1	Suit	**5**
1	Suit comfort levels concerning neck issues and mobility	**5**
1	Suit fit is still an issue	**5**
1	Suit improper fit-too uncomfortable	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Suit sufficent for ditching in North Atlantic	**5**
1	Suit thermal protection Training at the BST is a joke Search and Rescue	**5**
1	Suits	**5**
1	Suits	**5**
1	suits	**5**
1	Suits	**5**
1	Suits (survival), fuel tank, bolts for grear box assembly.	**5**
1	Suits need to be tested in salt water	**5**
1	Suits HUEBA flight	**5**
1	Suits Training Information	**5**
1	Suits, gear box, gloves	**5**
1	Suits, Hueba fitting, night flying seat ab back	**5**
1	Survival suit	**5**
1	Survival suit is very restricting around the head area, would be very difficult to escape in this suit	**5**
1	Survival suit Size of exit windows Aux. fuel tank in passenger dept	**5**
1	Survival suits	**5**
1	Survival suits fitting & sizes -General issue concerning helicopters operations & flights -Fuel tank inside cabin	**5**
1	Survival suits Aux tanks Response to emergency	**5**
1	Surviving a crash	**5**
1	Tank in chopper (fuel) Flotation support for chopper versus sea state Rescue response time	**5**
1	Tank in helicopter	**5**
1	That the chopper is in top operating condition.	**5**
1	That they are regularly checked for cracks etc. How do we know if they are checked after every flight.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	The 4 seats in the back are a recipe for disaster for the people who are in those seats. Have brought this concern up # of times.	**5**
1	The ability to survive a ditching, due to quick onset of hypo-thermia	**5**
1	The actual proven reliability of the S-92	**5**
1	The airworthyness of the S92, and the issues and the mis-leading information abou the unit. I think it is a pieve of junk. Overrated machine.	**5**
1	The amount of down time for helecopters the problem reported with these helecopters	**5**
1	The Aux. Fuel tank should be taken out of the passenger compartment. It presents an additional obstacle for executing a safe egress duing an emergency situation. It may introduce fuel into the passenger compartment should it or the fuel line become damaged in a crash situation this would not be acceptable on a jet/passanger Airliner. If extrafuel is required, re-engineer the present fuel tanks)	**5**
1	The availability of SAR aircraft in the event of a helicopter incident offshore. Timely search and resuce response!	**5**
1	The constant mechanical issues with these technologically advanced machines	**5**
1	The defendability of the S-92 helicopter the issues with the mounts cracking on the gear box and no one really knowing why and how wer are going to get out with double seating and as well fuel tanks inside the chopper.	**5**
1	The feet on the filter bowl are cracking (do they still not know the specific causes of this?)	**5**
1	The fuel tank inside the helicopter…come-on…it has to go	**5**
1	The helicopter itself	**5**
1	The mechancial reliability of the machine	**5**
1	The number of units available for transportation their should be more for the number of installations	**5**
1	The overall safety of the S-92	**5**
1	The reliability of the S-92 helicopter. We are not informed with a honest and truthful answer of why a chopper is down for maintenance or why it has returned from a flight	**5**
1	The S-91 is an helicopter is always on the limit of capabilites power and structural to allwo for 19 passenger. The S-91 will always be a ? Mark to me versus safety	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	The S-92 choppers air worthyness? Too many issues. Confidence in cougar management to save lives rather than a chopper. Are the appropriate fixes maded by Sysorsky engineers? Why so many issues still?	**5**
1	The S92 in general bad design	**5**
1	The safe operation of the S-92	**5**
1	The safety of the chopper	**5**
1	The survival suit	**5**
1	The they safe to ever been? We are told so but we are only hoping. I am scared to death to be flying every 21 days. I should not be so. We are not told when choppers don't' fly and are in for maintenance, whats wrong??	**5**
1	The uncertainty of the whole operation if something like our last tragic but prevenatble nightmare happened than it could happen again. Lets travel by boat case closed.	**5**
1	Thermal insulation/ water ingress of flight suits in ditching situation	**5**
1	Thermal protection of suits, constantly get wet in pool. Not used on Sea day.	**5**
1	These helicopters were supposed to be certified with a dry run of 30 minutes as a safety buffer. Other helicopters have this capability but ours does not yet we still continue to use these machines. This misleading information led to a fatal decision that caused the lives of 17 people	**5**
1	They continue to fly in adversary weather conditions (weather, HIGH SEAS)	**5**
1	They have proven to be unsafe, still no change in oil filter design, still landing in unsafe weather conditions offshore.	**5**
1	To be honest I strongly think they are not fit to be in the air and myself along with others don't feel safe on them and it seems that since the accident there never seam to be problems with the choppers they blame delays on weather witch is many times proven that wasnt the case in other words stuff is being witheld or covered up	**5**
1	To be informed of trouble	**5**
1	To have a standby helicopter ready to depart in a moment notice of any accident	**5**
1	To have very knowledgeable, experienced pilots	**5**
1	Too many hours in the air versus hours of maintenance -We do not have full disclosure with respect to maintenance issues	**5**
1	Too many people on board	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Training on helicopter needs to be increased. BST/ 3 year not sufficient at all	**5**
1	Type of chopper S-91 is most viberations I have felt on any chopper is 35 years 2. Ammount of flights versus number of choppers and pilots 3. Not enough choppers to evacuate everyone	**5**
1	Unreliable, often mech problems excessive alarms	**5**
1	Very difficult to zip up survival suit. May not be able to do it in an emergency.	**5**
1	We do not have 24hr Rescue availability. It is not sufficient to have such long wheel up times for both DOD & Cougar.	**5**
1	What about the 30 minute Run Dry Requirement	**5**
1	When ever ther's a machanical problem no matter what it may be, before loading passangers always test fly the helicopter after any repairs are made.	**5**
1	Why are they down more now??? If it was certified due to the remote possibility of it crashing due to loss of oil, why is it still certified???	**5**
1	Wind, fog, gear box	**5**
1	Window seat not available for everyone. I agressiveloy persue sitting in a window seat and so far have been successful every time, if I don't get a window seat I feel I may refuse to fly	**5**
1	# of choppers	**4**
1	1) Ice build-up 2) Ditching in weather inconducive for rescue 3)Mechanical Failure	**4**
1	1) Night flying 2) Flying in inclement weather 3) cramped seating	**4**
1	1) suits, poor fit, reduced visibility (movement, etc etc.)	**4**
1	1) The vibration 2) The transmission 3) the design of S-92	**4**
1	1) Various 'mechanical' delays 2) Response time of emergencies 3) No bathroom	**4**
1	Flying in High winds	**4**
1	Gearbox/ helicopter reliability and pilot knowledge of machine. 2. Not everyone has access to window/door 3. Fuel tank in passenger cabin.	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	lack of communication with problems that come up with regards to maintenance. 2. Survival suits are very uncomfortable 3. Hard to hear P.A. system in chopper	**4**
1	Lack of helicopters	**4**
1	Studs in gearbox cracking, again causing a ditch/crash situation	**4**
1	suits	**4**
1	The amoutn of downtime of the helicopters! The checks are being done, but why are they broken down so many times! 2. Vibration at times is very high, is this normal?	**4**
1	1.Taking off 2.Landing 3. vibration	**4**
1	4 seats in back of chopper. The amount of brakedowns with Helicopters. If you owned a car that brokedown as much you would get rid of it. Why were we never told that they did not have capability to rescue people at night until after crash	**4**
1	A lot of actions to take at one time using HUEBA	**4**
1	Ability to be rescued at sea in event of ditching	**4**
1	Above normal vibration levels internal mounted fuel tank additional helicopters would give more time for maintenance operations.	**4**
1	Abundance of mechanical trouble -->every other day 1-2 helicopters is down due to maitance/ mechanical trouble	**4**
1	afraid of a similar accident as 491	**4**
1	Are they going to stay flying	**4**
1	Aux fuel tank	**4**
1	Auxiliary fuel TK	**4**
1	Availability of upgrade and maintenance equipment	**4**
1	Being on the ailse sit. (not window) how do I do to scape under water? We don't train that on the BST.	**4**
1	Breakdowns Maitance Limitations	**4**
1	Bringing baggage on board - weight restriction	**4**
1	Chopper gear box	**4**
1	Chopper themselves	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Comfort and spae for individulas on helicopter tight space for exiting procedures. More single seats by windows. Not having to think about being in an aisle seat and some else to pop a window in an emergency.	**4**
1	Communication between Cougar/workforce	**4**
1	Concerns with four men in rear seat	**4**
1	Crash	**4**
1	Crashing bays	**4**
1	Dedicated SAR	**4**
1	Distance from possible rescue if helicopter ditches	**4**
1	Ditching concerns, is there a better way	**4**
1	Down time Info about copter down times Maintenance issues	**4**
1	During BST training do we need sea day every 3 yrs?	**4**
1	E452 has poor neck seal.	**4**
1	Egress suits PLB's (testing and functionality)	**4**
1	Emergency Response	**4**
1	Flight suit, leakage when immersed in water	**4**
1	Flight suits Mechanical issues with helicopters How info is passed along	**4**
1	Flying altitude	**4**
1	Flying at night Shared flights Inquiry updates	**4**
1	Flying in bad weather Not being kept informed Suits	**4**
1	Flying in high sea states	**4**
1	Flying to high messing around the fog lack of maintenance	**4**
1	Fuel stored inside chopper Transmission mounting bolts Room in seating arangments	**4**
1	Fuel tank in passenger compartment	**4**
1	Fuel tank inside # of helicopters	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Fuel Tank 2. 4 people in back, no room to put hood up 3. double row seating 4. communication between passanger and Pilots	**4**
1	Gear box	**4**
1	Gear box	**4**
1	Getting to and from the installation safely	**4**
1	Handles to aid in egress (windows-aux tank)	**4**
1	Helicopter - ensure it operates properly	**4**
1	Helicopter are still having problems with geer box always down for repairs, no concern with training but if you fall out of the sky now can you help your self. If you do a controlled landing this can control.	**4**
1	Helicopter down for maintenance	**4**
1	Helicopter egress in an emergency Everyone should have a window seat	**4**
1	Helicopter flight suits	**4**
1	Helicopter gearbox design	**4**
1	Helicopter Maintenance	**4**
1	Helicopter maintenance	**4**
1	Hopeing the pilots know the limitations of their vehicle (helicopter)	**4**
1	HUET training needs improvement i.e. escape with 2 passangers side by side. Escape from HUET with simulated fuel tank in place	**4**
1	I am concerned that the training received for emergency situations while onboard Helicopter is not as close to a real situation, therefore not properly preparing all the passengers properly	**4**
1	I do not think the Dept. of Transport regulations + certifications is not rigid enough for our geographical challenges (le distane over water etc)	**4**
1	I feel that we should all be supplied with some form of head protection. In the event of ditching inothe ocean, it would help if we could don a helmet to help prevent us from being knocked unconcious. If your knocked out your chances of escape are severly comprimised.	**4**
1	I hear there are only 3 helicopters for all rigs. Too many delays due to maintanance/ weather	**4**
1	If something goes wrong (crash) there generally is a low chance for survival	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Immersion suit has no neck seal. This offers protections from water ingress at all times and doesn't rely on passenger action to keep the seal	**4**
1	Inevitable incident/event will re-occur	**4**
1	Information as to problems with S-92	**4**
1	Interior fuel tank Copter Maint. Copter design	**4**
1	Is enough maintenance being done on choppers that do more than are flight per day.	**4**
1	It extremly uncomfortable compared to olf mustang. Heuba hard to get first breath. No internal tanks!	**4**
1	Lack of enough aircraft for the fleet offshore	**4**
1	Lack of first response in event of helicopter crash	**4**
1	Lack of info about weather and/or current technical problems with chopper	**4**
1	Lack of info when there is an issue, info not passed along	**4**
1	lack of movement in the suit= getting out if required thru a window could be a struggle	**4**
1	Lack of phone in flight informatgion for departure	**4**
1	Landing on water	**4**
1	Leaky suits	**4**
1	loss of oil pressure	**4**
1	Maintenance	**4**
1	Maintenance	**4**
1	Maintenance personel at cougar has enough experience on this new technology	**4**
1	Making it to/from my job safely	**4**
1	Mech problems the ability to land on water rescue in a case of emergency	**4**
1	Mechanical Mechanical Mechanical	**4**
1	Mechanical concerns	**4**
1	Mechanical issues	**4**
1	More training exiting a helicopter with the fuel tank location* during an emergency situation	**4**
1	Need proper rescue 24-7	**4**
1	Neoprone Gloves should be fitted to fuits for inflight use. This would give more dexterity in case of emergency	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Night flying	**4**
1	Night flying Foggy Conditions Adverse weather, wind	**4**
1	No explaination why choppers are out of sercie, no confidence in the S-92's	**4**
1	No window seats for all passengers	**4**
1	Not enough choppers	**4**
1	Not enough helicopters.	**4**
1	Not knowing current problems with the helicopters, reasons why they are not flying a given day (mechanical problems is not a adequate reason)	**4**
1	Number of delays due to mechanical issues	**4**
1	Number of people on helicopter	**4**
1	Openness about helicoptor problems 2) helicopter fatigue, being used too much between major checks 3) Helicoptors being overloaded with people	**4**
1	Overcrowded. Seats are to small.	**4**
1	Overuse with limited choppers	**4**
1	Passengers with window seats have a better/ quicker chance to escape. Passengers jump/rush to the heli-admin door or cougar heliport door to be the first in line in boarding the heli-copter so they can get a window seat. In my opinion the seats should be numbered and passengers designated toa seat and designation shoul dbe rotated so everybody has equal oppor-tunity for a window seat.	**4**
1	People who are large and in bad physical condition sitting next to me in the chopper	**4**
1	Pilots making dicisions to fly on and not ditch when they should have, trying to save flight 491 cost everybody their lives. Everybody could of went home that day and not to the bottom of the ocean. Life is more important than a machine.	**4**
1	Pooling arrangement- by this/ mean if operator has boats at their disposal and can send one due to fog issues then ar-rangement allows them to keep slot time next day. This is unfair as personnel offshore have no control of whn they can expect to get off installation.	**4**
1	Proper transfer of information regard aircraft status and flight conditions	**4**
1	Quality of the helicopters	**4**
1	Reliability	**4**
1	Reliability of S92	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Reliability Problems with choppers (much) Not enough of them	**4**
1	Rescue capability -Flight suits (how much better is the new suit over the leaky old suits) -Reliability of choppers (seems to be allot of mechanical issues every hitch)	**4**
1	right now it is the integrety of the cracking feet of the gear box Length of time given for repairs	**4**
1	S92 and its maintenance problems	**4**
1	S-92 is still new with only recent modifications to gear box that have not been proven (ie - filter bowl mod) -The S-92 does not have 30 minute dry run time	**4**
1	Safety of the helicopters	**4**
1	SAR Not enough choppers for the number of installations fuel tank	**4**
1	Seal around face	**4**
1	Seals on the suits (around head and wrists)	**4**
1	Seating	**4**
1	Seating arrangement (back of chopper)	**4**
1	Seating on board leaves no shoulder room. After 1-5 hours I am very stiff and am sure this would affect my ability to self rescue	**4**
1	Serch + Resque Avabality	**4**
1	Should have more anouncements during each flight?	**4**
1	Slow change out to the new survival suit	**4**
1	Still have not found problem with S92 and we are the test group flying in and out from offshore	**4**
1	Suit fitting. The new suit should be much better.	**4**
1	Suits	**4**
1	Suits	**4**
1	Suits	**4**
1	Suits	**4**
1	Suits are very bulky- would be good in the water but make escape harder	**4**
1	Suits, are they adequate with regards to seal	**4**
1	Survival in the event of failure of helicopters	**4**
1	That the pilots attempt to make it ashore again as opposed to putting the chopper down in a controlled ditching	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	The amount of down time the S-92 has did the Puma' have as much	**4**
1	The fuel tank seems to take up good window space on the right side. If you don't get a window you a in trouble	**4**
1	The maintance of the helicopters, the break downs that they have	**4**
1	The modle of helicopter is not reliable-a lot of break downs	**4**
1	The number of times helicopter are down for mechanical problems.	**4**
1	The seats; getting out of the windows	**4**
1	The use of 4 seats in the back row. The area is very confined and restricts movement.	**4**
1	There is not enough helicopters to do an effective job espe-cially when they get delays.	**4**
1	Time taken to upgrade equipment ie survival suits	**4**
1	Traing on HUEBA	**4**
1	Uncomfortable suit, new HTSI is much more comfortable and allows for easier head movement.	**4**
1	Vibration in helicopter	**4**
1	Vibration of the helicopter	**4**
1	Vibrations	**4**
1	Waiting around when weather is bad	**4**
1	Weather	**4**
1	Weather conditions (wind) - Fog -Darkeness	**4**
1	When you check the flight line and all the helicopters are not on the flight schedule, what is the problem with the ones that are not in service.	**4**
1	While it is most expedient method, I still would prefer a vessel transfer system to choppers	**4**
1	Why does the S92A still have FAR 29 certification? Failure of the lube system has been proven not to be remote.	**4**
1	Window access Suit manurability auxilary tank	**4**
1	Winter flights Night Flights High wind flights and high seas	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	1) Weather 2) Adequate training 3) Fitting of the suit	**3**
1	Comfort 2. Flight departures/ arrivals not consistant or dependable 3. Outdated helicopters	**3**
1	Crashing 2. The suit is very uncomfortable to the point of causing pain. Don't know if I could keep is zipped up duing a situation. 3. Would pilots conduct a controlled ditching or try to make land.	**3**
1	mechanical issues of the helicopter 2. chances of getting out if we crash 3. If the suits will allow for survival as long as they say	**3**
1	S-92 mechanical breakdowns too frequency	**3**
1	Suit 2. Icing 3. Seat not comfortable	**3**
1	1: Waiting long time at the port to fly 2: Bad weather during flying 3: Not getting back home on time	**3**
1	15 min rescue (wheels up) capability	**3**
1	Adequate maitenance -->Satisfied but always concerned	**3**
1	Age of choppers	**3**
1	Availability of infor regarding ops/incidents	**3**
1	Availabiltiy of choppers	**3**
1	bad weather conditions	**3**
1	Boyouncy when landed on water	**3**
1	Cold water,	**3**
1	Controlling of temperature (hot or cold)	**3**
1	crash	**3**
1	Crashing	**3**
1	Crashing	**3**
1	Ditching in the N. Atlantic and being able to escape the heli-copter	**3**
1	Ditching SAR Reliability of S92	**3**
1	Don't care for flying	**3**
1	egress in the event of ditching.	**3**
1	Equipment reliability	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Escape from Ditching	**3**
1	Fighting over cold water	**3**
1	fit of suits	**3**
1	Flight arrivals to rig	**3**
1	Flight going down	**3**
1	Flight suit - I am still using the E-452 and the fit is difficult to zip up	**3**
1	Flying during sig sea states	**3**
1	Flying foggy or high winds. Current suits are inadequate, can't move head easily make all issues transparant .	**3**
1	Flying in adverse weather sometimes overcrowded.I	**3**
1	Height which we fly	**3**
1	Heli failure/ crash (2) Emergency response from shore	**3**
1	Helicopter crashbox	**3**
1	Helicopter its self	**3**
1	Helicopter maintenance	**3**
1	Helicopter model itself	**3**
1	I don't trust the S92. I don't think it is a reliable machine	**3**
1	If the helicopter will crash; if the gears will break	**3**
1	It will break down	**3**
1	It's long and over cold rough water, with very small chance of survival if something goes wrong. IF the pilots can get the helicopter down safely then there is a chance. But it's a big if	**3**
1	Lack of information when there are delays with choppers Sometimes it is a concern has to why they seem to be delays for maintenance or broken down, when they are fairly new choppers and there is a big maintenance program in place!	**3**
1	Let personnel know what the problem is @ the time, not when it has to come from a committee or from the news.	**3**
1	Level of training of the pilots	**3**
1	Limited space to move inside helicopter	**3**
1	Longevity of Aircraft after lube failure. I liked the motion of a 30-minute window for the pilot to make decisions and act.	**3**
1	Machanical issues. Try to lond the rig in thick fog. Flying in poor weather fog high winds.	**3**
1	Machanical trouble	**3**
1	Maintenance issues (day to day)	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Maintenance manners of egress Loading/passenger numbers	**3**
1	Maintence	**3**
1	Maintinence, need more aircraft, search + rescue	**3**
1	Max weight of bag 11 KG is not enough some time	**3**
1	Mechanical failure	**3**
1	Mechanical Issues SAR Response Time Weather	**3**
1	Mechanical upkeep	**3**
1	Mechanicay Electrical Instrumentation	**3**
1	More helicopters in system, too many times we have one or two out of service. Need to fly at night if weather is okay.	**3**
1	Night flying.	**3**
1	Not enough helicopters to adequate do the job required safely.	**3**
1	Not enoughy choppers	**3**
1	Pilot experience	**3**
1	PLBs = extra ropes & wires to get caugt up	**3**
1	regular maintance	**3**
1	Reporting of information	**3**
1	Response time of SAR	**3**
1	Response time Survival suits Not enough training	**3**
1	S-92 not a reliable unit	**3**
1	SAR preparedness	**3**
1	Search and Rescue	**3**
1	Search and rescue capability	**3**
1	Search and resuce respone time Weather conditions	**3**
1	Serviceability	**3**
1	Should have a medic on board just in case of a emergency, such as a heart attack, choking etc.	**3**
1	Suit	**3**
1	Suit fitting properly	**3**
1	Suit integrity	**3**
1	Suits	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Suits	**3**
1	Suits	**3**
1	suits heut training placemetn of fuel tank (aux)	**3**
1	Suits Night Flights General Information	**3**
1	Suits, they are probably safe but they are uncomfotabel to a point of inhibiting ones ability to set quickly in an emergency.	**3**
1	Survival suit fitting	**3**
1	Survival suits	**3**
1	Survival suits	**3**
1	Survival suits, very hard on the neck with hours technology is advancing, there has to a more comfortable way for developing the neck area of the suit without compromizing the safety of the suit.	**3**
1	Take offs	**3**
1	The bulkiness of the suit affecting helicopter egress in an emergency situation	**3**
1	The helicopters	**3**
1	The number of choppers available. Not enough operational.	**3**
1	The rigidity of the hood on the survival suit.	**3**
1	Time Not knowing what the cause of delay Suits	**3**
1	Time wasted at heliport, 13/4/10 HCR crew requested to report for 1115, Fucat departurer scheduled for 2:30!! Why there is a lot more to safety than just flights, keeping people at heliport all day and then go offshore and work all night! Too many trip hazards why suits are laying ?two unreadable words?	**3**
1	Transport Cda regulatiors: should be treated as workers, not passengers. (xray machine is bullshit) (ID is on computer so shouldn't have to show ID). Boarding pass is bullshit.	**3**
1	Using the suit to train with during refreshers	**3**
1	Visibility Mechanical	**3**
1	Weather	**3**
1	Weather conditions sea state time of day	**3**
1	Weather- flight having to turn around	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	1) flying in fog 2) additional fuel tanks limited by vessel mottion for landing	**2**
1	Mechanical issues 2. Updated information on travel ?tues? 3.Seating arrangements, comfort issues to seating	**2**
1	Auxillary fuel tank inside cabin	**2**
1	Break Downs	**2**
1	Catastrophic failure at height + speed	**2**
1	Crashing	**2**
1	Ditching in inclememnt weather/rescue	**2**
1	Emergency response: there are no standby people in Gander between 4 PM and 8 AM. They are at home waiting for a call rather than at the facility	**2**
1	Extremely poor communication from cougar poor facilities @ St. John's inadequate for amount of personnel	**2**
1	Falling out of the sky	**2**
1	Flight suit Response time	**2**
1	Flying at night weather	**2**
1	Lack of information if helicopter is unserviceable or take off rotation- no need for detailed report but would be nice to know basic reason	**2**
1	Length of flight	**2**
1	Maintenance	**2**
1	Mechanical failur, protocol	**2**
1	Mechanical failure	**2**
1	Mechanical problems	**2**
1	Root cause of gearbox foot cracks appears unresolved (?) I haven't heard yet. In any case, the rigorous inspection program mitigates this (to my satisfaction anyway)	**2**
1	Suit fit	**2**
1	Suit sizes, comfort, and how well they function	**2**
1	Suit, getting there	**2**
1	Technical shape of chopper	**2**
1	The suits	**2**
1	We need more helicopter for transportation	**2**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Weather but, there is a very good job done by all to access weather that could potentially cause problems. Weather can still be unpredicatble.	**2**
1	Wind	**2**
1	?I believe that the many + serivice provider ie at the top of their home?	**1**
1	Altitude of flight	**1**
1	Boring	**1**
1	Crash	**1**
1	Crashing	**1**
1	Ditching	**1**
1	Does not have dry run time	**1**
1	Dry run time	**1**
1	Gearbox failure	**1**
1	If not sitting inside seat - to get past someone to get out of window large guys sitting @ window seats weather	**1**
1	Maintenance on chippers	**1**
1	Maintenance to Helicopters	**1**
1	Night flying. Ditching regulations	**1**
1	not enough info regarding helicopters. Reason for delays. Explaination of events during flights.	**1**
1	Seat arrangement all passengers should have a windown seat not isle seat	**1**
1	Should be more training with HEUBA should be BST with HUEBA in helicopter roll stop flying untill the continues gear box essues are straightened out and provin.	**1**
1	suits	**1**
1	suits	**1**
1	The choppers always seem to have problems. Never get home on time. Vibration on the machine Helicopter	**1**
1	The HEUBA training did not allow one to escape from the simulator with the HEUBA device. This needs to be part of the training.	**1**
1	0	**0**
1	1) Aux fuel tank 2) Announcments inside 3) Seating arrangements	**0**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	1) Impact! - does the absorb impact upon hitting the water 2) Egress 3) I don't feel safe!!	**0**
1	1) Mechanic's vs use of chopper 2) Limitation of following procedure when March 12 passes by. They will squeak on the procedure if under pressure 3) Heuba	**0**
1	1) Response time in an emergency 2) The amount of personnel being transported at one time on the helicopter 3) Not much faith in the safety of the S-92	**0**
1	Stiff neck zipper on suits 2. s-92 manufactors risk assessment process- how they approved the gearbox! 3. Delays!	**0**
1	Aux fuel tank. (should be gone) gear box mounting pads (New design) gear Boc fliter bowl (New design) Sets in back of chopper	**0**
1	Communication on Departure times	**0**
1	Duties night flying in heavy weather	**0**
1	Ending up in the ocean	**0**
1	Flighting in freezing rain or foggy conditions. Being rescued on a foggy day.	**0**
1	Flyers should know whats going on with the helicopters Shouldn't have to read in newspapers	**0**
1	Flying in 50 knot winds or better 2-Flying in sea states of 7m or 21 feet 3-Weather or not the pilot is going to attempt to land in a controled manner on water or try to get to land to save the chopper causing crash	**0**
1	Fuel tank (Aux tank) (2) Window seats for everyone (4) Overall safty of the aircraft (5)	**0**
1	Fuel tank P.A. announcements	**0**
1	Gear Boxes	**0**
1	Having to ditch and the weather condition at the time. Ex. Sea state/ fog/wind.	**0**
1	Helicopter	**0**
1	Helicopter falling apart	**0**
1	HUEBA Fuel tank inside Two many flights in one day	**0**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	I would be concerned about manufacturing and stability testing of product before putting on product market.	**0**
1	Machanical concerns that we don't know about. All personal should have HS1 suits before getting on chopper it is april 22 and I don't have one.	**0**
1	Making it in & out. Training of pilots in emergency situations Fuel tank in chopper	**0**
1	Most people talk aboiut 6 trips a year a lot of service personel are ad hoc & do 12 or more a year	**0**
1	Need more helicopter to get home on time.	**0**
1	Need more helicopters to take strain of the ones presents	**0**
1	Negativity of co-workers. Some people should not work offshore but continue to do so and are very negative about everything	**0**
1	No chance in Hell, am I getting out if I'm sitting next to some-one	**0**
1	Not enoujgh helicopter for installations	**0**
1	Poor communication between offshore workers and Cougar helicopters	**0**
1	proper maintenance	**0**
1	Proper maintenance on each helicopter (bolts)	**0**
1	Safety	**0**
1	Seating too close, face or head injusry on impact everyone should have window seats for egress SAR needed fulltime	**0**
1	seats suits weather	**0**
1	Stand-bye search rescue	**0**
1	Staying in the air	**0**
1	Suits should be checked for cold water -Flying in adverse weather, sea states, wind -Chopper reliability - maint history -Not enough choppers -Search & rescue vs. Cougar search & rescue	**0**
1	survival suits	**0**
1	The crack in the Wouseing is my concern. Why can't the get a thicker Wouseing installed.	**0**
1	The fuel tank should not be in the passenger cabin	**0**
1	The S-92 has a continious vibration problem. This is what led to the crash and the problem with the gear box.	**0**
1	The same suits used in BST sea day should be used for flights	**0**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	They leave when they really don't think then can land eg. Foggy.	**0**
2	(Suits) Extremely uncomfortable in hood sea/ neck area. Cannot move! If something happens, escape is impossibele is you are so trapped that you can'tmove your head/ neck! Are tey going to keep us warm and dry?	**5**
2	Excessive vibration in chopper 2. Aug fuel tank	**5**
2	2. making it too the destination	**5**
2	2. Number of passengers	**5**
2	2. We need to be using the norweigan suits. They repel heat in summer and absorb it in the winter.	**5**
2	30 minute dry run time not available on the S92	**5**
2	4 people seating in rear off chopper	**5**
2	4 Person seat in back very uncomfortable and tight space maybe only 2 person in back. Limit movement in donning and zipping up suits. Very difficult.	**5**
2	4 seats across the back	**5**
2	4 seats across the back, this would make it virtually impossible to escape in an emergency situation	**5**
2	4 seats together in rear of helicopter two of seats need to be removed.	**5**
2	All AD' be given top priority and complimented immediately possible	**5**
2	Always broken	**5**
2	Amount of downtime due to mechanical issues	**5**
2	Amount of non serviceable flights. (Down due lo mech problems	**5**
2	Arriving safely	**5**
2	Aux fuel tank (if needed inside chopper) should be back where it was first, with 2 single role's of seating, and put taller workers where the tank is	**5**
2	Aux fuel tank causes an egress issue.	**5**
2	Aux fuel tank in cabin when flying	**5**
2	Aux fuel tank in helicopter. Safety and egress hazard	**5**
2	Aux fuel tk it should be removed	**5**
2	Aux. fuel tank shouldn't under any case be inide the passenger cabin	**5**
2	Auxiliary fuel tank should be removed, one escape window per passenger	**5**
2	Auxillary tank	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Auxilliary fuel tank, why are we using this. We should have a helicopter that carries it's fuel eslewhere, other than the passenger cabin where it impeeds exits for an emergency	**5**
2	bad face seals on suits	**5**
2	Based on what I saw during survival training the survival face seal will leak when you are in the water.	**5**
2	Boat is the preferred way. Helicopter is extremely stressful	**5**
2	can't lean back in the seats	**5**
2	Catastrophic failure of helicopter in flights	**5**
2	Chopper maintainance- there should be maintaince performed on weekends/ nights instead of days when there should be flights. Too many days with choppers not working and large back llogs in flights. Then cougar trying to get flights and maintainance all at once.	**5**
2	Choppers flying in high winds or sea state. If a chopper has to ditch in these conditions the passengers do not have a chance	**5**
2	Communication about helicopter down time	**5**
2	Communication on the head phones; used to be poor quality	**5**
2	Concerned that the survival suit is too constricting (Neck area mainly)	**5**
2	Controlled descent by the helicopter- IF impacte the water too hard (G-force) you will be most likely, knocked out on impact	**5**
2	Cougar and employees not informing us when issues happen. No transparency	**5**
2	Cougar not letting us know what problems they are having with choppers!	**5**
2	Course of action a flight crew will follow in an emergency. (i.e. will they follow current procedures/operations manuals even if it means putting a helicopter down in the ocean "controlled")	**5**
2	Cracks in the foot mount	**5**
2	Crowding of personnel. No room for egress not trained for cramped egress static unhealthy postures	**5**
2	Dedicated SAR chopper in St. John's with wheel up of 30 mins.	**5**
2	Ditching cababilities	**5**
2	Ditching capabilities in different sea heights ie 5.0 - 6.0 m sea heights for S92	**5**
2	Ditching procedures. Once alarm is noticed, how much time will be spent before a controlled landing is considered.	**5**
2	Double row seating…it impedes existing (getting out the emergency escape windows) in an emergency	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	downtime	**5**
2	E0452 suit not fitting properly-being addressed	**5**
2	Each person should have a exit to themselves to ensure everyones safety	**5**
2	Effective rescue after a crash	**5**
2	Extrafuel tank blocking escape windows	**5**
2	First response times to emergency situation	**5**
2	Fitting of suits	**5**
2	Flight hours.	**5**
2	Flight inf during flight hearing of pilots	**5**
2	Flight suit being used on sea day to see how it will protect us. Given a chance to use the suit in the ocean.	**5**
2	Flight suit fitting & the amount of water that can enter the suit	**5**
2	Flight suit issues not properly fitting even with new suits (hooks)	**5**
2	Flight suits	**5**
2	Flying in extreme weather conditions	**5**
2	Flying in fog	**5**
2	Flying in these conditions prevents you from being resuce if anything happens	**5**
2	Flying in very foggy conditions for same concerns as #1	**5**
2	Flying in weather conditions that would not allow a practical, safe rescue. Mainly wind speed and sea heights.	**5**
2	Fuel tank	**5**
2	Fuel tank	**5**
2	Fuel tank	**5**
2	Fuel tank in the chopper inside no seems to want to charge this cause it serves a monetary concern for the company. Also this tank has a cover over it, another concern	**5**
2	Fuel tank inside cabin	**5**
2	Fuel tank inside helicopter	**5**
2	Fuel tank inside with passengers. Just because it did not dislodge in the crash this does not enure it will be entact next time. We need a helicopter adequate to travel the distance we require. We need a helicopter suiabel for our unique require-ment.	**5**
2	Fuel tank on board	**5**
2	Fuel tanks	**5**
2	Fuel tanks inside of the chopper	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Gear Box	**5**
2	Gear Box Issues	**5**
2	Gear box troubles	**5**
2	Have a good survival suit	**5**
2	Having a more realistic setting to train with The foxtrap campus does not acurately portray the S-92. Possible do refreshers with flight members we actually travel with	**5**
2	Having to ditch with sea states and fast rolover	**5**
2	Helicopter ditching ability - sea states etc	**5**
2	Helicopter issues/alerts	**5**
2	Helicopter realibility	**5**
2	Helicopter reliability is becoming a major concern always issues/break downs	**5**
2	How fast will cougar respond to maintenance issues in the future 1250 hours does not out if when lifes are at risk	**5**
2	How well trained are pilots in safety (BST etc) Procedures- why don't they wear the same suits as passengers	**5**
2	I am a large man and feel I have to fight to get a seat next to a large windon on the helicopter this should be arranged	**5**
2	I believe that the fuel tank should be on the outside of the aircraft, and if it must remain inside it should be placed on the double seat side with handels to grab so you can make your excape over it and out the window. I would much rather clime over the tank that another person	**5**
2	I believe the S92 has design/ engineering errors. It has excessive/ booming vibrations which cougar, it seems, are always trying to correct. I believe the problems are only being fixed temporarily and the "cause" cannot be fixed because it's a design flaw.	**5**
2	I get the impression that each time you bring up a concern, the feeling from management is "enough already" and you are labelled as a trouble maker	**5**
2	I have brought this concern in concern #1 to the safety committee and to date have not received a reply	**5**
2	I think having the fuel tank in the helicopter will be a hazard if you have to get out. Emergency situation will be more complicated with this tank inside.	**5**
2	I think this survey will never see the light of day	**5**
2	If chopper ditch is in high seas, will survivors be able to be rescued in high seas/wind.	**5**
2	If chord on suit is accidentally pulled there would be no chance of getting out of helicopter	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	immersion suits and neck area very stiff.	**5**
2	Information passed on regarding any maintenance completed on any helicopters of any signifigant nature at any time. Any fiindings that we should be made aware of.	**5**
2	Integrity of flight suit	**5**
2	Is sycorsky doing what they can to re-evaluate the gearbox issues (and the bypass flow value. Are they working to possibly redeign the problems with this type of helicopter. (All the downtime, they are having)	**5**
2	Issues with S-92	**5**
2	It seems that every time I fly Cougar is training another pilot	**5**
2	Ive been on deck the weather is the pits. Helo will fly out be so high high or not ever close, you cnnot ever hear the engine- and they are extremely loud why take the chance. Now you have a 3 hour turnaround!	**5**
2	Lack of confidence in S-92s based on past performance & manufacturers lack of transparency of faults	**5**
2	Lack of dry runt time capability. I think any chopper that flys over water should have minimum of 30 min dry run (no oil) capability. There are choppers available with this & we should have it	**5**
2	Lack of information from cougar when incidents occur. Poor communication on their part.	**5**
2	Lack of proper dry run capability on main gear box. Still a guess if MGB will last long enough for safe ditching after oil/ pressure loss	**5**
2	Lack of rigerous training for the BST. Some individuals should never be able to fly due to poor physical condition which would endanger others in an emergency	**5**
2	Landing procedure (emergency)	**5**
2	Less cramped in the seats more space to move when emergency happens.	**5**
2	Losing slot time duing delays when other installations can appear to command aircraft/ slot time-Example of this being when helicopter has to stay on thermal time one due in arrives and GST flights with earlier departure time been helo and slot time one hour after GST Schedule decided to take off first.	**5**
2	Maintenance	**5**
2	Management of helicopter safety by government & having emergency response in St. John's instead of tieing up choppers from cougar	**5**
2	Many problems occuring with the Helicopters are not brought fourth to the workers. All issues should be out in the open.	**5**
2	may fall out of the sky	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Mechanical issues	**5**
2	More frequent training	**5**
2	More realistic training with (HUEBA) system	**5**
2	My main concern is the safety of the airframes, reliability, maintenance required, they seem prone to cracks or other damage	**5**
2	night flights	**5**
2	Night flights	**5**
2	Night/day, low visiability flights are one thing but in high seas on a perfictly clear day and this will be the worst condition to be in the sea	**5**
2	Nighttime flying. Less than poor chance of having rescued in night/ less alone day.	**5**
2	No 30 minute “dry fly” capabilities	**5**
2	NO assigned SAR helicopter in St. Johns	**5**
2	no choice of “shoe”/”boot” on suit, always very big trip hazard on way to and from helicopter	**5**
2	No flying if weather is not suitable (ie) sea states winds/ windy	**5**
2	No fuel tank’s inside	**5**
2	NO SAR on the East Coast (St. Johns)	**5**
2	No trust in the S-92 helicopter. Having worked on the platform for 9 yrs I’ve seen a drastique number of mechanical delays since we started using the S-92s. Cougar are unable to maintain any kind of schedule with the S-92s and I would feel much safer in any other type of helicopter	**5**
2	Not always informed of what problem is when there is a problem with chopper	**5**
2	Not enough choppers	**5**
2	Not enough choppers in the area to transport passengers	**5**
2	Not enough disclosure about mechanical problems with helicopters.	**5**
2	not enough helicopters to safely handle flights to rigs	**5**
2	Not enough information passed on from onshore with regards to the choppers	**5**
2	Not having a seat dircely next to a window	**5**
2	Number of helicopters for the number of flights	**5**
2	Number of passengers per trip	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Number of people in the back row should be 2 instead of 4. There is only 2 exits next to thses working on the helideck at Hibernia, looking at the faces of the people in that back row trying to get their seat belts and hoods done ujp is not a nice feeling when you experience if yourself should not be allowed to have 4 people in the back of the helicopter.	**5**
2	Number of people on chopper Mandatory explanation of why choppers are down No rigg hopping	**5**
2	Number of people on chopper Mandetory explanation of why choppers are down No rig hopping	**5**
2	Old suits, were a concern, new suits are a great improvement	**5**
2	Over weight people not able to egress through the Emg. Exits with suits HUEBA Etc on	**5**
2	Overall safety	**5**
2	Ox. Fuel tank in passanger cabin	**5**
2	Passenger seating + egress in emergency- jammed in helicopter like sardines; very uncomfortable and very limited mvt.	**5**
2	Passenger seating specifically in rear. Too many personnel in confined area Hazard for evacuation and suit donning. Poor body positioning causing health concerns amoung workers. Should not be evern 2 people side by side. Will be very difficult to get out via window.	**5**
2	Personnaly I think cougar helicopters wouldn't organize a choir let alone a maintenance schedule on such equipment	**5**
2	PIB are short range, should be GPS, some in ?chirq? Could locate you in ditched	**5**
2	Pilots being aware of the limitations of the helicopter ie. fly time with dry gear box	**5**
2	Premature cracks in gear box and genral helicopter breakdowns	**5**
2	Proper Maintenance	**5**
2	Pull tab on flight suits to inflate vest. (Hard to locate + find too flat) Need a round ball that one can find with gloves on.	**5**
2	Quality of helicopters used	**5**
2	Ready status of SAR aircraft	**5**
2	Reliability fo S-92, Availability (Chopper break downs/faliures) chopper breakdown history	**5**
2	Reliability of aircraft	**5**
2	Reliability of choppers; availability	**5**
2	Remove auxillary fuel tank. In the even something may go wrong. 20 allows people an extra escape route.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Repair and maintenance of vehicles helicopter	**5**
2	Report to us (workers) each time there is soon. Issues with any helicopter.	**5**
2	Rescue ability	**5**
2	Rescue chopper	**5**
2	Rescue Helicopter	**5**
2	Rescue in case of ditching	**5**
2	Rescue response	**5**
2	Response time to an emergency	**5**
2	S 92 reliability	**5**
2	S+R availability	**5**
2	S-92	**5**
2	S-92 flight operations manual with regards to equipment alarms. I believe it has been changed for loss of oil pressure. What other alarm procedures shoule be reviewed?	**5**
2	S92 Helicopter	**5**
2	S-92 It was certified in the beginning because company said it was remote that oil loss would occue hence no dry run how that it has happened it was not remote yet the dept of transport has certified this helo to fly again so are they saying it is now remote again???	**5**
2	S92 mech troubles	**5**
2	Safety	**5**
2	Safety video should be for out bound and in bound passangers. Wo should not have to watch in bound when going out and not watch out bound when coming in. To long no one watchers after 5 min .	**5**
2	SAR capabilites + Availability	**5**
2	Sea conditions	**5**
2	Seach and rescue response	**5**
2	Search & Rescue	**5**
2	Search & Rescue	**5**
2	Search & Rescue	**5**
2	Search & Rescue response time	**5**
2	Search and Rescue	**5**
2	Search and rescue availability. It should be all hours that cougar flights are flying.	**5**
2	Seating arrangement large passengers jammed together rather than alternating larger and smaller passengers in seats	**5**
2	Should have a choice between helicopter or vessel.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Should have choice to travel by boat	**5**
2	Sitting next to people too fat to get out the window. Seriously people; get these unsafe people into a fitness program. They may require assistance to get fit again	**5**
2	Snow storms/ freezing rain	**5**
2	Standby chopper is not large enough to take a full complement of crash survivors on board	**5**
2	Stop seating 4 passengers across the back row of seats. It is not comfortable and does not provide proper erognomics, this can increase injury potential. It also makes it difficult to properly assume the crash position in an emergency (zippers, seatbelts, goggles etc.)Egress is impeded due to the congested nature of this seating arrangement	**5**
2	Successful ditch in water & escape	**5**
2	Suit issues -Everybody should have there own seats -Not enough info when chopper don't fly	**5**
2	Suit safety. Is it going to keep me afloat How much water will actually get in suit	**5**
2	suits	**5**
2	Suits - face seals *gloves - design and ability to donn them when your hands are wet	**5**
2	Suits need now standards and should all be custom fit	**5**
2	Survival suit	**5**
2	Survival suit ability to protect in cold water or event of a crash	**5**
2	Survival suits are very restrictive around neck. Would under ability for effective escape.	**5**
2	That information about the flight and chopper and weather conditions are being breifed before each flight.	**5**
2	The ability of fellow passengers to egress a helicopter. Over-weight and those in poor physical shape often fail egress manuvers during training	**5**
2	The Aux tank getting in the way of egress of a helicopter	**5**
2	The Aux. should be redesigned and put under the seats.	**5**
2	The competence of the other passengers in the helicopter	**5**
2	The fact that the same foot mounts seem to be the one that fails every time	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	The four seat arrangement in the back of the helicopter. I feel it would be impossible to escape an overturned helicopter from one of these seats the middle two. I have been traveling offshore now for eight years many trips I have to sit in this area. My posture as impeded blood flow to the point were I have to take off my seat belt to get blood flowing to my lower extremities	**5**
2	The Heubas came a little to late maybe. If HUEBA was available 2 years ago we might have had more one person survive the 491 incident. That's why we need to act now and give everyone a window seat to prevent or help prevent a fatality in case of a controlled landing. Give every one a window seat before it is too late	**5**
2	The HUEBA TRAINING. I just done my BST-R but had problems with the training. They would not give me my certificates, but I had the HUEBA training before, which is still certified by another institute. They are going to put me into a suit that is not marine certified, in which I will need for when I am in the sea, but will not pass me in my BST-R due to HUEBA training which I can only use when I am in the sea!	**5**
2	The HUEBA/BST training is with a one on one instructor and not a full chopper of passengers which is a more likely situation (ie. helicopter crash)	**5**
2	The not having an emergency response even since the Ocean Ranger Disaster	**5**
2	The number of maintenance/mechanical problems with the helicopter	**5**
2	The number of times that helicopters are out of service due to mainteance issues.	**5**
2	The ocean is cold!	**5**
2	The presence of the AUX tank in the passenger compartment. Sykorsky designed a helicopter with detatchable [UNREADABLE] fuel cells a cougar in their wisdom carries hundreds of litres of full inside the passenger compartment. NO STABILITY TESTING WAS DONE ON WATER!!	**5**
2	There are not enough helicopters. With all the glitches and shut-downs with these new sikorsky helicopters, combined with Grand Banks weather, there should be more helicopters serving the industry.	**5**
2	There seems to be a lot of turnover with pilots, I do not have a good felling about this. Seem to be a training ground for new pilots	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	There seems to be excessive vibration on these new helicopters compared to the older Super Pumas. If this is an inherent design flaw in these machines this was a probable cause in the breaking of the bolts on the oil filter and cracking now being caused in the feet mountings for the gear boxes. If these problems persit they should look at a different model helicopter	**5**
2	There should not be an auxiliary fuel tank inside the passanger compartment	**5**
2	These new suits that we use should be used on our sea dat. Not the red ones.	**5**
2	To many seats across the back of the helicopter. Should only be a maximun of 3.	**5**
2	To many seats in back row	**5**
2	Too many in back fow of helicopter	**5**
2	Training	**5**
2	Transparency of day-to-day incidents from installation to installation Re: Timely + Accurate sharing of incident reporting to work force.	**5**
2	Traveling when weather is questionable been on a lot that turned back or could not land	**5**
2	Trying to get out over an unconscious person on inside seat, I'm short	**5**
2	Uncomfortable and awkward suits	**5**
2	Unreliable flight line information	**5**
2	Vibration during flight. This does nothing for piece of mind	**5**
2	Vibration/safety of helicopters	**5**
2	Vibrations	**5**
2	We constantly fly in sea states that make rescue impossible. The helicopter cannot stay upwright our 4-5 meter sea-states or less. But we still fly over that height.	**5**
2	Weather	**5**
2	Weather	**5**
2	Well trained pilots	**5**
2	When company receive any safety alerts on those choppers they should be address. Promptly (Not given long term conditions to get repairs done) or to replace things	**5**
2	When experienceing technical problems the helicopter should fly low- just above the water	**5**
2	When something goes wrong need to know problems	**5**
2	Why choppers flights are cancelled due to "service" issues with no explaination	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Why do the mounting feet keep cracking. If a crack can be seen visually then it is too big of a crack. Do we have the best helicopters in the world are they as good as those used in the military?	**5**
2	Why do we fly in sea tataes higher then the helicopter can endure and stay upright if it were to land on the water	**5**
2	Will they get a controlled landing if ?Mokessay? And will I get out of the chopper. Even if you get out will you survive in cold water.	**5**
2	2. Seating arrangement (not ebing a ble to seat next to window sometimes)	**4**
2	4 seats in the rear of the hilicopter, the seats in the middle do not allow for good egress	**4**
2	4) Having to ditch	**4**
2	Ability to escape from a full (passenger) helicopter during an emergency situation -->especially if in isle seat -->lack of mobility with bulky suits and tightly packed passengers -->during training there are only two people in the HUET->each has a window seat	**4**
2	ability to exit submerged aircraft	**4**
2	Ability to fly in poor weather	**4**
2	Amount of people on the flights	**4**
2	aux fuel tank	**4**
2	Auxilliary fuel tank inside the cabin	**4**
2	Being unable to exit the helicopter after ditching, despite my training	**4**
2	Brace position does not protect the head and neck during impact	**4**
2	Breaking down	**4**
2	Choppers are always having trouble	**4**
2	Comfort	**4**
2	Ditching	**4**
2	Ditching capability of S-92 helicopter with current flotation package. Sea state 5 flotation is inadequate on many days. Need SS 6 flotation for winter flying	**4**
2	Employer doesn't seem sincere regarding using alternate means of transport	**4**
2	Excessive use of the same choppers	**4**
2	Fire while in the air	**4**
2	Flight crew obeying procedures	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Flight Delays	**4**
2	Flight info line not updated regular enough	**4**
2	Flight suit, need to be upgraded. The suit is very uncomfortable, hard to zip up, very stiff after zipping up for landing and tak off.	**4**
2	Flight suits safe to use	**4**
2	Flights in high winds above 60 knots	**4**
2	Flying after dark or low visibility	**4**
2	Flying in bad weather ie high winds	**4**
2	Flying in extreme weather conditions and wind	**4**
2	Fuel tank inside helicopter	**4**
2	Functionality of PLB	**4**
2	Fuselage inside cabin dangerous to personnel	**4**
2	Gearbox reliability	**4**
2	Having fuel tank inside	**4**
2	Helicopter Gearbox	**4**
2	Helicopter maintenance, this should be regular and warnings should not have a time limit on them. Eg repairs should be done right away and not in a number of hours	**4**
2	Helicopter not able to run 30 mins without gearbox Oil	**4**
2	Helicopter reliability	**4**
2	Helicopter Reliability	**4**
2	Helicopters seem to have a lot of down time due to mechanical problems	**4**
2	HUEBA more training	**4**
2	I wonder about the fuel tank inside the chopper	**4**
2	In cabin fuel tank. Its one more obsitcle to oversome when trying to escape. Again this is not included in the HUET training.	**4**
2	In the event of a ditch not being able to egress properly	**4**
2	Lack of flight information for arrivals to the platform	**4**
2	Lack of helicopter's, more maintenance, increase pressure to repair/etc, and push to put back into service	**4**
2	Lack of information by cougar. E.g. updating.	**4**
2	Lack of room on full flights	**4**
2	Lack of, or limited SAR capability	**4**
2	Looking for new job	**4**
2	Maintaining the helicopters Having confident and trained pilots an maintenance people	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Maintenance or component reliability (chopper in north sea has a main rotor failure)	**4**
2	Mechanical- I just don't like the "feel" of the S 9Too much vibration	**4**
2	messing around in fog	**4**
2	Moving in suits/ hard to move	**4**
2	My own abilites to respond to an emergency situation	**4**
2	Need auto hover on choppers. There is no night flight but if chopper is down in fog they wont say if they can rescue if no clear line of sight the chopper can not hover above	**4**
2	Night flying	**4**
2	Night flying capability	**4**
2	Nighttime flying	**4**
2	No 24/7 SAR in St. John's	**4**
2	No night flying (Delay in getting Mods done)	**4**
2	Noise levels while on route	**4**
2	Not enough information on the problems of the helicopter being presented in a timely matter	**4**
2	Not enough resources to get job done. Money seems to be problem here.	**4**
2	Offshore conditions, worst in world	**4**
2	Overcrowded helicopters	**4**
2	Phone lines not updated soon enough.	**4**
2	Pilot's qualifications	**4**
2	S92 (chopper)	**4**
2	Safety equipment (personal) used in transit by helicopter	**4**
2	SAR	**4**
2	SAR coverage/ response time	**4**
2	SAR response	**4**
2	Schedule efficiency	**4**
2	Search and Rescue capability	**4**
2	Search and rescue helicopter	**4**
2	Seating in back of air craft	**4**
2	Seating two passengers side by side should be single seating	**4**
2	Seems that almost every time you get on a helicopter there's a different pilot/co-pilot	**4**
2	suits	**4**
2	suits	**4**
2	Suits still uncomfortable	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Suits uncomfortable and at times it was very hot in them	**4**
2	Survival suit leakage When doing our BST, the suits we use for offshore are used in the pool, and our clothes are fully wet. When we use the marine institued suits for the sea day, we don't get wet at all!!	**4**
2	The auxillary fuel tank inside the helicoptor will impede passingers from exit	**4**
2	The extra fule tank in the cabin of the helicopter	**4**
2	The information being made available to passengers while flights are delayed or turned around is not thourough enough, causing stress on the passengers.	**4**
2	There should be seating arrangement for each flight. It may take some energy to determine who sits where.	**4**
2	Time for more engineering into gear boxes. I never heard tell of gear box toubles until we got these new choppers.	**4**
2	time of flights	**4**
2	Too many people on flights Aux tank	**4**
2	Training	**4**
2	Training which is given for helicopter travel is right, no need of risking anyone for further safety, when only the controlled landing is what we are trained for	**4**
2	Trouble hearing announcements during flight.	**4**
2	Updates on helicopter's issues	**4**
2	Using the Hueba	**4**
2	Wear and tear on chopper because of a lot of use	**4**
2	Weather	**4**
2	Weather delay is a big concern	**4**
2	When there is a problem during flight information should be passed on to the passengers	**4**
2	While cabin speaker system seems loud enough the clarity of the pilots voice is often of poor quality and difficult to understand.	**4**
2	With the old suits they were very uncomfortable	**4**
2	2. weather conditions	**3**
2	Adequate training	**3**
2	Alternate landing points pre built @ halfway points in ocean	**3**
2	Altitude of flights upto 1000 ft. I feel this could be much lower	**3**
2	Amount of down time	**3**
2	Aux fuel tank	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Aux tank	**3**
2	Bad weather such as fog, high winds, freezing rain	**3**
2	Cabin Comfort	**3**
2	Chances of getting out of helicopter if we crash	**3**
2	Crashing	**3**
2	Crashing without time to raise hood/ put on gloves	**3**
2	Delays due to weather	**3**
2	Distance of travel	**3**
2	Down arrow from the first box	**3**
2	Dry run time	**3**
2	Flight suits	**3**
2	Flying in unsuitable sea and wind conditions	**3**
2	Flying with a high # of passengers (ie 17)	**3**
2	Fuel tank	**3**
2	Full load of passengers during flight	**3**
2	Give passengers reasons for delays and mechanical troubles	**3**
2	Have rescue helicopter in addition to what is required to move personnel.	**3**
2	Heilo fuil tank	**3**
2	Helicopter operator are prompt in addressing service bulletin's from helicopter manufacturer	**3**
2	helicopter reliability	**3**
2	Help time	**3**
2	How capable the E45Z and HTSI suits are.	**3**
2	Human error	**3**
2	I think all choppers in this specific field should have a 30 minute dry run time!	**3**
2	Information concerning breakdowns	**3**
2	Is it necessary to fly so high	**3**
2	It is very hard to hear pilot announcements. In an emergency I would remove my hearing protection - if I had the time	**3**
2	Lack of all weater capability (for MEDEVAC as well as crew change)	**3**
2	Lack of information made available to travelers when helicop-ters are down for maintenance	**3**
2	Landing	**3**
2	Limitations of light requirements for flying ie :Dark, Fog	**3**
2	Maintaince	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Maintanance taking place. Why is there always choppers broken?	**3**
2	Maintenance	**3**
2	Maintenance issues & communication to passengers	**3**
2	Need more info on up dates for weather delays when stuck or delayed offshore.	**3**
2	New suite, watertightness in a ditching	**3**
2	No local search and rescue beyond what cougar provides	**3**
2	Not enough choppers to perform mantence and keep flights moving	**3**
2	old suite has a way stiff neck zipper seal but they are being replaced	**3**
2	Over 4SC	**3**
2	Overheating in my flight suit	**3**
2	People passing the training too easily- not having to complete all of the element of BST.	**3**
2	Pilot training issues	**3**
2	Remoteness of working locations vs SAR response	**3**
2	Resctrictions on flight. I would rather fly on a clean night then a foggy day. Please consider conditions, not just daylight.	**3**
2	S92	**3**
2	S92 Realibility	**3**
2	Suits are heavy and uncomfortable	**3**
2	There never on time	**3**
2	Time of rescue	**3**
2	Type of helicopter we are using	**3**
2	Use of HUEBA	**3**
2	Vibrations	**3**
2	Vibrations at times	**3**
2	Weather	**3**
2	Weather	**3**
2	Weather	**3**
2	Weather	**3**
2	Weather conditions	**3**
2	Weather Delays	**3**
2	Comfort	**2**
2	Ditching	**2**
2	Flight suit	**2**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Fog	**2**
2	Having to ditch	**2**
2	Hearing announcement by flight crew sometimes not heard due to noise of machine	**2**
2	If suits are good enough in the cold water. The yellow suits were not. Have those new one been tested	**2**
2	If the blades will let go	**2**
2	Is the type of Helicopter we use the best for the Job, or are we just stuck with these because of cost of replacement	**2**
2	Rescue procedures, how good are they	**2**
2	S92 [UNREADABLE]	**2**
2	Safety of choppers	**2**
2	SAR capabilities	**2**
2	Suits was a concern however, having been fitted with the new suits, this concern is gone away	**2**
2	There will be a suit trip injury at the heliport due to too many suits on floor. Consider adding hangers for waiting ppl.	**2**
2	Training-how often conducted (shorten length of time for refresher)	**2**
2	Underwater egress	**2**
2	Weather	**2**
2	?Most of the concerns rescues home nothing to do with the fly of the choppers and mostly of comfort.?	**1**
2	Any other mech failure	**1**
2	Breakdowns	**1**
2	Distance to + from rigs without alternate landing availability	**1**
2	Flight suits	**1**
2	Gas leak	**1**
2	Helicopter type	**1**
2	Horrendous survival suits-no availability, restricted vision. Boots to larde and high teip hazard offshore zips very stiff and difficult to close	**1**
2	Never get home on time	**1**
2	Pilot training and procedures	**1**
2	Rescue helecopter	**1**
2	Rescue time	**1**
2	search and rescue	**1**
2	Suits	**1**
2	Temperature during flights	**1**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Weather Delays	**1**
2	Will recommendations from the Wells Inquiry be implimented or will they be ignored like recommendations made after the Ocean Ranger diaster ie. 24 hr search & rescue in St. John's	**1**
2	Amount of pax	**0**
2	Aux fuel tank seats, IF exit is at all obscured then there shouldn't be a seat there	**0**
2	Fligh line not updated enough. The say every half hour but NEVER IS	**0**
2	Fuel tank in the cabin no padding in the back of the seats.	**0**
2	Fuel tank on board	**0**
2	helicopters down for maintenance a lot	**0**
2	If there is any safety concerns with the helicopter before flight time the passengers should be briefed	**0**
2	Proper rescue time & helicopter ready for fast rescue	**0**
2	Realistic training	**0**
2	Response time for rescue if needed too much time is wasted getting in the air.	**0**
2	Seat Belts are stiff difficult to adjust	**0**
2	Seats at the rear of the helicopter to crowded.	**0**
2	Standby chopper capable of rescuing all POB -Operators responsibility for cost of rescues -Number of people on choppers -Listen to front line workers, not office workers or lawyers -C-NLOPB should not regulate safety	**0**
2	Suits	**0**
2	There is a need for more helicopters	**0**
2	Too much vibration on S92 helicopters….makes for a nervous trip always	**0**
2	WHY THE CHOPPER HAS TO FLY SO HIGH	**0**
3	*Feet on the gearbox are continually cracking when is this going to fixed? * Oil pump splincs are not lasting long. Why?	**5**
3	3. keeping everyone safe	**5**
3	3. Time for reaction in case of Emergency	**5**
3	A lot of mechanical problems even when flights are on time usually breakdowns occur *More choppers	**5**
3	A lot of talk about flying at night. Seastate is concern. I have flown in days of clear weather + 8 meter sig seas. You do un-controlled landing in that and you are going under, not linking up, ant being rescued as a group or at all "Seastate"	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Aborted flight due to alarm should be treated as emergency and accompanied to shore by SAR.	**5**
3	Access to information	**5**
3	Aircraft should float	**5**
3	Aircrew emergency decision making and return for landing impossible, or unlikely, then risk ditching at risk of catastrophic failure? Decisions! Need to refer to the best in the business.	**5**
3	All mechanical issues too many issues and too long to get problems fix. No updates	**5**
3	All personal on board should have a window seat this will make it a lot better to get out. There are seats that I believe personel would not be able to escape from.	**5**
3	Amount of people on each flight and # of helicopters available. (Especially a search and rescue helicopter on standy at all times)	**5**
3	Aux Fuel tank	**5**
3	Aux fuel tank in helicopter	**5**
3	Aux fuel tank in Pax cabin	**5**
3	Auxilary fuel tank should not be in chopper Restricts access	**5**
3	auxillary fuel tank in cabin	**5**
3	Auxillary tank in cabin-impairs egress, limits utilization of exits and is a potential risk of fire.	**5**
3	Business before people. Should be people before business	**5**
3	Capability of airframe to remain intact and floating	**5**
3	Cash while landing on rig	**5**
3	Communication from courgar on shearing info with installations. This seems to be non-existent. Very poor.	**5**
3	Confidence in the S-92	**5**
3	Cougar employees, flight co-ordinator unavailable for questions related to up-coming flight schedule	**5**
3	Cracks in mounting feet of transmission. No clue as to what is causing it but still we fly. Doesn't make sense. I feel information is being kept away from workers. Manufacturer cannot be trusted. They look after their own interest.	**5**
3	Cracks in the gear box/feet	**5**
3	Didching prosegers	**5**
3	Does the pilot feel he is a hero?	**5**
3	Double Seating	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Each passenger needs to have a window seat or unrestricted access to escape	**5**
3	Electrical issues	**5**
3	Emergency response	**5**
3	Emergency response time	**5**
3	Engineering problem with Gearbox related issues on the S92	**5**
3	Every passenger should be seated onside window to improve chances of escape. No fuel tank.	**5**
3	Everybody needs their own window	**5**
3	Everyone needs there own window	**5**
3	Extra Fuel tank onboard	**5**
3	Flight procedures in the event of an emergency	**5**
3	flight suits	**5**
3	Flight suits	**5**
3	Flotation after landing on water	**5**
3	Flying during windy or snowy conditions. Last ?taip? In the helicopter was all white with snow and about 10 people were looking out cougar office windows at up land	**5**
3	Flying in bad weather/ sea state conditions	**5**
3	Flying in extreme weather conditions. Wind	**5**
3	Flying in low fog -There should be no night time flying	**5**
3	Flying in low visibility at night. If we go down. How are they going ot find us? They can't see anything. I disagree with flying in low vis + @ night. WE ARE DEAD!	**5**
3	Flying in the high seas and cold winter conditions with these suits (are they warm enough to keep you from freezing.	**5**
3	Flying when sea states are border line.	**5**
3	Flying without proper and new flotation system installed	**5**
3	Frequency of other issues with S92's such as cracked trans-mission mounts, chip light, engine failurs, vibration, etc. I realize that chopper are high maintenance but the S92 seems to have excessively high failures.	**5**
3	Fuel tank- AUX	**5**
3	Fuel tank inside cabin. Stability issues should the chopper land on water.	**5**
3	Fuel tank inside helicopter	**5**
3	Fuel tank inside helicopter	**5**
3	Fuel tank inside helicopter with passengers	**5**
3	Fuel tank inside.	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Fuel tanks on board.	**5**
3	Gear Box	**5**
3	Gear box assembly!! Guess no need to elaborate on this	**5**
3	Gear boxes foot pads and assembly	**5**
3	Gearbox concerns	**5**
3	Gearbox issues	**5**
3	Gearbox, not much has been done to make me feel that it is now safe to fly. Cracking in the feet and oil filter bolt still concern me. The way the oil returns to the gearbox is on the outside. Still depends on these three bolts.	**5**
3	good survival training - (practice makes perfect)	**5**
3	Having a fuel tank in the passanger cabin	**5**
3	Having adedicated rescue Helicopter that doesn't affect the ability of cougar to privide transportaiton services.	**5**
3	Having to get on helicopter wether you feel safe or not. If you ask questions @ cougar you risk loseing your job. They will complain to operator to do everything possible to get you fired. This has happened in the past.	**5**
3	Helicopter rescue - SAR ability	**5**
3	Helicopter S92	**5**
3	Helicopter seating arrangements with respect to internal aux fuel tank. If it is necessary to utilize aux tanks the the aircraft design is not up to the environment	**5**
3	HEUBA was a concern, very important improvement	**5**
3	How experienced the pilots are	**5**
3	I am not convinced the S-92 is the right machine for the role. It's all about money and behind the scenes deals and not worker safety	**5**
3	I believe that the Aux fuel tank has to be removed or people with die tring to escape through a window that will be blocked by this death trap. * Please have them take this out of the helicopter if its required locate it outside the aircraft.	**5**
3	I don't believe we should be traveling in darkness hours.	**5**
3	I have had a conversation with one of the main Cougar personnell and he assured me that they will not fly a helicopter unless they are 100% safe to fly. And I 100% believe him. I just think there is a design problem of the S92 filter bowl assembly. And it plays on my mind often during my flight to and form the instillation	**5**
3	I think that we should do a sea day in the flight suit. I am not confident that it will keep me warm in the water	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	I think the CNOPB, should have a good house cleaning, a lot of people are company breed. Whatever company wants they get, CNOPB just rubble stamps it	**5**
3	If an emergency arises how quick will we receive rescue	**5**
3	Imersion suit very bulky. Cannot properly move when zipped up.	**5**
3	In the even that a flight do go down, weather conditions should be able to permit a rescue	**5**
3	Inadequate training for HUET	**5**
3	Inexperience of some pilots	**5**
3	Is it necessary to have the auxillary fuel tank in the helicopter. Maybe they should rethink another place to store fule. The Puema helicopters never had them.	**5**
3	Know cougar's protocall on when an emergency come's up will they try and make land or wil lthey ditch in the ocean, and give us a chance to use our training!	**5**
3	lack of communication globally about maint. Issues on the sikorskies	**5**
3	Lack of information during delays on cancellations -->helicopters are often delayed/cancelled -->reasons why one not typically obvious and are usually found out through rumors	**5**
3	Lack of on-station/at ready SAR helicopters in St. Johns	**5**
3	Lack of resources	**5**
3	Learning survival suits	**5**
3	Making changes to safety equipment in more timely manner	**5**
3	More helicopters that work good	**5**
3	New aircraft	**5**
3	Night flights even with auto hover equipped helicopters	**5**
3	Night flights- SAR coverage at night/ weather + opportunites for rescue	**5**
3	Night flying	**5**
3	NO fuel tank in chopper	**5**
3	No fuel tank in chopper cabin Search & rescue should be cormorants	**5**
3	No fuel tank in passenger cabin	**5**
3	Not crashing	**5**
3	Not enough choppers	**5**
3	Not enough choppers.	**5**
3	Not enough communication between onshore operations and offshore operations	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Not enough cougar staff at heliport.	**5**
3	Not enough to do the Job	**5**
3	Not everyone has a window seat. Therefore I have to depend on someone else for my safety, exit from the aircraft, if I am sitting in an isle seat. Get rid of the internal fuel tank and winodw seats for everyone.	**5**
3	Offshore safety You can bring offshore safety to OH&S but even then management will still put it under the carpet!	**5**
3	Oil filter assembly	**5**
3	Ongoing gearbox problems with the S-92	**5**
3	over crowding on flights	**5**
3	Over dloade flights, small seats passengers are not skinny paople any more. I feel cramped up like I am in sardine can.	**5**
3	Overall reliability of S92. Gearbox feet cracking but still in use. Very high level of downtime due to maintenace issues. Shout not be using helicopter until issues such as the gearbox cracking are completely resolved- no rundry time for gearbox.	**5**
3	Overloading helicopter with equipment. (for use at work) Supply boats are for that.	**5**
3	Pilot decision making. They need to know what to do, its their call when something goes wrong. Not the passengers.	**5**
3	Pressure of auxillary fuel tank in passenger cabin. Increaded fire risk in the even of crash ofr ditching and comproming emergency egress in a fully loaded helicopter.	**5**
3	Proper saftey & survival gear	**5**
3	Removal of the rear seat on the helicopter should be done immediately.There is not enough room in this seat and if a ditching was to happen you would be stuck there till the people around you got out which may be too late. (not comfortable).	**5**
3	Remove the responsibility of safety from TIAE C-NLOPB. There is a serious conflict!!!	**5**
3	Replace the S92	**5**
3	Rescue availability	**5**
3	Rescue in heavy seas	**5**
3	Rescue Operation FASTER	**5**
3	Rescue Response time	**5**
3	Results of inq+ other will be swept under carpet just like ovean ranger-already as of this date “closed door” sessions taking place out of public eye	**5**
3	S-92	**5**
3	Safety	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Safety video needs revamping and get in line with other areas	**5**
3	SAR capability	**5**
3	Search + Rescue capabilities- too long- wheels away	**5**
3	Search and Rescue response time	**5**
3	Search and rescue should compare cormdrants vs. S92. If a stand by SAR chopper is availabe it should have full capabilities of reciving everybody, not just a couple. At a time	**5**
3	seats are not large enough to seat travellign often cramping the helicopter. Seat belts do not fit passengers	**5**
3	Seats on chopper don't seem solid enough to withstand any impact	**5**
3	Serse and Resue should be in St. John's 20 min wheels up.	**5**
3	Something wrong with the chopper that's not picked upon	**5**
3	Structural integrity	**5**
3	Suit comfort	**5**
3	Suit doesn't fit	**5**
3	suit not giving appropriate protection in cold water	**5**
3	Suits are a joke. During training on sea days/and pool exercises become completely filled with water. If this occurs in Jan, Feb, and March when sea temps are between -2 and +2° C your survival chances are slim to none	**5**
3	Suits did not fit properly, neck and wrist seals	**5**
3	Survival suit gloves will be ineffective in an acutal emergency	**5**
3	Survival suit. Not a good suit. Trouble with sizing. Neck seal not good to stiff on neck. Need new suits ASAP	**5**
3	Survive time in water	**5**
3	Survivial suits	**5**
3	Surviving in water	**5**
3	The always changing weather conditions	**5**
3	The auxiliary tank	**5**
3	The big risk to get people to platforms when there are backlogs. It seems that the oil companies do what suits them best and personnel are herded like cattle to get caught up or delays. I think this turnaround system comprimises the right maintenance of helicopter	**5**
3	The four seats in the back makes it very hard or makes people unable to get ready for a decting	**5**
3	The helicopter model being used has to date proven itself to be an unreliable source of transportation	**5**
3	The helicopter not equiped with dry run capability	**5**
3	The length of time it took to replace the suits	**5**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	The mechs. Who work on the helo should have to ride on the every day. Save a seat for them and no the same seat. Ive flown military helos all over the world and have more faith in them, then did ever have on the ones we fly on. If the military work on them they fly on them !	**5**
3	The number of chopper issues which make the helicopter unuseable	**5**
3	The quality and reliability of choppers	**5**
3	The response time of emergency services	**5**
3	The windows in cabins are too high for short people	**5**
3	To many people on one flight.	**5**
3	Training for HUET	**5**
3	Training in emergency procedures	**5**
3	Travelling during bad weather	**5**
3	Unfit (physically) people. There are people who can't and don't complete parts of their BST. I know at least 8 on [RIG NAME] that would not dit through the window, they are just another hazard in an emergency situation. If you can't complete training, for military, fireman, etc you don't pass, why do they pass offshore?	**5**
3	Wave height	**5**
3	Why does the gearbox continue to crack	**5**
3	Why not boat transfer???	**5**
3	Why, if the choppers do not meet the 30 minute dry run time, are they still permitted to fly	**5**
3	Will I be able to escape the helicopter with all the passengers kicking & screaming	**5**
3	Amount of downtime of helicopters due to mech. Problems	**4**
3	Aux tak. (NO training in Huet with a tanks.	**4**
3	Aux tanks	**4**
3	Auxiallary fuel tank inside cabin	**4**
3	Availability of SAR helicopter to be deployed wheels-up in 15 minutes	**4**
3	Back role of seating should be taken out	**4**
3	Comfort during flight	**4**
3	Crew experience	**4**
3	Current suit E452 is cumbersome, uncomfotable, and may not fit the same from one use to the next.	**4**
3	Ditching procedure	**4**
3	Ditching procedure	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Escape Route- wheere in chopper I am sitting and my nearest escape route, who is sitting by me and if that person poses an obstacle.	**4**
3	Fautly foot pads on the Gearbox assembly. Repairs should be made immediately to all units. Daily/ per flight inspections just aren't satisfactory. Flight 491 went down because it was believed that time was on theirside-It wasn't! If there's a problem fix it!	**4**
3	Flight suits	**4**
3	Flight suits still have room for improvement.	**4**
3	Flights taking place in less than ideal weather conditions. Ie landing in fog/poor visability, flying in less than survivvable sea conditions, etc.)	**4**
3	Flying after dark in addverse conditions	**4**
3	Flying in darkness/at night	**4**
3	Flying suits leaking water, and not being able to use them in open water in trainning	**4**
3	Fule tank making it more difficult to egress from helicopter	**4**
3	Gear Box mounting feet cracks	**4**
3	Helicopter escape training. Not sufficient when it comes to HUEBA usage.	**4**
3	Helicopter Maintenance	**4**
3	Helicopter reliability	**4**
3	Helicopter vibration	**4**
3	Helicopter vibration	**4**
3	How families feel about their loved ones travelling offshore and the added stress this places on the ofshore worker	**4**
3	If SAR operations are adequate	**4**
3	If the suits will allow for how long they say for survival	**4**
3	Insufficient amount of servicable aircraft.	**4**
3	Is 6000ft fly alt. low enough to make rapid decent for ditch	**4**
3	Knowing that the offshore industry does not require a full time SAR standbye helicopter is a concern. If this is a requirement elsewhere and has proven to be effective, then it should become a requirement here.	**4**
3	Lack of communication about helicopter maintenances issues	**4**
3	Lack of helicoptors available and where is the SAR helicopter	**4**
3	Lack of info on flight in advance of ?dravor? Many flights we wait for flight to go and receive little or no info.	**4**
3	Lack of rescue in St. Johns	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Lack of search and rescue and response time. Being rescued in sufficent time in the event of an emergency.	**4**
3	Lack of standby chopper and lack of choppers to cater to the offshore.	**4**
3	Low vis flights	**4**
3	Main gear box failure	**4**
3	maintenance	**4**
3	Maintenance 4. Fuel tank on board chopper	**4**
3	Mechanical issues (filter how assembly etc.) with sikorsky- (spelling) Helicopter	**4**
3	More single seats	**4**
3	Never know what the status of the helicopters are, especially mechanically and the update line	**4**
3	New suits. Are they as good as old ones, or are they better	**4**
3	Night flights. Not sure this is a great idea.	**4**
3	Night flying	**4**
3	Night flying and flying with GPS. In this age of technology why are still relying on manual/ visual flying when approaching platform.	**4**
3	NO reasoning for delays	**4**
3	Not enough	**4**
3	Often flight announcements are very loud	**4**
3	One turnaround trip per day (boomerang) One trip places a lot of stress on a person. What happen to 491 never leaves your mind.	**4**
3	Overloading - I know they have limits but sometimes I feel that the load is too much when weather is also a factor	**4**
3	Pilot stress levels	**4**
3	Pilot training	**4**
3	Poorly fitting survival suits	**4**
3	Reliability of S92	**4**
3	Reliability of the S-92 helicopter and how Sikorsky deals with faults that are found	**4**
3	Rescue response time	**4**
3	Rescue time if the chopper happens to ditch in the ocean	**4**
3	S.A.R. capibility	**4**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	S-92 reliability, these helicopters seem to spend more time down for maintenance than in the air flying. And the passengers never know, or have no avenue of finding out what is wrong or went wrong with the helicopter they were supposed to fly on	**4**
3	Seems the S92's always having problems and the cracked foot issues not having solved and we are still flying in them?	**4**
3	Should have appropriate equipment for night flying	**4**
3	Some window seats where half the seats is centre of window would make hard to escape	**4**
3	Suits that are worn on chopper very bulky and concerde if have to exit.	**4**
3	The flight suits are the worst thing every.	**4**
3	The return of night flights. We want to get off work also!	**4**
3	To much of a turn over of pilots	**4**
3	Training. We don't train on the machines we use or in the conditions we fly in, nor do we train with fuel tanks, 6 people crammed together	**4**
3	unable to hear announcements	**4**
3	Valcro on glove on flight suit. (Can not remove glove for the top on the straps are too long. (Need to cut off excess of creat a pull tab.	**4**
3	Vessel transfer availability. Crew boats should be a viable option. Boats suitable for personnel only should be used. More vessels could be used to streamline transfers. Boats are cheaper than choppers	**4**
3	Weather	**4**
3	What about the 30 minute drytime for the gearbox, is this being addressed to the satisfactory of all users including the US and canadian forces?	**4**
3	Windows in helicopter not large enough for underwater escpae. I'm 220 lbs.	**4**
3	With helicopter mech systems experience issues, lack of info to passengers	**4**
3	# of choppers available - i.e. small # of choppers = lots of flying time per chopper	**3**
3	Comfort because of long flights	**3**
3	Communication & clear announcements	**3**
3	Effect of Weather exposure	**3**
3	Evacuation from helicopter with type of survival suit being used.	**3**
3	Flight suit issues	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Frequent cancellations due to maintainence quite frustrating	**3**
3	Fuel tank in passenger cabin and the effet it will play in egress of the helicopter in case of an emergency.	**3**
3	helicopter buoyancy?	**3**
3	Helicopter mechanical failures	**3**
3	How can a fuel tank fitted inside a helicopter's passenger area meet regulation? I have grave concerns about this modification.	**3**
3	I believe that every passenger should have a window seat, although this way be hard to achieve, it would make everyone feel that they have a chance to survive if chopper goes in the water	**3**
3	If choppers can't fly have a crew change boat built with a helideck. They could refuel helicopters along route to increase payload and handles mass cargo. Many times flights overshoot and return.	**3**
3	Inadiquate training -I feel that 3 years in between refresher is too long -I feel that the HEUT does not adiquitly represent the S-92 helicopter -Training does not provide any practical on opening any of the exits -Training does not adress the very real possibility of ditching on ice	**3**
3	Information on cancelled flights	**3**
3	lack of number of helicopters to service the installations	**3**
3	Location of seats on chopper	**3**
3	No info about the choppers	**3**
3	Not very much seat space for individuals	**3**
3	PIB's not working	**3**
3	Position of aux fuel tank - 3 single seats next to escape windows are lost with aux tank on starboard side	**3**
3	Regular maintenance on helicopters	**3**
3	Safety training	**3**
3	Scuba gogles are cheap and low quality	**3**
3	Suits - the suits need to be fitted properly	**3**
3	suits (just fitted for new suit-should be a lot better!)	**3**
3	The number of passengers should not exceed sitting single file. Two abreast should never be. One exit a window emergency exit per passenger. Fuel Tank should never be in cabin of helicopter.	**3**
3	There should be less flight per person per year through job sharing or 2 weeks on and 4 weeks off rotation	**3**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Time of travel	**3**
3	weather	**3**
3	Weather conditions for travel	**3**
3	A meal before flying if held at heliport more than 2 hours	**2**
3	Fire	**2**
3	Frequency	**2**
3	Helicopter layout	**2**
3	Immersion suit standard	**2**
3	Level of comfort	**2**
3	Not enough helicopters in case one breaks down + be able to fly at night	**2**
3	Passanger Weight	**2**
3	Seating arrangement	**2**
3	Survival suits	**2**
3	The harsh environment	**2**
3	The level of comfort of passengers while travelling offshore/ onshore	**2**
3	Travelling over water for long distances	**2**
3	Will there be a leak again	**2**
3	Aux fuel tank in passenger cabin	**1**
3	Listen to the concerns of people quicker I brought up the idea of heuba in 1998 and it was said that the idea came up in 2000 (not true)	**1**
3	Not enough machines to fill the work load for offshore transportation, machines overworked compare to 1997 with only Hibernia on the grand backs. Now more operators with the same amount of machines	**1**
3	Passenger training	**1**
3	Seating on chippers, too many people on choppers. Everyone need a window seat or exit door to sit by.	**1**
3	Suits	**1**
3	Vibration on helicopters	**1**
3	We need the extra fuel tank removed so passengers can access the window on that side of the helicopter easier for an escape route. Sometimes there might be a need to use a seat to aid in escaping	**1**
3	4 seats in the back, shouel be 5 and they should try and sit people so that everyone' comfortable.	**0**
3	Biggest concern for me regarding safety on chopper is : how much can people in authority get safety issues pasted just to accomedate procedures?	**0**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Boots on flight suits too big and bulky….may effect escpae from small windows for S92	**0**
3	BST is not hard enough. Should be some harder conditions while doin pool excercises.	**0**
3	CHOICE OF CHOPPER OR BOAT	**0**
3	Concerned about flying in high seas, when rescue it limited. Concerned about rescue capabilities	**0**
3	Evacuation from chopper with the type of survival suit	**0**
3	Flying these helicopters after dark greatly reduces your survival and rescue chances	**0**
3	Helicopter reliability	**0**
3	How tired are people when they get off helicopter	**0**
3	I don't field that replacing the bolts in the chopper has elmited the stresses that caused the problem in the first place. I field the stresses are still there!	**0**
3	I never want to fly at night again or in 6 or 7 metter seas because the floatation capability is only rated for 5 meters	**0**
3	Mandatory explanation why choppers are delayed or broke down -The operators are planning on returning to night flights & low visibility flights when inquiry is over, what is the the pupose of inquiry	**0**
3	People dime their cares on the ? With more deficency than the "O" tolerance on the choppers ?	**0**
3	S.A.R. chopper should be on standby 24/7 with wheels up time of 15 min or less	**0**
3	Seat belts you cannot tighten around your waist	**0**
3	Suits	**0**
3	Suits are cumbersome and ill fitting	**0**
3	The amount of delays and chopper availabiltiy	**0**
3	The history of the S-92s maintanence/break downs is questionable at best. They should have a second look at the quality of the S-92 and consider upgrading to something more reliable	**0**
3	There aren't any more, really what it all comes down to is at the end of the day no matter where we are or what we are all doing. Us as working people all over the world we are in God's hands. I think everyone is doing the best they can to make sure that this and other incidents are prevented	**0**
3	Too long of distance without anywhere to land between heliport and vessel	**0**
3	Traveling in reduce vis 1/2 Nm (rescue)	**0**

APPENDIX D: QUESTION 35 RESPONSES

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	Weather, helicopters should not take any chances on weather or sea state, if it is not good enough outside, the helicopter don't fly	**0**
3	When there is a known problem such as what happened on March 12/2009. that could have catastrophic results, helicopters should be grounded immediately until problem is rectified.	**0**
3	With tank in chopper will it imped us from getting out on that side.	**0**
3	Withdrawing night flights when conditions during day can equally be as bad. Night flights are operated to smooth operaters and require issues addressed to make operated.	**0**
3	Workers having to stay back offshore, fatigue, when the their time is up 21 ?down?	**0**

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	*An extra chopper to ensure a better chance of performing maintenance on rest of fleet (Pressure to get choppers in the air less)
3	*Dedicated chopper + crew at the ready for emergency situations with all the proper gear that's needed.
2	>Have choice of boat transfer
1	1 extra heuba bottle for a designated passenger to use as "the last man out as stated in my attached letter. A lot of us are trained scuba divers and I know that we would all volunteer to sit in the middle seat in the back to make sure every-one is out of a submerged helicopter before we leave
2	1 person 1 seat no doubling up
1	1 seat removed from the rear. To allow more moveability and esy of donning sutis. Hpods.
1	1. better suits 2. more flotation 3. no fuel tanks 4. better training (BST)
1	1. Upgrade the gearbox to one that actuall runs "dry" for the 30 min standard. Also improve the overall "mechanical" availabilty of the helicopter. There are time when the machine in not available for use over 50% of the time-Nobody would own a private vehicle and feel safe using it if it were broke down as often as the S-92, Pilots must be aware of what the machine is capable of in all Emergency situations.
1	1/2 hour dry run time
3	10-15 min response time for SAR rescue. Thank you!
2	2) Better, more comfortable suits
2	24 Hour dedicated SAR for offshore facilitices. It should be mandatory for the amount of work now, and upcoming offshore in the future.
2	24 hour SAR with 15 minutes wheels up time.
1	24 hr facility occupation in Gander. That would eliminate the time it takes to get to the search and rescue center
2	24 hr search & rescue in St. John's
2	24 hr search & rescue in St. John's
1	24 hr Search & Rescue with a max of 15 min wheels up time. Should have a dedicated airframe for Search & Rescue in all weather conditions.
3	24 hr search and rescue at Cougar. The federal governemnt give Cougar a contract to this work.
1	24 hrs rescue
3	24/7 rese and rescue in St. John's. No fuel tank inside choppers Everyone weeds and window seat.
1	24/7 SAR base in St. John's
1	24/7 search and rescue with 30 min wheels up

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	25h serch and rescue.
1	30 min D.R.T. like Canadian military version of S92 was fitted with
2	30 min dry run proven.
1	30 min dry run time on choppers if that means new choppers then SO. Money is no object when it comes to safty
1	30 minute dry run capability! A cannister type of container, for the aging population, instead of bags to possibly use when we have to pee! (when ex; a boomerang flight!)
2	30 minute dry run time for the S 92
2	4 seats in rear of helicopter removed. At least two of them.
2	7/7 days a week flights
1	a 24-7 search and recue chopper available in St. Johns year round
3	A change in rotational schedules from 3 and 3 to a similar system as in Norway that has 2 weeks on the rig and 4 weeks off can reduce the risk to the individual.
1	A dedacted search and rescue helicopter
3	A dedicated emergency helicopter on standby anytime there is a helicopter in the air. Ready to go in few minutes with a fully trained search and rescue crew.
2	A dedicated helicopter in place for 24/7 search and rescue, with 15-20 minutes wheels up capability
2	A dedicated rescue helicopter
2	A dedicated search + rescue chopper not a “crew chopper” making workers late to get home.
2	a dedicated search and rescue helicopter
1	A different type helicopter
1	A different type of helicopter to be used offshore here
2	A dry run capability for hilicopter with a btter warning systems oil circulation and lost of oil.
3	A extra helicopter
1	A family member travelled to rig on a S-92 down in the gulf and on every flight he was on, there was a mechanic/flight enginer flying with them monitoring the helicopter in the air with his laptop
1	A full time emergency response available in St. Johns
1	A heavier and thicker gearbox housing installed. The we wouldn’t have to wonder if its going to crack again. If this cracks its cracking in the air no on the ground.
2	A more dependable helicopter
2	A more harder corse to get better training and if personal don’t’ pass you don’t’ go offshore find a nother job.
3	A new type gearbox that has been tested and proven in the offshore industry
3	A new type of helicopter or more helicopters so there is less flight hours on each helicopters

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	A newer safer chopper
3	A real choice of mean of transportation (more boats)
3	Ability to fly after dark
2	Access to helicopter maintenance records
2	Act faster for safety comments submitted
2	Actual suits should be used in the BST training that tests ability. The type of suits that people are fitted for should be the ones used.
2	Add a bit to the fleet of choppers.
2	Additional aircraft
2	Additional Airframes where possible
2	Additional bed spaces on boats if needed
1	Additional choppers
1	Additional helicopters to ensure adequate time for maintenance of other helicopters
1	Additonal aircraft
1	Adequate floatation on helicopter for our sea states, in case of emergency landing
2	Aditional helecopter to allow more time for scheduled maint. Thus reducing delays
2	Again people too unfit. They are a risk to themselves and others. Lets help these people get fit with whatever support is needed
1	All grounded
3	All new aircraft go through getting the bugs worked out of them. It takes time to be proven to be reliable and dependable. Being reliable and dependable does not come from an engineers design on what company personnel state. Aircraft shoule have at least 5000 hrs. flying time and be proven reliable before ebing stationed to fly over cold ocean water on a daily basis.
3	All personnel to be fitted sonner not later with the new suits, giving more manuverability in the head section of the suit
1	All personnell should be transported by boat.
1	All single seating
2	All single seating near windows
2	Alternate landing pads built on water
3	Alternate location for the interior fuel tank, you are sitting on a bomb while flying, this should not be, the helicopters need updating by all means so does the system
1	Alternate means of transport to/from offshore
3	Alternate means of travel for workers
3	Alternate method of transportation. Larger vessel to do more movement of POB at one time rather than multiple flights or other type of transportation.
1	Alternate transportation options/choices

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Alternate transportation…vessels
2	Although Aux tank is not a big concern to me. I would prefer to see it gone.
3	Always have a search and rescue helicopter waiting for immediate response in the case of emergency.
1	An improvement in communication on flight turnarounds. It is getting better, but also room for improvement
3	An independent safety, board tryely looking after the people who's lives are at risk.
3	An open to all public emergency management system, to seach on and to participate on ?
2	Announcement are hard to hear use electronic head phones.
2	Announcements on the chopper when in flight are most times misunderstood when we had the pumas the headsets had the announcements through an could be understood clearly
2	Any alerts with choppers be made aware to safety committees offshore.
1	Any concerns expressed by workers should be addressed
2	arrange people according to size for seating
2	Arrange seating so that everyone sits next to a window.
2	As a worker safety rep for almost 7 yrs I feel looked down on by my managers for bringing up contraversal issues when I don't accept their first explaination and I dig in and take a stand to push for a better answer or explaination I feel as a safety rep you could easily commit carrer suicide for pushing the envelope and I have actually been told by some supervisors that there are other supervisors that will get even with me when they get the opportunity. I feel that if it were not for the protection I get for being a safety rep and also for the union, that my job would be very much in jeporady.
1	As long as the Improvement are cautiosly being imporved this mode of trans is safer than driving are vehicle on the road.
1	As worker's we should be made aware of any concerns found in Routine matieanince
3	assembly should be mounted at a bottom location, not on a side location
1	Assign seats based on sizes of passengers
2	Assigned seating, depending weight/height.
2	Assistance or check by crew after donning suit to assure proper seal.
1	Assortment of survival suits. Mandatory warm clothing be worn inside the suit.
1	At least 1 additional aircraft for backup
2	At least 2 alternate or emergency landing pads should be between St. John's and the closest rig. 300 km is too far to go between places to land for this shor hand helicopter.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	at least an extra chopper to be available for more passengers to arive and depart. Suits have been modified so that's a bonus and extra training has been included
1	Auto hover
2	Auto hover
2	Auto hover capabilities ASAP. We need to be able to be found or rescued at night and in poor visibility
2	Aux fuel tank
1	Aux fuel tank removed from inside chopper.
2	Aux tank shouldn't be required if you travel with less people. If you have to have it, it wouln't be an issue if you had single file people on both side. NO need for someone to go over tank. (an illustration included with the single seating in helo as well as place for aux tank)
1	Aux tanks removed
1	Aux. fuel tank removed
1	Auxiliary fuel tank relocated outside
2	Auxillary fuel tanks.
1	Availability of thermal undersuits. As worn by divers in a dry suit, the cabin temp in chopper would have to be lowered but survivability would be increased
3	availabilty for parts quicker.
3	Be able to fly at night
2	Be able to pop out of the windows in the s92 chopper. The ones in Dunker are not the same.
1	Be more up to date on all helicopter down time
2	Betta training
1	Better (UK style) suits
1	Better aircraft needed
3	Better benefits for family members when & if something may happen going to or when your offshore
1	Better communication- be more open
2	Better communication between Cougar and offshore workers
3	Better communication for travellers, let us know what's going on
2	Better communication from the flight crew in flight. Still can't hear all announcement's.
2	Better communication of break downs to worker. What caused the helicopter to be removed from service. This should be communicated in a timely manner
1	Better communication, new fuel tank, no aux tanks
1	Better communications from Cougar to the passengers right across the board
1	Better communications to workers regarding problems and issues

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Better com's
3	Better comunication between cooger and workers. Flying in weather conditions like fog and high wind, sea states is not sure as long as this is happening workers don't feel safe
1	Better confidence - flying - its great that they communicate anytime there are issues and how they are resolving but would feel better if there were not so many issues
1	Better explanation of mech. Problems with choppers
2	Better face seal.
2	Better fitting suits
2	Better fitting suits
1	Better flight suits
3	Better flight suits
1	Better flight suits improving water tight integrity.
1	Better flotation on helicopter -Peoples concerns made more important -Chance to go by boat if could -More analysis needs to be done on the oil companies themselves and C-NLOPB should be split into two compartments so a safety division can monitor the oil companies
2	Better flotation package on helicopter at earliest opportunity.
2	Better gearbox design
3	Better gearbox system
2	Better helicopter with actual 30 min dry run time
1	Better helicopters
1	Better helicopters requiring less down time.
2	Better helicopters. It is onw thing to fly 30 miles over water another to fly 180 or twice that in case of no laundry. Need a helicopter that has better dry run etc.
1	Better HUET training and more often every 2 years
1	Better information on breakdowns
1	Better information on maintenance for the helicopters.
1	Better line of helicopters. Flying at a lower altitude doesn't make it any safer in an emergency landing
1	Better maintaineance
3	Better organization by cougar and available information accessable to the workers.
1	Better organization in helo getting in on time
3	better organization with the tele service when we call to know flight details
2	Better orgization with flights
1	Better P.A. system in chopper or go back to old head sets

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Better public passenger and helicopter transportation. Communication to create a better service for all concern.
3	Better quality choppers
2	Better reporting on helecopter issues
1	Better SAR capability
1	better SAR response
2	Better sealig flight suits that are more comfortable to wear
2	Better search & rescue services
2	Better search + Rescue
2	better search and rescue
1	Better seating/ less congestion
2	Better seats
3	Better speaker system or headsets with coms with pilots
1	Better suits
1	Better suits
1	Better suits
1	Better suits
1	Better suits
1	Better suits
2	better suits
1	Better suits even above and beyond HTS1 helmets in corporated with suits
2	better suits, bigger exits
2	Better suits, which I think is ongoing.
1	Better suits. Was just fitted w/ new suits and it appears OK. I like them.
1	Better survival gear
1	Better survival suits
2	better testing of suites
2	Better training
2	Better training
1	Better training for emergency situations
1	Better training-HUEBA used in HUET training
2	Better understanding of helicopter capabilities ie. 30 minute dry flying time cracked feet in gearbox mount
1	Better updates on issues/problems with the S92
3	Better updates -more helicopters not enough for the work -They are over worked -Make them spend the millions they are making

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Better uptime
2	Better weather limitations
2	Better weather observations, not flying in suspect conditions!
2	Bettter immersion suits
1	Bigger + more comfortable
1	Bigger escape windows
2	bigger float
1	Boat
2	Boat
3	Boat
2	Boat travel is safer. Give me a choice.
1	Bring back night flights for clean nights
2	Bring good head sets so pilots communication with personnell/passengers is better
1	Bring in additional aircraft by current, operator-cougar-or-bring in some competition I.E. another helicopter operator.
1	BST recrunt very year
2	BST refresher every 2 years.
2	BST should include HUET training that utilized realistic S92 helicopter body & seats. Training should include windows like those in chopper in use & aux tank if their use is continued.
3	BST Training in colder water? Training module in pool need improvement?
2	Buy a work boat as the assies have down under! Go from rig to rig and all parties concerned driving up the cost!
1	Buy all new ones
3	Buy sell magazines on chopper for reading.
3	call in times should be longer for family reasons
3	Change model of helicopters or at the very least complete redeign of gearbox.
1	Change of suit-to heavy and restricting.
1	Change out air craft all together
3	Change out the S-92's with super Pumas.
2	Changes should be made to the gear box assembly.
1	Check Gear Boxes 6-8 hr fixing. Check every flight.
2	Check-in notice should be updated, phone info line needs to be more frequently updated.
3	Choice of Helicoptor or vessel.
2	Chopper is worst I have ever been on world wide to much viberation and needs to be corrected.
1	Chopper not to fly in such low vis

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	C-NLOPB are biased toward the safety regulations in the oil companies favor. This is completely unacceptiable
3	C-NLOPB should not regulate safety.
2	C-NLOPBwears two hats, which are regulatory & developmental. These are in my opinion a conflick of interest! Oil operators will not initiate, but if required to conduct their business a certain way they will eventually “toe the line” to the point of unprofitability with such massive profits at stake much can be accomplished toward ensuring all are tranported with the least risk
2	CNOPB or government should be more involved in offshore safety. Don’t trust the oil companies to do everything right.
1	Communication
2	Communication, we are passengers never know what is happening with current flights. When we are told weather delay it could be sunny offshore, so is it really a weather delay or a maintenance issue, and what type or maintenance issue.
1	Communications & updates provided in timely manner Note: Both from Cougar & [OIL COMPANY]
1	Companies say they are more open about flight issues yet transparenty no there
2	Company need to have a good look at the issues with the helicopters
2	Competition another helicopter company
1	Complete reevaluation/testing of S-92 to far/jar 92 standards (dry run) as previous approval appears to have missed the spirit of the requirements
3	Concerns should be taken very seriously
1	Confident means of egress
2	Constant wait time @ heliport due to maintenance, pilots timing out
2	Continually improve on suit design
1	Cougar and sikorsky continue and express that the fatigue in the gearbox mounting brackets are not as a risult of excessive vibration. In my opinion this is the root cause of the continuing problem with the hair lines cracks in the mounting brackets.
1	Cougar does its part but as said earlier the units (S-92) are unreliable
1	Cougar need to be held more accountable flight times, more choppers ect
1	Cougar seems to be doing their best to keep us safe. Whatever means are needed to support them should be maintained and possibly increased
1	Cougar should be more open with what happens with choppers
1	Couple of times a year their should be question answer period to talk about concern.
2	Create some sort of updat board for helicopter issues which provides prompt updates.
2	Crew change boat and use a helicopter as a back up
1	Cummiaction in chopper
2	Cut down on vibration, after crash vibration was drastically reduced.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Daily meintence schedule on chopper. What repairs are done/ or checks made. Needs to be more informed.
3	Danger Pay
3	Decision making in critical conditions. However, unpleasant. Taking the lesser of 2 evils.
2	Decrease # passengers/ flight
2	Dedicate SAR Helicopter
2	Dedicated boat, which can take many passangers, for crew change. It can be disgined for crew change, travel faster with less deck space.
1	Dedicated crew change boast with a helideck. Payload too small chopper 1/2 full and can't make 2nd or 3rd pass at location.
2	Dedicated military or coastguard SAR based in St. John's
1	Dedicated SAR aircraft - 2 on availability in St Johns
1	Dedicated SAR aircraft in St. John's provided by governemnt or industry, with " Best Possible" response time. State of the art aircraft with latest search technology.
3	Dedicated SAR chopper stationed in St John's with wheel up of 30 mins or less & capable of night rescue
2	Dedicated SAR equipment.
1	Dedicated SAR helicopter in SJ 24 hr SAR coverage from Gander
2	dedicated search & rescue in St. John's
1	Dedicated Search and Rescue for St. John's
1	Dedicated standing for SAR/ Emergency Response
3	Design Helicopters to withstand impacts with Ocean.
2	Different chopper
1	Different choppers.
2	Different gearbox manufactures
1	Different helicopter
1	Different helicopter (type)
3	different helicopters
1	Different helicopters. Ones more suited for the aplication.
1	Different suits less bulky
1	Different type
2	Different type of chopper
1	Different type of helicopter with a run dry time of at least 30 minutes
1	Discontinue using the S-92
1	DND SAR at St. Johns 24/7

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Do a control ditch in the sea on a calm day and see how controlled the real situation would be.
1	Do not overload
1	Do not put 4 persons in the back of the helicopter. Give everyone a window seat so there is easy exit in case of a controlled landing.
2	Do not put passengers in middle rear only have single row seating.
3	Do not use S92 until the serious issues are resolved. Use machines with a industry minimum run dry time.
2	Do something with the Aux fuel tank. It has already been said that egress past this tank is “impossible”
1	Don’t crash
3	Don’t’ fly at dark , and in high seas. You should also have more helicopter to prevent them from being overused.
1	Don’t’ fly during high winds or Air turbulance.
1	Don’t have none
1	Don’t do any night flying
1	Don’t fly when sea state is above 3m Don’t fly in very foggy condition’s Don’t fly when poor visibale “snow or fog”
3	Don’t keep people @ heliport for hours when weather is down. Make better decisions about flying
1	drinks
1	Dry run time
1	Due to the amount of time is lost due to helicopter delays it is important that the cougar information line is updated on a regular basis. Family and friends rely on this line for accurate information. Delays in flights should be reported more frequently.
2	During helicopter malfunctions, free release of info to passengers
1	each person has escape window
1	Effective search & rescue
3	Eliminate aux fuel tank from passenger cabin. Less pay load with more flights.
1	Eliminate aux tanks
2	Eliminate/Greatly reduce night time flying
2	Emerg response time improved
1	Enough choppers in fleet to support number of personnel C-NLOPB should not regualte helicopter safety (conflict of interest) Mandatory explaination why choppers are delayed/cancelled which means the truth!
3	ensane suite are exceptable
2	Evaluation of long term effects of high levels of vibration on board S-92 in terms of mechanical failure

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Every helicopter should be started before passenger get on board.
3	Every incident and Reason why a helicopter is down should be publicized to the people traveling on them.
3	every passenger have a window seat.
1	Every passenger should have access to a window to be able to escape. Should not have to wait for a person to escape before you get a chance.
1	Every person to have a window seat
3	Everyone should have a primary window exit.
3	Everyone should have there own window seat.
2	Exgtra fuel tank removed from inside cabin and mounted outsided or in the floor of the cabin.
2	External Fuel tanks
3	Extra choppers to get more flights out during good weather windows.
1	Extra flights.
3	Extra Flotation
1	Extra fuel tank not in the cabin
2	Fairness + equality in scheduling of choppers
3	Fairness of flights to all installations, eg: all flights should be in order, no Thursday flights ahead of Wednesday flights
2	Faster flying choppers.
3	Faster issue of new suit
1	Faster resolution of safety concerns like HEUBA. Seems to take too long to respond to improvements.
2	Faster response time for search and resuce. 24 hour overage for search and rescue. Heated emmersion suits for longer survivial time in the water.
1	Faster response time to a ditching A standby crew on the ready More helicopter so maintenance will never feel the pressure to push back on preventative maintenance
1	Fastia wheels up response time. Proven 30 min “run dry time”
1	Figure out why these choppers have so many issues.
2	Find or make new flight suits even better thatn the new modified one
3	Find the root cuae of the mount feet problem. It is no comfort for the workers knowing the feet continue to crack. We should not continue to replace feet knowing they will eventually crack.
2	Finding suits that are acceptable for leakage rates.
1	Fix all 3 concerns
1	Flair
1	Flight immersion suit improvements in line with concerns.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Flight suit seems to be improved greatly for comfort, not sure about water immersion. Now making them available to all passengers.
1	Flight suit should not be as bolkey
1	Flights on time
3	Flights returning because of mech. problems must be escorted
2	Floying in high winds should be looked at more closely. Have flown several times and landed on the rig with 60 knots or more wind speed. Seems unstable to me.
2	Fly at night to get more flights into prevent delayed returns.
2	Fly at night, this should be normal ops.
2	Fly lower when having problems
2	Fly with less people so not to have the tank inside
3	Flying in bad weather. Sea state should be lowered from 5 to 3. From 7 metre seas to 4 or 5 which is still bad.
2	Flying nighttime (should not)
1	Flying time between mantance
2	foot mounts that don't crack
2	Forget the boarding pass, more lenient for Worker travelling to work.
3	Formation of a staffed, full time at-ready SAR base in St. Johns
1	Fuel tank located outside
1	Fuel tank looked at instead of moving from one side of helicopter to the other
1	Fuel tank moved (extra one)
1	Fuel tank not in passanger areas of the helicopter
1	Fuel tank placement
1	Fuel tank re-aligned in different position, to access windows easier.
2	Fuel tank removed from cabin.
1	Fuel tank removed from chopper.
1	Fuel tank she be installed outside like the one that came with the helicopter.
1	Fuel tank-removed
3	Fuel TK should not in the passenger area
3	Full disclosure -Knowing about the lack of "dry run time" could have prevented the 491 tragedy. What else is being withheld & when will our next tradgedy bring more problems to light?
3	Full time Sar standby AC
1	Fulltime SAR chopper
2	Fulltime SAR in St. John's
1	Gear box in these helicopters changed out- like U.S. department of defence done with these choppers

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	Gear box mounting brackets.
2	Gear box problems needs to be fixed. Not just replace it when you see it is broken.
2	gearbox 30 min runtime without oil.
1	Get better helicopters
3	Get faster boats. Current boats are slow.
1	Get helicopter adequate to suit our need. 1. all passengers get exit. 2. helicopter holds enough fuel without need for Aux tank inside helicopter with passengers.
1	Get more choppers
1	Get more helicopters so that they can fullfill service to rigs when one goes out of service
1	Get more helicopters. That way they can be maintained when issues arise, without disrupting flight schedules
1	Get New
2	Get New
3	Get New
2	Get night flights back. Often fog clears offshore at night.
3	get rid of double seats and fuel tank.
1	Get rid of Sikorsky, source out different kind of chopper
1	get rid of that tank
1	Get rid of them
1	Get rid of them 2 seats in the back row. Should only be window seats.
1	Get rid of them and go to work boats
1	Get SAR coverage in St. Johns
2	Get the norwegian suit.
1	Getting new suits in place
2	Give EVERY passenger a window or poor (means for immediate escape)
3	give info sessions/tours/ect to family members, show them what their loved ones go through to go offshore, show them the facilities on shore and videos of offshore. They really don't understand and can't appreciate what controls are in place to keep everyone safe
2	Give people a choice to take vessel instead when weather is favorable. Seems like the boat is OK when big oil wants it for their purpose (FOG)
2	Give personnel the opportunity to "flight suits" on sea day training to give them comfort in integrity of suit. I feel the testing used to gauge water engress in inadequate +flawed.
1	Give us a survival suit that fits properly and don't leak
3	Gloves that can be put on before you go into the water and that would allow you to acitvate the life jacket, etc.
1	Good maintainance on the helicopters

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Government needs to do something to attract competition for cougtar. A monopoly on offshore transport can lead to a lax in safety.
1	Hardles on windows + Aux tank to be installed.
3	Hav ededicated personell to answer questions regarding flight list, combined flights, 24 hrs/day
3	Have less people on flight so everybody can have a window seat.
3	Have 24/7 coverage in St. John's for SAR with minimum wheels-up time
2	Have a better response time for a emergency chopper
1	Have a landing pad in between the riggs. So just in case emergency it could land there
3	Have a passanger ferry other than supply boats dedicated for personal transfers. I am aware that during winter months this be not be reasonable but during the months it can be used it would offer a safe way for travelling to/from offshore.
1	Have a rescue team located offshore to ensure quick response - maybe have helipad available on "Hebrar" platform designated for this purpose
2	Have ability to get off rig other that heliciopter. I.E. we have I crane certified as man riding. When that crane is out of service, only way on or off rig is by helo. This causes frustration and can lead to flights being attempted when they probably shouldn't.
2	Have bag checkers be more professional. They are not cops. Remove aux tank Stop hauling cargo on crew change flights. Extra weight not needed.
2	Have Huet traing to be realistice full complimint of passangers and aux tank with Huba.
2	Have knowledge that the suits have been tested.
1	Have more choppers in service to handle flights to installations. Right now there are not enough choppers. Cougar is trying to do to much with too few choppers.
3	Have more competition from helicopter providers
2	have more helicopters so more maintenance can be carry out they could have one in shor at all times.
1	Have new HTS-1 suits tested by our memebers in cold water conditions
1	Have only 3 seats in rear of chopper
3	Have some accountability somewhere in this industry, seems to be a lot of pass the buck in this mode of transportation. Getting even the basic answers out of these people is a chore. It seems you can't ask a simple question about helicopter travel without fear of reprecussion.
1	Have the HEUBA training include escape with the unit from the simulator
1	Have the suits changed
1	Have this gear box replaced with dry run capability.
1	Haven't got enough aircraft for the amount of rigs.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	having a chopper specificlaly for the rescue in St Johns with the 15 minute wheels up whenever there is choppers in the air
1	Headset. Usually can not hear what pilots are saying.
2	Headsets that you can hear P.A.s in helicopter <with good sound>
2	Headsets with audio to hear announcements better
2	Heated emmersion suits to geive longer survival time in water. Faster response time for search and rescue.
3	Helicopet on stand by for emergency response
1	Helicopter Boyancy bags improved or flying to match sea states
1	Helicopter operator should react as soon as practially possible to service bulletins to ensure the safety of personnel flying- even if it means grounding the helicopters for a period of time.
1	Helicopter reliability!
1	Helicopters are good as long as the proper checks are completed
1	Helicopters changed out and updated more often
1	Heli-suits are very restrictive. I.E. bulky and don't fit well. The hood is difficult to fasten no matter what size of suit you wear. In the event of an emergency this would make an escape extrememly difficult, the boots are too big and bulky.
1	Hoods on survival suite have to be changed, the stiff neck is inadequate.
2	How they respond to the Maintenace
2	However many exits are in a helicopter that is how many people should be allowed
1	HTS-1 should take care of this concern
2	HUEBA used in helicopter escape drills.
1	HUET excercises don't simulate escaping over an aux fuel tank. If I can't prove that I can do ti under controlled conditions, How can I be expected to do it in an emergency? Same goes fro escaping with multiple passengers seated across the back row. I need to know that I can do it.
1	HUET training more frequent
2	I believe that these choppers should have to have all foot mounts changed out. Mayber they need to be made out of different material (stronger)
3	I feel that all these choppers should be required to have 30 minute dry run capabilities as was suppose to be the requirement originally
1	I feel the S-92 are not living up to the demand that is being put on them. They seem to be broke down way to often, and that gives no just me but my coworkers the same feeling that we had prior to the 491 incident. It was said to me on many occasions that it only a matter of time beofre it happens again lets pray that it doesn't.
1	I know it may not happen but I think the entire S-92 fleet operated by cougar should be replaced by a chopper that has a better track record

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	I know that suit sizes have been addressed as well as some of the features. These have been well regarded changes. However, I believe contant review and oversight of suits must be completed on a regular basis.
1	I spoke about boat transfer. I believe that we all should be given the choice of transportation, boat or chopper. I don't understand what the issue is here, I am not the only one who feels this way. I cannot understand how a company who can run a business as big as this is (Hibernia) cannot supply us with the option of boat over chopper transfer
2	I thank Judge wells for this opportunity to voice our concerns. [NAME]
1	I think maybe a different aircraft would be suitable
1	I think there should be more choppers available to fly when others are broken down!
3	I think we should work toward the shortest time frame possible (15 min) when considering rescue of personnel. We work in a dedicated area offshore these oil platforlms that are constantly inhabitated by people traveling to an fro on a daily basis therefore ther should be an adequate syhstem in place for emergency response.
3	I would like to crew change by boat rotwer than helicopter. I feel more safe by boat
2	I would like to see 24/7 emergency response with 15-20 minutes wheels up in St Johns
1	I would like to see a different manufacture of the helicopter. After 291 I do not trust Sikorsky and their operating procedures, especially with the 30 minute dry run capability also, much less mechanical issues
1	I would like to see A helicopter in place with a 30 minute run day time.
1	I would like to see emphasis put on keeping the helicopter in the air, rather than training on how to escape a downed helicopter. If an airplane crashes, do they look at training passengers to escape or do they look at preventing the crash.
1	I would like to see extra helicopters in the fleet so it will make more time to get the proper maintenance done. Also auto hover installs as soon as possible. I would like to see all people have a window seat available. I do not feel safe sitting in an asile seat next to another person
1	I would like to see less men flying at one time, so you are not so cramped up
1	I would like to see more of the 'rumors' that get raised by workers put to rest by the owner/ operator companies along with cougar. Cougar seems to be the 'offical voice' but the owners/operators need to feed in here too.
2	I would like to see our rotation change from 3 on 3 off to 3 on 3 off or even 2 on 4 off. This will cut down on the amount of flights to and from offshore. Less flights means leass chances of encountering a situation with helicopter ditelling
1	I would like to see the fuel tanks put on the outside of the chopper
2	If a helicopter makes a cargo run, no passengers should be allowed on board.
3	If a passenger experiences a boomerang, he/she finished for that day not setup on another flight - 1 hr later to the same location & boomerang again! This is [UNREADABLE] treatment!

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	If chopperdoes run out of oil (again), that the pilot does ditch it immediately instead of trying to make it land.
2	If floatation support is attached to chopper for a specific sea state we should only travel at that time and condition weather conditions that determined if the chopper has to land at sea and has flotation support in order to vacate the chopper inot a life raft.
1	If these choppers are the latest and designed for offshore transportation why do we need an add on tank in order to travel our flight range. This should have been factored in initially in its designer.
1	If these machines are this unreliable they should be replaced with a model that is more dependable and the worders can have confidence in. Each installation shoul have their own helicopter so that the number of take-off and landings will be reduced.
1	If they could tell us sooner if our flights are bumbped
1	If they resume night flights, I would like to see a 15 min response time for search and rescue
2	if windows can't be lowered then "booster seats" should be provided or a means of lowering/ raising chopper seats so all PAX are comfortable with window level.
2	Immediate remediation of any directives received by Cougar from Sikorsky
1	Implement min standard of 30 min dry run time.
2	Implement TC AD's even before deadline date (s). NO extensionns!
2	Imporve helicopter downtime by adding more choppers
1	Imporve suits
3	Improve communications between pilots & passengers
2	Improve EPIRP deployment system for helicopter EPIRB
2	Improve on professional reputation. Try and keep schedules on time. Don't stay or give excuses. Be straight forward with all travellers
3	improve or replace all survival suits being presently used for offshore transportation
1	Improve reliability of helicopters- seems to be a high # of helicopter out of service for maintenance aneed to improve spare parts for helicopters.
3	Improve requirement for physical ability. 5'9" 350+ pounds is not physicall fit to travel offshore.
2	Improve SAR
2	Improve search and rescue respond time- 30 hr- max 7/24
3	Improve seating arrangements. Improve training. Breathing under water, not natural. 10 min training won't help.
3	Improve suits
3	Improve suits!
1	Improve survival suits
3	Improve the BST

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Improve the heli suits which is in progress
2	Improve the suits - the new suit is improved but not perfect - work is needed to improve face seal/size/gloves. Gloves is an imp issue to me an not having the confidence to be able to put them on wet is a real issue
2	Improve training and give any additonal training available concerning helicopter safety.
3	Improved ability to land on facility in fog. This wil reduce return “Boomerang” trips.
1	Improved and more comfortable flight suites giving more manouervability.
1	Improved design
3	improved egress- slightly longer windows?
1	Improved flight schedule updates
1	Improved headphones
2	Improved HUET training to include egress with 2 persons side by side, and egress with Aux fuel tank in place. As per concern #1.
2	Improved impact protecting in the event of a hard landing
2	Improved logisics
1	Improved reliabilty + regularity of flights
2	Improved SAR being implemented -Continue no night flights until SAR capabilities established for night rescue
1	Improved Search & Rescue in St. John’s
1	Improved seating.
1	Improved sound system as per concern #2
1	improved suit fittings
2	Improved training in helicopter emergencies
3	Improvement with the choppers, gearboxes and the amount of downtime they incure.
1	Improvements should be done on all things listed above
2	Improvemets on eequipment to allow helicopter transportaion in poor visibility
3	In comfortable with alternate transportation but it takes so long (12-14 hrs) out and back (24-28 Hrs) late getting home it’s a double edged sword. It feels safer but cuts into your time home!
3	In the BST training, the HUEBA set should be used in conjunction with the HUET Exercise. They are done seperately now, and this does not reflet real life sitatuion. This si not a good practice, and shouel be rectified.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	In the event of a problem, the helicopter should automatically desend to a very low altitude. If something catestrophic happens, at least the pilots can put it down very quickly as opposed to falling from 200ft. In the case of 491, I still have trouble understanding why the pilots didn't decend to a low altitude (ie 50'), and inched the helicopter along back to shore. When the helicopter lost its tail rotor, at least they wouldn't have fallen from such a height>200'. I don't know, and as tragic as it was, maybe more people would have survived the impact.
1	Incorporate fuel tank mock-up in HUET traner to assess risk during egress
1	Increase bag weight allowance.
1	Increase number in the pool
3	increase response resources for emergency situations
1	Increase size of window.
2	increased number of V/L's and improved transportation stratigy
2	Independent safety board for helicopter safety for overall safety on all the rigs & platforms. Thanks Mr. Wells!
1	Information on upgrades to choppers
2	Informed why the choppers are not operational.
2	Install floating landing pad halfway
1	Instead of training every three years it should be a minimum of a year for retraining.
3	Institue a 2 on / 3 off rotation
3	Intercom should be improved, you can't understand what the pilot says. There should be an inquiry has to why there are so many new pilots. There is no core groups. I've worked in the offshore a lot of years. This helicopter has placed a lot of stress on me, causing great difficulty on my family before take off and to workers. I'm used to it, so I just live with it.
1	Investigate optional airframe
3	Investigate the role of Offshore support with respect to training certification for weather reporting, flight tracking, site specific variables, direct & indirect communications with flights
2	Is there such a thing as a dry-run time? On any chopper. If it is why can't we get it? It would make us feel a lot better Thank-you! For your concern for us
3	Issues with helecopter to be made known to passengers Some issues are being witheld
3	It is extremely important that night flights be avoided even when Cougar has full SAR capability. You must remember that SAR is secondary. The bottom line is your chances are greatly reduced of affecting a safe ditching at night.
3	Keep choppers in the air. If you go in the water offshore you're chance of survival is slim at best

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Keep doing the pre flight checks. 2-3 people if need be. In case the first person misses something the second or third person might catch it. Thanks guys.
3	keep mataínces up on the chopper
3	Keep night flights only for emergencies
1	Keep people informed
2	Keep people informed and up to date during delays and cancellations. If the flight is delayed due to weather, teel is there is fog/freezing rain/wind etc.) If they are having mechanical trouble, tell us.
1	Keep travellers informed directly, not through the media. Maybe maintain data-base of email addresses and let travellers know when issues arise
3	Keep up communication with workers (it has improved one the inquiry)
1	Keep up the mechancial checks and address all issues promptly
3	Keep up with maintenance.
2	Keeping personnel informed
2	know exactly what the fog requirement are
1	Know the process for RM's
1	Knowing that Resque service is avable = not out of service or on training
3	Known flying limitations ie/ visibility, wind, sea state and governing body to enforce them companies must provide adequate and timely means to transport workers.
3	Land/Take-off in Fog
1	Larger escape windows, some are already big but not all are the same size. Some small one's could be changling to larger people in real situations
1	Larger window escape
2	Larger windows for escape
2	Less "onshore" experts, better communication with offshore personnel
2	Less amount of personnel in helicopter so everyone has an equal opportunity for escape in an emergency situation.
3	Less crowding on choppers.
1	Less departure delays. Quicker/ more accurate flight info
1	Less maintenance time
1	Less passengers for more room to aid in exit during emergency.
1	Less people
2	Less people in each helicopter max 14 pax.
1	Less people jammed in. neck seals on survival suits ie. like North Sea
3	Less people on board. 17 too high.
1	Less people on chopper/more flights. You should not have to sit by someone. Everyone should be by a window or form of escape.
3	less people on each flight

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	Less people on flights - 17 people on 1 helicopter and 4 0r 5 people in back row of helicopter is too tight for comfort
3	Less people on the chopper so everybody has a chance to be sat at a window seat for easy access
2	Less people per flight; especially when internal tank installed
2	Less people/flight
3	Less seats on back, overcrowded
1	Less viberation in cabin.
3	Let employees be informed about any mechanical issues.
3	Lets get more uip time so frustration of going home is minimum. We have lost personnel due to late crew change.
1	Letting passengers know what mech. Problems they have.
1	Light weight Gore-tex suits -Costum suits for everyone
2	Like to be given more info when helicopter a down for maintenance to what the nature of the problem.
1	Like to see the helicopter owners, hand out more information on flight status. Lately everything is kepted secret from everyone. -Lets see the mech reports. Since we lost the copter, has there been anymore deflects.
1	Limit # of persons on the chopper. Should not be 2 people side by side. Single file on both sides of the chopper. Get another chopper + make 2 trip if need be. (illustration included showing single seating on both sides of heli)
1	Limit the number of people per flight to limit 4 people to back row.
1	Limits put in place for windspeeds and not left to the operators.
1	Line updated more often
2	Listen to front line workders (offshore workers) not office workers.
2	Listen to the people that fly on the choppers, not office personnel who don't.
1	Listen to the people who are using, flying in the choppers, for suggestions. Look at what happends when you listen to "offiicals" and "experts" about the aircraft (S-92)
2	Listen to the personnel who are travelling on the choppers every three weeks, not the people in the office who don't fly offshore.
2	Listen to the workers that is flying all the time not the people in the offices
1	Local St. John's S & R
1	Locally based rescue helicopter w / crew on 24 hour standby.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Longer flying hors that is suitable for offshore NL environment (which is not typical) where personnel cannot get off the rig on time due to fog, weather, lack of helicoptor availability then this creates other safety hazards offshore (personnel working > 21 days and their minds are at home). This is a major issue for offshore personnel and as a result many experienced personnel are requesting transfers outside of the country. It is a snowball effect. Personnel should be able to get home in time except in extraordinary circumstances.
2	Longer time (air capacity HEUBA)
1	look at getting a better type of helicopter
1	lower flying altitude
2	Lub up seat belts or something like that
2	Maintenance of Equipment.
2	Maintenance routine
3	Maintenance, maintenance, maintenance.
1	major modification to gearbox to prevent studs from cracking! (I.e. design system without studs)
3	Make all concerns public when they come about. Not at a later date.
2	Make briefings of helicopter delays/cancellations more detailed to passengers.
2	Make flight information reliable
1	Make Huet training more realistic
1	Make more chopper available.
3	Make sure the follow what they say instead of flying at 2000 ft then moving up to ??? Because they don't say
3	Make the temperature onboard the helicopter more controlled for passengers.
3	Make vessel transfer more available and efficient
2	Making seats more comfortable
1	Modifications to the suit hood. This is in progress!
3	Monitor sea states over and window time set.
1	More aircraft-->less "wear & tear" on each one
1	More and enhanced side emergency response
1	More and upto date improvements on plane line.
3	More availability of helicopter incident to offshore workers
2	More available aircraft
2	More boat travel when weather is OK. Limit trips on chopppers limits the risk.
1	More boats for passangers only to limit flying in poor conditions.
3	more capable helicopters (IR, Auto hover)
2	More capible helicopters
3	More care + concern for the workers from the clients ([OIL COMPANIES] etc.)
1	More choppers

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	More choppers
1	More choppers
1	More choppers
1	More choppers
2	More choppers
2	More choppers
2	More choppers
3	more choppers
3	More choppers
3	More choppers
1	More choppers
1	More choppers are needed
1	More choppers available on Grand Banks
1	More choppers for area
1	More choppers put in service
1	More choppers so maintenance & break downs do not impact worker travel
2	More choppers so they would not have to be full almost every trip, so that everyone could be seated next to an emergency exit
1	More choppers to service offshore installations. When choppers are cancelled due to weather no one has control. But on crew change days when at time two choppers down for mech. Reasons then run out of daylight hours to complete flight causes stress/ moral offshore low/ frustrated employees
2	More choppers which would enhance preventative maintenance
1	More choppers Better equiped choppers (for night/low vis flights)
1	More choppers We need more choppers available to take the stress off the existing ones
1	More choppers, + maintainance
2	More choppers; to reduce work load on ones in service
1	More comfort during trravel, mechanical concerns addressed more fully
1	More comfortable suits
1	More comfortable suits that more then that allow you to move more free.
1	More comfortable suits with added mobility
1	More comfortable survival suits
2	More communication
2	More communication between passengers and pilots
1	More communication between pilots and passengers regarding temperatures comfort levels.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	More communication on chopper times when they are deployed should give proper reason
3	More communication on why the chopper is broken there are times that a chopper could be out of service for day without telling anyone why.
1	More communication to workers as to why flights are cancelled or delayed. Not just noted ina book but direct communication.
3	More communication when helicopters have problems
3	More consideration of sea states when flying.
3	More controlled landings, not the rush to land.
2	More Cougar helicopter support
1	More dependable helicopters
2	More detailed briefings in bad weather + helicopter maintenance issues.
3	More effective Huet training. Survival suits should be fit tested in water (pool).
2	More employer awareness on air transportation for all the services involved not just operator or drilling/production contractors
3	More extensive physical assesment for HUET training
1	More feedback
1	More feedback from cougar
3	More flexable neck and hood
3	more flights
2	More floatation on choppers
2	More focus/follow up with mechancial issues (for helicopters)
3	more frequent and better training with Hueba for excaping a sumerged helicopter
1	More helicopter
1	More helicopter. Closer search and rescue.
2	More helicopter-growing industry.
1	More helicopters
1	More helicopters
1	More helicopters
1	More helicopters
1	More helicopters
1	More helicopters
1	More helicopters
1	More helicopters
1	More helicopters
2	More helicopters
2	more helicopters

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	More helicopters
1	More helicopters You cannot control the weather but we shoul have more helicopter for the number of installations offshore
1	More helicopters and pilots
1	More helicopters in fleet. At present, the current fleet is stretched. More helicopters could possibly allow for greater maintenance and checking.
2	More helicopters in the fleet. Study every single safety suggestion.
1	More helicopters in the fleet. To ensure worker can travel offshore and return home on their scheduled departure times. Stress does strongly affect workers when they are held offshore due to shortage of flights for the day or pilots timed out etc. Safety is affected everyday that you are held offshore. No uplift in pay as do the company employees or union employees. This all has a mind set that affect you
1	More helicopters or more reliable ones. After 3 weeks of 12 hr shift I would love to get home on time.
1	More helicopters required for offshore transportation
1	More helicopters that are more uncomfortable
1	More helicopters to better manage down time.
1	More helicopters to handle the volume of passengers when helicopters are out of service for maintenance they have no extra to fill in. This causes delays
1	More helicopters to reduce workload of helicopters
1	More helicopters, and everyone with a window seat.
1	More helicopters.
3	More helicopters.
1	More helicopters. More helicopter companies to allow for more flights to allow workers to get home on time
1	More helicopters. Not having enough resources is a big problem. Money is the problem .They will not spend money unless forced, even for safety.
1	More helicopters-less time in the air if more helicopters were available
1	More helicoptors - see explanation below
2	More helicotper needed for number of fields
1	More hellicoppers.
1	More in depth training for emergency situation
1	More info of mech problems when they occur
2	More info on helicopter maintenance/problems
3	More information
1	More information for helicopter flights.
1	More information for those traveling on helicopters
1	More information from cougar regarding mtce. On the S-92

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	More information on delays
1	More information passed on too persons traveling on flight
1	More information with mechancial problems
2	More input into safety concerns
1	More machines available
1	More machines, headphones that work to hear announcement by pilots like before. All passengers have a window seat in case of emergencies.
1	More maintenace on helicopters.
1	More maintenance on helicopters. All memo's concerning copters and its safety are to the affress immediately. I would like to see more concern with keeping to copters in the air. The suits are important but no my 1st concern. (Helicopter in the Air)
2	More mechanics/technicians
1	More of them
1	More open information re maintenance and pilot training.
1	More open information Better, more comfortable suits
1	More openess with regard to info…regarding any issue with helicopters. IE maintenance issues logisitc issues
1	More openness when it comes to problems with the choppers
2	More or louder speakers.
1	More pilots and choppers
2	More realistic training for Huet
3	More relaistic training/emergency perparation
1	More reliability in choppers
1	More reliable aircraft
1	More reliable airframs. Seems like always choppers out of service due to mechanical issues doesn't install high level of confidence in flyer.
1	More reliable chopper with dry run capability. Removal of aux. fuel tanks inside chopper.
1	More reliable chopper. One that doesn't have a faulty gear box mounting problem. One that has a better deigned filter bowl system. One that has fuel tanks big enough mounted on the outside of chopper. One that has dry run capability. One were each person hs their own escape exit.
1	More reliable helicopters used
1	More reliable service Miss to many flying days due to helicopter maintenance Do maintenance on days when no flights are scheduled
2	More reports regarding the failures and repairs on each helicopter accessible to travellers.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	More restrictions on when we fly
2	More rigorous safety training
1	More room and able to read to relieve the boredom of a long flight.
1	More room for bigger personel
3	More single seating. Have single seat by window and single seat by aux tank. Trying to zipper up survival suit is more difficult in double seat especially in an emergency.
1	More staff
1	More stress testing on helicopters
1	More strict rules for flights in foggy conditions
2	More stringent training (BST)
1	More suitable weather when flying
1	more tests
1	more through inspection
1	More training
3	More training + safety
3	More Training in ditching situations
1	More training in pool with suits we use on chopper, 14-16 workers in simulations chopper instead of 2-3 plus using HEUBA bottles when we do the chopper roll. With 14-16 workers that will get the situation close to the real situation
2	More training on helicopterof IE HUET
2	More training on Hueba
2	More training, and stricter regulation for pass/fail HUET training
2	More transparency for reasons chopper has service or flights cancelled for such reasons.
1	More units so the maintainence program can be more strigent and personel transportation will not be affected.
1	More up to date time departures
1	More updates during flights on what is transpiring & if an alarm comes in, to let personnel know immediately
1	More window seats used
1	Mount tank externally
1	Move Fuel Tank
2	Move fuel tank to outside location
3	Move testing, by crew/worker rep's not paid employee's of mustang/etc
2	Mr. Wells should speak to the employees not supervisors. I'm sure he would hear of incidents with the helicioter that would be of great importance. Incidents are reported, but fall on deaf ears. (Lies on part of [NAME] at the emergency)

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Need for a new helicopter or return of the puma's. The S-92 has not shown to be reliable + most all workers believe there is no safety on these helicopters. (use boats)!!
3	Need imporvement in suits, training + practice.
2	Need more choppers
2	Need more choppers
1	Need new suits and training at sea in them
2	Need openness between workers and operators on maintenance issues
2	Needs to be on time
1	New and improved choppers with single seats for everyone and a better chance of survival if this is implemented
2	New choppers
2	New design of suit. Helly Hansen has failed its design.
1	New guideline for Transport Canaga for flying offshore. Unless guideleines change it is still business as usual.
1	New helicopters
1	New helicopters
1	New helicopters
1	New helicopters or gear boxes.
1	New kind helicopter, kind that is not so stress structural/ power
1	New scuba gogels
3	new suit (all ready in progress)
1	New suit. Different brand. Same as diving dry suit.
1	New suits
1	new suits
2	new suits
3	New suits as they have in the North Sea. Note: This survey is a great idea and hopefully it will be taken very seriously.
2	New suits-better
1	New survival suits
1	New type of chopper
1	New, faster, choppers, which will reduce travel time.
1	New/Different chopper (not s-92) S-61 or Eqiv.
1	Newer choppers
3	Night flight needs to be reintated we need a night search rescue chopper now not later.
1	Night flights
1	Night flights
2	NIGHT FLIGHTS

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Night flights cancelled permanently.
1	Night flights restarted
1	Night flying , and more choppers
2	Night flying auto hover equipment
3	Night flying capabilities
1	Night flying capability
2	Night in witch they fly
1	No Aux fuel tank in passenger compartment
1	No aux tanks
3	No auxiliary fuel tank in machine
2	No extra fuel tank
1	No flights during high winds. No trying to land offshore in thick fog.
2	NO flying at night
1	No flying in adverse conditions
3	No flying in fog
2	no flying in inclement weather
1	No flying through freezing rain.
1	No flying when sea state above 5m
1	No fuel tank in cabin -No rigt hopping - increased landings & take offs
1	No Fuel tank in passenger compartment.
1	No fuel tank inside
3	No fuel tank inside. Each passenger having his/her own escape route. Not having to wait for another person to get out first or egress over fuel tank.
2	No fuel tanks in passanger cabin
3	No glights in night, only flights flying when ever there is a 100% chance of picking people up if there is a accident. -Low visible - no flights should leave for rig, lately helicopters have come in on instruments, not visible looking. Main concern if helicopters are backing up
2	No modification should be made to choppers. Eg. Fuel tanks -flotation device. Etc.
1	NO more personnel onboard than the number of window seats
3	No night flight
2	No night flights
3	No night flights
3	No night flights
3	No night flights
1	NO night flights, limits low flying sea conditions
1	No night flights, unless emergency

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	No night flying
1	No paired seats on helicopters
1	No suggestions again more helicopters would mean fewer hours on each.
1	No travel in low vis
2	Not allowing the aux tank inside the helicopter
2	Not fly in high winds or high sea state
1	Not flying over 5 metre seas as the supply vessels FRC will not be able to launch & recover anyone
1	Not seat 4 across the rear seat. Fly with fewer people
2	Not to be looked down upon when asking Questions at helicopter.
3	Not to be looked down upone when asking employee Question about flying/ boats transportation.
2	not to used a ex tank
3	Not use the choppers going to the rigs a training ground for other pilots. Training should be done with empty choppers not full choppers with workers lives at risk
1	Nothing to improve- all ok
3	Obtain the equipment needed to continue night flying
3	Old design wasn't broke why fix it
2	only have 3 seats in the back
2	Only one flight turn around should be allowed per day.
1	Open Door policy/ Freedow to information with no secrets regarding helicopter problems and design changes from cougar, sikorsky, united Tech, Transport Canada, all Authorities. Provide updates as required.
3	Openess
1	Operators should issue thermal undergarments to be worn in additon to flight-suits as base layer to increase thermal protection and wick away any moisture that enters the suit.
3	Operators should provide full search and rescue capabilities for their industry.
1	Opitional boat transfer
1	Option to take boat
1	Optional travel method
1	Other means of transport via vessel
1	Other means of transportation
2	Other means of transportation
3	Other means of transportation
3	Overall Improvement in s-92 mech areas!
1	Overcrowding
1	Passenger comfort. I am big and I find the longer trips difficult.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Periodic statements of checks and/ or findings provided to users
1	Personal flight suit
3	Personal opinion Id feel that with flight 491 crash. If our safety committee has known about safety alert or or stubb, we would not get or a happen until they were fixed. I feel that lack of communiaction was a contributing factor causing that crash.
3	Personnel or staff skills.
1	Pilot training review
2	Pilots should practice auto-rotations and emergency landing regulary and should be very comfortable and competant with these manoeuvers
1	Pilots talking to passengers personally prior to flight in briefing room.
1	Pilots to communicate better with passengers especially when something happens (such as bad vibrations)
1	Place need for critical maintenance as # 1
2	Possibly redu navg system if main gearbox fails
3	Post all bulletins on mechanical problems
3	Post list of items that helicopter do not fly. Eg: fog/freez rain/ & list of past indicator lights on & how was fixed
1	Pre briefing re: any maint concerns/alerts
2	Problem free choppers Remove Aux tank
3	Problem with gear boxes taken care off. Oil companies, spending more on safety.
2	Produce more helicopters; this would allow more flights while also reduce payload, which would enable the aux fuel tanks to be moved
2	Proper fitting suits
1	Proper management of requirements for helicopters flying offshore
2	Prove that the chopper used can ditch effectively in the sea state she flies in.
2	Provide permant floatation on aircraft
1	Provide better hangers for survival suits offshore (to protect the neoprene face seals from damage). Wet suit hangers (?)
1	Provide dry run capibilities as a back up
1	Provide improved refreshment cafeteria area communicate delays more effectively and reason for delays
1	Provide insulated underwear to wear with the flight suit. For extra warmth in winter.
3	provide larger fuel tank; remove center row seating & provide each passanger with escape access
1	Provide more choppers. Will reduce night flights and allow for better maintenance checks on helecopters.
1	Provide more helicopters.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	Purchase a boat dedicated to vessel transgers only.
1	Purchase true FAR 29 Aircraft. With true dry run capability.
1	Put SAR techs on each flt. This is done in other parts of the world. Why not here.
3	put smaller people in the back seats
2	Quicker availability of replacement parts
3	Quicker response time for SAR. Under 30 minutes is achievable via dedicated equipment/crews
3	Re engineer a new gearbox for the S92 that has a improved dry run time, or get a new chopper
2	Re evaluate the effectiveness of Melum Mansen suits
2	Recert S92 based on actual flight data
2	Reconfigure seating
2	Recurring mechancial issues to be resolved.
2	Reduce # of passengers
1	Reduce amount of personnel on each flight. Add more choppers to reduce the strain on those machines due to the increased workload.
3	Reduce number of passengers per flight.
3	Reduce passenger amount so that each person has direct access to escape
2	Reduce people or pay load to improve safety & exits
2	Reduce seat # to accomadate aux fuel tank
3	reduce seating capacity
1	Reduce the wind speed and sea state in chick the choppers are allowed to fly.
2	refrain from night flights
1	refresher for HUEBA training every year, as a lot of people are very intimidated with breathing underwater.
1	Regular briefings by the helicopter flight crew before departure. Including expectant weather conditions, review of ASB's and status of ASB with helicopter that will be flown.
1	Release any & all info regarding flying state of S-92 helicopters
2	Removal of Aux fuel tank
1	Removal of auxilary fuel tank -Better training -More frequent refresher training -Better flight suits -Larger HEUBA bottles with more air -Management to show more interest in workers concerns
1	Removal of fuel tank
2	removal of fuel tank
2	Removal of fuel tank from passenger

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Removal of tank more emergency exists Incoporate new suit more quickly.
1	Removal of the rear seat + removal of the auxillary fuel tank as I think this is a safetly concern + should not be inside the helicopter. Would you want you gas tank sitting to you in your car???
2	Remove 2 seats from back of helicopter. Tight and uncomfortable, not very easy to zip up suits.
1	Remove aux fuel tank
2	Remove aux fuel tank
3	Remove aux fuel tank
3	remove aux fuel tank from helicopter! Fly with fewer passengers, less crowded helicopter.
3	Remove Aux fuel tank from Pax cabin
1	Remove Aux tank for Helicopter. If helicopters cannot travel distance required with manufacturers fuel tank then they obviously have the wrong helicopters for the job.
1	remove aux tank from cabin completely. If extra fule required put it outside.
2	remove aux tank or put it back where it use to be located
1	Remove aux tank!
1	Remove aux tank,
1	Remove aux tanks
2	Remove aux. fuel tank from passenger cabin
1	Remove Aux. Fuel tank from passenger compartment
2	Remove auxilary fuel tank
1	Remove auxiliary fuel tank
3	Remove feul tank from passenger cabin (use external fuel tank (s))
1	Remove fuel tank
1	Remove fuel tank
3	remove fuel tank
2	Remove fuel tank from passenger cabin
1	Remove fuel tank inside chopper
2	Remove fuel tank, and everyone should have there own window seat.
2	Remove fuel tank. Less passanger's
3	Remove interior fuel tank.
3	Remove it!
1	remove ox tanks from cabin
1	Remove tank
2	Remove Tank

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	Remove tank
2	Remove tank size could be smaller
1	Remove tanks! If not required
3	Remove the Aux fuel tank.
1	Remove the Aux tank
2	Remove the aux tank so each person has individual egress window
1	Remove the extra fuel tank
1	Remove the fuel tank stored inside the helicopter
2	Remove the fule tank inside the helicopter
2	Remove the two seats in the rear row of the aircraft.
2	Removeal of fuel tank
1	Repairs to Transmission Bolts
1	Replace all gear boxes and assemblies with more robust units
1	Replace current helicopter with a safer more reliable machine
2	replace gear boxes on S92s before mounting paws break
2	Replace old suites which they are doing right now
2	Replace or modify the hoods on the flight suits
1	Replace S-91 with proven technology of the S-61.
1	Replace s-92 with a more reliable helicopter
3	Replace S92 with more capable chopper with real “run dry” capability & one that is more reliable
1	Replace Sikorskys
1	Replace the gearbox with new hybreads
1	Replace the S-92 with dependable helicopters
3	Replace the sutis quicker
2	Rescue
1	Rescue 24-7 15-20 minute wheels of
3	Rescue chopper for St. John’s that is didicate of offshore oil + gas industry.
2	Rescue helicopter in St. John’s with the proper equipment for emergency response
2	Rescue helicopter manned and ready @ all times
1	Rescue located in St. John’s
2	Rescue time
2	Rescue time is too long
3	Response time needs to be improved immediately as this should have been changed since the Ocean Ranger inqury
1	Response time; a full time SAR operation base in St. John’s -24-7
2	Retrained every 2 years.

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Retrofit gear box to have 30 min run dry
1	Return to nite flying- ensure pilots are trained and practice nite flights on regular basis
1	Re-vamp flights suits to be more user friendly and functional.
1	Review of flights suits, other than provided by Helly Hansen
3	Review the current standards for flying in high wind, sea heights, and think about the recue aspect, not the flying aspect. Because it is a numbers game, and another incident is likely to happen again, IF nto a a real emergency, but now an increaded occurance of a ocean landing, ditching.
2	Review the helicopters in use on the East coast and ensure that we truly have the best availble in the worl. Both of the commerical and military use
3	S + R chopper not big enough to rescue all personnel .
1	S92 reliability has to change or another helicopter needs to be chosen for offshore transportation
2	Safer & proven helicopter
1	Safer chopper, gearbox improvements, better suits, stick mandate as to what to do under emergency situations, no if, and, or buts as to what we should do in a situation where people lives are concerned.
2	Safer choppers If the S-92 is not accepted by the millitary, why do we accept it
1	Safer helicopter design, taking into account a ditched, flipped over helicopter in the water. Greater escape ability -->Each person with escape exit.
1	Safety briefing.
1	Safety concerns dealt with ASAP and left for time intervals such as the bolts of the gear box that had a repair time of 1250 flying HRS or 1 year period
2	Safety improvements as seem appropriate by the inquiry
3	Safety should focus on keeping helicopters in the air. It seem we are accepting the fact that another helicotper will crash and we are more concerned with the aftermath; suits, search and rescue escape training, etc.
1	SAR
1	SAR based in St. Johns
2	SAR in St Johns 24/7
2	SAR in St. John's not reloate out of gander but provide service for St. John's offshore.
2	SAR in St. John's to accompany returning helicopter due to alarm status.
1	SAR operations
2	SAR should be ready to fly at all times- no having to pull seats out of a machine and trying to prep it for take-off after an emergency.
1	SAR stationed in St. John's 24-7
2	SAR- which is coordinate or run by the Air Force

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	SAR, SAR techs with night vision goggles, auto hover
1	Sea states for helicopter flight are currently higher than allowed by the helicopter manufacturer. I raised this issue at a town hall meeting and was told “we are not flying boats!”
3	Search & rescue
1	Search & Rescue 24 hour service
3	Search and Rescue in NL
1	Search and rescue response as fast as possible
1	Search and rescue response times
3	Search and rescue should be cormarants
3	Seastate issues
1	Seat assignments prior to boarding would alleviate the stress of knowing where you are sitting.
1	Seat is too upright. Uncomfortable. Seat should be laid back slightly.
3	Seating should be improved no way four men in back of helicopter impossible to move!! Try it with four 200 pound men!
3	Seating to be improved less POB on board.
1	Seating waiting on flights
1	See inspection report of chopper
3	Set up the safest flying program possible and follow it.
1	Setter search + Rescue capabilities
3	Sharing of safety concerns between offshore JOHSC committies and pilots. Meetings to discuss ideas and concerns.
1	Shold be North Seas standards for safety, family time. 2 & 3 or 2 & 4 week rotation. The stress and divorce rate is bad in the oil industry
1	Shorten video to 5 min I have been 40+ years in our industry and the video is a joke.
1	Should be north sea standards, 2 on 3 off or 2 on 4 off. Less flights and more family time
1	Should have a larger inventory of helicopters. Far too often people are adding days to their offshore rotation because no aircraft available.
2	Should need the aux fuel tank to be in the cabin with the passengers. If more fuel is needed then maybe should travel with less passengers and eliminate the aux fuel tank.
3	Should only be single seats in the chopper
3	Should try to check for a different type of helicopter.
1	Show me someone exiting thru a side window
2	Significantly better (comfortable/usefull) amenities @ the heliport…Checking in too many passengers and crammed inot too small a space for long periods of time…

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	Single row seating on both sides of the helecopter
2	single seating
1	Sitting position should be rotated each flight. Seats designated by flgiht crew.
1	Soe concern 1 and 2
2	Somehow show that the SAR is sufficient
1	Something set up half way to facilitate landing. Take a couple of years to get it done right
3	Sometimes when the choppers land on the helideck, there's a lot of movement from side to side, up & down, also a lot of vibration I would like to see the auxillary tank removed in case of emergency The seating arrangement, which has 4 people in the back seat, is not safe
3	Sometimes you have trouble hearing pilot announcements. There one stop cords you can submit. However I have noticed this to be an issue on a couple ocassions
3	specific helicopter design for offshore transportation
1	Stand by chopper with 10 minute lift off.
3	Status (unreadable) when it comes to checking the helicopters over after any flight
1	stop night flights except in emergencies
1	Suit which is being addressed
2	suits
2	Suits are being modified, time will tell how good they are
3	Suits are in the process of being changed out, seems like a better suit (improvement)
1	Suits better fitting-why aren't all personnel fitted for new suits by now this should be priority-but we have no indicated as to when we will be fitted
3	Suits hopefully will be better when they are replaced with the newer models… this remains to be seen as I have not flown in yet.
1	Suits need much improvement. I know there have been some mods, not sure of their significance at this point.
2	Suits need to stay cooler so you can put on extra clothing
1	Suits to be changed See U.K. suits
1	Suits, Training, Information
1	Survival suit with a simple to operate and effective seal.
2	Survival training every year
1	Take a greater consideration for passenger consideration
2	Take a seat out of the back row or just have someone in every second seat in this row
1	Take fuel tank out and give every one a escape window
3	take out aux tank

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
2	Tell us why choppers aren't flying or working.
2	test the suit in the true elements like on our sea day. Not in the pool
1	The auxiliary tank removed or at best put handrailg on tank.
1	The BST/HUEBA training should be more realistic. Full chopper/HUET
1	The changes I would like to see are changes to the above concerns. No ones seem to care abou these concerns on the company/ CNLOPD sides. Sure hope Judge Wells can do what no one else can!!
1	The choice to take a boat when available!
3	the C-NLOPB is not qualified to handle safety complaints
1	The easy one is to keep people better informed about daily operations including reasons for delays and revised departure times.
3	The gear box issues needs to be fixed completely not a bandaid fix this problem is a big issue siwth passengers.
3	The industry is growing Need more choppers
2	The new HTS-1 Suits are a big improvement, however they need to be tested by THE WORKERS in cold water conditions
1	The new suits should be much better form the bit I have seen thus far
1	The new suits will be much better
1	The new survival suit in service
1	The size of suit available. For now they are too big or too small. Unsafe and uncompatable.
2	The updating of the phone line with information at least every hour. Now it is sometimes 4-5 hrs
2	There MOST definitely should be a 24-7 Sar outfit stationed in St. Johns. As what happened during the accident what is the since sending/using the exact same chopper for SAR operations that just ditched whos to say while that one is on the way for rescue that the same thing wont happen to that one
2	There seems to be frequent flight cancellations du to technical problems with the helicopters. I'm not sure how this could be addressed, but it is a concern.
2	There shoud be more helicopters in service to transport personle on a less stressfall way.
2	There should be a means of informing all offshore personnel on the chopper maintenance/updates. It shouldn't be only hearsay but a formal e-mail letting us know the status/integrity of the helicopters. Just like my own vehicle I want to know what is wrong with it & the outcome!
3	There should be no rig hopping-multiple take-offs and landing Number of personnel, space/person, seats on chopper.
3	There should never be night flying again. I feel everybody liks this way
1	They need more helicopters to much pressure of Couger to get by with what they got

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	They should have more choppers in place I don't think they have enough to cover the rigs they have especially if one or two are down for maintenance
2	This change might allow for the removal of the aux fuel tank if they have less cargo
2	This is a serious concern- In an emergency personnel would never escpae through small windows on helicopter, or have time to zip up gloves on etc. Concern of boots needs to be addressed.
3	Timely completion of implimentation of new flight suits.
1	To have choppers that can land in fog, leace in fog, fly in fog, freezing rain etc. With all the technology out there today, we still don't have enough technology to have a chopper fly in all kinds of weather.
1	Top level - maintenance. - continuous improvement to crafts -pilot training and recurrence -passenger training
1	Training
2	Training
2	Training for worst case/ realistic scenarios
3	Training showing that 17 people can exit an overturned helicopter in sea states and water temperatures plus the wind conditions that the helicopter flies in.
1	Training times shortened for BTS-R and HUET
2	Transportaion by boat this ilimantes all problems
2	Treat the fligths as a service not a necessity. Comfort to and from the platform will make for a more relaxed atmosphere.
1	Treatment of passengers. We are often "left in the dark" during delays. Also it has occurred that we have been given meals to eat after waiting long periods when it has come to my attention there is a large carrateria upstairs for Cougar employees. Why can't we eat there like civilize dpeople. We often joke that we are "herded like sheep"
3	Try to make people more confident
1	Two big me shouldn't sit side by side.
1	Unlikely to see it changed now with the investment put into present flight suits but I would favour a passively sealed suit that does not rely on zipper up, but rather flexible neck seal such as used in other locations offshore & the military. A suit that holds its integrity throughout the flight is preferable in a sudden emergency.
2	Unsure sure of survivability in flight suits, cold water training should be done for every person.
2	Up Date flight line more often.
1	Update the flight line more often so we know whats going on.
2	Updates re: the gearbox/bolts, etc & how confident Cougar is.
1	Use a better make of helicopter I hear Eurocopter makes one hell of a good helicopter in the 19-22 pax range

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
3	Use a more reliable aircraft
1	Use boat
1	Use boats exclusively
1	Use boats insetad of choppers
1	Use Huba in the Huet training not a serperate training in the pool at the same time.
1	Use of different type of helicopter
1	Use of HUEBA in the ?word? Not just a chain
3	Use of statistics to show the safely ?word? Of transfer to offshore platforms/rigs us swafety record of other modes of transportation ie buses, trains, cars, planes etc. (ie other modes of transportation that people use to get to work)
3	Use of Super Puma Helicopter
2	vibration issues improved
1	Vibration issues resolved on land & take offs
2	Vibrations need to be taken care of
3	We used to look forward to our last day about the rig and the only problem would be the weather-now its how many helos are working? Who cares if the cost is more-get the best and the rest will take care of its self.
1	Weather condition limits
1	Weekly updates on the status of the helicopters and any safty bulletions
1	What would it take to put two gear boxes in our choppers like our search and recue choppers?
3	When flights are being cancelled and no information is passed on to the workers regarding why choppers are being cancelled it make me think that there is something to hide. Why not make offshore workers aware of the situations
1	When in training in HUET flipping over with breathing appartus would be very beneficial!!
2	When new ideas like HUEBA comes out on the market don't wait 9-10 yrs to check & impliment
3	Why is this piticular helecoptor seem to require more maintenance that the old Puma. And do we really have enough helicopters for the amount of offshore work.
2	Window seating for everyone
1	Window seats for all passengers
1	With reliability so poor we need more helicopters
3	With the amount of maintenance required on the S92, the opertators and cougar need to look at addition helicopters.
2	With the introduction of the HUEBA a blunt ended knife shoule be provided in the evenet hat one becomes entangled in the event of getting tangled up in an egress

APPENDIX E: QUESTION 36 RESPONSES

NUMBER	SUGGESTION
1	With weather concerns here off our coast there should be more boat transfers because of the fog not with the choppers.
1	Work boats used for transportation .
1	Yearly helicopter safety refresher
1	Yes. More helicopters

[HUSKY 2010-03-30]

To All Staff & Contractors,

As you are aware, the C-NLOPB has appointed Commissioner Robert Wells, Q.C. to conduct a public inquiry into the transportation of workers to the offshore of Newfoundland and Labrador to ensure that the risks of helicopter travel is as low as reasonably practicable.

As part of this Inquiry, Commissioner Wells would like the passengers traveling by helicopter to the offshore to complete a survey prepared by Aerosafe, an expert retained by him. It will take approximately 10 minutes to complete the survey. All passengers are asked to check in at Cougar's heliport in St. John's 10 minutes earlier than the normal one hour to allow enough time to complete the survey at the heliport and ensure there are no delays in boarding the helicopter.

As a Party with Standing, Husky Energy is requesting personnel who travel offshore to participate in this survey to support the objectives of the Inquiry, which is to improve the safety of transport by helicopter to our offshore facilities. We have attached an introductory letter from Commissioner Wells for your information.

We encourage your participation and thank you for your cooperation in this effort.

Trevor Pritchard
General Manager, Operations

[SUNCOR 2010-03-30]

[To all employees and contractors:]

As you are aware, the C-NLOPB appointed Commissioner Robert Wells, Q.C. to conduct a public inquiry into the transportation of workers to the offshore of Newfoundland and Labrador to ensure that the risks of helicopter travel is as low as reasonably practicable.

As part of this Inquiry, Commissioner Wells would like the passengers travelling by helicopter to the offshore to complete a survey prepared by Aerosafe, an expert retained by him. It will take approximately 10 minutes to complete the survey. All passengers are asked to check in at Cougar's heliport in St. John's 10 minutes earlier than the normal one hour to allow enough time to complete the survey at the heliport and ensure there are no delays in boarding the helicopter.

The survey is to dropped into a secure box at Cougar's heliport.
An introductory letter from Commissioner Wells has been attached for your information. We encourage your participation and thank you for your cooperation in this effort.

<<Memo re Helicopter Passenger - 2010-03-30.pdf>>

Michele Farrell
Manager, Environment Health & Safety
Suncor Energy Inc.
Telephone 709 778-3698
Cellular 709 687-1644
Facsimile 709

[HMDC 2010-03-31]

To all employees and contractors:

The C-NLOPB has appointed Commissioner Robert Wells, Q.C. to conduct a public inquiry into the transportation of workers to the offshore of Newfoundland and Labrador to ensure that the risks of helicopter travel is as low as reasonably practicable. As part of this Inquiry, Commissioner Wells would like the passengers travelling by helicopter to the offshore to complete a survey prepared by Aerosafe, an expert retained by him. It will take approximately 10 minutes to complete the survey. All passengers are asked to check in at Cougar's heliport in St. John's ten minutes earlier than the normal one hour to allow enough time to complete the survey at the heliport and ensure there are no delays in boarding the helicopter.

HMDC requests your participation in this survey to support the objectives of the Inquiry and thank you in advance for your cooperation in this effort.

The survey is to be dropped into a secure box at Cougar's heliport. Please see Commissioners Wells' message attached.

Best regards,

Paul Sacuta, P. Eng.
HMDC President and Operations Superintendent
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March 31, 2010

To All Staff & Contractors,

As you are aware, the C-NLOPB has appointed Commissioner Robert Wells, Q.C. to conduct a public inquiry into the transportation of workers to the offshore of Newfoundland and Labrador. The main goal is to ensure that the risk of helicopter travel is as low as reasonably practicable.

As part of this Inquiry, Commissioner Wells would like the passengers traveling by helicopter to the offshore rig Stena Carron to complete a survey prepared by Aerosafe, an expert retained by him. It will take approximately 10 minutes to complete the survey. All passengers are asked to check in at Cougar's heliport in St. John's 10 minutes earlier than the normal 1.5 hours to allow enough time to complete the survey and to ensure there are no delays in boarding the helicopter. The survey is to be dropped into a secure box at Cougar's heliport once completed.

ConocoPhillips Canada is requesting personnel who travel offshore to participate in this survey to support the objectives of the Inquiry. We wish to help improve the safety of transport by helicopter to our offshore facility.

Attached is an introductory letter from Commissioner Wells for your information.

We encourage your participation and thank you for your cooperation in this effort.

Regards,

Barry Hexton
Drilling Manager

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador • Canada

Page 1 of 1

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Project Manager
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May 11, 2010

To All Staff & Contractors

As you are aware, the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) has appointed Commissioner Robert Wells, Q.C. to conduct a public inquiry into the transportation of workers to the offshore of Newfoundland and Labrador. The main goal of the Inquiry is to determine and recommend improvements to the safety regime to ensure the risks of helicopter transportation of offshore workers in the Newfoundland and Labrador Offshore Area is as low as reasonably practicable.

As part of this Inquiry, Commissioner Wells would like the passengers traveling by helicopter to the offshore rig Stena Carron to complete a survey prepared by Aerosafe, an expert retained by him. It will take approximately 10 minutes to complete the survey. All passengers are asked to check in at Cougar's heliport in St. John's 10 minutes earlier than the normal 1.5 hours to allow enough time to complete the survey and to ensure there are no delays in boarding the helicopter. The survey is to be placed into a secure box at Cougar's heliport once completed.

Chevron Canada Limited is requesting personnel who are traveling offshore to participate in this survey to support the objectives on the Inquiry. We wish to help improve the safety of transport by helicopter to our offshore facility.

Attached is an introductory letter from Commissioner Wells for your information.

We encourage your participation and thank you for your cooperation in this effort.

Regards,

Dan Fisher

Dan Fisher
Project Manager

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador • Canada

DEVELOPED BY

AEROSAFE
RISK MANAGEMENT

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador • Canada

AUGUST 2010

Offshore Helicopter Safety Inquiry

Cougar Personnel Survey Report

DEVELOPED BY

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About Aerosafe Risk Management

Aerosafe Group is a global aviation safety and risk management company which provides risk management services, support and tailored solutions to aviation companies around the world. With offices in North America, Australia, India, China and New Zealand, Aerosafe is recognized as an international leader in this important field. The Aerosafe Group has been invited to set standards with aviation regulators, industry groups and companies alike and operates at the operational, enterprise, sector and industry levels in the application of modern governance, safety oversight, risk management and safety management systems.

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AUGUST 2010

Offshore Helicopter Safety Inquiry

Cougar Personnel Survey Report

AEROSAFE
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The Cougar employee survey was carried out by Aerosafe Risk Management (Aerosafe) at the request of the Commissioner of the Offshore Helicopter Safety Inquiry as an extension to the passenger survey conducted into helicopter safety in May 2010.

The survey was issued over a short time frame and even in light of this limitation the survey attracted a very high level of employee participation. The results in this survey are reflective of an organization with employees that are confident in the safety of their helicopter operation. The openness of comment in the survey demonstrates a healthy safety culture with an open reporting culture.

I wish to express the thanks of Aerosafe to Cougar Helicopters and all of the Cougar employees whose cooperation made the survey possible.

Yours sincerely,

Kimberley Turner
Chief Executive Officer
30 August 2010

Offshore Helicopter Safety Inquiry
Newfoundland and Labrador • Canada

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P.O. Box 8037
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Fax: (709) 722-1363

August 10, 2010

Dear Cougar Personnel:

You will remember that in April the Inquiry engaged Aerosafe Risk Management to survey offshore workers on offshore helicopter safety issues.

It was suggested at the Inquiry that for completeness I should also survey Cougar personnel. I have asked Aerosafe to work with Cougar to issue a similar set of survey questions of Cougar's personnel. Enclosed you will find the survey which can be completed in about 10 minutes. Please take the time to complete the enclosed survey and deposit the completed survey into the secure box near the entrance to Cougar's heliport within 48 hours.

Your role as an employee of Cougar is quite different from the role of an oil operator employee, but nevertheless it would be helpful to have your perspectives. The survey is not an internal survey of Cougar's organization but is designed to get your opinions on offshore helicopter safety and ways in which you think it could be improved.

Yours sincerely,

Robert Wells, Q.C.
Commissioner

Note: If you have any questions regarding the survey please contact Michael Roberts at Aerosafe at 202-449-7693 or email: oshsi-survey@aerosafe.com.au.

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EXECUTIVE SUMMARY

This Report was requested in June 2010 by the Commissioner, Offshore Helicopter Safety Inquiry (OSHSI), Newfoundland and Labrador, Canada, the Honourable Robert Wells, Q.C. This Report presents the information and viewpoints gathered by means of a survey about helicopter safety matters from employees of Cougar Helicopters Inc. (Cougar). Cougar provides helicopter transportation services to the offshore oil installations in the Newfoundland and Labrador offshore area. This survey was issued at the request of the Commissioner as an extension to the passenger survey conducted in April and May 2010. The results of the Cougar employee survey are to be read in conjunction with this initial survey report.

The survey was qualitative in nature and was given to employees of Cougar to complete voluntarily. Direct encouragement to participate was offered by the Commissioner in a letter which accompanied each survey. Similarly, the General Manager of Cougar sent a message supporting employee participation to company employees. The survey was distributed over a three-day period at the Cougar heliport in St. John's, Newfoundland. The survey attracted an excellent response rate which demonstrated a high level of interest of Cougar employees in participating in the Inquiry process.

It should be noted that slight modifications were made to the original survey issued to offshore oil workers so that it would be suitable for employees of a single aviation company. Most, if not all, Cougar employees who participated in the survey have a good working knowledge of aviation operations and safety management systems. This high level of aviation knowledge and experience provides the Inquiry with a different perspective from that of the passengers. The issues identified by Cougar employees were consistent with those identified by the workers in the passenger survey.

The results of the survey of the Cougar employees indicated that the employees viewed Cougar as a good employer that conducts safe operations. With that said, there is a level of concern with the current situation and the additional pressure of the circumstances that have followed the accident. The survey did not validate if these issues were real or perceived.

In addition to this, there was recognition by employees of Cougar that they work in a high risk environment as a result of factors such as difficult weather conditions, sea states and the hazards associated with night flying.

The open and informative responses in the questions with an open answer response field indicate an aviation organization that has a healthy and honest reporting culture. The reporting culture is a key element of an aviation safety management system. There is a useful level of detail in the suggested areas of improvement that provides the Inquiry with input from the perspective of the employees of the aviation provider.

Overall the results of the survey were consistent and extremely positive despite the awkwardness that these views could potentially create in the customer-service provider relationship. The survey results are reflective of an organization with a mature safety culture.

Accord Acts	The Canada-Newfoundland Atlantic Accord Implementation Act and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act.
Newfoundland and Labrador Offshore Area	The offshore area as defined in the Accord Acts.
Operator	A company which has been issued an authorization pursuant to the Accord Acts to conduct work or activity within the Newfoundland and Labrador Offshore Area.

Acronyms and Abbreviations

ASFQ	Unknown
BST	Basic Survival Training
CCR	Central Control Room
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
ECC	Emergency Coordination Center / Emergency Control Center
EHIS	Environmental Health Information Services
ERT	Emergency Response Team
HSE	Health, Safety and Environment
HSEQ	Health, Safety, Environment and Quality
HUEBA	Helicopter Underwater Emergency Breathing Apparatus
HUET	Helicopter Underwater Escape Training
IR	Infrared
IRP	Industry Risk Profile
JOSHC	Joint Occupation Safety and Health Committee
OSHSI	Offshore Helicopter Safety Inquiry
PLB	Personal Locator Beacon
SAR	Search and Rescue
SHTR	Unknown
SMS	Safety Management System

AUGUST 2010

Offshore Helicopter Safety Inquiry

Introduction

Introduction

Following the fatal accident of Cougar Flight 491 on March 12, 2009 off the coast of St. John's, Newfoundland, the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) established the Offshore Helicopter Safety Inquiry (OSHSI). The purpose of the Inquiry is to

> determine what improvements can be made so that [C-NLOPB] can determine that the risks of helicopter transportation of offshore workers is as low as is reasonably practicable in the Newfoundland and Labrador Offshore Area. [Commissioner's Terms of Reference]

In order to solicit the views of the offshore helicopter passengers with respect to practices which may reduce the risks of helicopter transportation, a survey of passengers flying in the Newfoundland and Labrador Offshore Area was undertaken in April and May 2010. Following the public hearings in June 2010, Commissioner Wells requested that the same opportunity be given to the workers of the helicopter provider, Cougar Helicopters Inc. (Cougar).

In order to gather the views of the employees of Cougar at the St. John's base, a second survey was undertaken in August 2010. The survey of the staff at St. John's was almost identical to the Passenger Survey, with modifications to suit the different group of respondents. The results of this second survey are contained in this report, forming an addendum to the initial Passenger Survey Report. It is crucial that this Cougar Personnel Survey Report be read and considered in conjunction with the Passenger Survey Report, and not in isolation.

Overview

The survey of employees at Cougar's St. John's base provided to aircrew and to other Cougar employees involved in supporting flying operations the opportunity to contribute to discussions about the safety of offshore flying operations. The employee population included those that fly to offshore installations, as well as those who provide technical, operational and administrative support to the aircrew. This survey report enabled them to identify their concerns and suggestions for the improvement of offshore helicopter travel, as well as providing an overview of the current safety practices and culture in the industry.

The Cougar Personnel Survey was instigated following the OSHSI public hearing sessions in June 2010. During review of the Passenger Survey Report it became evident that soliciting the opinions of those personnel that are involved in the operation of helicopters in the offshore industry would be valuable to the Inquiry.

Survey Background

The Commissioner's Terms of Reference allow for the use of a survey as an instrument by which information can be gathered.

The survey is intended to identify any concerns or risks associated with offshore helicopter travel, as well as any practices which may reduce or eliminate the risks. It is intended that the survey gather information which depicts the safety culture of the helicopter operator and the safe operations of the helicopter, particularly with respect to escape, evacuation and rescue procedures when travelling by helicopter.

A survey is a method of gathering information from a population. The Aerosafe survey was available to all St. John's Cougar personnel. It provides a simple means for the population to contribute to the Inquiry and the improvement of the safety of personnel travelling offshore by helicopter.

Survey Objectives

The primary objective of the survey is to contribute to the Commissioner's report in respect of the Offshore Helicopter Safety Inquiry's Terms of Reference:

(a) Safety plan requirements for Operators and the role that Operators play in ensuring that their safety plans, as represented to and approved by the Board are maintained by helicopter operators,

(b) Search and rescue obligations of helicopters by way of contractual undertakings or legislative or regulatory requirements,

(c) The role of the C-NLOPB and other regulators in ensuring compliance with legislative requirements in respect of worker safety.

Aerosafe Risk Management constructed a survey which is designed to address these requirements by:

1. Collating information about helicopter operations and the safety of helicopter operations, and where relevant, training received prior to offshore flights

2. Collating information about Cougar's safety culture, including risk assessments and safety management systems, and

3. Collating risks and risk-reducing practices which have been identified by employees of Cougar.

Answers to these three requirements will contribute to the Commissioner's investigation into the existing safety regime in place within the Newfoundland and Labrador offshore oil and gas industry as well as identifying practices which may reduce the risks of helicopter transportation.

An additional objective is to provide a means for those who work in the offshore helicopter industry to make their opinions known to the Commissioner. While a number of stakeholders, including Cougar, have had an opportunity through a variety of measures to participate in the Inquiry, this survey allows all staff involved in helicopter transportation in the area to participate. This also reflects a consistency in approach whereby the passengers took part in a survey to gather their opinions, while their employers were recognized as a party with standing. Similarly, Cougar Helicopters Inc. is a recognized party in the Inquiry, and this survey gathers the opinions of potentially every individual who is involved in helicopter flights to offshore locations.

Assumptions & Limitations

This survey was developed within the context of the following assumptions:

1. The survey was done at the request of the Commissioner, Offshore Helicopter Safety Inquiry, Newfoundland and Labrador, Canada and addresses the requirements of the Inquiry.

2. The survey was independently developed and administered. The survey results were compiled independently and this process was free of any external influence.

3. There was regular liaison among the Commissioner, Inquiry Counsel and Aerosafe during all stages of survey development and administration.

4. It is assumed that all Cougar employees at the St. John's base received advance notice of the survey.

5. It is assumed that the information entered onto the survey was freely given, voluntary and supplied without coercion of any kind.

6. It is assumed that the information provided by survey participants is complete, true, correct and free of external influences.

7. The information is a true reflection of the eligible participant's response at a particular time to the set of questions asked on the survey.

8. There has been no disclosure of survey results by Aerosafe prior to the date of submission to the Commissioner.

9. It is assumed that the Report once submitted to the Commissioner will be made publicly available on the Inquiry website.

10. The original surveys are safely stored until direction is given to Aerosafe by the Commissioner for their complete destruction.

This OSHSI survey is subject to the following limitations:

1. The survey was made available to Cougar employees at the St. John's base over a short (two-day) period from 11 August to 12 August 2010.

2. Employees were requested to undertake the survey during working hours and were asked to dedicate 10 to 15 minutes of their time to complete the survey.

3. The Passenger Survey, on which the Cougar Personnel Survey was based, was made available on the Inquiry website and was therefore publically available at the time of the Cougar Survey distribution.

4. The results of the Passenger Survey were on the OSHSI website, presented at the public hearings and profiled in the media.

Survey Structure

In order to address the objectives, the Passenger Survey was constructed using a number of established Industry Risk Profile (IRP) techniques to identify risks in the offshore oil and gas helicopter transportation industry.

The survey was divided into the following five parts:

1. General Information
2. Helicopter Transportation and Operations
3. Employer's Safety Culture
4. Additional Information
5. Opportunities for Improvement

Each of these parts allows a specific aspect of the survey objectives to be achieved, e.g., the opening General Information captures demographic information about participants. A cross-tabulation of these results may then identify emergent trends which are specific to one or more groups categorized, for example, by age, job role and so on.

Survey Administration

On Monday, August 9, 2010 the survey for Cougar employees was delivered to Cougar's heliport in envelopes containing a copy of the survey with the Commissioner's introductory letter.

The security arrangements for storing the completed surveys were found to be satisfactory. On the morning of Tuesday, August 10, 2010, Mr. Hank Williams, General Manager of Cougar, provided all Cougar employees with notice that the survey was being conducted. He provided a copy of the introductory letter from the Commissioner, and encouraged all personnel to participate in the survey. Accommodations were made for those employees that requested access to the survey but were unable to be present at the heliport during the survey period.

An Aerosafe contact email address and direct contact phone number were also made available to survey participants.

The survey was conducted over a two-day period and took approximately 10 to 15 minutes to complete. 67 completed survey forms were delivered to Aerosafe. The response rate was found by Aerosafe to have been 59%, i.e., 67 responses out of 113 employees.

About this Report

The intention of this survey report is not to interpret the results, nor to draw conclusions. The report is intended to present the results in summarized form, which may allow conclusions to be drawn, if appropriate. The results for each question are provided as a percentage of the overall number of completed surveys. This enables the reader to comprehend the overall response, and may lead to future analysis of the results to identify trends or draw comparisons.

While the objective of the survey is to assist the Commissioner in reporting on the specific mandate of the Inquiry, the purpose of this report is not to provide an answer to each of the aspects. Rather this report will summarize the responses to each question and empower the audience to make an assessment of the helicopter transportation operations and the safety culture in the industry.

Report Structure

The results for each question are contained in the following section. This provides a tabulation of the results as well as a snapshot of the response characteristics. A number of Appendices are attached to provide a record of the responses to the free text questions.

In the case of Question 6, participants are asked to specify their safety appointment or job role, if any. A frequency count of each of the answers is included. Responses are included along with the statistics for Question 6. Question 9 asks the employee to identify any changes in the safety practices of helicopter operations if they have selected "yes" in the first part of the question. These extended answers are broadly categorised into 38 categories, and a frequency of response for each of the categories is included. The individual responses are contained in Appendix A.

The number of respondents who explained their answer to Question 24 was only three. Each of these responses is included in the discussion of the Survey Results.

The responses for Questions 34 and 35 form a significant segment of the survey. In order to present the data without alterations, each of the responses, as written on the surveys, is contained in Appendix B and C for Questions 34 and 35 respectively. These responses were broadly categorised in order to provide some indication of the frequency with which each of the concerns or suggestions was raised. The categories used parallel those used in the Offshore Worker Survey Report, with additions as needed. This frequency count is contained in the Survey Results, as well as a record of the number of times each category was listed as first, second and third on the surveys. In the case of Question 34, it is asked that each of the concerns is rated for how significant the concern is on a scale of 1 to 5. This rating is included in Appendix B.

Analysis Techniques

The results from the surveys were compiled in the Aerosafe survey database. In order to maintain consistency of technique and quality control, one person was responsible for data entry with an additional Risk Advisor in charge of conducting periodic checks of the data entry. The process was overseen by Aerosafe's Chief Risk Officer, Mr. Michael Barron.

Where more than one response was given to a question requiring only a single answer, the responses were recorded but the answer was declared “invalid”. Similarly if the respondent had marked an answer which was not applicable, for example Question 16 which was only to be answered if the answer to Question 15 was ‘Yes’, the response was recorded as “invalid”.

In Part 2 of the survey respondents were asked to answer Questions 11 to 20 (inclusive) only if they indicated “Yes” or “Occasionally” in Question 10. If any respondent answered “No” in Question 10, then any responses in Questions 11 to 20 were recorded as “invalid”.

The analysis of the results is primarily descriptive in order to avoid data manipulation and drawing potentially misleading conclusions. The results illustrate both frequency of response and percentage of response. The combined number of unanswered questions and invalid responses are recorded for each question.

AUGUST 2010

Offshore Helicopter Safety Inquiry

Survey Results

Survey Results

The overall responses from the personnel are positive about both the helicopter transportation and operation and the employer's safety culture. The opportunity for personnel to identify concerns about helicopter transportation and any suggestions for improvement had a reasonable response rate. This enabled some overall grouping of the concerns and suggestions in order to provide an overview of the frequency with which topics arose. The categories used parallel those used in the Passenger Survey Report, with additions as needed.

The results are presented to enable a summary of the personnel's opinions and are not analyzed for reasons as to why they may be held. Some description of the results is included in order to provide a method of comparison of results between questions.

Response Rate

The total participation rate was 59%. This sample size of 67 allowed a margin of error of 8% with a 95% confidence interval.

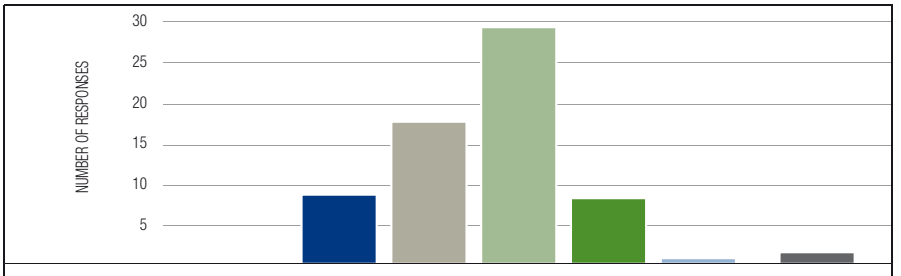
The overall response rate was high for the survey. The large number of results not only indicates the keenness of personnel to play an active role in improving the safety of offshore helicopter transportation, but it also enables accurate conclusions and observations to be made from the survey results.

Part 1 General Information

Part 1 of the survey provides an overview of the demographic breakdown of the respondents. Although an analysis of the results based on demographics is not included in this report, future evaluations may choose to undertake this task.

Q1: Age

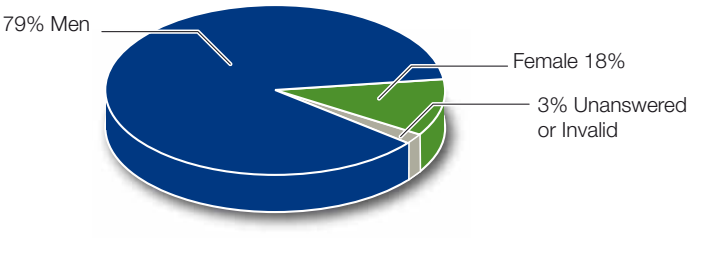
Forty-three percent (43%) of respondents are aged between 40 and 49. This is followed by personnel aged between 30 and 39, who comprised 27% of the respondents. The median age range was 40-49.



ANSWER	TOTAL	<20	20-29	30-39	40-49	50-59	60+	UNANSWERED OR INVALID
Number of Responses	**67**	0	9	18	29	8	1	2

Q2 : Sex

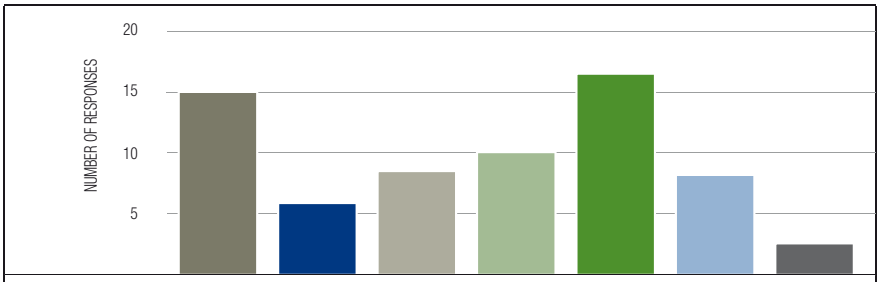
Of the 67 respondents, 79% were male and 18% were female. 3% of personnel did not answer this question.



ANSWER	TOTAL	MALE	FEMALE	UNANSWERED OR INVALID
Number of Responses	67	53	12	2

Q3: Job Role

The most frequently identified job role was "Administration/Finance", constituting 24% of all respondents. 15 respondents, or 22%, are "Pilot" and 10 respondents identified themselves as "Maintenance Engineer". The number of people identifying as "Executive/Manager" consisted of 13%.



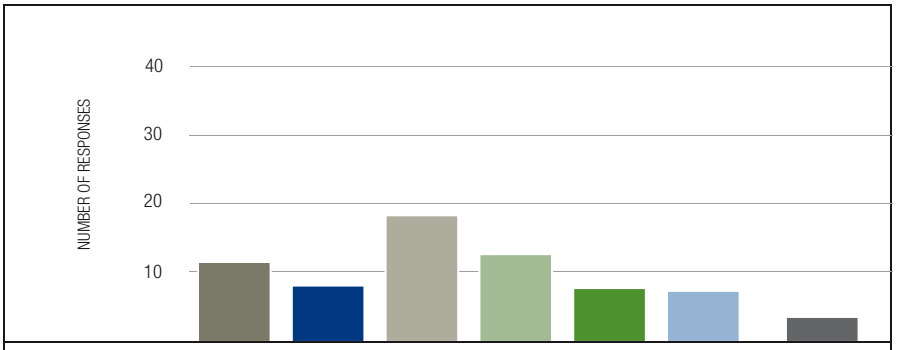
ANSWER	TOTAL	PILOT	RESCUE SPECIALIST	EXECUTIVE / MANAGER	MAINTENANCE ENGINEER	ADMINIS-TRATION / FINANCE	OTHER	UNANSWERED OR INVALID
Number of Responses	67	15	6	9	10	16	8	3

12% of respondents selected “Other.” The following is a list of the positions recorded.

JOB ROLE	NUMBER OF TIMES IDENTIFIED
Ramp / Security	2
Quality Control	1
Passenger Movement Controller [PMC]	1
Safety Coordinator	1
Safety Director	1
Search & Rescue [SAR] Pilot, Search Rescue Lead Pilot for St. John’s	1
Supervision	1
TOTAL	**8**

Q4: What area of the organization do you work in?

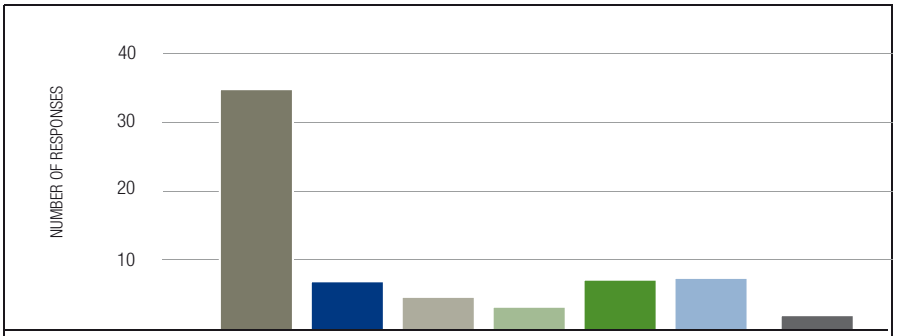
Twenty-seven percent (27%) of respondents work in “Flight Operations” within the organization. 18% of respondents work in “Maintenance” and 16% work in “IT/Finance”.



ANSWER	TOTAL	IT / FINANCE	SEARCH & RESCUE / SAFETY	FLIGHT OPERATIONS	MAINTE-NANCE	PASSENGER MOVEMENT / OPERATION CONTROL (OCC)	OTHER	UNANSWERED OR INVALID
Number of Responses	**67**	11	8	18	12	7	7	4

Q5: How many trips to the rig/platform would you make each year?

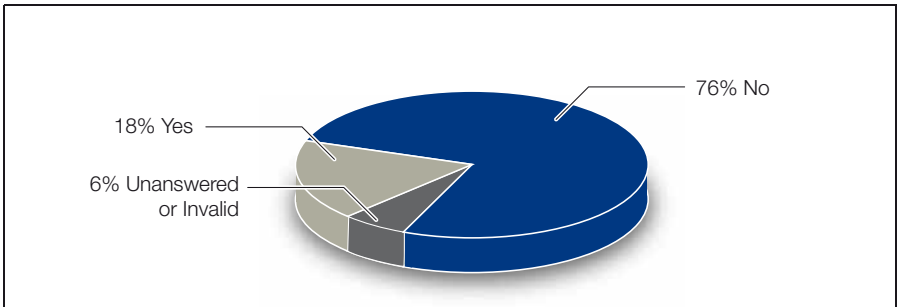
Fifty-one percent (51%) of personnel do not make any helicopter trips in a year. 24% of personnel make more than 51 flights each year and 10% make between one and three trips per year.



ANSWER	TOTAL	NONE	1-3	4-12	13-50	51-100	>100	UNANSWERED OR INVALID
Number of Responses	**67**	34	7	5	3	8	8	2

Q6: Do you hold a specific safety appointment or role with your employer?

Eighteen percent (18%) of participants indicated they hold a specific safety position with their employer. 13 respondents identified their safety roles, which are tabulated on the following page.



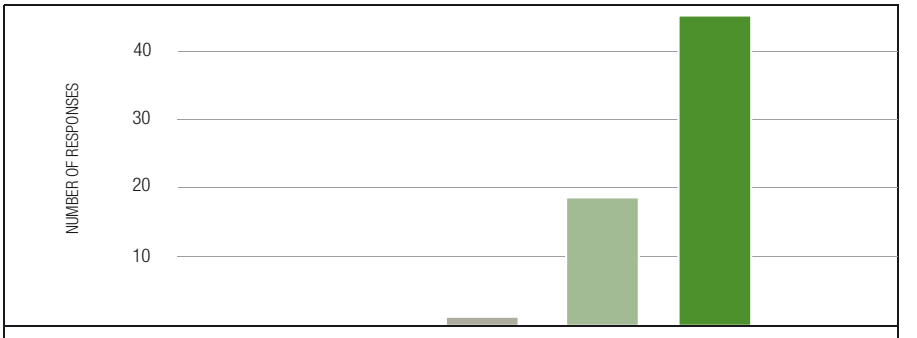
ANSWER	TOTAL	YES	NO	UNANSWERED OR INVALID
Number of Responses	**67**	12	51	4

GENERAL INFORMATION: QUESTIONS 1-6

SAFETY ROLE	NUMBER OF TIMES IDENTIFIED
SMS Committee Member	2
Chief Pilot Type-SK92	1
Director of Flight Operations	1
Director of SMS	1
Flight Data Monitoring	1
Helideck Inspector	1
Base Aviation Safety Officer	1
Safety Coordinator	1
Shift Lead	1
SMS Committee Chair	1
Training	1
Training Captain for Line ANS SAR	1

Q7: What is your level of confidence in respect to the safety of helicopter transportation?

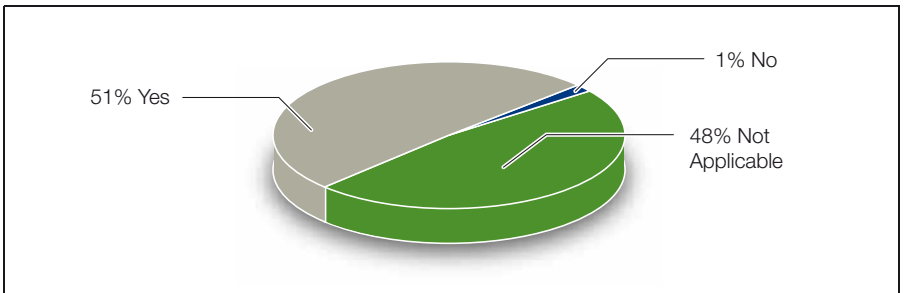
Of the respondents, 28% and 67% felt "confident" or "very confident" (respectively) about the safety of helicopter transportation. This total, 96%, indicates an overall confidence in helicopter travel safety. 4% of personnel indicated 3 out of 5. There were no responses indicating 1 or 2 on the scale, where 1 represented "not confident".



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**67**	0	0	3	19	45	0

Q8: Do you feel safe when travelling in helicopters to and from the rig/platform?

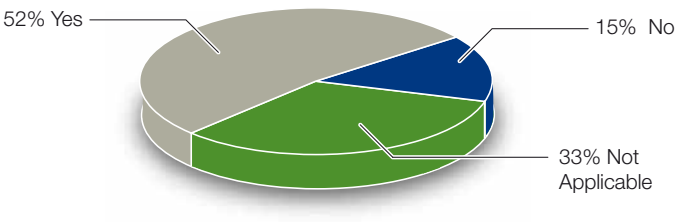
Thirty-two (32) respondents indicated that this question was not applicable to them. 34 or 51% of all respondents answered "Yes". This is equivalent to 97% of respondents to whom this question applies. 1 respondent answered "No".



ANSWER	TOTAL	YES	NO	N / A	UNANSWERED OR INVALID
Number of Responses	**67**	34	1	32	0

Q9: Following the Flight 491 accident, have you noticed any changes in safety practices of helicopter transportation?

Thirty-five (35) respondents indicated that they had noticed changes in safety practices following the Flight 491 accident. 22 people, or 33% of personnel, indicated that this question was not applicable. 15% of respondents answered "No".



ANSWER	TOTAL	YES	NO	N / A	UNANSWERED OR INVALID
Number of Responses	67	35	10	22	0

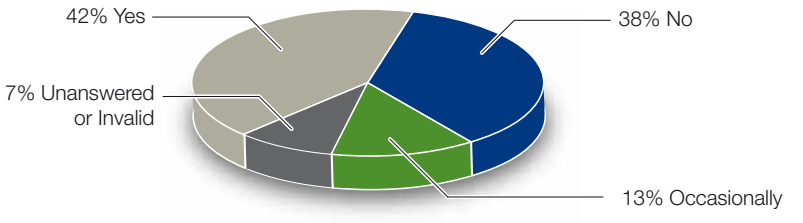
The following provides a summary of the frequency with which safety changes were identified by respondents. The recorded changes are included verbatim in Appendix A.

SAFETY CHANGE OBSERVED	NUMBER OF TIMES IDENTIFIED
Flight limitations (visibility/weather/fog/night) closely adhered to	12
New/better suits/better suit fit/fitted better	11
HUEBA/HEEBS implementation (and associated training)	8
Concern for safety more evident/safety at forefront/ safety precautions	6
Improved SAR	6
Training	6
Flying at lower altitude	4
Helicopter maintenance procedures more rigorous/more downtime for maintenance	3
Pre-flight briefing changes/more detailed	3
General S-92 performance	3
New rules and equipment	3

SAFETY CHANGE OBSERVED	NUMBER OF TIMES IDENTIFIED
Closer or more inspections/pre-tests/safety checks/ greater attention to detail/more attentive	2
Passengers/crew more aware about safety/emergency procedures	2
Increased security/screening	1
Better flotation gear	1
All safety issues have been increased and improved	1
Tracking and recording of flight data information	1
More personnel to perform tasks	1
Company directives flying schedules	1

Q10: Does your role require you to fly in the helicopter?

A total of 55% of participants said “yes” or “occasionally,” and a total of 45% answered “no” or did not answer the question.



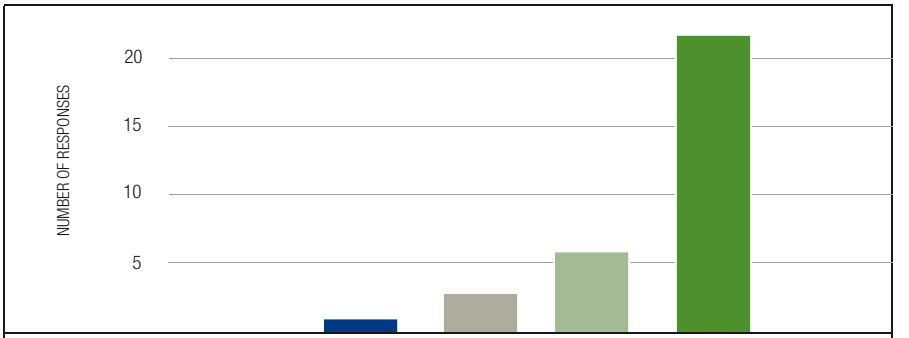
ANSWER	TOTAL	YES	NO	OCCASIONALLY	UNANSWERED OR INVALID
Number of Responses	67	28	24	9	6

IMPORTANT SURVEY NOTE

The following 10 questions were taken only by people who answered “yes” to question 10 and were those whose roles require them to fly offshore. For the purposes of calculating percentages, the total number of respondents for Questions 11-20 is assumed to be 37 (the number of respondents who answered “yes” or “occasionally” to Question 10). The “unanswered or invalid” response numbers include the 30 respondents who are excluded from these questions; however, these respondents were disregarded when percentages were calculated.

Q11: How capable do you feel to respond to an emergency situation in a helicopter?

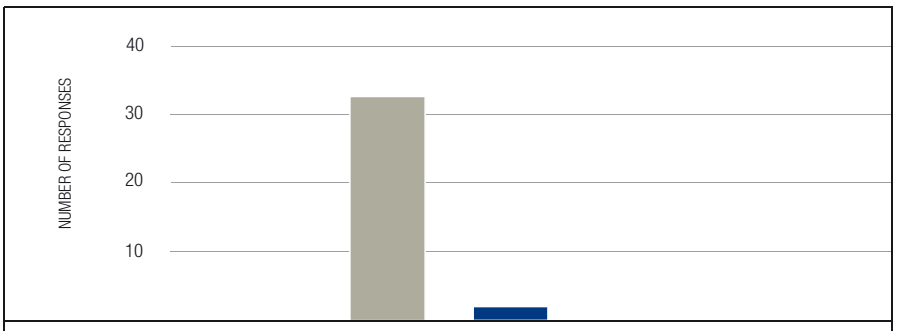
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, 16% and 59% felt capable or very capable of responding to an emergency situation in a helicopter, as indicated by an answer of 4 or 5 out of 5. This total, 76%, indicates that the majority of respondents feel that their emergency response capability is high. 8% of respondents indicated 3 out of 5, a neutral response, to the capability level. In total 3% of respondents (one response) did not feel capable, scoring 2 out of 5.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR NOT APPLICABLE
Number of Responses	**67**	0	1	3	6	22	35

Q12: Have you received training for emergency situations in helicopter operations?

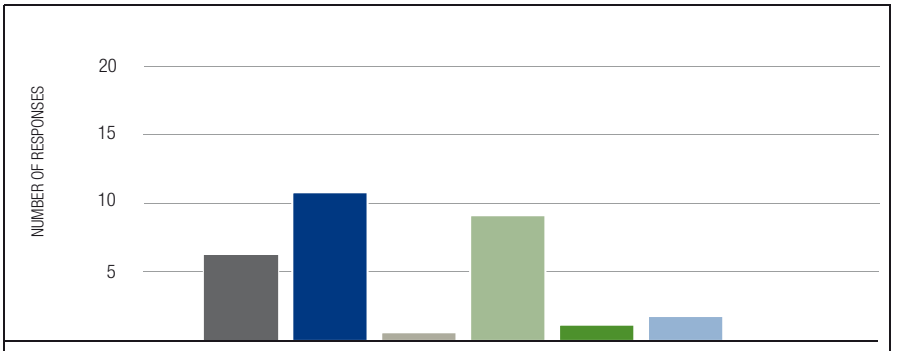
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, 84% indicated that they had received training for emergency situations in helicopter operations. A couple of personnel had indicated “no.”



ANSWER	TOTAL	YES	NO	UNANSWERED OR NOT APPLICABLE
Number of Responses	**67**	31	2	34

Q13: How often do you receive recurrent/refresher helicopter safety training?

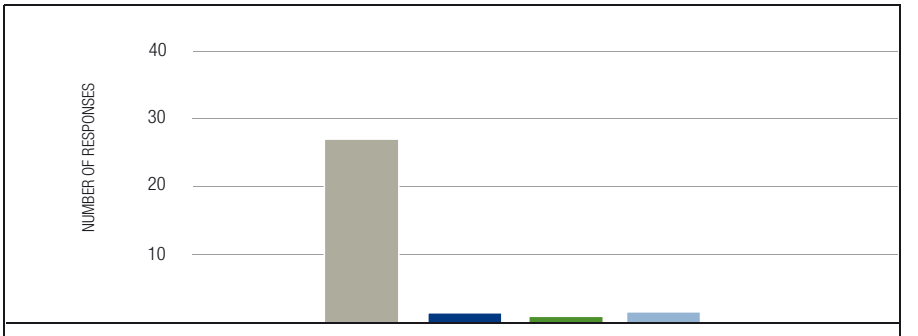
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, 30% of respondents indicated that they received recurrent or refresher helicopter safety training once every year. A total of 46% of personnel whose role requires them to fly in a helicopter receive helicopter safety training at least once per year.



ANSWER	TOTAL	TWICE A YEAR	ONCE A YEAR	EVERY TWO YEARS	EVERY THREE YEARS	CAN'T REMEMBER	N / A	UNANSWERED OR NOT APPLICABLE
Number of Responses	**67**	6	11	1	9	2	3	35

Q14: Did the helicopter safety training involve physical drills or exercise?

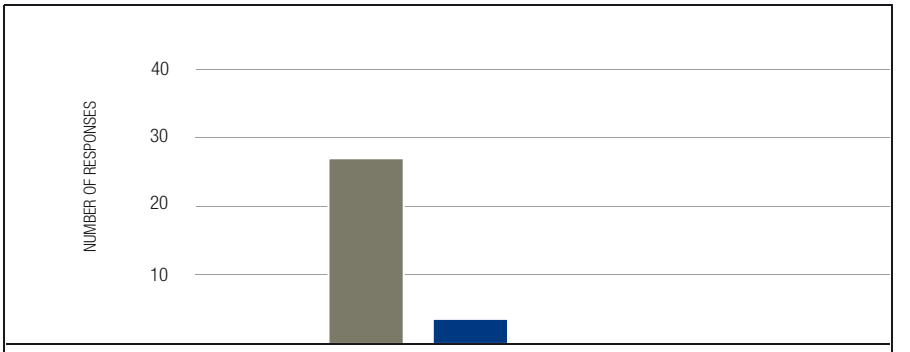
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, 73%, indicated that the helicopter safety training involved physical drills or exercises. 6% said no to this question.



ANSWER	TOTAL	YES	NO	DON'T KNOW	N / A	UNANSWERED OR NOT APPLICABLE
Number of Responses	**67**	27	2	1	2	35

Q15: Have you undertaken Helicopter Underwater Escape Training (HUET) training?

Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, 76%, or 28 employees, have undertaken HUET training.

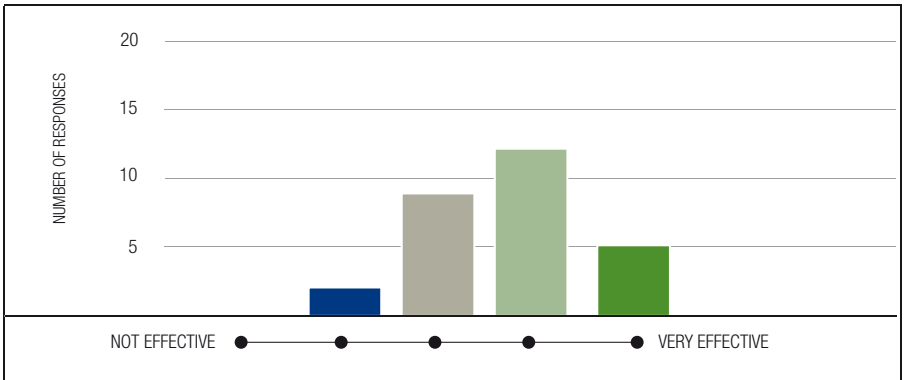


ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR NOT APPLICABLE
Number of Responses	67	28	4	0	35

The following question was taken only by people who answered "yes" to Question 15, those who have undertaken HUET training. Percentages for Question 16 have been calculated using 28 as the total number of respondents.

Q16: How effective is the HUET training?

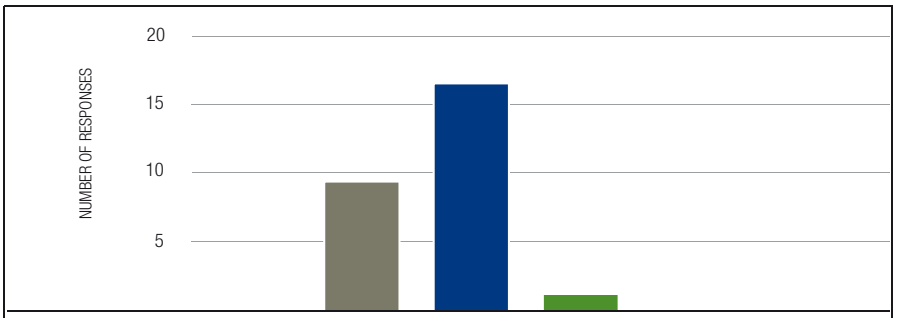
Of the respondents who indicated in Question 15 that they have undertaken HUET training, when asked to rate the effectiveness of the HUET training on a scale of 1 to 5—with 5 being very effective—36% of passengers scored it as 4; 54% of passengers rated the HUET training as 4 or 5 out of 5. 28% of respondents indicated 3 out of 5.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR NOT APPLICABLE
Number of Responses	67	0	2	9	12	5	39

Q17: Do you have any concerns with the breathing device, PLB or other personal safety equipment issued to you at the heliport?

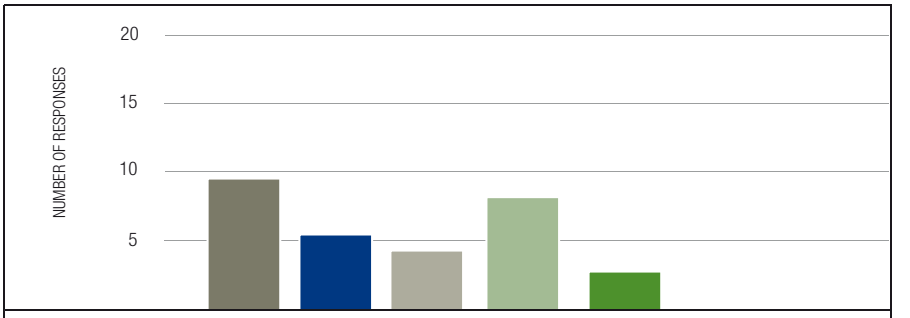
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, the most frequently identified response to this question was "no" with 46% of participants indicating that they are not concerned with the safety equipment issued to them. 24% of respondents indicated "yes" to this question.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR NOT APPLICABLE
Number of Responses	**67**	9	17	2	39

Q18: Do you have any concerns with your survival suit?

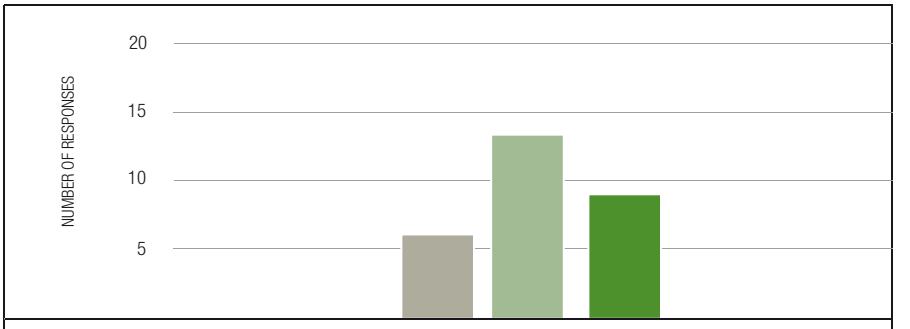
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, the most commonly identified response was 1 out of 5, indicating no concern with survival suits. This response was selected by 24% of personnel. Combining the responses for 1 and 2, i.e. not concerned, comprises 38% of responses. The responses at the other end of the scale, indicated by 4 or 5 out of 5, correspond to 27% of all respondents.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR NOT APPLICABLE
Number of Responses	**67**	9	5	4	7	3	39

Q19: How satisfied are you with the adequacy of the training and procedures on how to use the safety equipment?

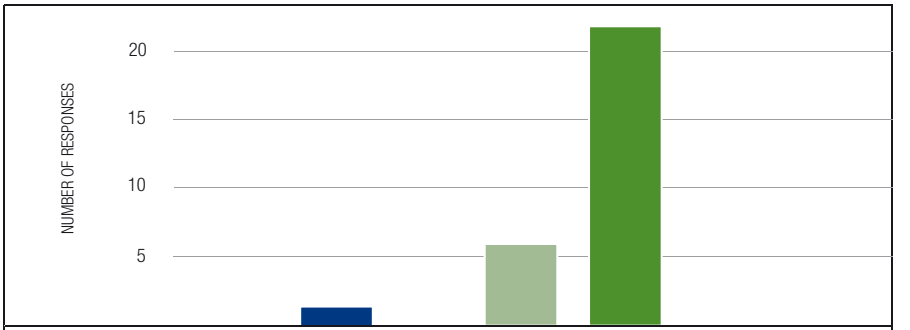
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, a total of 59% of personnel are satisfied with the adequacy of training and procedures on how to use safety equipment. No respondents scored 1 or 2 out of 5 for this question, indicating that no respondents are dissatisfied with safety equipment training and procedures.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	67	0	0	6	13	9	39

Q20: When you are travelling by the helicopter how satisfied are you that you get the right amount of information about helicopter operations?

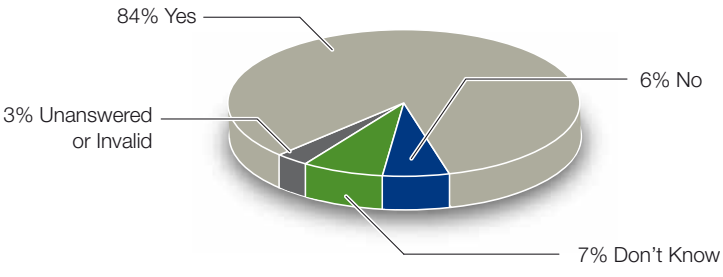
Of the respondents whose roles require them to fly offshore as indicated by their response to Question 10, 62% of personnel indicated that they are very satisfied with the amount of information they receive when travelling by helicopter. Combined responses for satisfied and very satisfied, 4 and 5 out of 5, comprise 78% of all responses. Only 1 respondent indicated dissatisfaction with the amount of information received.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR NOT APPLICABLE
Number of Responses	67	0	1	0	6	23	37

Q21: Do you believe there is an adequate level of overseeing of safety (safety oversight) for helicopter transportation?

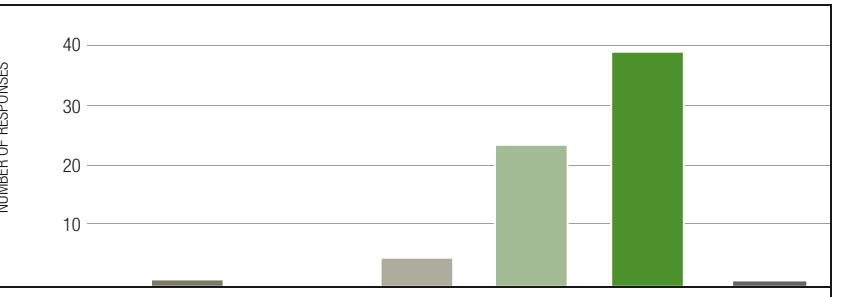
Fifty-six (56) personnel, or 84% of respondents, indicated that they believe there is adequate safety oversight for helicopter transportation. 6% of personnel selected "No", and 7% of personnel indicated "Don't Know".



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	56	4	5	2

Q22: Please rate your organization's safety culture?

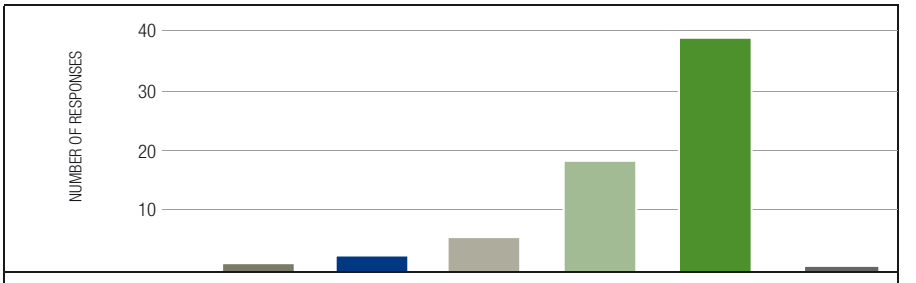
Thirty-nine (39) personnel, or 58% of respondents, rated their organization's safety culture as "Excellent". A further 33% indicated 4 on the scale of 5. This equates to 91% of respondents rating the safety culture as 4 or 5 out of 5, where 5 represents excellent. 6% indicated 3 out of 5, and 1% rated it 1, where 1 indicates a "poor" safety culture.



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**67**	1	0	4	22	39	1

Q23: Do your consider your organization/employer to have an open reporting culture?

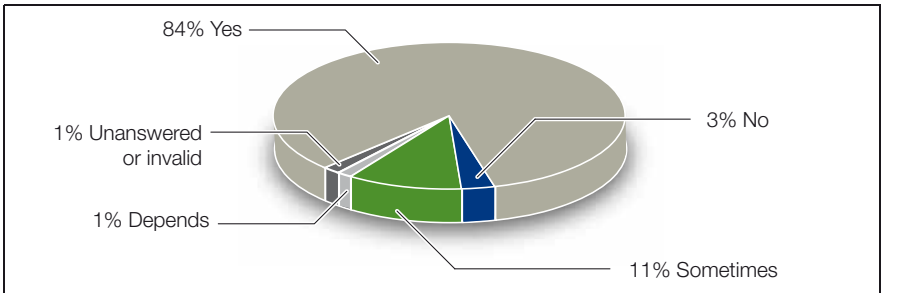
A "very open" reporting culture was identified by 58% of participants. 28% of personnel indicated 4 on the scale of 5, and 7% indicated 3 out of 5. 4% of respondents indicated either 1 or 2 on the scale, where 1 represented "closed culture".



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**67**	1	2	5	19	39	1

Q24: Are you comfortable that you are able to personally raise your safety concerns?

Eighty-four percent (84%) of respondents indicated they feel comfortable to personally raise their safety concerns. 11% of respondents indicated "Sometimes". The explanations given in response to this question are included below.

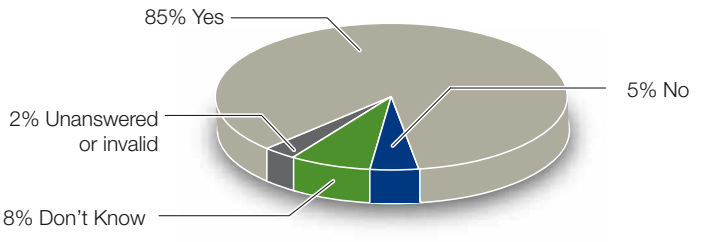


ANSWER	TOTAL	YES	NO	SOMETIMES	DEPENDS	UNANSWERED OR INVALID
Number of Responses	**67**	56	2	7	1	1

Answer	Explanation
It Depends	As long as it doesn't prevent flying
Yes	But I am in a position to make changes anyway
No	It has improved over the past year, but there is still room for improvements. Pilot concerns are pushed aside, people that do not fly offshore make light of our safety concerns, comes down to the cost!

Q25: Does your organization/employer have a confidential reporting system for safety?

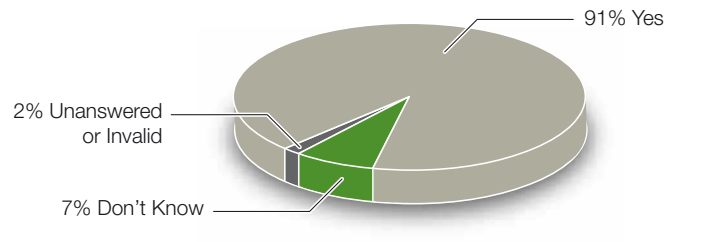
Fifty-seven (57) or 85% of personnel responded "Yes" to this question. 12% of all respondents indicated either "No" or they "Don't Know" about the existence of a confidential reporting system.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	57	3	5	2

Q26: Does your organization/employer have a Safety Management System?

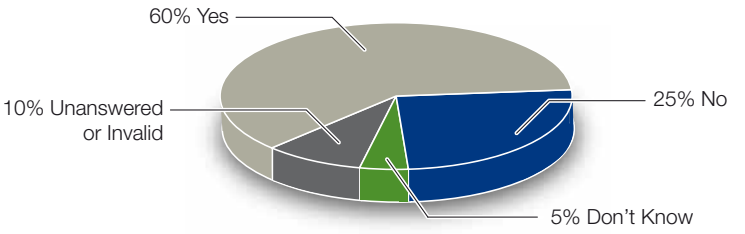
Ninety-one percent (91%) of respondents confirmed that their organization or employer has a Safety Management System (SMS). 7% of respondents indicated that they "Don't Know".



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	61	0	5	1

Q27: Have you received training on the Safety Management System?

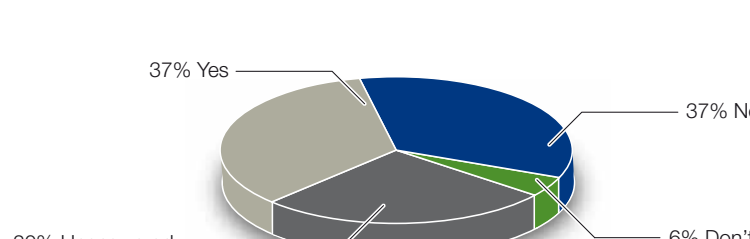
Sixty-seven percent (67%) of personnel have received training on their organization's SMS. This is over two-thirds of the people who indicated in the Question 26 that their organization had an SMS. More than 27% of employees have not received training in their organization's SMS. 6 respondents had an invalid response to this question, as they had answered "No" in Question 27.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	41	17	3	6

Q28: Do you regularly use the Safety Management System?

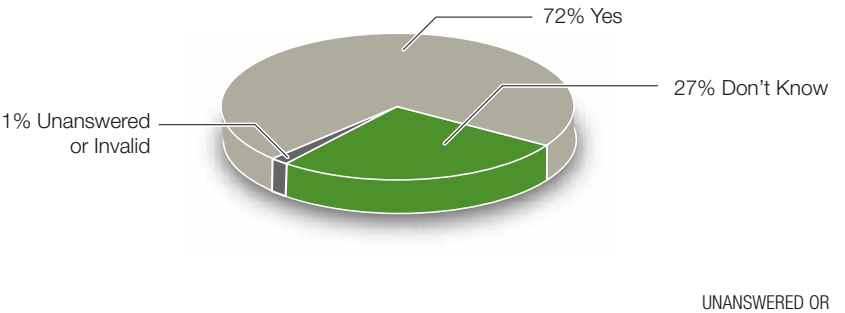
Equal numbers of people answered "Yes" and "No" to this question, with 23 responses for each. 18 respondents indicated this question was not applicable and therefore did not answer.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	23	23	3	18

Q29: Does your organization/employer do risk assessments?

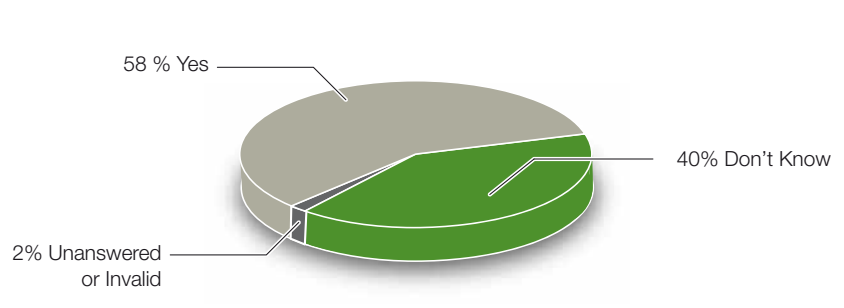
Forty-eight (48) or 72% of participants indicated that their employer or organization undertook risk assessments. 27% of respondents did not know if risk assessments were undertaken.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	48	0	18	1

Q30: Does your organization/employer have a risk assessment on helicopter transportation?

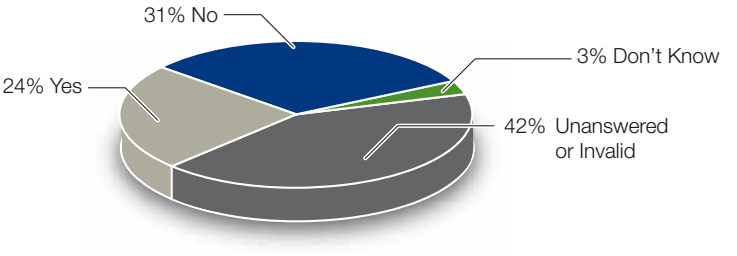
Fifty-eight percent (58%) of participants indicated that their organization had a risk assessment on helicopter transportation. 40% did not know whether or not their organization had a risk assessment on helicopter transportation.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	39	0	27	1

Q31: Have you seen a copy of the risk assessment on helicopter transportation?

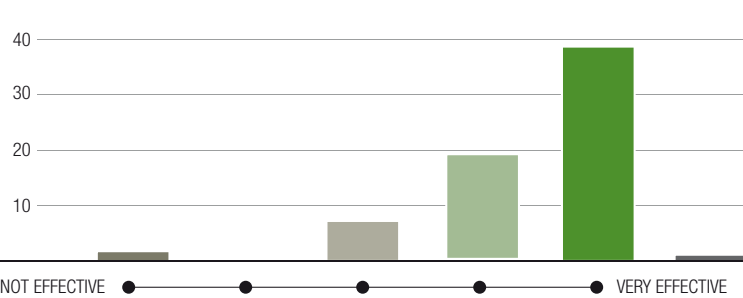
Twenty-four percent (24%) of personnel have seen a copy of the risk assessment on helicopter transportation. 76% of personnel did not give a positive answer of "yes." 42% answered not applicable or invalid as they had answered no to the previous question.



ANSWER	TOTAL	YES	NO	DON'T KNOW	UNANSWERED OR INVALID
Number of Responses	**67**	16	21	2	28

Q32: How effective do you believe your safety committee is in addressing safety concerns?

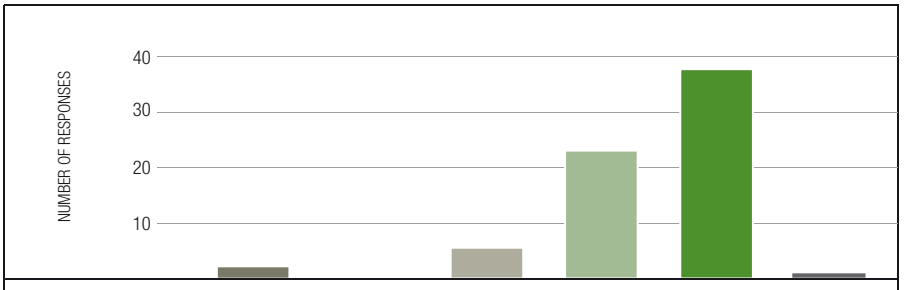
When asked to rate the effectiveness of the organization's safety concerns, 57% selected 5 out of 5 on the scale, where 5 represented "Very effective". The total of 57 participants, or 85%, chose either 4 or 5, indicating an effective safety committee. 10% indicated 3 on the scale, and less than 3% answered either 1 or 2 on the scale of 5, where 1 indicated "not effective".



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	**67**	2	0	7	19	38	1

Q33: How satisfied are you with the level and amount of information regarding helicopter safety available to you?

The most frequently identified response is 5 on the scale of 1 to 5 and with 5 representing "very satisfied", comprising 55% of all responses. 88% of personnel answered either 4 or 5 on the scale, and 3% answered 1 or 2, where 1 indicated "not satisfied".



ANSWER	TOTAL	1	2	3	4	5	UNANSWERED OR INVALID
Number of Responses	67	2	0	5	22	37	1

Q34: Additional Information

Thirty three (33) respondents identified at least one concern in this part of the survey. In total 78 concerns were identified. These were broadly grouped in 19 fields in order to provide an indication of how frequently similar concerns were identified. The frequency is shown below. Each individual response is contained in Appendix B. Respondents were asked to identify how significant each concern is, with 5 indicating they are "extremely concerned" and 1 indicating "not a big concern." The most frequently identified concerns dealt with survival suits and SAR capability.

		FREQUENCY						
			TOTAL FREQUENCY AS CONCERN SIGNIFICANCE					
		EXTREMELY CONCERNED						NOT A BIG CONCERN
	CONCERN GROUP	TOTAL	5	4	3	2	1	CONCERN NOT RATED
1	Suits	9	4	1	2	1	1	0
2	SAR (location, rescue response time, availability)	8	2	5	0	1	0	0
3	Oversight of safety / regulations / safety enforcement	7	3	2	1	1	0	0
4	Safety as a priority / timely implementation of safety measures	6	4	0	1	0	0	1
5	Training	6	2	1	2	1	0	0
6	Flying in bad weather / visibility / sea states / proper limitations in place for these	5	1	4	0	0	0	0
7	Inadequate personnel numbers, long shifts, fatigue	5	1	1	1	0	0	2
8	Pilot and crew procedures, experience and decision-making skills / response in emergency	5	2	1	1	1	0	0
9	Night flying	4	2	1	0	1	0	0

			FREQUENCY					
			TOTAL FREQUENCY AS CONCERN SIGNIFICANCE					
		EXTREMELY CONCERNED						NOT A BIG CONCERN
	CONCERN GROUP	TOTAL	5	4	3	2	1	CONCERN NOT RATED
10	Amount and level of information / transparency / communication about helicopter operations	4	0	1	1	0	0	2
11	OTHER	4	2	0	1	0	0	1
12	HEEDS / HUEBA	4	3	1	0	0	0	0
13	Gearbox	3	2	1	0	0	0	0
14	Ditching (including flotation)	2	0	0	1	0	1	0
15	Helicopter maintenance / mechanical failure / equipment failure / inspection / reliability	2	1	1	0	0	0	0
16	Communication inside helicopter	1	0	1	0	0	0	0
17	Human factors (size / reaction)	1	0	1	0	0	0	0
18	Number of flights for each passenger	1	1	0	0	0	0	0
19	S-92A performance / choice of helicopter	1	0	0	0	1	0	0

QUESTION 35: OPPORTUNITIES FOR IMPROVEMENT

Q35: Opportunities for Improvement

The final part of the survey asked respondents to suggest three opportunities for improvement in helicopter transportation. A summary of the results is included below. Each individual response is contained in Appendix C. The frequency column in the table below indicates the total number of times each suggestion topic was identified.

	SUGGESTION FOR IMPROVEMENT	NUMBER OF TIMES IDENTIFIED
1	Training / training updated / more frequent / more realistic	13
2	Safety regulations / regulator improved	9
3	Improved suits – fit / thermal protection / gloves / hood / seal / mobility / comfort / customized	7
4	Improved SAR (location / response time / availability)	7
5	Improved communication frequency / level / amount between Cougar and Operators to passengers regarding all aspects of helicopter operations (including flight line)	3
6	Use different helicopter model	3
7	Pilots well trained / correct emergency procedures in place	3
8	Increase medical / physical requirements for offshore workers	3
9	Allow air operators to manage transportation-related issues	3
10	Better scheduling for employees (more advance notice) to reduce stress / fatigue	3
11	Better working conditions, increase morale	2
12	Additional helicopter(s) / crew	2
13	Fly only in limited sea states / weather / visibility / strict limitations for these	2

	SUGGESTION FOR IMPROVEMENT	NUMBER OF TIMES IDENTIFIED		
14	Improved maintenance / inspections procedures	2		
15	Improved aircraft capabilities	2		
16	HUEBA / HEEDS	2		
17	Increase weather information / accuracy	2		
18	Resolve all mechanical problems / reliability	1		
19	General improvement to safety	1		
20	No night flights	1		
21	Bring back night flying (with appropriate measures in place)	1		
22	Proactive information campaign	1		
23	Compare east coast of Canada to other areas with safe practices and adopt as appropriate	1		
24	Lower payloads on the helicopter	1		

AUGUST 2010

Offshore Helicopter Safety Inquiry

Appendices

The contents of the following Appendices are a presentation of the raw data submitted by survey respondents. In the interest of full transparency, comments made by survey participants were transcribed as submitted. Typographical errors have not been amended in the interest of maintaining accuracy of comment.

APPENDIX A: QUESTION 9 RESPONSES

Changes in safety practices following the Flight 491 accident

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	1. Too much focus on data that passengars cannot use distract us from focusing on other saftey areas. 2. Better flotation gear. 3. Helmets. 4. Better Emergency checklist and procedures.
Yes	A restrictive set of guidelines from the offshore operations sikorsky amndments to the MGB practices and operation
Yes	All safety issues have been increased and improved.
Yes	Altitude restriction, HEEDS (Emergency breathing device). No flight at night
Yes	Better suits, more training in emerg. Procedures and Awareness
Yes	Briefing video, suit change
Yes	Enhanced SAR posture, enhanced safety diligence. Enhanced training and focus.
Yes	Flight planning, night currency for pilots, briefings of passengers, new suits (offshore) SAR response within Cougar, tracking and recording of flight datas information
Yes	HUBA bottles for pilots, additional SAR training and crews.
Yes	HUEBA for Pax and Pilots, redesigned PAX suits, increased SAR response and capability
Yes	HUEBA implemenation
Yes	I have seen numerous safety initiatives post 491, ie: alititude, crew suits, emergency egress devices, crw life vests etc…
Yes	If feel safety practices within the maintenance dept. were very good pre-accident.
Yes	increase in SAR
Yes	It's always been very safe. Safety has always been first
Yes	Less pressure to depart when weather is bad.
Yes	Lower Att and no night flights
Yes	Major improvements, more security for passenger, better training for pilots, more attention to small details, better understanding of the risk involved in flying overwater.
Yes	Many new initiatives from aircrew/passenger/maintenance and original SMS implementation
Yes	More awareness fo the passenger safety more personnel to perform tasks and more personal training
Yes	More Awareness of practices already in place-better communication/info
Yes	New immersion suits, HEEDS helicopter SOP's, company directives flying schedules, flights of nigh, SAR.
Yes	New risk management assements, no passenger movements during nights. More thought put in to the risk before sending a flight offshore.
Yes	New safety equipment has been added to the survival suits
Yes	New suits, new rules, new equipment
Yes	night flying has stopped, more emphasis is put on safety when performing maintenance tasks.

APPENDIX A: QUESTION 9 RESPONSES

Changes in safety practices following the Flight 491 accident

SURVEY RESPONSE	CHANGES IDENTIFIED
Yes	Night flying restriction. Less customer pressure to launch when weather conditions are relatively unfavorable.
Yes	No night flights pax air bottles transmissions improvements, pilot air bottles, etc.
Yes	No night flights to rig
Yes	No night flying
Yes	No night passenger movements
Yes	RS numbers up, RS dedication chopper, new suits
Yes	Sea state 6 modification, HUEBA, Survival suit issues addressed, A/C modifications, increased training and awareness
Yes	Survival suits, focus on training
No	We have only changed the altitude. Nothing needed to be scheduled it is a very safe and professional company!!

APPENDIX B: QUESTION 34 RESPONSES

Concerns with helicopter transportation

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	As a pilot, the immersion suit is great, however Cougar supplies standard cotton underwear for under the suit. This is unacceptable for this type of suit. Also the HEEDS bottle should have a hose attached to the bottle not just the mouthpiece attached to the bottle on egress, bottle weight would pull the mouthpiece from the mouth.	**5**
1	Colour and effectiveness of pilot survival suits.	**5**
1	Flying the S-92 in sea state conditons that is designed to handle. There are many ways and many factor's are need to determine sea states. The oil companies and my employer have not developed any type of procedure to aid pilots in determining what sea states are on a given day. To give you an example, I put this concerns into our SMS and they got dismissed by the director of flight operations.	**5**
1	Inability of S92 transmission to operate without oil	**5**
1	Lack of a "dedicated" (not for passenger use!) helicopter for SAR operations. An A/C designed "specifically" for SAR/	**5**
1	Mechanical problems	**5**
1	Night flying (should not be done to the possibility of an effective rescue)	**5**
1	None, oil operators should allow the helicopter companies to conduct their own business.	**5**
1	Not being able to fly at night. This was never a concern to me before but now that we have been told that we cannot fly at night currency and proficency is a concern to me. I don't understand why we cannot fly at night?	**5**
1	Onshore aviation weather observers are required, legally, to be trained/examined/certified to environment canada standars. Many if not most of the ofshore aviation weather observers do not have this level of training and are certainly not examined and certified in environment canada. Why is this?	**5**
1	Some personel equipment used for protection, like survival suit or breathing device are not the beast on the market. More research needs to be done.	**5**
1	With increased oil production offshore. The number of people have and will continue to increase travel offshore. Thus increasing the element of risk. The highest level of safety must be attained to eliminate any safety issues.	**5**
1	Passengers have far too much access to information regarding a snag or problem with the aircraft. This causes too much anxiety among group s of passengers, resulting in unstable mindsets while traveliing on the helicopters.	**4**

APPENDIX B: QUESTION 34 RESPONSES

Concerns with helicopter transportation

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
1	Q 16 and Q17 HUET is completed in a controlled environment, it will probably never be like the pool. Breathing devices along with goggles give passengers a FALSE sense of security, both items are focused on too much.	**4**
1	Qualified and trained SAR crews are maintained.	**4**
1	Rectifying the S92 Gearbox issues	**4**
1	Fatigue due to long duty days (14hrs) while wearing an uncomfortable (very worn) survival suit.	**4**
1	Flights conducted at extreme end of duty day in marginal weather.	**4**
1	Adequate thermal protection under immersion suit.	**3**
1	Mis-information of industry	**3**
1	Rescue specialits require a better survival suit one that is more breathable and better suited for intence work/ swimming.	**3**
1	The HUET training is every 3yrs. I believe that it should be a yearly requirement, every 3 years you are not comfortable with the skills on exiting the helicopter underwater. It will certainly increase the skill level required if there is ever a time needed for this skill.	**3**
1	Turn arounds	**3**
1	Survival suit and training	**2**
1	Well built aircraft (see p. 4)	**2**
1	Last minute changes provide operational pressure yet customers still want on time.	**2**
1	Level of Pilot training/experience	**2**
1	no concerns	**-**
1	Only new, don't know the industy enough yet to make valid concerns.	**-**
1	As a company, I have no concerns	**-**
1	I have no concerns. If our crews are willing to operate/ fly our fleet of helicopter then I would have no issues flying with them.	**-**
1	I have no serious concerns with Helicopter transporation	**-**
1	Lack of AMEs, need more guys, lack of communication, better shift rotation between days and nights don't always practise what they preach!	**-**
2	Aux fule tanks mounted internally are no issue to passengers. Up until 2005 the Super Pumas also had internal Aux tanks wich blocked access to 2 window and up to 3 passengers sat on for the entire flight. The aux tank is a requirement for this location and there is no other aircraft available that can do the job without aux tanks.	**5**

APPENDIX B: QUESTION 34 RESPONSES

Concerns with helicopter transportation

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	Crew rest- flight crews are often subjected to vey long days (14hrs) 10hrs of which could be spent sitting at the hangar on weather hold. This leaves the pilots feeling lethargic and tired making it difficult to focus. There is no quiet place for aircrew to rest while on hold at the COugar heliport.	**5**
2	During HUET training flight suits leaked terribly.	**5**
2	Lack of adequate/appropriate HUET training for SAR crews. Crew trg should be a dedicated intensive program for air crews in a simulated environmental condition.	**5**
2	Living conditions for touring pilots are unacceptable. 5 pilots are crammed into residential home. Schedule often means pilots are coming and going at all hours. Disrupting rest patterns often it is unclean and damp in the basement. The basement rooms do not meet occupancy code. Very little is done to address these concerns.	**5**
2	Search and rescue readily available (24/7)	**5**
2	SMS (safety management system. On several occasions concerning items have been entered into the SMS. On some occasions management will access the system and change what they have written, and the person will get called into the office and told not to write it again. We were told thatthis system was to be non punitive but believe me that is not the case.	**5**
2	The breathing device, the pilots wear a different device companred to the passengers. Pilots wear the bottles that is incertified into the life jacksts. Due to costs of replacing these jackets (that's what we are told) we are stuck using this device. The HEEDs bottle are much more cumbersome and more room for errors, companred to what the passengers wear. I would like to see the pilots get the bottles that are attached to the suit with the breathing hoses. The safety department are made up of people that do not regularly fly offshore; no pilot to represent the pilots concerns, therefore our requests are pushed asside due to costs!	**5**
2	To much focus on crews trying to appease pas. You do not see airline (pilots) appeasing pax with written reports for delays. This is taking away the pilot's focus.	**5**
2	Training: some of the training, like the HUET is not realistique of the condition that we are flying in. Higher cover of training is required to improve confidence and give you technics for survivals.	**5**
2	With regards to the helicopter and its operators what issue's they are having with gearboxes and compenents. I am very concerned.	**5**
2	Weather	**4**

APPENDIX B: QUESTION 34 RESPONSES

Concerns with helicopter transportation

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
2	SAR. I think that SAR should be a governemnt controlled service, not left to cougar as most people are not trained proficiently.	**4**
2	Night flights should not be conducted exept for emergency	**4**
2	Oil companies are large, powerful and in reality contorl overall safety of cougar flight operations. I feel that cougar management is very reluctant to challenge any customer wishes and directors. This is driven completely by commercial interest.	**4**
2	Passengers are (some of them) too large and unfit to be reasonablly capable of escaping helicopter.	**4**
2	New aircraft not as servicable as they should be.	**4**
2	Current SAR posture and effectiveness	**4**
2	Pressure/ rules sictated by oil companies temd to dictate air operators, with little/ no knowledge in aviation	**3**
2	Uneducated perceptions of safety	**3**
2	Water landings	**3**
2	Night flights	**2**
2	SAR response time	**2**
2	Low Moral and motivation, working night night is proven that it affects your health. 12 hour shift are too long.	**-**
3	(S.A.R) Although the SAR program is moving forward in my opinion it is currently taking the wrong path. As pilots some of us are currently forced to SAR standby even though we are not properly trainged to do so . We are current according to the regulations, but many of us are not capable of doing what would be expected of us it (God forbdi) another helicopter crashed in the ocean. To perform SAR missions over water safely takes a lot training, and pilots are put in the position where they may have to. This is not a position that I enjoy being put in.	**5**
3	Attitude: Before the accident every one, expect the flight crew, thought that going on the helicopters was like taking the train or bus. NO one in the oil industry was listening the consern of Cougar.	**5**
3	Insufficent operational control or independence of SAR operations from passendger movement operations lack of knowledge of SAR operation by key management personell.	**5**
3	Oil companies need to worry about getting the oil out of the ground and let the "helicopter" company worry about the helicopters. I use to work for an aviation company, now I work for a bunch of "know it all who if they weren't so cheap when it comes to safety we wouldn't be going through all of these issues. How come no one asked about safety on the rigs/ platforms.	**5**

APPENDIX B: QUESTION 34 RESPONSES

Concerns with helicopter transportation

CONCERN NUMBER	CONCERN	SIGNIFICANCE LEVEL
3	People do not embrace "personal accountabilty for their own survivaly. For example, the want the offshore salary and lifestyle but do not like the suit or survival training.	**5**
3	Flying over stormy sears where there is no chance of surviving an otherwise ditching at sea	**4**
3	Lack of adequate and effective SAR response; if weather conditions (visibilty and sea state) preclude a timely and effective rescue once has to question why passengers and travelling offshore on that given day.	**4**
3	P/A system in A/C and its reliability to brief passengers in an emergency	**4**
3	SAR program at Cougar is no where near what is expected by the oil companies. Having come from DND SAR program, much needs to be directed before any SAR could be performed, MEDEVAC excluded.	**4**
3	Too many inexperienced flight crew in the system now	**4**
3	Survival suits/ more in depth training marine institute.	**3**
3	There is much emphasis put on the passenger comfort and safety, but there is a a huge disconnect when it come to crew safety! A review of the qualification and experience levels of the SAR crews. The use of flight crews and level of fatigue due to shorages of crews. my concern is the SAR crew qualifications, they are the people that we depend on as they have the experience and capability to do the job and the use of flight crews there is an ongoing shortage of crews. Flight crews duty days are switched around so frequently, and the rest times are limited.	**3**
3	Woule the A/C stay afloat in the North Atlantic	**1**
3	NO meeting between crew chiefs and management! Crew Chiefs should have regular meeting with their guys to voice opinions and concerns. This should be relayed by crew chiefs in meeting with management. Need more meetings.	**-**

APPENDIX C: QUESTION 35 RESPONSES

Opportunities for improvement

NUMBER	SUGGESTION
1	A dedicated "SAR only" aircraft "not" to be reconfigured for passenger use.
2	A schedule that allows you to know what you're doing at least a few days ahead of time.
3	A source of weather information every 50-60 min to the offshore field.
2	Additional enhanced SAR training for EFR crews.
2	Allow night flying while having the government cover night rescue on a 30 minute or 1 hour response time.
3	Anonymity of the SAR department with total operational control and sell dispatching capabilities.
2	Appoint an independent industry safety overseer/regulator which can operate objectively and without concern for commercial perceptions. C-NLOPB is clearly not a good choice.
3	Attitude change: from ACC management in the industry. Oil industry and off smore flying industrie.
1	Attitude change: Realizing the risk involved and doing everything to reduce it. Training, equipment, SAR aircraft.
1	Basically, I would like to see less malfunctions with the S-92. I feel that people had more reliability in the Super Power's that we had for the first few years.
2	Better aircraft (eurocopter EC 225)
1	Better aircrafts (old technology/lots of minor issues on the S92)
2	Better communation on both sides
2	Better definition of roles: Air operators: operate/manage the aircrafts; oil companies: operate/manage oil-related issues
1	Better emergency training for crews and passengers which would hopefully instill more confidence and comfort during flight. Also some sort of seminar for passengers outlining the nature of most aircraft deficiencies and how they are dealt with (safely). As well as the challenges present in operating these aircraft offshore St. John's
1	Better satalite coverage to view fog during summer fog season and better weather forecasts for offshore
2	Better training for every one. Oil worker, suppervisor, air crew.
1	Boost moral, company is making money lets see some profit sharing cheques bring pizza in for the night shift once in a while, its done on day shift. Treat people fai anything to boost moral.
2	Company allow money to purchase own thermal protection rather than using the one they think is appropriate.

APPENDIX C: QUESTION 35 RESPONSES

Opportunities for improvement

NUMBER	SUGGESTION
3	Compare the East Coast of Canada to the GOM when it comes to safe practises and then pass it on. Remember this entire event albeit tragic was not a controlled event therefore the statistics go way up when it comes to not surviving. If this was a controlled ditching vs "crash" and we lost all those people I would agree that we have a problem...it was a "crash" @ 20+G's! The only problem that day was a catastrophic failure that the flight crew were unable to diagnose.
1	Correct the immersion suit issue. Correct the HEEDs issue.
2	Correct the living conditions to a standard that exists else where.
2	Customers (oil operators) must use their own aviation advisors to convey helicopter and operations issues to passengers.
1	Different flight suits for pilots. The ones that they have are dark in color and are not very visible if something happend and they needed to be rescued.
2	Ensure all flight survival suits are water tight with perhaps some sort of internal heat source.
1	Ensure offshore aviation weather observers are trained to environment Canada standards and are examined and certified by environment Canada.
2	Final thoughts. Although this survey is not long enough to address all of my concerns. I do appreciate the opertunity in touching on some of the more important ones. I think this company as grown to big to fast, and safety has been sacrificed to do so. I give you an example, I cannot remember the last time there was a saftey meeting. I can assure you it was long before the crash of flight 491.
3	General overhaul of dispatch requires additional people to relieve heavy work which will mitigate mistakes in flight planning.
3	Have transport Canada regulate more rules.
1	Helly Hansen should take over suit issuance within Cougar at the Heliport to ensure passengers are getting info from the people who provide and work hands on with the suits 365 days a year.
1	HUET/ Underwater training more often (once a year)
1	I don't have any suggestions for improvements in helicopter transportation.
1	I would like to fly in conditions that would allow for a reasonable chance in ditching successfully, and allowing passangers and crew to exit safely. I would like to see a non punitive way of addressing our concerns. I think SMS entries should do to an outside source to get analized. I would like to see a higher level of training with regards to safty equipment (Personal equip).
3	Implement an effective SAR response capable of timely and successful rescue driving all scenarios when passenger flights are taking place.
3	Improved offshore approaches to be able to land in 1/4 mile visilibity
3	Improved TC regulation concerning night shifts.
1	Improved Transport Canada requirements and regulations for AME recurrent training. Move recurrent training for type endorsements and equipment (i.e. hoist training) mandatory by TC.

APPENDIX C: QUESTION 35 RESPONSES

Opportunities for improvement

NUMBER	SUGGESTION
1	Improvement can be made if we (pilots) have a representative in the safety department to put forth our concerns. At the moment people that do not fly offshore are representing us, therefore due to costs in changing things such as breathing devices, goggles, safety equipment, suits are pushed aside. They are more concerned about wearing safety equipment around the hander than where our work place as pilots is over the Atlantic ocean, that's where our concern is!! We nee someone to represent our issues! Perferbly to an outside agency not cougar safety department!
1	Keep on top of new improvements on the SK 92
1	Less False information about the industry in the media! Perhaps a pro-active information campaign.
2	Less payloads on the helicopter, oil companies want bigger machines, more capacity, instead of putting more helicopters in service.
3	Mandatory stop flying at least 1 day per week to do extra maintenance checks on helicopters. (Ex- no flying on Sunday)
2	Manpower requirement. Regulated by T.C. So there are enough AME's endorced on the A/C type during a shift.
3	Manfactures to ensure all major issues with any new helicopters and corrected and addressed before they are released for purchase.
1	More aircraft in the "pool" so we can get the job done on time.
3	More captain's for the base and less as a training base for now fist officers that are to be employed at other company bases.
2	More hands on training
1	More hangar space and less clutter in the hangar to effectively and comfortably perform maintenance duties.
1	More strict medical and physical requirement for working in this harsh environment.
1	More training and safety training so all are issues are fully addressed
1	More training Marine institute instead of recurrent being 3 yrs, should be 18 months.
1	New Hire, don't know the industry well enough yet to make valid suggestion for improvements
2	Night time passenger flights should not resume.
1	On-going safety improvements are taking place at all times
2	Possibility for personal to schedule his/her own recurrent training above the minimum requirement if required.
1	Proper color and certifies pilot suits as used in north sea.
3	Recurrent type course training on specific aircraft.
2	Remind oil workers that the company who they work for chose the S92 and like any new piece of machinery or equipment there are growing pains.

APPENDIX C: QUESTION 35 RESPONSES

Opportunities for improvement

NUMBER	SUGGESTION
1	Require a level of physical fitness of passengers who regularly fly offshore. I believe this would benefit the individual and their fellow passengers safety in the event of an emergency.
1	Re-visit flight time/ daily duty periods for flight crews with respect to the challenge we offshore environment and physical discomfort and related fatigue caused by wearing a very worn survival suit.
2	SAR crew specific training (e.g.) HUET for military SAR crews offered by survival systems.
1	SAR should be independent or monitored by independent agency.
1	Stop question the "professionals"…No one demands to hear from the Air Controls captain as to why we are departing for Europe after a 2 hr mechanical delay!
2	The HUET training is an extremely importantly skills, yet the program is developed for people that work on the rigs. There is no program that directly hit the air crew. We are expected to take care of the aircraft and passengers during an emergency situation over the Atlantic ocean. There is no program to this date that directly geared towards how to handle these situations. I believed there should be a specific program developed for pilots, again with a pilot to help develop this program!
3	There have been some improvements since the crash of flight 491. We have received HEEDS bottles. Other than the Heeds bottles and some changes in emergency procedures, I have not seen any other changes that could improve the safety of our company. I once again thank you for the opportunity to express my concerns, and wish you the best of luck with the inquiry, and I look forward to seeing positive changes for the future. Thank you.
3	There needs a regular schedule made up for the flight crews. Due to shortage of crews, and short notices on changes in the schedule, there are regular and daily occurances where pilots have to remind the scheduler and planners what duty day rest is needed. Australia have a very strict fatigue matrix that we could certainly benefit from! more of an indepth look at crew fatigue, and the benefits of crew rest should be researched!!
1	To educate the people who are being transported to the rigs for work on the abilities of the sar componant of Cougar
2	Type C dispatch is a good way to mitigate risk related to weather.
1	Weather (Sea state limits) the operators have no consistancy.
2	Working at Cougar you see a lot of people going offshore that you wonder how they passed their medical and training. I thnk they should look into what is involved in their actual medicals, and how they evaluate them.

Offshore Helicopter Safety Inquiry
Passenger Survey

AEROSAFE RISK MANAGEMENT

EMPLOYEE CONFIDENTIALITY:
Your responses will be kept strictly confidential and no information released will identify individual respondents.
If you are uncomfortable answering any of the questions below, please leave that question blank.

Aerosafe Risk Management has been engaged by the Commissioner of the Offshore Helicopter Safety Inquiry to conduct an independent survey of helicopter transportation. This survey is your opportunity to provide direct input into the Inquiry process – your voice will be heard!

We expect that this survey should take 10-15 minutes and we look forward to your response. The results of the survey will be available on the inquiry website **www.oshsi.nl.ca** from August 31, 2010. If you have any questions regarding the survey please contact Aerosafe by phone 202 449 7693 or email oshsi-survey@aerosafe.com.au

Thank you for your time and participation in this extremely valuable activity.

PART 1: GENERAL INFORMATION

Q1 **Age** ☐ <20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

Q2 **Sex** ☐ Male ☐ Female

Q3 **Job Role** ☐ Pilots ☐ Rescue Specialists ☐ Executive/Manager
☐ Maintenance Engineer ☐ Administration/Finance ☐ Other

If "Other" checked above please specify: _____

Q4 What area of the organization do you work?
☐ IT/Finance ☐ Search & Rescue/Safety ☐ Flight Operations ☐ Maintenance
☐ Passenger Movement/Operation Control (OCC) ☐ Other

If "Other" checked above please specify: _____

Q5 How many trips to the rig/platform would you make each year?
☐ None ☐ 1-3 ☐ 4-12 ☐ 13-50 ☐ 51-100 ☐ >100

Q6 Do you hold a specific safety appointment or role with your employer?
☐ Yes ☐ No If yes, please specify _____

PART 2: HELICOPTER TRANSPORTATION & OPERATIONS

Q7 On a scale of 1-5, what is your level of confidence in respect to the safety of helicopter transportation?
(not confident) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very confident)

Q8 Do you feel safe when travelling in helicopters to and from the rig/platform?
☐ Yes ☐ No ☐ N/A

Q9 Following the Flight 491 accident, have you noticed any changes in safety practices of helicopter transportation?
☐ Yes ☐ No ☐ N/A

If you answered yes, what have been the changes you have seen? _____

_____

_____

continued on page 2

Q10 Does your role require you to fly in the helicopter? (If you do not fly offshore go straight to Question 21)

☐ Yes ☐ No ☐ Occasionally

Q11 On a scale of 1-5, how capable do you feel to respond to an emergency situation in a helicopter?

(not capable) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very capable) ☐ N/A

Q12 Have you received training for emergency situations in helicopter operations?

☐ Yes ☐ No ☐ N/A

Q13 How often do you receive recurrent/refresher helicopter safety training?

☐ Twice a Year ☐ Once a Year ☐ Every Two Years ☐ Every Three Years ☐ Can't Remember ☐ N/A

Q14 Did the helicopter safety training involve physical drills or exercises?

☐ Yes ☐ No ☐ Don't Know ☐ N/A

Q15 Have you undertaken Helicopter Underwater Escape Training (HUET) training?

☐ Yes ☐ No ☐ Don't Know ☐ N/A

Q16 On a scale of 1 to 5, if you answered "Yes" to Q16, how effective is the HUET training?

(not effective) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very effective) ☐ N/A

Q17 Do you have any concerns with the breathing device, PLB or other personal safety equipment issued to you at the heliport?

☐ Yes ☐ No ☐ Don't Know ☐ N/A

Q18 On a scale of 1-5, do you have any concerns with your survival suit?

(not concerned) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very concerned) ☐ N/A

Q19 On a scale of 1-5, how satisfied are you with the adequacy of the training and procedures on how to use the safety equipment?

(not satisfied) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very satisfied) ☐ N/A

Q20 When you are travelling by the helicopter, on a scale of 1-5 rate how satisfied are you that you get the right amount of information about helicopter operations?

(not satisfied) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very satisfied) ☐ N/A

PART 3: EMPLOYER'S SAFETY CULTURE

Q21 Do you believe there is an adequate level of overseeing of safety (safety oversight) for helicopter transportation?

☐ Yes ☐ No ☐ Don't Know

Q22 On a scale of 1 to 5, please rate your organization's safety culture?

(poor) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (excellent)

Q23 On a scale of 1 to 5, do you consider your organization/employer to have an open reporting culture?

(closed culture) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very open)

Q24 Are you comfortable that you are able to personally raise your safety concerns?

☐ Yes ☐ No ☐ Sometimes ☐ It depends *(explain below)*

_____

_____

continued on page 3

Q25 Does your organization/employer have a confidential reporting system for safety?

☐ Yes ☐ No ☐ Don't Know

Q26 Does your organization/employer have a Safety Management System?

☐ Yes ☐ No ☐ Don't Know

Q27 If you answered "yes" in the last question, have you received training on the Safety Management System?
(If you answered "No" in Q26, go straight to Q29)

☐ Yes ☐ No ☐ Don't Know

Q28 If you answered "yes" to the last question, do you regularly use the Safety Management System?

☐ Yes ☐ No ☐ Don't Know

Q29 Does your organization/employer do risk assessments?

☐ Yes ☐ No ☐ Don't Know

Q30 Does your organization/employer have a risk assessment on helicopter transportation?

☐ Yes ☐ No ☐ Don't Know

Q31 If answered "yes" to Q30, have you seen a copy of the risk assessment on helicopter transportation?

☐ Yes ☐ No ☐ Don't Know

Q32 On a scale of 1-5, how effective do you believe your safety committee is in addressing safety concerns?

(not effective) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very effective)

Q33 On a scale of 1-5, how satisfied are you with the level and amount of information regarding helicopter safety available to you?

(not satisfied) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very satisfied)

PART 4: ADDITIONAL INFORMATION

Q34 What are your top 3 concerns with helicopter transportation?

Concern 1:

On a scale of 1-5, how significant is this concern? (not a big concern) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (extremely concerned)

Concern 2:

On a scale of 1-5, how significant is this concern? (not a big concern) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (extremely concerned)

continued on page 4

Concern 3:

On a scale of 1-5, how significant is this concern? (not a big concern) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 (extremely concerned)

PART 5: OPPORTUNITIES FOR IMPROVEMENT

Q35 What improvements would you like to see in helicopter transportation?

Opportunity for improvement – Suggestion 1:

Opportunity for improvement – Suggestion 2:

Opportunity for improvement – Suggestion 3:

4

APPENDIX E: MEMO TO EMPLOYEES INTRODUCING SURVEY

Good afternoon:

As you are aware, the C-NLOPB has appointed Commissioner Robert Wells, Q.C., to conduct a public inquiry into the helicopter transportation of workers to/from the Newfoundland & Labrador offshore. The objective is to ensure that the risks of helicopter travel are as low as reasonably practicable.

As part of this Inquiry, Commissioner Wells has already surveyed the workers traveling by helicopter to the offshore and would now like to have the views of Cougar's personnel regarding helicopter safety. The survey of Cougar personnel will be conducted by Aerosafe, an aviation expert retained by the Commissioner. Completed surveys will be seen only by Aerosafe; identities will remain confidential and will not be known by Aerosafe, the Inquiry or Cougar.

Aerosafe advises that it will take approximately ten minutes to complete the survey. The Commissioner's office has delivered the surveys and they will be distributed throughout the building later today. Individual surveys will be provided to staff in a self-sealing return envelope, addressed to Aerosafe. We are informed that the Commissioner's office has made arrangements to retrieve the secure box containing completed questionnaires on Thursday, August 12 at 5:00 p.m. When you receive your survey, take the time to complete it and deposit it into the box located in the lunchroom.

If you are not scheduled to be at the St. John's base this week, but are in the St. John's area and wish to participate, you may drop by and pick up a questionnaire from the Payroll office. I emphasize, however, that we have been informed the secure box with completed surveys will be picked up on Thursday, August 12 at 5:00 p.m. by the Commissioner's office for return to Aerosafe.

On behalf of the Wells' Inquiry, Cougar Helicopters encourages all personnel who are available to participate in this survey to support the objective of the Inquiry. Attached is an introductory letter from Commissioner Wells for your information.

Thank you for your participation and cooperation in this effort.

Hank Williams
General Manager
Enclosure

P.S. Please note the secure box is located in the lunch room, and not at the entrance to the heli-port as mentioned in the attached letter.

Phase I

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