**EUROPEAN ORGANISATION**
**FOR THE SAFETY OF AIR NAVIGATION**

EUROCONTROL

# SAFETY SURVEY COURSE
# REFERENCE MATERIAL
# Part 2–Guidance and Examples

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**Abstract**

This document provides reference material for the conduct of Safety Surveys by Air Navigation Service Providers (ANSP). It is the second of two such documents and provides guidance on achievement of the ESARR3 requirement for ANSPs to conduct Safety Surveys as part of the Safety Assurance process (Level 2). The document also provides illustrative examples (Level 3).

**Keywords**

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| Safety Management | Safety Survey | Organisational Factors |
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| Targeted Safety Survey (TSS) | Unsafe Acts | |
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**CONTENTS**

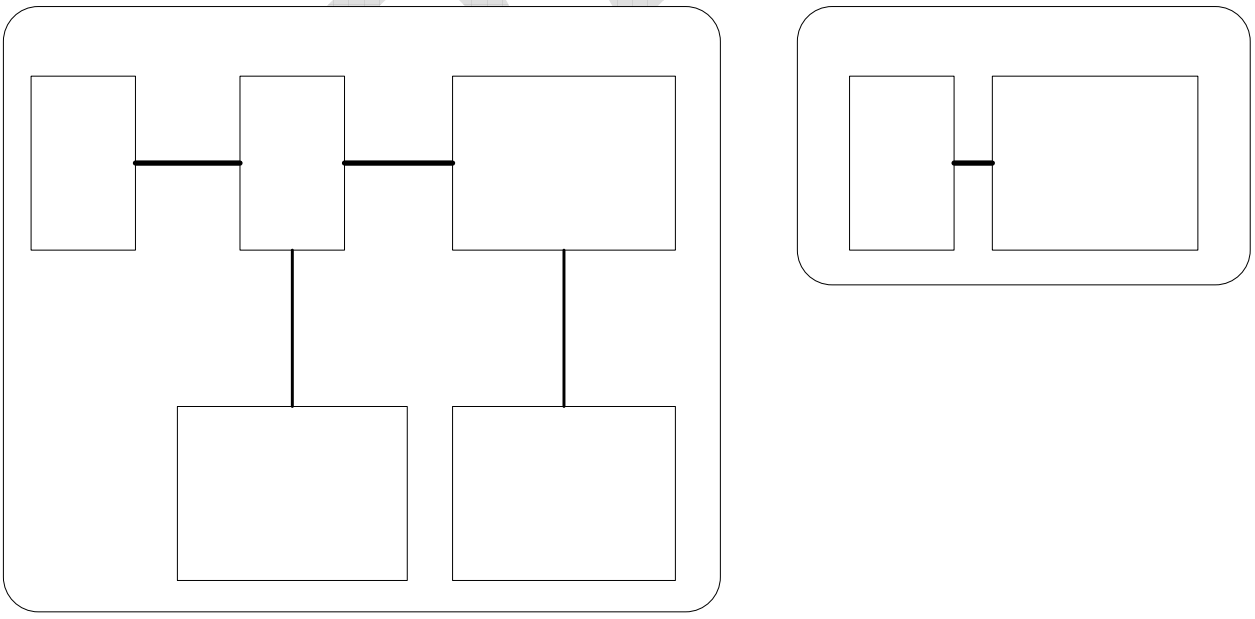
## Executive Summary

This Safety Survey reference (SURV) document has been developed to support the Safety Survey course by providing guidance for the conduct of Safety Surveys by Air Navigation Service Providers (ANSP). The guidance has been developed, inter alia, from a study into Safety Survey best practice within Air Traffic Management (ATM) and other industries.

This is the second of two such documents and provides amplifying guidance on Safety Survey methods and techniques together with examples (Levels 2 & 3). The General Principles (Level 1) were provided in the first document (SURV) Part 1.

These guidelines consequently reflect the scalability of the Safety Survey process which will need to be adaptable to both large and small ANSP organisations, often with very different cultures. This volume has been designed to provide practical guidance to staff responsible for planning and implementing Safety Surveys within ATM organisations. It provides information on the Safety Survey methods and techniques which may be selected for use in order to satisfy the ESARR 3 Safety Survey requirement which has been summarised in Volume 1. Not all Safety Survey methods and techniques will be applicable to every ATM service provider due to differences in size organisation and culture; these guidelines have therefore been produced in a way which offers readers the relative advantages and disadvantages of each technique.

The structure of this document is illustrated diagrammatically below:



# Section One – Guidelines (Level 2)

# CHAPTER 1
# SCOPE OF THE GUIDANCE

## 1.1 Scope of the Reference Material

1.1.1 As explained in Part 1 of the reference material, Safety Survey is needed to help satisfy a key aim of ATM Safety Management Systems (SMS) - the minimisation of the ATM contribution to accidents and incidents. EUROCONTROL Safety Regulatory Requirement (ESARR) 3 requires that ATM service providers should establish processes to carry out Safety Surveys as a matter of routine to review operational units and significant areas of activity.

1.1.2 Because of its importance, the Air Navigation Service Provider's (ANSP) arrangements for Safety Survey will be an important aspect of focus for Regulators.

1.1.3 The purpose of this document is to provide information on the various Methods and Techniques which can be used by ANSPs in order to allow them to satisfy the ESARR 3 requirements for Safety Survey.

1.1.4 As explained in Part 1 of the Guidelines – 'General Principles' , the fundamental requirement which ANSPs must satisfy is that Safety Surveys should be proactive and should be performed in a planned and systematic way.

1.1.5 Such surveys should:

a. Examine the safety performance of the whole unit in general and in some specific areas.

b. Look, in particular, at the performance of the SMS.

c. Be focussed on continuous improvement.

d. Be carried out by personnel who are independent of the function which is being examined.

1.1.6 ANSPs should ensure that their Safety Surveys are comprehensive enough to be able to address each of the main categories of accident causation, namely: Organisational Factors, Local Workplace Factors and Unsafe Acts[1] together with effective safety barriers.

1.1.7 This can be achieved by using an appropriate combination of the survey types which are explained in Part 1, shown at Figure 1.1 and should include:

a) Periodic Safety Surveys (PSS).

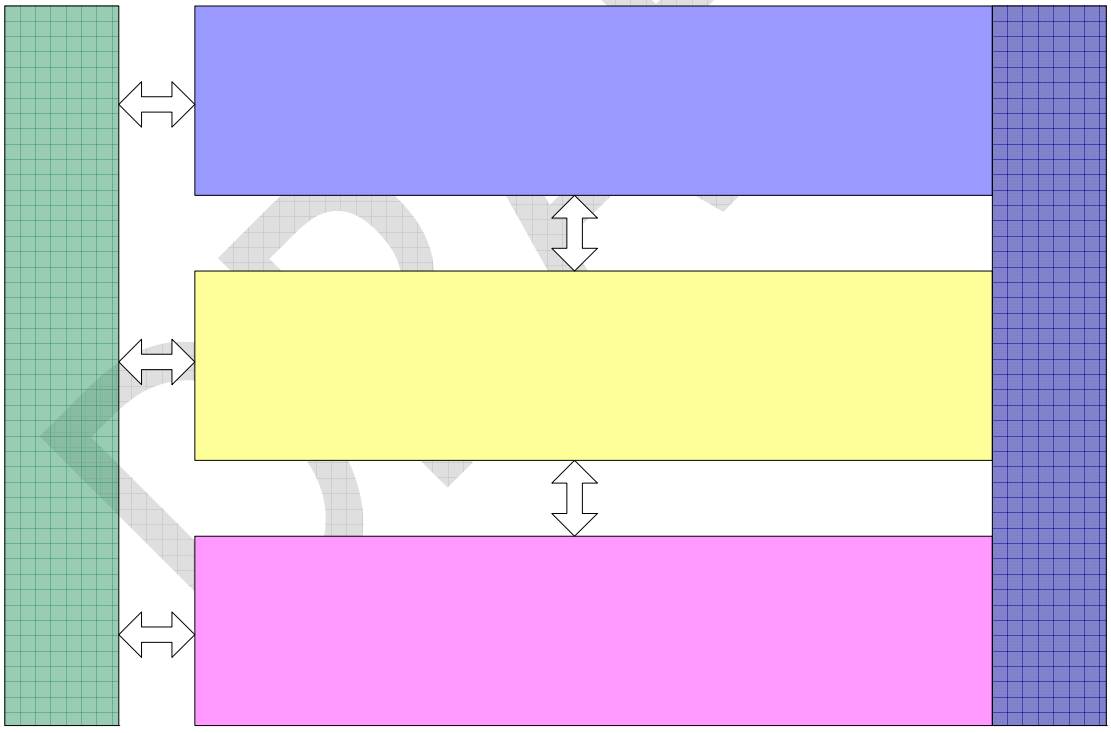
[1] These terms are explained fully in Part 1 and will be dealt with in context in later chapters of this document.

b) Targeted Safety Surveys (TSS).

c) Continuous Safety Surveys (CSS).

1.1.8 ANSPs also need to demonstrate that their Safety Survey arrangements have been planned, designed and conducted in accordance with a comprehensive and logical process which includes an effective means of disseminating and following-up results. The overall process is described at Chapter 3 and explained in the context of each Safety Survey type at Chapters 4 to 7.

1.1.9 Examples of the use of Safety Survey methods and techniques within ATM, and, where useful other industries, are provided in Section 2 of this document and are introduced at Chapter 8.



# CHAPTER 2
# APPROACH

## 2.1 Approach

2.1.1 Certain methods and techniques lend themselves to specific types of Safety Survey whereas others can be more generally applied. A variety of suitable such methods and techniques are provided in Chapters 4 to 7 of this document in order to provide choice in tailoring Safety Survey to the specific needs of ATM Service providers of various size, culture and other local variations. The relative merits and disadvantages of each method and technique are described in order to assist in the selection process.

2.1.2 The methods and techniques are chosen from those which have practical application in the ATM environment and can be implemented within ATM service provider organisations without the need for specialist external support (although there is nothing which would prevent the use of external survey specialists if required).

2.1.3 References to more detailed explanations of techniques have, wherever possible, also been included to assist those who have deeper research needs with locating specialist source documentation.

# CHAPTER 3
## SURVEY PROCESS

## 3.1 SURVEY PROCESS

3.1.1 Figure 3.1 shows that there are three basic top-level survey sub-processes namely: survey inputs (or initiators), survey design and survey outputs (or lesson dissemination). Practical guidance will be given in this report on the selection and use of the different survey types, methods and techniques and this guidance will be related to each of the survey sub-processes shown in Figure 3.1.

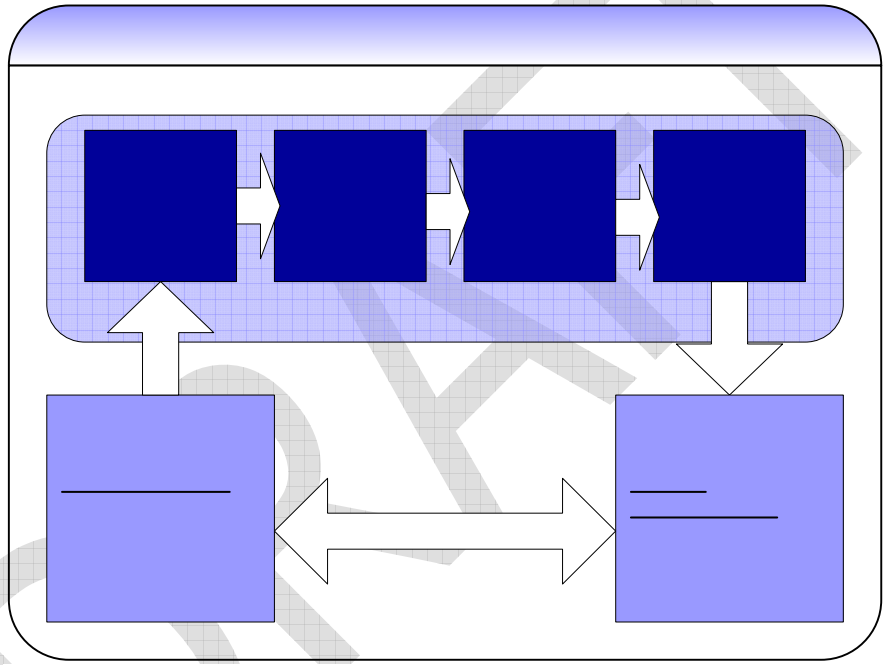


**Figure 3.1. Safety Survey Process**

## 3.2 SURVEY INPUTS

3.2.1 Survey Inputs are the stimulus or initiators of a particular survey type. It can be seen from Figure 3.1 that survey initiators are generally different depending upon the survey type. For example, a specific Targeted Survey could be initiated by a specific outcome from an SMS safety monitoring process while a Periodic Safety Survey would be initiated as part of a rolling annual programme of such surveys.

## 3.3 SURVEY DESIGN

3.3.1 Figure 3.1 also depicts the individual steps involved in Survey Design which are: Planning, Data Collection, Data Analysis and Derivation of Findings. Each individual survey design stage can use different survey methods and techniques depending on the survey type and the specific survey aim. A summary of each survey design stage follows.

3.3.2 Each stage of the Safety Survey process is described further in the following Chapters of this material, each of which has been written to stand alone in its own right. However, it is important at this stage to gain a general appreciation of the process used by surveyors during the data analysis, data collection and derivation of survey findings in particular.

## 3.4 SURVEY PLANNING

3.4.1 The survey planning stage involves normal planning activities such as identification of survey tasks and resources, and scheduling to ensure that the survey aims and objectives are achieved. Numerous planning methods and techniques can be adopted depending upon the organisation.

## 3.5 DATA COLLECTION

3.5.1 Data collection is the stage when the specific qualitative or quantitative data are collected by the surveyor from the organization, department or individual subject to survey. A Best Practice investigation has shown that many different techniques and supporting tools are used for survey data collection and no consistency in choice was identified. Often, the choice was dependent upon the surveyor's preferences and familiarity with the specific technique or tool and this is perfectly acceptable.

## 3.6 DATA ANALYSIS

3.6.1 Data Analysis is the stage where the specific qualitative or quantitative data are analysed by the surveyor and initial findings are suggested..

3.6.2 Analysis of qualitative data is not simple, and although it does not require the often complicated statistical techniques of quantitative analysis, it is nonetheless difficult to handle the usually large amounts of data in a thorough, systematic and relevant manner. Marshall and Rossman offer this excellent description:

*"Data analysis is the process of bringing order, structure and meaning to the mass of collected data. It is a messy, ambiguous, time-consuming, creative, and fascinating process. It does not proceed in a linear fashion; it is not neat. Qualitative data analysis is a search for general statements about relationships among categories of data."*[2]

[2] Marshall and Rossman, 1990:111

3.6.3 The purpose of analysing data is to obtain usable and useful information from which conclusions and recommendations can be drawn. Irrespective of whether the data is qualitative or quantitative, data analysis will:

- Describe and summarise the data;
- identify relationships between variables;
- compare variables;
- identify the difference between variables;
- forecast outcomes.

3.6.4 A misconception, and source of confusion for many people, is the belief that qualitative data collection techniques generate only qualitative data (text, words, opinions, etc) and that quantitative data collection techniques generate only quantitative data (numbers). Sometimes this is the case, but both types of data can be generated by each approach. For instance, a questionnaire or structured 'interview will often gather factual information, for example, age, salary, length of service (quantitative data) – but may also seek opinions and attitudes (qualitative data).

3.6.5 A second misconception is that statistical techniques are only applicable for quantitative data. Once again, this is not so. There are many statistical techniques that can be applied to qualitative data.

3.6.6 An understanding of basic statistical terms and ideas and the ability to carry out some statistical analysis (elementary or otherwise) is nonetheless useful. Competence in these techniques, even at a basic level, is a valuable skill in its own right. Consequently, background information on basic statistical techniques is provided for reference within a separate Annex within this document.

3.6.7 A third misconception is that qualitative data analysis is easy. There are many ways of conducting qualitative research and thus many ways of analysing the resulting (qualitative) data. For example, having conducted an interview, transcription and organisation of data are the first stages of analysis. This would then be continued by systematically analysing the transcripts, grouping together comments on similar themes and attempting to interpret them and draw conclusions.

3.6.8 The general principle adopted within these guidelines is that processes involving complex statistical analysis are neither necessary nor desirable for the majority of ANSP survey activities. This is because Safety Survey is an internal activity which must generally be carried out within the experience and competence of ATM service providers. Accordingly, this document provides information on simple means to analyse data from Safety Surveys which are intended to be of basic practical use to ANSP staff.

## *3.7* DERIVATION OF FINDINGS

3.7.1 The last stage of surveying is to derive the survey findings from the available survey data. Various automated and manual tools and techniques can be used to derive findings, particularly from quantitative data, or they might simply be derived inductively from the data by the surveyor.

3.7.2 Each stage of the Safety Survey process is equally important to the success of the individual survey and the overall SMS Survey process. Different methods and techniques can be used for the different survey stages as appropriate. Guidance will be given on the selection and use of the different survey methods and techniques and this general guidance will be related to each of the survey sub-process shown in Figure 3.1.

## 3.8 SURVEY OUTPUTS

3.8.1 Survey Outputs are the conclusions and recommendations from the survey findings that must be disseminated throughout the organization. This is actually the most important stage in the overall process but, regrettably, is often the stage which is conducted in the least structured manner and can result in valuable safety improvements being overlooked or delayed. Various means of dissemination are available and the most suitable must be used to ensure that the principle of continuous improvement is implemented and that, where appropriate, safety is adequately promoted throughout the organization.

3.8.2 Recommendations from each of the 3 main survey types which together constitute a comprehensive ESARR 3 Safety Survey regime should additionally be forwarded to those with the power and responsibility to implement safety improvements in the form of a simple Safety Survey Action Report which may be attached to the more detailed survey report itself. A suggested format for such an action report which may be used with PSS, CSS and TSS is provided as a template at Annex A. Such Action Reports should be retained on file as an audit trail which shows the Provider's progression of remedial action and continuous safety improvement. These records may be examined during Safety Regulatory Audits.

3.8.3 Moreover, the collated results of an ATM service provider's Safety Survey activities should subsequently be forwarded to senior management in the form of an Annual Safety Survey report. A possible format for such reports is also provided as a template at Annex B.

## 3.9 FEEDBACK

3.9.1 The outcome from each type of Safety Survey can be fed back into the system in such a way that it may provide a trigger for special attention to be paid to particular aspects of ATM operations or maintenance within another survey activity. Figure 3.1 shows that survey lessons learned must be fed into the evaluation of survey initiators (producing a closed-loop system) which informs the initiation of future surveys. The output from Safety Surveys can also be used as part of the Safety Assurance process to inform and update the relevant Safety Cases and their associated Hazard Logs.

# CHAPTER 4
# PERIODIC SAFETY SURVEY METHODS & TECHNIQUES

## 4.1 General Description

4.1.1 Safety Survey activities need to identify the accident causal factors which operate at the ANSP organisational level, which is removed from the 'sharp end' of ATM delivery. Such Organisational Factors can contribute to a breakdown in safety leading ultimately to conditions which make an accident involving an ATCO or a Maintenance Engineer more likely. Such factors could include, for example, strategic decisions, forecasting, budgeting, allocating resources, planning, scheduling, communicating, managing, etc. These factors are likely to be influenced by the culture of the ANSP organisation and can be communicated to control rooms, maintenance facilities, etc, where they can lead to the development of Local Workplace Factors likely to promote unsafe acts.

4.1.2 The most suitable form of Safety Survey that can be undertaken to discover and highlight such detrimental Organisational Factors is the Periodic Safety Survey (PSS). This is a survey type which, over a prescribed period usually two years, seeks to examine all the facets of an ANSP's activities. Figure 4.1 illustrates that PSS is a broad, but shallow Safety Survey type. In other words, PSS is unlikely to highlight specific unsafe acts performed by an ATCO on an ATC console. PSS can only examine specific parts of an organisation in 'snap-shot' – it does not by itself provide continuous monitoring of ATM operational or maintenance activity.

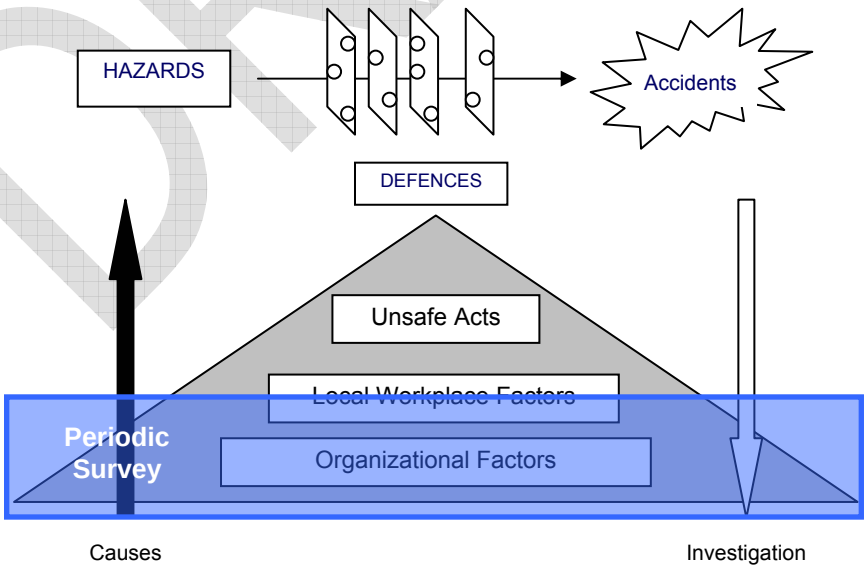



**Figure 4.1 – Periodic Safety Surveys**

4.1.3 PSS can be broadly classified as a survey method that addresses workplace or organisational (safety) procedures, personnel and training and equipment issues.

4.1.4 PSS are often (but not always) linked to an organization's Quality or Environmental Management System assurance process and some excellent guidance material can be found in ISO190113 which suggests that a survey process should cover the following main survey activities:

- Pre-*Inspection* Activities
- Document *Review*
- *Inspection* Preparation
- Detailed Planning
- The *Inspection*
- Formal Report
- Corrective Action
- Follow Up

4.1.5 From this, it can be seen that two specific methods are used to undertake such surveys namely: Inspections and Document Reviews. A study undertaken to determine best practice for ATM Safety Survey4 showed that the methods used are similar for PSS.

4.1.6 With reference to the generic Safety Survey Process Model (described in Chapter 3) both Inspection and Review methods used for Safety Survey have similar issues relating to their Initiation and Input, Outputs, Planning and Data Analysis. However, the survey methods have different issues relating to Data Collection. The remainder of this chapter is structured to provide information on their similarities and differences.

## 4.2 Survey Initiators and Inputs

### 4.2.1 Survey Initiators

4.2.1.1 PSS are usually initiated by a planned and comprehensive programme of surveys across the specific organisation as part of the overall SMS activity. PSS should normally be planned to cover all safety-related people, procedure and equipment issues across all functional areas of the organization over a defined period of time.

4.2.1.2 In planning an annual programme of PSS to ensure comprehensive organizational coverage, it will be necessary to take account of significant changes in the areas of Organisation & Procedures, Personnel & Training and Equipment in order to focus priorities.

### 4.2.2 Survey Inputs

[3] BS EN ISO 19011: 2002 Standard, Guidelines for Quality and/or Environmental Management Systems Auditing.
[4] Safety Surveys in ATM: A Review of Best Practice, EUROCONTROL Report, Issue 1, January 2005.

4.2.2.1 In order to be able to plan a programme of PSS, ANSP staff will need a number of inputs from various sources.

4.2.2.2 In addition to copies of Operating Procedures and appropriate technical manuals, survey planners will need manning lists and watch rosters together with information about the level of training and qualification of operational and technical personnel who may be observed. Information about the ATM equipment in use may also be needed and should be obtained from equipment documentation including performance charts and, where appropriate, coverage diagrams.

## *4.3* Survey Planning

### 4.3.1 General

4.3.1.1 The planning of PSS Inspection or Review will need to consider practical issues such as the resources available and the scope and scheduling of the survey within the organizational context of the ANSP in question. An excellent source of information on detailed process guidance for auditing and audit planning can be found in the document Auditing the ISO19011 Way[5] and this is equally useful for PSS.

4.3.1.2 Broadly, the PSS process should cover the following survey activities:

- Pre-Inspection Activities
- Document Review
- Inspection Preparation
- Detailed Planning
- The Inspection
- Formal Report
- Corrective Action
- Follow Up

4.3.1.3 An example of general guidance for the format of a PSS can be found in the Periodic Survey Planning Checklist which is illustrated at the end of this section

4.3.1.4 More specifically, the PSS planning process should answer the following questions:

- What is to be surveyed?
- Who is to survey it?
- When is it to be surveyed?

[5] Auditing the ISO 19011 Way, British Standards Institution, 2003

4.3.2 **What is to be Surveyed?**

4.3.2.1 The basic requirement is for PSS to survey, over a given period of time, the entire organization by department or functional area. It is usually desirable for an ANSP to ensure that the PSS time period is consistent with the SMS reporting period which is usually an annual requirement.

4.3.3 **Who is to Survey it?**

4.3.3.1 When considering the choice of inspector or inspection team there is an obvious trade-off between their familiarity with the area under inspection and their objectivity. It may be necessary for an inspector to be familiar with the inspected area to ensure that information of sufficient detail can be obtained but this must be traded with the benefits brought by a new and relatively objective perspective. Ideally, if resources permit a team of inspectors would be used to cover both domain expertise and objectivity.

4.3.4 **When is it to be surveyed?**

4.3.4.1 The timing of a PSS is also important relative to the subject for review. For example, it is not worthwhile reviewing a department for compliance with a new or amended SMS procedure if there has been insufficient time to undertake compliance.

## *4.4* Survey Data Analysis Techniques

4.4.1 Various techniques may be used to analyze the data collected by the primarily qualitative data collection techniques. If a survey has been relatively simple then the analysis of the data will also be relatively simple and may not necessitate the use of other techniques. However, for many Safety Surveys a large amount of qualitative data must be analyzed to identify trends and make comparisons in order to extract useful information.

4.4.2 In general, quantitative techniques may be used to analyze the data collected during an Inspection or Review and a comprehensive discussion on the many available techniques is beyond the scope of this guidance document. However, simple but commonly used statistical analysis techniques can be used to analyse and present data. General guidance on the data analysis techniques is given in Annex F in addition to some useful references for more detailed information on more complex statistical analysis techniques.

## *4.5* Derivation of Findings

4.5.1 Once the survey data has been collected and analyzed to provide meaningful information the next stage is to draw some conclusions or findings relating to the ATM environment. This stage of the survey is perhaps the most important and will always necessitate input from domain experts to realise practical solutions to potential problems.

4.5.2 The derivation of meaningful conclusions and recommendations can of course be undertaken by those involved in the inspection. However, it is often best to have the solutions to specific problems designed primarily by the experts working in the area that was inspected. In this way, their expertise can be brought to bear

on the problem and they will more readily accept ownership of the proposed solutions.

## *4.6* Inspection Method

### 4.6.1 **Description of Method**

4.6.1.1 An inspection can broadly be described as a physical examination of arrangements for the conduct and support of ATM including scrutiny of arrangements for the management of safety and which may also include the verbal and/or written questioning of staff.

4.6.1.2 The fundamental difference between an inspection and a review is that an inspection should focus on what should be done rather than what has been done to provide safety assurance. An inspection should therefore provide timely information on the validation of SMS assurance activities. In other words, are the planned safety activities necessary and sufficient to provide the required level of safety assurance?

4.6.2 **Data Collection Techniques.** Various qualitative data collection techniques can be used to facilitate an inspection including the use of checklists, questionnaires, structured and semi-structured interviews. The choice of a suitable technique will to a great extent depend upon the familiarity of the inspector with each one.

4.6.2.1 **Checklists.** Checklists can be very useful as the compilation of the list can prompt an inspector to think about issues that may not have been immediately apparent; particularly if lists already exist from similar organizations or functional departments. It is also useful to provide the area to be inspected with an advance copy of such lists before the inspection to give some idea of the information and resource requirements beforehand. However, care should be taken not to give the impression that an inspection will be entirely constrained by the checklist and to make it clear that some ad-hoc queries may be presented in addition.

4.6.2.2 **Questionnaires.** Questionnaires are a useful data collection technique for PSS; however, despite their apparent simplicity, constructing a successful questionnaire can be time consuming and loaded with biases and ambiguities while the results can be rife with the potential for misinterpretation. The use of questionnaires is a generic data collection technique across all types of Safety Survey including Targeted and Continuous surveys and is therefore examined in more detail in annex C.

4.6.2.3 **Brainstorming.** Brainstorming is a technique used as a means to obtain useful data during an Inspection and these can range from completely ad-hoc to rigid predetermined questioning. Brainstorming is examined in more detail in Annex E.

4.6.2.4 **Interviews**. Interviews are often used as a means to obtain useful data during an Inspection and these can range from completely ad-hoc to rigid, structured events. Typically, most interviews are conducted in a semi-structured form where some questions are predetermined but the interview will naturally present opportunities to ask others in addition. Interviews are another generic data collection technique used across all types of Safety Survey including Targeted and Continuous surveys and this topic is therefore also examined in more detail in Annex D.

## *4.7* Review Method

### 4.7.1 Description of Method

4.7.1.1 A review can be described as a retrospective examination of general and/or specific arrangements for the safe conduct and support of ATM including detailed scrutiny of documented SMS activity.

4.7.1.2 The fundamental difference between a review and an inspection is that a review should focus on what has been done rather than what should be done to provide safety assurance. A review should therefore provide retrospective information on the verification of SMS assurance activities. In other words, did the safety activities undertaken provide the required level of safety assurance?

### 4.7.2 Data Collection and Analysis Techniques

4.7.2.1 Various qualitative data collection techniques can be used to facilitate a review including the use of checklists, questionnaires, structured and semi-structured interviews in a similar manner to Inspections and therefore the basic guidance on these techniques will not be repeated here. Again, the choice of a suitable technique will to a great extent depend upon the familiarity of the reviewer.

4.7.2.2 However, the emphasis of a Review will usually concentrate on a review of organizational documentation including records and procedures. Data for this kind of PSS is collected through each Unit and separate sections providing documentary evidence of the results of all SM activity conducted over a nominated period, possibly two years, to a central location for collation and storage. This can be achieved either in paper form or, more efficiently, using electronic data storage. At larger ANSPs this can be achieved through use of a dedicated server area.

4.7.2.3 The type of data collected needs to be predetermined and should include, for example evidence relating to: Performance Monitoring & Reporting, Safety Improvement, Training, Safety Awareness and Safety Assurance arrangements. Such evidence would also include, for example, the reports raised as a result of other Safety Survey activity carried out at the unit. When gathered together, this document trail provides a very useful central record of the key safety management activities which have taken place within the ANSP over the given period.

4.7.2.4 At predetermined periods to coincide with the ANSPs survey cycle, the safety evidence from a particular unit, for example, is gathered together and scrutinised by a nominated Review Board. The size and scope of the Review Board will vary between ANSPs of different sizes and cultures etc but should normally include specialist representatives from operational and technical Divisions, and can usefully include SM and QA staff.

4.7.2.5 The Review Board should be chaired by an individual of appropriate authority within the organisation. In scrutinising the gathered documentation, the Review Board will be required to make an assessment of the SM performance of the unit concerned. Significantly, it should allow any shortfalls and/or emerging best practices to be identified and appropriate recommendations made for improvement. The Review Board proceedings may be conducted in a formally-structured committee style using standard agenda items or could use less formal brainstorming techniques depending upon the culture of the organisation. Guidance on the conduct of brainstorming is provided at Annex E of this document.

## *4.8* Survey Outputs

4.8.1 PSS are used to provide assurance of the continuing safety across an ANSP as an integrated part of the SMS. A narrative report summarising the outcome of the Survey should normally be produced by the PSS Team Leader. The findings from PSS should evaluate the steps that the ANSP should take to ensure that all Safety Survey findings are reported and acted upon. Each report should include recommendations for remedial actions where survey findings indicate that such action is necessary. Specifically, in order to ensure that ANSP Management have the opportunity to act upon survey promptly, the PSS Team Leader should normally raise a Safety Survey Action Report which categorises the recommended actions and identifies a responsible action officer. A suggested format for such a report is provided at Annex A.

4.8.2 PSS findings should normally also be communicated throughout the organization as part of the annual SMS reporting procedures. An example format for an Annual Safety Survey Report to Senior Management is provided at Annex B.

4.8.3 It should be noted that the PSS itself should also evaluate the internal process of feedback to ANSP staff of safety lessons learned and to seek evidence that there is a culture of continuous improvement. Broadly, evidence should be sought during a PSS to establish whether survey findings are disseminated properly both internally within an ANSP and, where the benefit to safety overrides any commercial issues, externally to other ANSPs, organizations and agencies as appropriate. This aspect is included in the illustrative PSS Checklist which follows.

# Illustration 4.1 EXAMPLE PSS PLANNING CHECKLIST

## PSS SCOPE

- The scope of a PSS should confirm that the following essential requirements for safety are met:
    - There is a structure on the unit for the management of safety that ensures effective arrangements exist for promoting safety, monitoring safety performance and processing safety issues.
    - Hazards are identified and the potential for causing or contributing to an accident or incident is recognized for each element contributing to functional safety in the air traffic service being provided.
    - Levels of staff are appropriate to the task and approved procedures and instructions are in place and are being followed, with a satisfactory level of competency and training to operate the systems and facilities and maintain their integrity.
    - Formal procedures exist to handle normal ATM activities and foreseeable emergencies.
    - Appropriate equipment and facilities of the correct design, reliability and function are provided to meet the requirements of the service.
    - The correct incident reporting processes are being followed.
- During PSS there will be opportunities to monitor and report on other aspects of functional safety. These include:
    - Examples of good practice or particular success that are worthy of reporting to higher formations and other units.
    - Perceived shortcomings in personnel, procedures or equipment that, although not essential for functional safety, could detract from safety performance and therefore place heavier demands on personnel performance than necessary.

## SAFETY SURVEY TOPICS

- An annual PSS will need to cover the above but certain surveys will need to vary in detail and depth.
- The following topics are identified as the essential elements of functional safety that need to be addressed by PSS for each element within an ANSP's organisation. This is achieved by physical inspection and questioning. Guidance on formulating and presenting verbal questions is provided at Annex D. For some Surveys it may additionally be helpful to supplement the inspection activity by forwarding written questionnaires in advance of the PSS inspection itself. Guidance on the preparation of questionnaires is provided in Annex C.

- **Safety Management Responsibility**

- PSS should evaluate the managerial arrangements for ATM safety. PSS should seek out evidence that adequate arrangements are in place to discharge the obligations of the ANSP to achieve ATM safety requirements. For example:

    - Are safety responsibilities unambiguous and understood?
    - Are Terms of Reference (TORs) of ANSP safety staff and other operational and technical staff up to date and do they address responsibilities for functional safety?
    - Is the management of change, re-organization, contractorization addressed satisfactorily?
    - Does the ANSP have suitably experienced staff to meet the established SM tasks?
    - Are ANSP surveys carried out regularly and adequately documented?
    - Have appropriate ANSP staff regularly attended safety meetings?
    - Are safety meetings chaired and attended at an appropriately senior level?
    - Are local arrangements for the staffing of remedial issues from safety meetings both timely and effective?

- **Documentation**

- Surveyors should evaluate the adequacy of the documentation relating to the unit's ATM safety. For example:

    - Is all safety documentation complete and in use, including safety-related order books?
    - Are all amendments up to date?
    - Are unit arrangements for the local display of information relevant to the safety of flight accurate and up to date?
    - Are documents available to those who need them?
    - Is there an effective system for feeding back shortcomings to the document originator?

- **Staffing and Training**

- PSS should evaluate the capability of the ANSP in discharging ATM safety responsibilities. Surveyors should assess whether the staffing levels are adequate and determine whether there is sufficient evidence that staff are competently discharging their ATM safety responsibilities. For example:

- Are essential staffing levels established and appropriate?
- Are qualifications and training defined for key safety posts?
- Are competencies measured via practical and theoretical checks and what are the results of such checks since the last survey?
- What is the current staffing level and what has it been since the last survey?
- Is appropriate training available? Are funds and time made available for attendance?
- How are contractors assessed for staffing, qualifications and experience?
- Are adequate arrangements in place for the training of staff in safety-related roles?

- **Incident Reporting**

- PSS should evaluate the steps that an ANSP takes to ensure that ATM safety incidents and occurrences are reported and acted upon. PSS should seek evidence that incidents are adequately investigated, where ANSP investigation is required. PSS should also evaluate the feedback to ANSP staff of the lessons learned and to seek evidence that there is a culture of continuous improvement. For example:

    - Are the various occurrence reporting systems in place and well known by ANSP staff?
    - Are the reporting systems locally publicized adequately?
    - Are ANSP arrangements for the reporting and investigation of incidents sufficiently comprehensive?
    - Is local distribution of incidents and occurrence reporting forms adequate?
    - Is the radar and voice recording capability and arrangements for impounding of recordings adequate?
    - Have all incidents and occurrences been investigated adequately?
    - Have the circumstances of local and remote incidents and occurrences been disseminated and publicized widely at intra-ANSP level?
    - What has been the incident and occurrence record since the last survey? What trends are there?
    - What action has been taken locally to follow up incidents and trends?
    - Has there been any feedback from incidents at other ANSPs?

- **Safety Culture**

- PSS should evaluate the attitudes and behaviour of staff with respect to ATM safety. PSS should seek evidence that there is an open, proactive culture within the ANSP that encourages honest reporting of occurrences, issues and concerns, within an environment that seeks to learn and improve. For example:

    - Are operations and technical staff generally aware of the ANSP approach to functional safety?

    - Is there an awareness of the need for reporting instances when safety is at risk?

    - Is there an open system to maximize the no-blame environment (where national legal systems permit such an approach)?

    - Is there a conscious and visible attempt to raise the profile of ATM safety (for example with posters, discussion groups, safety management on meeting agendas, etc)?

    - Are local arrangements for publicizing ANSP ATM safety management activities adequate in terms of:

        - Posters (sufficient in number and prominently displayed)?

        - Local ATM safety briefings?

- **Unit Safety Case and Assessments of Change**

- PSS should evaluate the ANSP processes for safety assurance. In particular, PSS should seek evidence that changes to ANSP operations or management are accompanied by appropriate assessments of the impact of changes on ATM safety. PSS should also seek out evidence that the identified hazards and assumptions used in the Unit Safety Case are subject to regular review within the unit. For example:

    - Are the hazards identified in the Unit Safety Case regularly reviewed?

    - Is there a system to identify new hazards to operations and maintenance?

    - Have safety assessments been carried out for all safety-related procedural and organizational changes?

    - Is there a link between current performance, incidents and defects to the Unit Safety Case?

- **Hardware**

- PSS should evaluate the management of the ATM safety-related equipment (hardware) used by the ANSP. For example:

    - Is the Design and/or Support Authority defined and effective?

- Is the documentation in place (e.g. user and maintenance manuals) to support the equipment?
- Are reliability targets set and being met?
- What significant defects and trends are being experienced? What is the effect?
- Are safety significant spares identified and available?
- Is maintenance up to date? Are concessions properly authorized?
- Are there any issues associated with new equipment?
- Have unit-originated hardware changes followed the established configuration management process?

- **Software**

- PSS should evaluate the management of the ATM safety-related software used by the unit. For example:
    - Is the software under configuration control?
    - Is the Design Authority/Support Authority defined and effective?
    - Is the documentation in place (e.g. user manuals) to support the software?
    - Are reliability targets set and are they being met?
    - What significant problems and trends are being experienced? What is the effect?
    - Are concessions or fixes (patches) properly authorized?
    - Are there any issues associated with new software?
    - Have unit-originated software changes (where applicable) followed the established configuration management process?

- **Interfaces and External Factors**

- PSS should seek out evidence that there are good working relationships with other organizations (eg other ANSP, military ATM etc) concerning ATM safety and determine the extent of external influences on safety performance.

- PSS should evaluate the information flow between the ANSP and these other organizations to determine if all appropriate functional safety information is properly exchanged.

    - Have any changes to airspace had an adverse effect on functional safety?

- Is there a good working interface with other ATM units on functional safety?
- Have any changes in the ANSP organization and/or types of activity had an impact on ATM safety?
- Is there a good working interface with Design/Support Authorities on ATM safety?
- How is the interface with contractors managed?
- Are contractors taking part in the unit safety management process?

# CHAPTER 5
# CONTINUOUS SAFETY SURVEY METHODS & TECHNIQUES

## 5.1 General Description of CSS Methods

5.1.1 The PSS methods described in the previous chapter have traditionally formed the bedrock of survey activity at ATM Service provider organisations. Although such surveys are particularly good at identifying the organisational factors which could lead to downstream safety problems, they are unlikely, for example, to highlight specific unsafe acts conducted on ATC consoles, or in technical work areas and can only examine parts of an organisation in 'snap-shot'.

5.1.2 In reality, potentially unsafe acts occur from time to time which could manifest as the final stage in the creation of an accident. Examples could be uncorrected read-back errors, misplaced label displays, incorrectly marked flight strips etc. However, the vast majority of such acts are counteracted by other defences or are 'self-corrected' such that they are rendered inconsequential. Unless such acts lead to an incident report or coincidentally occur whilst a PSS is actually in progress, they will not be known about as such Periodic Survey Methods do not provide continuous monitoring.

5.1.3 The safe operation of an ANSP within the ATM system involves the complex interaction of suitably trained people (both operations staffs and technical personnel), the organisations in which they work, the procedures they are required to follow and the equipment they must maintain and operate. Although the type of Safety Survey described in this chapter is primarily designed to focus on the performance of the people, it does, however, also provide an insight into safety-related equipment issues and the organisation & procedures within which the people must operate. It can also provide a useful insight into the safety-related behaviour of teams in the workplace.

5.1.4 For these reasons, the suite of Safety Survey types which should be included in a Survey regime includes Continuous Safety Surveys (CSS). CSS looks at the workplace, both operational and technical, during normal operations and, although it is less likely to highlight the underpinning Organisational Factors, as illustrated below, it identifies the things that were effective, such as barriers, as well as those which fail. CSS, therefore, performs a key role in providing feedback to ANSP management on the effectiveness and efficiency of the SMS as it is implemented locally. It provides ANSP senior management with a very good means of surveying the safety 'health' of the organisation at the point of delivery.

5.1.5 Whereas organisations with SMS traditionally collect information on failed safety performance, CSS has the additional advantage that it allows safety behaviour to be shaped by successful practice; in other words, it is proactive. The system is used to identify what stops accidents rather than just what causes them. As Figure 5.1 shows, this Survey type is therefore very useful in measuring the effectiveness of defences and barriers in overcoming the effects of potentially

unsafe acts and can provide useful guidance in shaping the further development of safe operating practices.

5.1.6 CSS can be particularly effective in enabling ATM providers to assess their resilience to systemic threats, operational risks and front-line personnel errors. The logic which underpins this is that the trademark of an expert controller, assistant or ATM technician is not necessarily years of experience rather it is how effectively they have mastered the skills needed to manage the compromise between delivery & safety.

5.1.7 A number of CSS approaches are available for selection and use by ANSPs. These may be divided into two main methods: 'Over-The-Shoulder Observation' and 'Self Assessment'. Each survey method has its unique advantages and disadvantages and will be suitable for eliciting a certain type of safety-related, qualitative or quantitative data. Surveys can be carried out using a combination of methods and techniques to achieve a given aim. Although compliance with ESARR 3 requires that some form of CSS takes place, the survey methods and techniques are not in themselves mandatory. Variations of these methods and techniques may be adapted to the size and culture of ANSP organisations and, accordingly, are described in the following paragraphs together with information on their relative merits and disadvantages.

## *5.2* OVER THE SHOULDER OBSERVATION METHOD

### 5.2.1 **Description of Method.**

5.2.1.1 In this type of Survey, an observer monitors routine ATC or associated Engineering activity in order to record events for later analysis. The basic principle is to arrange, on a routine basis, the accurate watching and recording of normal activity relating to ATM safety as it occurs, particularly with regard to cause and effect. A range of options is available for the selection of observers and this is discussed further in the planning section of this chapter. Moreover, a key aspect of this type of survey is the development and selection of a suitable framework upon which to base the observation and recording. Again, a range of options is available and will be discussed later in a planning context.

5.2.1.2 Such surveys could observe and evaluate the safety-related behaviour of individual controllers, assistants, technicians etc or of entire teams. This aspect of the scope of observation may be driven by particular survey initiators and will be discussed further under this heading.

5.2.1.3 Advantages. The 'Over the Shoulder Observation' form of Safety Survey has the advantage that normal ATM operations and associated engineering activity is observed as it is actually occurring. It therefore provides very immediate feedback of the safety behaviour of the organisation at the point of delivery. This survey method can provide early warning of emerging adverse safety trends. Significantly, It can also provide very useful information about the effectiveness of safety barriers and positive safety behaviour. It therefore provides ongoing and direct feedback concerning the effectiveness of the SMS.

5.2.1.4 Disadvantages. This form of Safety Survey can be expensive in terms of resources as it is a routine activity and requires the involvement of dedicated observers who also need to be trained. The successful use of this survey method is dependent upon the preparedness of individual controllers, assistants and technicians to subject themselves to the presence of an observer whilst they are discharging safety-related functions. In most cultures, such willingness normally depends upon individual trust that observations are being carried out for the common good and are on a very strictly no-blame basis. The positive involvement and support of appropriate Trade Associations is likely to be a firm underpinning requirement. ANSPs in certain nations may find there are cultural and/or legal barriers to the effective operation of this kind of observation-based Safety Survey and will need to discharge the CSS remit through another method such as self-assessment. Finally, it is necessary to recognise that, at least during the early stages of use of such methods, the behaviour of individual participants is influenced by the presence of an observer. Until the routine presence of observers becomes accepted, the early results of such surveys can be somewhat distorted.

### 5.2.2 **Survey Initiators & Inputs**

#### 5.2.2.1 Survey Initiators

5.2.2.1.1 Over-the-shoulder observation as a form of continuous survey is a routine activity which lends itself well to the ESARR 3 requirement to survey normal operations. As such, it does not need a specific initiating event or trigger

and would normally be planned as a routine and ongoing survey activity. Over the shoulder type surveys may therefore be initiated as a result of a specific survey timetable. They may also be initiated as a result of a requirement imposed by management for operational and technical teams or watches to carry out a prescribed number of such observational surveys in a given time period. Following a significant change in equipment, organisation, procedures, training or personnel, it may be useful to initiate an observational type survey in order to provide confirmation of safe operation of the new 'normal'. These aspects are described further in the Planning section.

5.2.2.1.2 Although such observational surveys are routine activities, the precise area of operations or engineering which is subjected to survey may be selected as a result of feedback from other survey activities, such as periodic inspections or targeted studies which highlight areas of particular safety interest. Similarly, though not initiators in the true sense, observations from Regulatory or QA audits may assist in prioritising the areas which are to be subjected to over-the-shoulder type observation in a similar way.

5.2.2.1.3 The study of trend information from Safety Monitoring activities concerning, for example ATM-related accidents and serious incidents, both from within the specific organisation and from elsewhere in the wider ATM system, may also help to focus the relative priority of certain operational or technical areas for observational survey.

### 5.2.3 Survey Inputs

5.2.3.1 In order to be able to plan a regime of Over the Shoulder Observation, ANSP staff will need a number of inputs. In addition to copies of Operating Procedures and appropriate technical manuals, survey planners will need manning lists and watch rosters together with information about the level of training and qualification of operational and technical personnel who may be observed. Information about the ATM equipment in use may also be needed and should be obtained from equipment documentation including performance charts and, where appropriate, coverage diagrams.

5.2.3.1.1 Specifically, the planners will need information from the appropriate Safety Cases and supporting documents relating to relevant hazards and the ways in which it is intended that they will be mitigated. Where an established Safety Case exists, the most likely location for such information will be the Hazard Log.

5.2.3.1.2 Further background information on ATM-related accidents and incidents of relevance to the roles to be surveyed should be obtained from the organisation's Safety Monitoring process and from external sources, and from the personal experience of ANSP staff.

5.2.3.1.3 The Survey Input information described above could subsequently be used by surveyors for self-briefing purposes or, where resources permit, could be used within a local observer/surveyor training programme.

### 5.2.4 Survey Planning

#### 5.2.4.1 General

5.2.4.1.1 The planning function associated with this form of CSS is focussed on the identification of survey tasks and resources, and scheduling to ensure that the survey aims and objectives are achieved. The planning process seeks to answer the questions:

- What is to be surveyed?
- Who is to survey it?
- When is it to be surveyed?
- How is the survey to be conducted?
- How are the survey results to be analysed and used?

5.2.4.2 **What is to be surveyed?**

5.2.4.2.1 The basic requirement is that CSS should be applied to 'normal operations'. Over the shoulder observations can be directed to survey the safety-related performance of individual operational and technical staff. Alternately, or in addition, such surveys could be set up to observe ATC operations or maintenance team behaviour.

5.2.4.2.2 The observation of nominated individuals could in some organisations be carried out as part of a recurring standards evaluation or competence checking programme where such exists. This and the team-based observation can be a particularly useful vehicle for the sharing of best practice between units and separate operational/technical watches.

5.2.4.2.3 In the interests of objectivity and standardisation it is important that those planning a regime of over the shoulder surveys should be careful in selecting the type of activity to be observed. It would be neither appropriate nor helpful to observe only the highest workload operational or technical functions. Similarly, the observation of only the less-demanding functions could equally generate survey data which was atypical and from which meaningful lessons should not be drawn.

5.2.4.2.4 Therefore, ANSP staff responsible for planning a CSS regime involving over the shoulder observations should issue guidance to observers on which of the physical functions are to be surveyed during a given period. The aim, in such a continuous survey regime, would be to provide coverage of all safety-related operational and technical functions during a nominated cyclical calendar period which may vary from organisation to organisation.

5.2.4.2.5 Recording of Safety Survey observations and findings must be planned to be conducted in accordance with a pre-designated framework which is developed to meet local needs and provides a consistent structure.

5.2.4.2.6 The development of such frameworks is a key aspect of the planning process. They typically take the form of a simple model or taxonomy[6] of key relevant safety performance attributes. At an early stage in the planning process, therefore, individual ATM provider organisations need to develop such survey

[6] Taxonomy - A term drawn from natural science where it is used to describe a classification of things according to their presumed natural relationships. In this context the term is used to describe a categorisation of factors which are relevant to the safe conduct of normal ATM functions.

taxonomies to cover the relevant local conditions and the respective operational and technical operating environments. Examples of typical taxonomies for ATM Operations and Technical staff are provided respectively at Illustration 5.1 and 5.2 at the end of this Section and may be used as templates for the development of suitable survey material for local use. A number of such frameworks will need to be developed in order to match the operational and technical roles to be observed. The more detailed content of the taxonomies themselves will change over time as operational and technical processes evolve and ANSPs gain more experience in the planning and conduct of this type of survey.

5.2.4.2.7 The actual use of these taxonomies is covered later in the data collection section.

5.2.4.2.8 Taxonomy Development.

5.2.4.2.8.1 In planning a CSS regime including Over the Shoulder Observation ANSPs need to develop taxonomies which will allow observers to record potential threats to ATM safety and the means by which they are addressed. The taxonomies must also allow the observers to record the safety-related errors which may be generated during the process and the means by which ATM operations and technical personnel 'manage' these errors. The taxonomies must be concise and focussed such that they allow observers to look for specific aspects of ATM activity and behaviours which from past experience and/or from other SM activity are associated with particular risk and to record them in a way which will allow simple categorisation and analysis on a continuous day-to-day basis.

5.2.4.2.8.2 In developing such taxonomies it is necessary to find a logical means of categorising the activities to be observed. Where the ATM activities to be surveyed follow a set sequence, such as in an airfield setting with clearances for start, push-back, taxi, departure etc, this can be used to form the basis of a phase-based taxonomy. This approach is used in LOSA where observation forms are developed around the phases of a single particular flight. In the majority of ATM roles, however, this approach is less likely to be useful. An ATC controller at a busy area control centre, for example may, during a given period on console, provide a service to a large number of aircraft in the en-route phase. For such roles event-based taxonomies can be developed in a way which allows activities of key ATM safety interest to be recorded and this style of taxonomy is likely to be of greater utility to ATM service providers.

5.2.4.2.8.3 It is generally helpful to categorise these areas of key ATM safety interest into four main groups: ATM Equipment, ATM Procedures, People and the Environment. Areas of key safety interest can be drawn from study of past ATM safety incidents and accidents together with information drawn from hazard identification and assessment activity conducted as part of safety case development. In particular the Hazard Log can be a rich source of such information. The process of developing data collection forms normally takes the following form:

- It is first necessary to identify key safety-related functions appropriate to the role to be surveyed. This information can be drawn from terms of reference, job descriptions, training profiles, safety case reports and, particularly, from personnel who are particularly experienced in the appropriate role. Safety-related functions which could be addressed might include the controllers planning, decision-making and communication

activities, use of equipment, and, for airfield controllers, handling of potential ground threats such as runway incursions by vehicles and aircraft. Safety-related factors for technicians might include the formal release/return of safety-related equipment and associated coordination of maintenance activity with operational staffs together with specific local threats which may be posed by maintenance activity to ATM operations. Providers may, additionally, find it useful to include personal safety in the workplace issues (eg protection from electrocution, use of protective equipment etc) alongside the pure functional safety aspects. Examples of such factors for ATC controllers and ATM technicians are provided in template form at Illustration 5.1 respectively at the end of this Section for local adaptation.

- Having identified the relevant safety-related functions it is then necessary to categorise the most common relevant safety threats. The main purpose of a simple categorisation system is to make the recording task of the observer easier, to allow the subsequent identification of trends and permit simple statistical analysis of the emergence of specific types of threat over time. It may be helpful to categorise such threats broadly into Equipment, Procedures and People (Human Error). Again, this can be drawn primarily from personal experience but may also be identified from study of safety assessments carried out during the SM process and extracted from relevant Hazard Logs. Not all threats will be captured at this time and there will always be a need to identify new threats. The list of threats is likely to evolve continuously as ATM service providers gain experience in the conduct of such surveys. An example of a simple categorisation system is given at Illustration 5.1 at the end of this Section.

- Given that one of the main benefits of CSS is to highlight the safety defences which are being implemented successfully it is helpful, again, to categorise the defences which may be employed. Again, not all defences will be captured at this time and this list is likely to evolve continuously. It is recommended that a relatively simple categorisation system is employed in the first instance.

- A Safety Survey observation form should then be developed for local use. A generic example of such a sheet is shown at Illustration 1 at the end of this Section could be used as a template for local adaptation. The aim is to provide the observer with a simple means of recording what has been observed, which safety threats had an impact upon the ATM activities in question, how these threats were managed and what the consequences were for ATM safety.

#### 5.2.4.3 **Who is to survey it?**

5.2.4.3.1 There are, of course, significant resource implications associated with this type of survey approach, together with issues of personal and trade association sensitivity. A range of options is available.

- The observers could be drawn from a dedicated team of evaluators, perhaps unit training or safety staffs.

- Larger ANSPs may be able to use observers drawn from a sister unit or airfield from that being observed.

- Observers could be engaged directly by ANSPs from external consultants on a contractual basis.

- ANSPs could identify a proportion of the existing operational and technical staff who would carry out survey tasks as an additional part of their primary duties.

5.2.4.3.2 All of the above options have resource implications and selection of the most suitable approach will vary between ATM service-providers according to their size, culture and other factors.

- Dedicated Team Of Observers. The operation of a dedicated team of observers allows a high degree of standardisation and management control but is relatively expensive unless the role is combined with an existing team function such as, for example, training and/or safety. The potential for a conflict of interests between other such team functions should also be borne carefully in mind. Such teams can also become somewhat 'distant' from the immediate problems of the workforce particularly where their team functions do not allow them to retain operational/technical currency.

- Observers Drawn From Other Units Within The Organisation. The use of observers drawn from other parts of the organisation can be useful in providing a degree of impartiality whilst satisfying the ESARR 3 requirement for Safety Survey to be an internal activity. Organising and scheduling survey activities can be more difficult under such arrangements however and would be likely to involve a degree of negotiation with a wide variety of separate line managers. This would probably mean that it would be difficult to arrange such surveys on a sufficiently frequent basis to meet the 'continuous' remit.

- Contracted Observers. Although the use of observers contracted directly to the ATM service provider would also provide a degree of impartiality and could be argued to meet the spirit of the ESARR 3 requirement for such survey activities to be 'internal', a number of associated potential disadvantages should also be considered. Firstly, in order to be effective, such observers would need to have credibility in the eyes of those being observed. In that contractor's staffs are unlikely to have local operational/technical currency or, at least, familiarity with local procedures and equipment it would be quite difficult for the ATM service provider to place sufficient confidence in the accuracy of their observations. Secondly, in order to meet the requirement for such surveys of normal activity to be carried out on a continuous basis, the use of observers contracted on a commercial basis could be prohibitively expensive.

- Existing Operational & Technical Staff As Observers. ANSPs may choose to include basic safety observer training in their local continuation training regime for a selected proportion of existing staff members (typically 10%). Provision of basic safety observer training to a wide selection of ATM personnel can lead to difficulty in obtaining a consistent approach. However, it does provide the benefit of greater involvement of the workforce and can provide a ready pool of observers in each location and on each watch etc. Observer duties would, however, need to be carried out in addition to the individual's primary role. This approach has the advantage that observers remain 'credible' in the eyes of those being observed as they are their peers and are themselves in current operational/technical practice. This approach also has the advantage that it provides a large pool of observers upon which

to call. It also inculcates a wider culture of acceptance of such survey activity as a normal part of ATM activity and can enhance the safety culture of the organisation. In other words, it reinforces the message that safety is not just the concern of a small number of people 'the safety team' but is an activity to which the wider ATM community can and must contribute.

5.2.4.3.3 The Need For 'Buy In'. Whichever approach is selected for safety observers, there will be Trade Association implications and it will be necessary in many cultures to secure 'buy in' from the staff who are to be surveyed. If the observational survey regime does not have the trust of the user community it will probably not be successful in helping to identify key safety improvements. If operational/technical staff are reassured that their Trade Associations support the use of observational Safety Survey methods as a positive means of improving safety and, as a result, will reduce the risk that they themselves will be involved in safety incidents/accidents the survey regime is more likely to secure their commitment and support. Conversely, if staffs view the process as merely a 'management tool' to spy on them it will not secure their full commitment and valuable opportunities for safety improvement could be lost. It is therefore important that ATM service providers should liaise closely with the appropriate Trade Associations at an early stage in the process of planning to introduce an observation-based survey regime.

5.2.4.3.4 Observer Training. A key precursor activity to the effective conduct of observation-based surveys is the training of observers. This can be carried out internally as part of either a dedicated observer training regime or as part of normal continuity training for operations and technical staffs where a proportion of staffs are to be nominated as observers. Such training may be available commercially from external training providers and academic institutions. Whichever training path is selected it is important that sufficient numbers of properly trained observers are planned from the outset and maintained on a continuous basis in order to provide sufficient assurance that a continuous regime of observational survey will be maintained at a steady rate.

5.2.4.4 **When is it to be surveyed?**

5.2.4.4.1 The scheduling and timing of observation-based Safety Surveys will be driven to a large extent by the chosen source of observers. Where a dedicated and exclusive team of observers is employed this could form part of a rolling programme of surveys of the operational and technical functions within the organisation. Where a proportion of the operational and technical workforce is nominated and trained as safety observers the scheduling of survey periods could be accomplished in a number of ways:

- Each nominated observer could be tasked with completing a set number of observations (either by function or time period) during a nominated period, typically each month. The selection of survey timings could be left to each individual observer. This approach would have the advantage of allowing some freedom to each observer to plan his/her individual survey schedule to fit other workload commitments. Whilst positive from a resource perspective, this could have the disadvantage that survey activity only took place during relatively quiet periods when observers were not engaged in their own primary operational/technical functions.

- Operational and technical section leaders/watch managers could be tasked with ensuring that a certain nominated number of observational

surveys of each function was carried out by the observers assigned within each section during each nominated calendar period. This would provide the advantage of greater management involvement and 'ownership' of the observational survey process. Whichever criteria are used for timing observational surveys it is important to bear in mind that the overriding requirement is to survey normal operations in order to provide a safety health-check. Such surveys should therefore neither be carried out exclusively during busy periods nor only during quiet periods. Surveys should be arranged to take place during typical operating periods and should include both busy and quiet periods in order to provide survey results which will be sufficiently meaningful and upon which sufficient reliance can be placed.

5.2.4.4.2 In general, where organisations operate CSS such that surveys are underway within the organisation on a more or less continuous basis it is easier for people to accept the presence of observers as merely a normal activity and not modify their behaviour as a result.

5.2.4.5 **How is the Survey to Be Conducted?**

5.2.4.5.1 The survey takes the form of the observation and recording of ATM operational and technical functions. Observers record potential threats to ATM safety and the means by which they are addressed. They also record the safety-related errors which may be generated during the process and how ATM operations and technical personnel manage these errors. This method allows observers to look for specific behaviours which in the past it is known have been associated with serious ATM incidents and/or accidents and to observe the ways in which such behaviours are managed within the local day-to-day approach to ATM safety.

5.2.4.5.2 Observation is carried out on a strictly no-blame basis. The individuals who are observed are not identified individually. The organisational basis for this no-blame arrangement will need to be set up at the planning stage and the necessary details publicised well in advance to all those who will be affected. Depending upon the approach taken for the selection of observers, ATM organisations may choose to identify individual observers only by some form of reference number where this is judged most appropriate, for example where a dedicated and known team is not used.

5.2.4.5.3 The observational survey can be supplemented, where required, with a short structured interview of the people being surveyed once the observational period is complete. A very short series of questions could be used to guide this interview, focussed on the key areas of People & Training, Organisation & Procedures, Equipment and SM and this should be prepared in advance. Examples of the style of questions are given at Illustration 5.1 at the end of this Section. Guidance on the preparation of such questionnaires and the techniques to be used for interviewing may be found at Annexes C and D respectively.

#### 5.2.4.6 How are the survey results to be analyzed and used?

5.2.4.6.1 It is important that the intended use of survey results is identified at the planning stage in order to ensure that the most appropriate data collection and analysis techniques are selected.

5.2.4.6.2 Although both the analysis and dissemination of findings from such surveys is discussed in later sections it is important to draw an early distinction at the planning stage between surveys which are intended to provide qualitative and quantitative safety data. The most common form of CSS is likely to provide qualitative material such as, for example, best practice material for inclusion in safety awareness publications as part of the process of continuous improvement. Some quantitative data may also be derived from CSS such as, for example, a breakdown of the occurrence rates of certain types of error which could be used in support of safety case arguments.

5.2.4.6.3 Arrangements should be put in place at the planning stage for the results from CSS activities to be collected and recorded centrally for subsequent analysis by SM staff. The simple categorisation system outlined at illustrated at Illustration 5.1 at the end of this Section will allow the information drawn from these surveys to be collated in a logical manner for subsequent analysis at varying degrees of depth.

### 5.2.5 Data Collection Techniques

5.2.5.1 The technique requires the surveyor to observe and record, factors which could have an impact on the safe conduct of operations. For example the observer will be required to record an ATC controller's reaction to safety threats, the generation of errors and the extent of self-correction. As well as identifying safety threats, this process highlights good safety practices which are effective barriers to potentially unsafe situations and this form of survey therefore provides positive feedback on the effectiveness of in-place safety arrangements.

5.2.5.2 In preparation for the survey, observers should familiarise themselves with the survey taxonomy and required format of the observation activity. If observing an individual for the first time, it would be helpful for the observer to put the individual at ease by explaining the purpose of the survey and the ‘no-blame’ nature of the observation. The intention is to reassure the individual that they should behave normally in conducting their tasks.

5.2.5.3 It is important that the observer should not become involved with the personnel who are being observed during such a survey. In particular, it would be inappropriate for the observer to be engaged in questions on, for example, procedures or actions. In order to function effectively as an observer it is important that the observer remains sufficiently detached from what is taking place and the associated decision-making that he is able to record events accurately and operate properly as an observer.

5.2.5.4 Once the period of observation has come to an end, the observer should normally have a discussion with the person observed in order to clarify any issues of fact. In so doing, the attitude of the observer will be particularly important. The most useful approach is one in which the observer, who may well be a peer, tries to get inside the mind of the person observed in order to place observations in context and understand the appropriate threat and management

measures which are relevant to the situation. This will assist in better understanding, not only what occurred but why it occurred.

5.2.5.5 It is therefore helpful for observers to use the correct elicitation techniques during post-survey discussions and to focus on the key areas. For example, when providing direct feedback on an observed activity where safety-related procedures were apparently not followed it can be helpful for the observer first to ask what should have been done in the given circumstances. By then asking what was actually done it can help to reinforce cause and effect and may assist in highlighting underpinning organisational issues such as under-manning or poorly written procedures. Guidance on such techniques is provided in Annex D. Where this form of direct feedback is to form part of an ANSP's CSS regime, such elicitation techniques should be included in the observer training programme.

5.2.5.6 This discussion also provides an opportunity for the observer to apply the short interview questionnaire where it is intended that this technique is also to be used.

5.2.5.7 It may therefore be possible for direct verbal feedback to be given by the observer into cause and effect. This approach has many benefits in terms of openness and immediacy; however it may not be a suitable feedback mechanism in certain cultures or may not be physically possible or desirable due to time pressures and/or workload.

5.2.5.8 Although Data Analysis techniques are to be covered in the next chapter, with this type of survey it is likely that some form of simple data analysis may be made on the spot by the observer based on his/her experience and specialist knowledge. Therefore, whilst the details are still fresh in mind, the observer should complete the CSS observation taxonomy sheet (Example at Illustration 5.1 at the end of this Section) which will be collated centrally and used as the basis for subsequent safety analysis. A key requirement for the generation of effective data from CSS is that observers follow closely and accurately the recording methodology prescribed at the respective unit. The taxonomies, in particular, provide an important means of ensuring standardisation and objectivity and should be completed conscientiously.

5.2.5.9 Objectivity is also a very important requirement. The required situation is one in which, regardless of the personality and background of the observers, provided they are appropriately trained and using the same taxonomy, any number of observers would, when observing the same activity, record the same result.

### 5.2.6 Data Analysis Techniques

5.2.6.1 It will be seen from the foregoing that the qualitative judgement (or expert opinion) of the observer taking part in CSS is key to success in gathering meaningful data. A relatively simple categorisation system, such as that outlined in Illustration 5.1 at the end of this Section will allow a range of analysis techniques to take place.

5.2.6.2 The details from continuous observations may be stored merely in paper form or entered into a local data base system. Such systems can be very complex and may be suited to only the largest ANSPs with substantial data analysis resources. In most cases, however, very effective analysis can be made

merely with the use of straightforward office applications such as spreadsheet tools.

5.2.6.3 It is usually helpful if the data from CSS is collated centrally, and preferably by staff who are able to validate and moderate the observation findings for consistency and accuracy. Unit safety management staff are usually well suited to this task and are able readily to identify potential and actual safety shortfalls together with Best Practice from the data provided.

5.2.6.4 A range of techniques is available for the analysis of data derived from such surveys. Some of the techniques available are very sophisticated. However, given the resources of most ANSPs and the nature of the data which this kind of survey is likely to yield it will invariably be the case that very simple statistical analysis will yield the most practically useful results.

### 5.2.7 Derivation of Findings

5.2.7.1 In the past within ATM there was a tendency to focus only the unsafe acts of individuals without considering the contribution of either the workplace or organisational factors and their effect on the constraints and resources acting on the practitioners at the 'sharp end'. CSS can provide the information which will allow senior management at ANSPs take a much wider view.

5.2.7.2 Simple collation of CSS results over time will yield management information concerning:

- Which local threats to ATM safety are the most significant in terms of (potential) consequences.
- Which local threats to ATM safety occur most frequently.
- Which are the most common errors by ATM operations and technical staff which lead to (potentially) unsafe acts.
- Which are the barriers and acts of self-correction which, most commonly, prevent such threats and errors from leading to unsafe acts?
- What new threats and errors are emerging?
- What new barriers and defences are our operators and technicians using in the workplace to counter emerging threats?

5.2.7.3 The straightforward presentation of such information can be helpful in informing the process of continuous improvement. However, more valuable findings can be derived over time through study of changing trends in CSS observations. Once an initial baseline of threat and barrier information has been gathered over a fixed period it is possible to derive more sophisticated findings from trend analysis. For example, an indication of the effectiveness of particular safety awareness activities at a unit may be determined through CSS results indicating positive changes in certain behaviour over time.

5.2.7.4 CSS can provide a ‘fly-on-the-wall’ real time picture of ATM system operations which can guide management strategies concerning safety which will feed into ATM training and operations. In particular, CSS can assist in identifying examples of superior performance that can be reinforced and used as positive

examples in unit training programmes. This type of survey basically provides a data-driven approach to the development of countermeasures to operational threats & errors.

5.2.7.5 In order to be really effective, however, it is necessary that the findings from CSS are considered frequently and actively by unit SM staff, either at regularly scheduled safety meetings or through specially convened 'brainstorming' sessions in order to derive unambiguous and practical recommendations for continuous improvement which can be approved by senior management. Guidance on brainstorming techniques is provided in Annex E.

### 5.2.8 **Dissemination Of Findings**

5.2.8.1 The findings from this form of CSS can be disseminated in a number of ways:

- Management Action Reports. Findings can be consolidated into a straightforward narrative report for with firm recommendations for remedial action to be approved by senior management. It is important that this process forms a part of the organisations normal management activity and, accordingly. it is, therefore recommended that the outcome of CSS activities is consolidated by unit safety staffs into regular Safety Survey Action Reports showing recommendations together with approval and implementation status. An example format for such a report is at Annex A. A summary of CSS results should also form part of the Annual Safety Survey Report to the ANSP Senior Management as illustrated at Annex B. Such reports need to be retained in order to provide a key audit trail in support of ESARR 3 compliance and it is likely that they will become a key item of interest by Regulators during the conduct of formal safety regulatory audits.

- Safety Awareness Material. Findings can be used in Safety Awareness material for ANSP personnel. Such material is likely to take the form of leaflets, CDs, safety posters and possibly entries on safety-related intranet pages. Where dealing with internal awareness for ANSP personnel, simple Pie Charts or Histograms can be particularly effective at showing a breakdown of the most significant threats, common errors and effective barriers. This can be a particularly productive means of disseminating the SM message and is prime example where 'simple is better'. A simple pie chart circulated or placed on notice boards at regular (weekly or monthly) intervals can be an effective way of disseminating safety trend information to the workforce. It is important, however, for the continued workforce confidence in the value of the system, that such material also indicates what is being done as a result of the survey findings and shows management commitment to resource continuous improvement.

- Management Presentations. The findings can provide useful material for inclusion in periodic management presentations and briefings to ANSP personnel whether physical, web-based or in video form.

- External Awareness Material. Where relevant, and particularly where the actions of external actors such as aircrews or other ATM organisations play a part in the safety threats and/or barriers, it can be helpful to disseminate CSS findings regularly to these stakeholders such as the airlines and other airspace/airfield user groups.

### 5.2.9 **Feedback**

5.2.9.1 This form of CSS may provide early warning of new emerging threats or error types or could indicate areas of weakness within the SMS. As such they could provide very useful feedback into the other forms of Safety Survey to be conducted as part of an ESARR 3 regime. CSS results could be used to guide safety managers in prioritising their PSS annual programme to embrace certain areas of the organisation. Where a specific area of perceived safety weakness or change in threat is indicated the CSS results could trigger the requirement to conduct an in-depth TSS which would examine a specific area of ATM operations and/or maintenance.

5.2.9.2 CSS can also provide both qualitative and quantitative feedback concerning the safety arguments and assumptions which underpin safety cases and associated safety assessments. Over time the output from CSS can be useful in substantiating assumptions made concerning, for example, the operational significance of certain types of equipment failure or the frequency of occurrence, in practice, of certain types of human error.

5.2.9.3 In these ways CSS is part of a closed-loop system which informs other parts of the SMS.

# ILLUSTRATION 5.1: CONTINUOUS SAFETY SURVEY PROFORMA TEMPLATE – OPERATIONS STAFF (5 PAGES)

| Date/Time Of Survey | Observer ID (Name or number as appropriate) | Position Being Surveyed |
|---|---|---|
| | | |
| **Activity Level Observed (eg Heavy/Light/Medium etc)** | | **Experience/Qualifications of Person being Observed** |
| | | |

| Observation Proforma (ATC Controller) |
|---|
| **Planning**<br>Observe and consider the controllers ability to plan on an effective course of action which would prevent conflicts and provide adequate aircraft separation and/or terrain clearance. – use of planning information and aids, pre-emptiveness (Make notes below) |
| |
| **Situation Awareness**<br>Observe and consider controllers ability to detect flight path/terrain conflicts in a timely manner. – awareness, vigilance, use of available information systems etc. (Make notes below) |
| |
| **Decision Making**<br>Observe and consider the controllers ability to decide on an effective course of action to resolve conflicts tactically in order to provide adequate aircraft separation and/or terrain clearance. – use of information sources and automated aids etc (Make notes below) |
| |

| |
|---|
| **Communication – Instructions & Clearances to Aircrew**<br>Observe and consider controllers ability to communicate effective instructions or information required by ATC Regulations to ensure that safe aircraft separation is maintained. – Issue of instructions, and clearances, clarity & precision etc. (Make notes below) |
| |
| **Communication – Safety-Related Information to Aircrew**<br>Observe and consider controllers ability to communicate other information relevant to the safety of flight promptly and accurately using G/A comms. – issue of meteorological information, airfield information, pressure settings clarity & precision etc .(Make notes below) |
| |
| **Communication – Safety-Related Information to other ATM Agencies**<br>Observe and consider controllers ability to communicate information relevant to the safety of flight promptly and accurately using terrestrial comms. (includes coordination, handovers clarity & precision etc etc) .(Make notes below) |
| |
| **Teamwork**<br>Observe and consider controllers ability to perform effectively as a member of an ATM team. – eg. effectiveness and timeliness of liaison, delegation of tasks etc .(Make notes below) |
| |

| Continuous Safety Survey Analysis Taxonomy | | | | | | |
|---|---|---|---|---|---|---|
| **Observation Serial No** | **Observation Description (Narrative)** | **Affected Safety-Related Function (See Index)** | **Safety Threat Codes (See Footnote[7])** | **How was safety-threat countered (Narrative)** | **Threat Management Codes (See Index)** | **Consequence Code (See Index)** |
| 1 | During very busy period, controller failed to notice that (c/s) had failed to level at assigned flight level on climb out from (a/f) – incorrect readback. A/c flew at incorrect level for distance of 12 nm. | SA Situation Awareness | A8<br>H5<br>A2<br>H1(HW) | Controller noticed incorrect level from SSR label display and queried with (c/s). Level instruction repeated and ac descended to correct level. | M4 | 1 |
| | | | | | | |
| | | | | | | |
| | | | | | | |



[7] **A** Requires immediate remedial action. Safety of ATM Operation is in serious jeopardy until effective measures are in place.
**B** Signifies a significant shortfall with safety implications. Remedial action is to be staffed and implemented as soon as possible, not later than 1 month.
**C** ATM safety could be affected. Remedial measures are to be staffed and implemented within 3 months.

# Index

## Functions

P: Planning
SA: Situation awareness
DM: Decision Making
C1: Communications; Instructions & clearances
C2: Communications; Information to Aircrew
C3 : Communications ; information to ATM

## Consequences

1. Safety threat countered successfully

2. Safety threat not effectively countered and only providence prevented a reportable incident.

3. Safety threat led to a reportable incident.

## Safety Threats

**Human Error**

H1: Human Error by ATC Controller (Tactical)
H2: Human error by ATC controller (Planning)
H3: Human error by ATC Assistant
H4: Human error by ATM technical personnel
H5: Human error by aircrew
H6: Human error by other external personnel (eg adjacent ATC unit)
H7: Other (Specify)

**Human Error - Amplifiers**

HW: High Workload
HD: Distraction
HF: Fatigue
HU: Unintentional slip/lapse/mistake
HI: Intentional Violation

**Procedures**

P1: Loss of Flight Strip Data
P2: Corruption of Flight Strip Data
P3: Aircraft Proximity to boundary of radio/radar coverage
P4: Deficient or ambiguous local operational orders/procedures
P5: Deficient or ambiguous operational orders/procedures from superior formations
P6: Deficient or ambiguous technical orders/procedures from superior formations
P7: Deficient or ambiguous local technical orders/procedures
P8: Deficiency in contractor's operating or engineering procedures
P9:Inappropriate Display filtering.
P10: Procedural documents missing/incomplete
P11: Other (Specify)

**Equipment**

E1: Loss of primary radar data
E2: Corruption of Primary Radar Data
E3: Loss of secondary radar data
E4: Corruption of SecondaryRadar Data
E5: Loss of Aircraft Label Displays
E5: Corruption of Aircraft Label Displays
E6: Loss of Informationl Displays
E7: Corruption of Information Displays
E8: Loss of Display Console
E9: Ground-to-ground communications failed or degraded
E10: Ground to Air Communications failed or degraded
E11: Ancillary Comms equipment (eg headset, splitter box) failed
E12: Loss of Navigation Display data (eg Maps)
E13: Corruption of Navigation Display Data (eg Maps/Navaids)
E14: Failure of Digital Data Exchange means
E15: Corruption of digital data means
E16: Poor Human Computer Interface
E17: Other(Specify)

**ATM Environment**

A1: Adverse Weather
A2: Air Traffic Loading
A3: Aircraft emergency/rerouting
A4 : R/T Language Difficulties
A5: R/T Non-Standard Phraseology
A6 : R/T Frequency Loading/Congestion
A7: Similar callsigns
A8: Aircrew non-compliance (including level Bust)
A9: Other (Specify)

## Threat Management

**Human**

M1: Controller Training
M2: Assistant Training
M3: Technician Training
M4 : Controller vigilance
M5: Technician vigilance
M6 : Assistant vigilance
M7 : Other (Specify)

**Organisational**

MO1: Operations room/ Workspace layout
MO2: Monitoring/Supervision
MO3: Work space heating/lighting/noise control
M04: Other (Specify)

**Procedural**

MP1: Separation Standards
MP2: Standard Operating Procedures
MP3: Contingency/Emergency Procedures
MP4: Coordination Procedures
MP5: Read Back Procedures
MP6: Working hours/time on console limitations
MP7: Other (Specify)

**Equipment**

ME1: Multiple data sources /redundancy
ME2: Equipment integrity/reliability
ME3: Back-Up/ alternate communications means
ME4: Radar/Radio Interference Protection Features
ME5: Other (Specify)

| Continuous Safety Survey –Interview Questions |
|---|
| **People & Training.** Are there any differences between the way you actually have to do things and the way you were trained? |
| **Organisation & Procedures.** Are there any differences between the way you actually have to do things and the way the procedures are written? |
| **Equipment.** What are the most safety-significant potential equipment pitfalls (traps) associated with the ATM systems you must operate or maintain? |
| **SMS.** Do you have any practical suggestions for ways in which the safety of ATM service provision at this unit could be improved? |

**NB The above formats are for illustrative purposes and should be adapted for local use.**

## Illustration 5.2: Continuous Safety Survey Proforma Template – Technical Staff (2 Pages)

| Date/Time Of Survey | Observer ID (Name or number as appropriate) | Department Being Surveyed |
|---|---|---|
| | | |

**Observation Proforma (ATM Technical Staff)**

| |
|---|
| **Task Completion**<br>Observe and consider technicians ability to safely complete the maintenance, rectification or installation task including such issues as: electrical isolation; manual handling; working at heights or permits to work (Make notes below) |
| |
| **Functional Testing**<br>Observe and consider technicians ability to safely undertake functional testing of equipment to ensure safe operation before hand over to operations staff (Make notes below) |
| |

| **Documentation**<br>Observe and consider technicians ability to correctly document the maintenance, rectification or installation procedure including such issues as: signatures; recording of hazards; suggestions for procedure amendment; safety improvements or general changes. (Make notes below) |
| --- |
| |

| **Post-Task Debrief & Procedure Review** (Observer talks to Technician)<br>By comparing the procedure with corresponding technician actions, observer and technician can judge whether procedures as written are safe, logically ordered, and complete. (Make notes below) |
| --- |
| |

**NB The above format is for illustrative purposes and should be adapted for local use.**

## *5.3* SAFETY ASSESSMENT PROFORMA METHOD

### 5.3.1 **Description of Method.**

5.3.1.1 This form of CSS is very similar to the Over the Shoulder Observation form of survey described above in that it also seeks to gather data about safety threats and the effectiveness of barriers on a continuous basis by monitoring normal operations and maintenance activity. However, rather than use third party observers, the method requires ATC controllers and Technicians to conduct the assessment themselves at the end of designated work periods using locally designed forms.

5.3.1.2 This method may, therefore, be summarised as the estimation of the extent and/or quality of factors which influence ATM safety positively or negatively, by individuals responsible for providing an ATM service or associated support.

5.3.1.3 Advantages. The Safety Assessment Proforma form of Safety Survey shares with Over the Shoulder Observation, the advantage that normal ATM operations and associated engineering activity is observed as it is actually occurring. It therefore similarly provides very immediate feedback of the safety behaviour of an organisation at the point of delivery. This survey method can provide early warning of emerging adverse safety trends. Significantly, It can also provide very useful information about the effectiveness of safety barriers and positive safety behaviour. It therefore provides ongoing and direct feedback concerning the effectiveness of the SMS. This CSS method has two distinct advantages over the former method. Firstly, because individual controllers are required to complete the safety assessment themselves it is far less resource intensive. It is not necessary to train observers or divert staff periodically from their primary tasks for observation purposes. Secondly, this form of Safety Survey may be more acceptable in cultures which are not able to accept the presence of safety observers in the workplace or where there are national legal obstacles to safety reporting on a no-blame basis.

5.3.1.4 Disadvantages. This form of Safety Survey has the major disadvantage that those directly involved in the task of ATM provision, and associated maintenance support are probably less well placed to notice threats particularly during busy periods. They are, of course, also less likely to realise that they have committed errors and may be unwilling to admit them as they would not otherwise have been discovered. An additional disadvantage of this method is that without continued management vigilance this method can too easily become a mere chore or simply ‘more paperwork’. At the end of a busy period in the workplace, it is mere human nature that attention may not focus on diligent completion of a safety assessment proforma as a priority. This is particularly relevant where proformas are not sufficiently focussed and too much information is requested.

### 5.3.2 **Survey Initiators & Inputs**

5.3.2.1 Survey Initiators

5.3.2.1.1 Like Over the Shoulder Observation, the Safety Assessment Proforma method as a form of continuous survey is a routine activity which lends itself well to the ESARR 3 requirement to survey normal operations. Similarly, it does not need a specific initiating event or trigger and would normally be planned as a routine and ongoing survey activity which becomes a part of normal every day

activity in the workplace. Following a significant change in equipment, organisation, procedures, training or personnel, it may be necessary to make changes to the type of information requested in order to provide different confirmatory safety information. This is described further in the Planning section.

5.3.2.1.2 The precise areas of operations or engineering which are required to participate routinely in this kind of survey may be selected as a result of feedback from other survey activities, such as periodic inspections or targeted studies which highlight areas of particular safety interest. Similarly, though not initiators in the true sense, observations from Regulatory or QA audits may assist in prioritising the areas which are to be subjected to this kind of survey in a similar way.

5.3.2.2 Survey Inputs

5.3.2.2.1 In order to be able to plan a regime of Safety Self Assessment, ANSP staff will need a number of inputs. In addition to copies of Operating Procedures and appropriate technical manuals, survey planners will need information about the ATM equipment in use they may also need information from the appropriate Safety Cases and supporting documents relating to relevant hazards and the ways in which it is intended that they will be mitigated. Where an established Safety Case exists, the most likely location for such information will be the Hazard Log.

5.3.2.2.2 Further background information on ATM-related accidents and incidents of relevance to the roles to be surveyed should be obtained from the organisation's Safety Monitoring process and from external sources.

### 5.3.3 Survey Planning

#### 5.3.3.1 General

5.3.3.1.1 The planning function associated with this form of CSS is focussed on the identification of the following:

- What is to be surveyed?
- How are the survey results to be analysed and used?

#### 5.3.3.2 What is to be surveyed?

5.3.3.2.1 The basic requirement, that this form of survey should normally be applied to 'normal operations', is satisfied by directing the survey toward the safety-related performance of individual operational and technical staff. The aim is to provide coverage of all safety-related operational and technical functions on a day to day routine basis although this method could also be used selectively to survey specific operational or maintenance activities, possibly following a process of organisational change.

5.3.3.2.2 A key aspect of the planning process is the design of a suitably concise and comprehensive safety assessment proforma. At an early stage, therefore, individual ATM provider organisations need to develop such proformas to cover the relevant local conditions and the respective operational and technical operating environments. At the larger ANSPs a number of such proformas may

need to be developed in order to match the operational and technical roles involved.

5.3.3.2.3 Proforma Development.

5.3.3.2.4 The term proforma has been used rather than questionnaire as the Safety Assessment Proforma method is a continuous survey method and must become a regular part of each days work activity. Although the proforma will offer the opportunity for individuals to provide more detailed input if they wish, its primary aim is to gather routine safety data in a way which will not be onerous for the individual and will therefore be supported.

5.3.3.3 The proforma needs to be designed such that it can be completed quickly and accurately by the individual controller or technician using 'tick-boxes' wherever possible. It should normally also allow events to be reported by exception. An example of a typical proforma is provided at Illustration 5.3 at the end of this Section and may be used as template for local adaptation.

- It is first necessary to identify key safety-related functions appropriate to the role to be surveyed. This information can be drawn from terms of reference, job descriptions, training profiles, safety case reports and, particularly, from personnel who are particularly experienced in the appropriate role. Safety-related functions which could be addressed might include the controllers planning, decision-making and communication activities, use of equipment, and, for airfield controllers, handling of potential ground threats such as runway incursions by vehicles and aircraft. Safety-related factors for technicians might include the formal release/return of safety-related equipment and associated coordination of maintenance activity with operational staffs together with specific local threats which may be posed by maintenance activity to ATM operations. Providers may, additionally, find it useful to include personal safety in the workplace issues (eg protection from electrocution, use of protective equipment etc) alongside the pure ATM safety aspects.

- Having identified the relevant safety-related functions it is then necessary to categorise the most common relevant safety threats. The main purpose of a simple categorisation system is to make the recording task of the observer easier, to allow the subsequent identification of trends and permit simple statistical analysis of the emergence of specific types of threat over time. It may be helpful to categorise such threats broadly into Equipment, Procedures and People (Human Error). Again, this can be drawn primarily from personal experience but may also be identified from study of safety assessments carried out during the SM process and extracted from relevant Hazard Logs. Not all threats will be captured at this time and there will always be a need to identify new threats. The list of threats is likely to evolve continuously as ATM service providers gain experience in the conduct of such surveys.

5.3.3.4 Given that one of the main benefits of CSS is to highlight the safety defences which are being implemented successfully it is helpful, again, to categorise the defences which may be employed. Again, not all defences will be captured at this time and this list is likely to evolve continuously. It is recommended that a relatively simple categorisation system is employed in the first instance. The aim is to provide the individual with a simple means of recording what has occurred, which safety threats had an impact upon the ATM activities in

question, how these threats were managed and what the consequences were for ATM safety.

#### 5.3.3.5 How are the Survey Results to be Analysed and Used?

5.3.3.5.1 It is important that the intended use of survey results is identified at the planning stage in order to ensure that the most appropriate data collection and analysis techniques are selected.

5.3.3.5.2 Arrangements should be put in place at the planning stage for the results from CSS activities to be collected and recorded centrally for subsequent analysis by Safety Management staff. The simple categorisation system outlined at illustrated at illustration 5.3 will allow the information drawn from these surveys to be collated in a logical manner for subsequent analysis at varying degrees of depth.

#### 5.3.3.6 Data Collection Techniques

5.3.3.6.1 The technique requires individual controllers and technicians, on a routine basis, to complete survey forms at the conclusion of activity periods. This can be achieved simply using paper proformas at workstation which are completed at the end of a period of contolling or maintenance activity or at the end of a shift. Again, the reporting system should operate on a strictly 'no-blame' basis and the identity of the reporter would not normally be recorded.

5.3.3.6.2 ANSPs may choose to require this data to be entered electronically by the submitter at suitable entry terminal within operations or technical areas. This would have the advantage of making the subsequent data analysis task easier but would make the recording task more onerous for the individual controllers/technicians with the risk that fewer would be completed.

5.3.3.6.3 Individuals would be required to record factors which they consider have had an impact on the safe conduct of operations. As well as identifying safety threats, this process highlights good safety practices which are effective barriers to potentially unsafe situations and this form of survey therefore provides positive feedback on the effectiveness of in-place safety arrangements.

5.3.3.6.4 Space should also be provided for the individual, exceptionally, to provide narrative comment relating to the safety significance of the events recorded and offer opinion regarding remedial actions.

### 5.3.4 Data Analysis Techniques

5.3.4.1 It will be seen from the foregoing that the qualitative judgement (or expert opinion) of the reporter is key to success in gathering meaningful data. A relatively simple categorisation system, such as that outlined in the Illustration 6.2 at the end of this Section will allow a range of analysis techniques to take place.

5.3.4.2 The details from received self assessment forms may be stored merely in paper form or entered into a local data base system. Such systems can be very complex and may be suited to only the largest ANSPs with substantial data analysis resources. In most cases, however, very effective analysis can be made merely with the use of straightforward office applications such as spreadsheet tools.

5.3.4.3 It is usually helpful if the data from this ongoing survey activity is collated centrally, and preferably by staff who are able to validate and moderate the observation findings for consistency and accuracy. Unit safety management staff are usually well suited to this task and are able readily to identify potential and actual safety shortfalls together with Best Practice from the data provided.

5.3.4.4 A range of techniques is available for the analysis of data derived from such surveys. Some of the techniques available are very sophisticated. However, given the resources of most ANSPs and the nature of the data which this kind of survey is likely to yield it will invariably be the case that very simple statistical analysis will yield the most practically useful results.

### 5.3.5 **Derivation and Dissemination of Findings and Feedback**

5.3.5.1 The derivation and dissemination of findings from self assessment survey, together with the process of feedback is exactly the same as was described earlier for the 'Over-The-Shoulder Observation' technique and will not be repeated here. However, this method provides an alternative means of systematic review, which can be used by ANSPs to recommend improvements where needed, to provide assurance of the safety of current activities, and to confirm conformance with applicable parts of the SMS.

## Illustration 5.3 Continuous Safety Survey – Safety Assessment Proforma Template

| Date/Time | Operating Position |
|---|---|
| | |
| **During this period of operational activity, in your opinion did any factor threaten your ability to provide a normal safe ATM Service. (Tick the appropriate box below)** | |
| **YES** | **NO** |
| If YES Please tick the appropriate boxes below | |

| | Please Indicate Which Of The Safety-Related Functions Below were affected and by which Threats | | | | | |
|---|---|---|---|---|---|---|
| **Safety Threats** | **Planning** My ability to plan on an effective course of action which would prevent conflicts and provide adequate aircraft separation and/or terrain clearance. | **Situation Awareness** My ability to detect flight path/terrain conflicts in a timely manner. | **Decision Making** My ability to decide on an effective course of action to resolve conflicts tactically in order to provide adequate aircraft separation and/or terrain clearance. | **Communication – Instructions & Clearances to Aircrew** My ability to communicate effective instructions or information required by ATC Regulations to ensure that safe aircraft separation is maintained | **Communication – Safety-Related Information to Aircrew** My ability to communicate other information relevant to the safety of flight promptly and accurately using G/A comms. | **Communication – Safety-Related Information to other ATM Agencies** My ability to communicate information relevant to the safety of flight promptly and accurately using terrestrial comms. |
| **Human Error** | | | | | | |
| H1: Human Error by ATC Controller (Tactical) | | | | | | |
| H2: Human error by ATC controller (Planning) | | | | | | |
| H3: Human error by ATC Assistant | | | | | | |
| H4: Human error by ATM technical personnel | | | | | | |
| H5: Human error by aircrew | | | | | | |
| H6: Human error by other external personnel (eg adjacent ATC unit) | | | | | | |
| H7: Other Hman error(Specify) | | | | | | |
| | | | | | | |
| **Procedures** | | | | | | |
| P1: Loss of Flight Strip Data | | | | | | |
| P2: Corruption of Flight Strip Data | | | | | | |
| P3: Aircraft Proximity to boundary of radio/radar coverage | | | | | | |
| P4: Deficient or ambiguous local operational orders/procedures | | | | | | |
| P5: Deficient or ambiguous operational orders/procedures from superior formations | | | | | | |
| P6: Deficient or ambiguous technical orders/procedures from superior formations | | | | | | |
| P7: Deficient or ambiguous local technical orders/procedures | | | | | | |
| P8: Deficiency in contractor's operating or engineering procedures | | | | | | |
| P9:Inappropriate Display filtering. | | | | | | |
| P10: Procedural documents missing/incomplete | | | | | | |

| | Please Indicate Which Of The Safety-Related Functions Below were affected and by which Threats | | | | | |
|---|---|---|---|---|---|---|
| **Safety Threats** | **Planning** My ability to plan on an effective course of action which would prevent conflicts and provide adequate aircraft separation and/or terrain clearance. | **Situation Awareness** My ability to detect flight path/terrain conflicts in a timely manner. | **Decision Making** My ability to decide on an effective course of action to resolve conflicts tactically in order to provide adequate aircraft separation and/or terrain clearance. | **Communication – Instructions & Clearances to Aircrew** My ability to communicate effective instructions or information required by ATC Regulations to ensure that safe aircraft separation is maintained | **Communication – Safety-Related Information to Aircrew** My ability to communicate other information relevant to the safety of flight promptly and accurately using G/A comms. | **Communication – Safety-Related Information to other ATM Agencies** My ability to communicate information relevant to the safety of flight promptly and accurately using terrestrial comms. |
| P11: OtherProcedural (Specify) | | | | | | |
| | | | | | | |
| **Equipment** | | | | | | |
| E1: Loss of primary radar data | | | | | | |
| E2: Corruption of Primary Radar Data | | | | | | |
| E3: Loss of secondary radar data | | | | | | |
| E4: Corruption of SecondaryRadar Data | | | | | | |
| E5: Loss of Aircraft Label Displays | | | | | | |
| E5: Corruption of Aircraft Label Displays | | | | | | |
| E6: Loss of Informationl Displays | | | | | | |
| E7: Corruption of Information Displays | | | | | | |
| E8: Loss of Display Console | | | | | | |
| E9: Ground-to-ground communications failed or degraded | | | | | | |
| E10: Ground to Air Communications failed or degraded | | | | | | |
| E11: Ancillary Comms equipment (eg headset, splitter box) failed | | | | | | |
| E12: Loss of Navigation Display data (eg Maps) | | | | | | |
| E13: Corruption of Navigation Display Data (eg Maps/Navaids) | | | | | | |
| E14: Failure of Digital Data Exchange means | | | | | | |
| E15: Corruption of digital data means | | | | | | |
| E16: Poor Human Computer Interface | | | | | | |
| E17: OtherEquipment (Specify) | | | | | | |
| | | | | | | |
| **ATM Environment** | | | | | | |
| A1: Adverse Weather | | | | | | |
| A2: Air Traffic Loading | | | | | | |
| A3: Aircraft emergency/rerouting | | | | | | |
| A4 : R/T Language Difficulties | | | | | | |
| A5: R/T Non-Standard Phraseology | | | | | | |
| A6 : R/T Frequency Loading/Congestion | | | | | | |
| A7: Similar callsigns | | | | | | |
| A8: Aircrew non-compliance (including level Bust) | | | | | | |
| A9: Other ATM Environment (Specify) | | | | | | |

| If you cited Human Factors as a Threat – Please tick any of the boxes below which provide amplification.. | |
|---|---|
| **Human Error - Amplifiers** | |
| HW: High Workload | |
| HD: Distraction | |
| HF: Fatigue | |
| HU: Unintentional slip/lapse/mistake | |
| HI: Intentional Violation | |

| **Threat Management**. Please tick the box below which, in your opinion, indicates the management factor which prevented the safety threat from resulting in a reportable occurrence. | |
|---|---|
| **Human** | |
| M1: Controller Training | |
| M2: Assistant Training | |
| M3: Technician Training | |
| M4 : Controller vigilance | |
| M5: Technician vigilance | |
| M6 : Assistant vigilance | |
| M7 : Other (Specify) | |
| **Organisational** | |
| MO1: Operations room/ Workspace layout | |
| MO2: Monitoring/Supervision | |
| MO3: Work space heating/lighting/noise control | |
| M04: Other (Specify) | |
| **Procedural** | |
| MP1: Separation Standards | |
| MP2: Standard Operating Procedures | |
| MP3: Contingency/Emergency Procedures | |
| MP4: Coordination Procedures | |
| MP5: Read Back Procedures | |
| MP6: Working hours/time on console limitations | |
| MP7: Other (Specify) | |
| **Equipment** | |
| ME1: Multiple data sources /redundancy | |
| ME2: Equipment integrity/reliability | |
| ME3: Back-Up/ alternate communications means | |
| ME4: Radar/Radio Interference Protection Features | |
| ME5: Other (Specify) | |
| ME1: Multiple data sources /redundancy | |
| ME2: Equipment integrity/reliability | |
| ME3: Back-Up/ alternate communications means | |
| ME4: Radar/Radio Interference Protection Features | |
| ME5: Other (Specify) | |

| **Consequences** Tick the box below which Best Represents The Outcome | | | Please Provide Amplifying Narrative Details below including your recommendations for Safety Improvement. |
|---|---|---|---|
| | | | |
| 1. Safety threat countered successfully | 2. Safety threat not effectively countered and only providence prevented a reportable | 3. Safety threat led to a reportable incident. | |

# CHAPTER 6
# TARGETED SAFETY SURVEY METHODS & TECHNIQUES

## 6.1 General Description of TSS Methods

6.1.1 The two other Safety Survey methods described in these guidelines provide a very useful combination of a periodic, broadly-based 'snapshot' of safety arrangements within an ANSP and day to day survey of activities at the workplace.

6.1.2 From time to time, however, it will be necessary to focus in some depth on a particular area of ATM activity where, for example, experience has shown that particular risk is present, that new hazards may be present or that there may be scope for further improving safety defences.

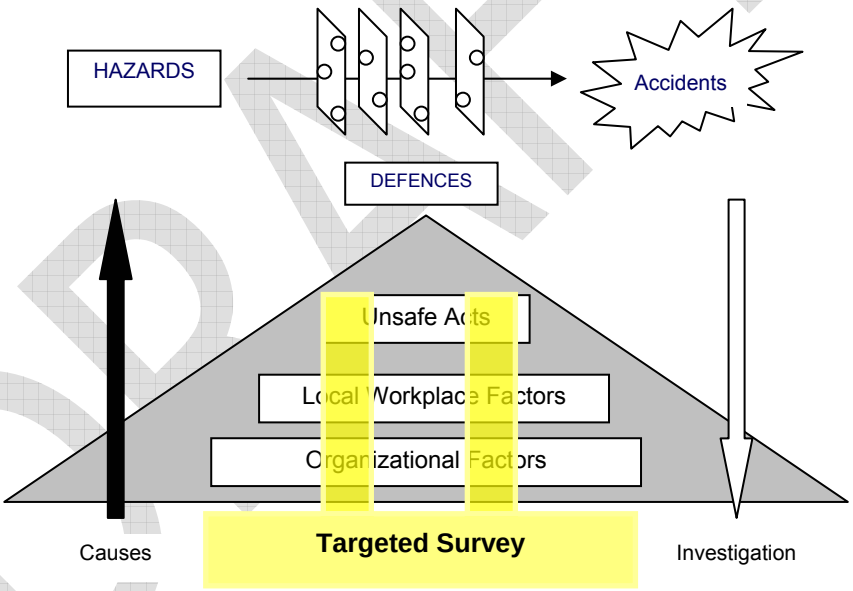



**Figure 6.1 - Scope Of Targeted Safety Survey**

6.1.3 For these reasons, the suite of Safety Survey types which should be included in a survey regime includes Targeted Safety Surveys (TSS). As Figure 6.1 shows, TSS is a 'narrow and deep' form of survey which yields specific information about a nominated area of interest and provides information of sufficient depth upon which to base decisions about wide ranging remedial action.

6.1.4 The aim is that ATM service providers should use this type of in-depth study to survey areas of particular perceived safety vulnerability. National Regulators may, from time to time, offer guidance on particular areas of ATM activity for study and may be expected to pay particular attention to the conduct and follow-up of such study activity during safety audits.

6.1.5 Although compliance with ESARR 3 requires that some form of TSS should takes place, the survey methods and techniques are not in themselves mandatory and no frequency is set for the conduct of such studies. A very wide range of techniques is available for TSS and, indeed, this type of survey is one which can often lend itself to innovative approaches. Whichever techniques are employed, a key requirement of TSS is that it should provide a deep look which allows analysis of the full range of relevant Accident Causation Mechanisms including Organisational Factors, Local Workplace Factors and Unsafe acts.[8]

6.1.6 TSS is categorised within this document into two broad methods: the Bespoke Study Method and the Attitude Survey Method. Within these methods, particularly the former, there is a wide range of study techniques which can be applied. Variations of these methods and techniques may be adapted to the size and culture of ATM Service provider organisations and, accordingly, are described in the following paragraphs together with guidance on their relative merits and disadvantages.

## 6.2 BESPOKE STUDY METHOD

### 6.2.1 **Description of Method.**

6.2.1.1 The term 'bespoke' originates from tailoring and describes the process of having clothes made to order. In the context of Safety Survey, this term refers to any dedicated study which is targeted upon a particular safety aspect of ATM activity. From this it will be recognised that almost any type of dedicated safety study will fall into this category and that is entirely appropriate. The study technique used should be selected by the ANSP to suit the perceived problem, or to suit particular specialist skills or tools which are available for use.

6.2.1.2 Clearly certain study techniques will have greater utility than others for studying certain areas and care should be taken in selecting that which is most appropriate to local circumstances. These guidelines are deliberately not prescriptive in this regard. The relative advantages and disadvantages of each technique will merely be outlined in order that providers may take this into account when organising this kind of study activity. The overriding requirement, however, is that the scope of each of these studies should be set with sufficient depth to allow the full spectrum of potential accident causation mechanisms, from unsafe acts, through workplace factors to organisational factors, to be addressed.

6.2.1.3 Advantages. The Bespoke Study approach to Safety Survey has the key advantage of flexibility. It also allows a relatively narrow object of study to be examined in great depth. The study techniques used can be selected by the ANSP to suit the perceived problem, to match particular specialist skills which the provider may have or to exploit specific tools which are available for the ANSP to use. This type of survey is already a popular means of satisfying the ESARR 3 requirement by ANSPs as it has the advantage that it can normally be carried out by suitably experienced ATM personnel within their normal operational or technical skill-set.

6.2.1.4 Disadvantages. This form of Safety Survey can be quite demanding in terms of resources both during the period of study itself and the subsequent analysis and reporting. It is therefore necessary in the interests of efficiency for

[8] A full description of these Accident Causation Mechanisms is provided in Volume 1 of these Guidelines.

ANSPs to ensure that this type of survey is focussed appropriately. A further disadvantage is therefore that such narrowly focussed studies may not reveal weaknesses in other parts of the Organisation or at other work areas from those which are the specific object of study.

### 6.2.2 **Survey Initiators & Inputs**

#### 6.2.2.1 Survey Initiators

6.2.2.1.1 The need for a Targeted Study may be triggered by a number of factors. They may be initiated as a result of a specific type of safety occurrence, incident or accident either within the aegis of the ANSP concerned or occurring elsewhere within the ATM community. EUROCONTROL initiatives to study ATC 'level-busts' and runway incursions are provide good examples of such study initiators. Occasionally safety events in other industries may trigger the need to study a specific aspect of ATM activity and this may be directed by a Regulator.

6.2.2.1.2 The requirement for such a study may be initiated by an ANSP as a result of, for example, proposed or recent changes in procedures, manning levels, training or organisation. It may often be useful to initiate an bespoke safety study following significant changes in order to provide confirmation of continued safe operation under new or trial arrangements. A further trigger for such a study may come from ATM personnel, controllers and technicians through open reporting of particular safety concerns either individually or through respective Trade Associations.

6.2.2.1.3 Finally, the findings of other ESARR 3 Safety Survey activity at the unit, PSS or CSS may recommend that a bespoke safety study is carried out in order to examine a particular problem area which has come to light.

#### 6.2.2.2 Survey Inputs

6.2.2.2.1 In order to be able to plan a bespoke safety study ANSP staff will need to know where to look and will need to be guided by the initiator of the study requirement as outlined above. The following inputs are likely to be needed:

- Safety Incident trend material from the Safety Monitoring process.
- Copies of relevant Operating and Maintenance Procedures
- Copies of relevant Airspace Charts, Approach Plates and Airfield Diagrams.
- Copies of appropriate technical manuals.
- Manning lists and watch roster
- Information about ATM equipment relevant to the study such as performance charts and coverage diagrams.
- Information from the appropriate Safety Cases and supporting documents relating to relevant hazards and the ways in which it is intended that they will be mitigated. (Where an established Safety Case exists, the most likely location for such information will be the Hazard Log).

### 6.2.3 **Survey Planning**

6.2.3.1 **General**

6.2.3.1.1 The planning function associated with this form of TSS is focussed on the identification of survey tasks and resources, and scheduling to ensure that the survey aims and objectives are achieved. The planning process seeks to answer the questions:

- What is to be surveyed?
- Who is to survey it?
- How is the survey to be conducted?
- How are the survey results to be analysed and used?

6.2.3.2 **What is to be surveyed?**

6.2.3.2.1 The very flexible nature of this type of study raises the risk that that the focus of study activity could drift or 'creep' over time away from that which is originally intended. It is therefore essential that a very clear and comprehensive objective is set for the study from the outset.

6.2.3.2.2 For simple short-duration studies this may be a straightforward task. However, where the study task is likely to be complex or where the range of study options is not clear it can be helpful to conduct a brainstorming session with key stakeholders in order to ensure that the study objectives are appropriately set. Guidance on the conduct of brainstorming sessions is provided in Annex E.

6.2.3.3 **Who is to survey it?**

6.2.3.3.1 The choice of surveyors is likely to be dependent upon the scope and scale of study needed. A range of options is normally available.

- The surveyors could be drawn from a dedicated team of perhaps unit safety staffs.
- Larger ANSPs may be able to use observers drawn from a sister unit or airfield from that being observed.
- Surveyors could be engaged directly by ANSPs from external consultants on a contractual basis.
- ANSPs could identify a proportion of the existing operational and technical staff who would carry out survey tasks as an additional part of their primary duties.

6.2.3.3.2 All of the above options have resource implications and selection of the most suitable approach will vary between ANSPs according to their size, culture and other factors.

- Dedicated Study Team. The use of a dedicated study team drawn, for example, from existing unit safety personnel has resource implications.

As such staffs are unlikely to be intimately familiar with the detail of the topic to be studied some familiarisation time would be necessary and this would be likely to require the involvement of other suitably qualified ATM operational and/or technical staff. However, this approach for TSS has the advantage that specialist SM, scientific and analytical skills can be brought to bear on a particular problem. Some ANSPs feel that this approach also has the advantage that the output from such studies provides the workforce with tangible evidence of the value of the safety team and direct feedback on the value of the SMS in providing continuous improvement.

- Study Team Drawn From Other Units Within The Organisation. Organising and scheduling study activities can be more difficult under arrangements where a study team is assembled from other units within the organisation and would be likely to involve a degree of negotiation with a wide variety of separate line managers. Such personnel would also be less familiar with the local workplace factors involved and might also need a period of pre-study familiarisation. Unless there is a particular requirement for impartiality, therefore, such as a study into issues of individual skill and competence, this approach is not likely to be attractive.

- Contracted Study Team. Although the use of a study team contracted directly to the ATM service provider would meet the spirit of the ESARR 3 requirement for such survey activities to be 'internal', a number of associated potential disadvantages should also be considered. Firstly, such contractors would be unlikely to have local operational/technical currency or, at least, familiarity with local procedures and equipment. It would therefore be quite difficult for the ATM service provider to place sufficient confidence in the accuracy of their observations. However, the use of contractors as part of a study team led internally may be a useful means of overcoming resource difficulties for short duration studies of this kind.

- Existing Operational & Technical Staff As Study Team. ANSPs may choose to involve ATM operational and/or technical staff in safety study activity in addition to their normal duties. This can be difficult to schedule and may present resource difficulties, however this approach provides the benefit of greater involvement of the workforce in SM activities. This can have a positive impact upon unit safety culture and brings career broadening benefits for the individual. This approach has the additional advantage that the study team members are themselves in current operational/technical practice and are therefore likely to be very familiar with the subject matter to be studied. How is the survey to be conducted?

6.2.3.3.3 Such surveys can be conducted using a wide range of techniques. Such techniques can be employed singly or in combination and may include:

- Physical observation.

- Checklist-guided verbal questioning.

- Additional mandatory reporting.

6.2.3.3.4 Physical Observation. Where a particular ATM operational or maintenance activity is to be studied some form of physical observation is likely to be necessary. This can be carried out in a similar way to the 'Over-The-Shoulder Observation 'technique used in CSS where operational and/or technical functions are observed and carefully recorded by an observer using some form of prepared study proforma. One ANSP visited during a Safety Survey best practice review had used this method very successfully to study perceived workload problems in terminal airspace. An observer patiently recorded many hours of terminal control operations logging occasions where positive interventions by the controller became necessary in order to build up a picture of airspace 'hot-spots'. This particular study was quite labour intensive and involved many man-days of observer time. It is possible that ANSPS could utilise data recording and replay facilities for similar study activities in order to increase efficiency.

6.2.3.4 Checklist-Guided Verbal Questioning. An interview approach can be used as an alternative to observation or, more often, as a supplement to it. This involves a short structured interview using a series of questions which should be developed to provide the required degree of depth. In examining Workplace factors and Organisational Issues, for example, it may be helpful to structure questions around the key areas of People & Training, Organisation & Procedures, Equipment and SM. Guidance on the preparation of questionnaires and the techniques to be used for interviewing may be found in Annexes C and D.

6.2.3.5 Additional Mandatory Reporting. This study approach gathers additional information on study topics of interest by requiring additional reporting of nominated events or circumstances. Such reporting can be achieved using proformas at the workstation similar to the Self-Assessment Proforma Technique described for CSS. It can also involve external agencies such as aircrews, other ATM service providers and other airspace/airfield users submitting reports in paper form or electronically via a dedicated web-site. Recent studies into level-busts and runway incursions provide good examples of this general approach.

6.2.3.6 **How are the survey results to be analysed and used?**

6.2.3.6.1 It is important that the intended use of survey results is identified at the planning stage in order to ensure that the most appropriate data collection and analysis techniques are selected.

6.2.3.6.2 Although both the analysis and dissemination of findings from such surveys is discussed in later sections it is important to draw an early distinction at the planning stage between surveys which are intended to provide qualitative and quantitative safety data.

6.2.3.6.3 Arrangements should be put in place at the planning stage for the results from TSS activities to be collected and recorded centrally for subsequent analysis by the study team or dedicated safety staff.

### 6.2.4 Data Collection and Analysis Techniques

6.2.4.1 From the foregoing it will be recognised that the range of data collection techniques which could be brought to bear on bespoke studies is virtually limitless. Data collection will commonly be based upon physical

observation, the use of questionnaires and verbal interview. These techniques are described fully elsewhere in these guidelines and will not be repeated here.

6.2.4.2 The data collected may be stored merely in paper form or entered into a local data base system. Such systems can be very complex and may be suited to only the largest ANSPs with substantial data analysis resources. In most cases, however, very effective analysis can be made merely with the use of straightforward office applications such as spreadsheet tools.

6.2.4.3 A range of techniques is available for the analysis of data derived from such surveys. Some of the techniques available are very sophisticated. For example, using local specialist knowledge, one ANSP fed the results of a series of terminal airspace conflict observations into a mapping programme designed for geological use. This produced a 'contour map' of airspace utilisation which was used to make recommendations for the improvement of terminal manoeuvre routings. However, given the resources of most ANSPs and the nature of the data which this kind of survey is likely to yield it will invariably be the case that very simple statistical analysis will yield the most practically useful results.

### 6.2.5 **Derivation of Findings**

6.2.5.1 In deriving findings from this type of survey it is important to ensure that sufficient depth is applied to be able to draw conclusions not only about the specific organisational issue, workplace factor or type of potentially unsafe act in question but findings which cover all of these factors. It is desirable that the derivation of findings from such studies should lead to recommendations for action which are focussed not only on the unsafe acts and workplace issues but also on wider Organisational factors. Again, the breadth and depth of potential findings may be such that a form of structured brainstorming may be an effective means of deriving properly focussed remedial recommendations.

### 6.2.6 **Dissemination Of Findings**

6.2.6.1 The findings from bespoke safety studies can be disseminated in a number of ways:

- Management Action Reports. Survey findings can be consolidated into a straightforward narrative report with firm recommendations for remedial action to be approved by senior management. It is important that this process forms a part of the organisation's normal management activity and it is, therefore recommended that the outcome of each TSS activities is also consolidated into a specific Safety Survey Action Report which shows recommendations together with approval and implementation status. An example format for such a report is at Annex A. A summary of CSS results should also form part of the Annual Safety Survey Report to the ANSP Senior Management as illustrated at Annex B. Such reports need to be retained in order to provide a key audit trail in support of ESARR 3 compliance and it is likely that they will become a key item of interest by Regulators during the conduct of formal safety regulatory audits.

- Safety Awareness Material. Finfings can be used in Safety Awareness material for ANSP personnel. Such material is likely to take the form of leaflets, CDs, safety posters and possibly entries on safety-related intranet pages. Where dealing with internal awareness for ANSP

personnel, simple Pie Charts or Histograms can be particularly effective at showing results. It is important, however, for the continued workforce confidence in the value of the system, that such material also indicates what is being done as a result of the survey findings and shows management commitment to resource continuous improvement.

- Management Presentations. The findings from TSS can provide useful material for inclusion in periodic management presentations and briefings to ANSP personnel whether physical, web-based or in video form.

- External Awareness Material. Where relevant, and particularly where the actions of external actors such as aircrews or other ATM organisations play a part in the safety threats and/or barriers, it can be helpful to disseminate TSS findings regularly to these stakeholders such as the airlines and other airspace/airfield user groups.

### 6.2.7 **Feedback**

6.2.7.1 TSS results can provide both qualitative and quantitative feedback concerning the safety arguments and assumptions which underpin safety cases and associated safety assessments. In these ways TSS is part of a closed-loop system which informs other parts of the SMS.

## *6.3* Attitude Survey Method

### 6.3.1 **Description of Method.**

6.3.1.1 Although drawing on the techniques described earlier in these guidelines, this TSS technique deserves specific mention in its own right because it can be used to derive useful information which covers the depth of factors from unsafe acts through to underlying organisational issues.

6.3.1.2 This technique is distinguished from other bespoke Safety Surveys using questionnaire techniques by the fact that the aim of such surveys is to gather safety data relating specifically to the attitudes of those being surveyed. In this context ‘attitude’ relates to a particular behaviour or way of thinking about issues which are relevant to the safety of ATM activity. Such a survey is most commonly used to gather information about the Safety Culture of an organisation.

6.3.1.3 This technique may, therefore, be summarised as the collection of data by questionnaire on the beliefs and opinions of individuals responsible for providing an ATM service or associated support concerning factors which influence ATM safety positively or negatively.

6.3.1.4 Advantages. Such a technique can be very useful in helping to determine safety-related workplace factors and their underlying organisational basis. If the questionnaire is administered in a suitably confidential manner it may also be possible to gather useful information about unsafe acts. When conducted at intervals this survey technique can provide early warning of emerging adverse safety trends. It can also provide very useful information about safety improvement and positive safety behaviour. Although construction of a suitable questionnaire is a significant undertaking, this technique has the additional advantage that it is not particularly resource-intensive.

6.3.1.5 Disadvantages. The development and analysis of initial Attitude Survey questionnaires can be a complex task which may require the involvement of specialist human factors expertise if inappropriate conclusions are not to be drawn.

### 6.3.2 Survey Initiators & Inputs

6.3.2.1 The survey initiators and inputs for this technique are broadly similar to those for the other TSS techniques and will not be repeated here. A specific trigger for this kind of attitude survey, however, may be a significant organisational change such as a transfer of ATM responsibility between public and private sectors or a merger of different ATM organisations. The real value in such surveys can be in revealing change over time by repeating such surveys at periodic intervals.

### 6.3.3 Survey Planning

#### 6.3.3.1 General

6.3.3.1.1 The planning function associated with this form of TSS is focussed on the identification of the following:

- What is to be surveyed?
- Who is to survey it?
- How is the survey to be conducted?
- How are the survey results to be analysed and used?

#### 6.3.3.2 What is to be surveyed?

6.3.3.2.1 This type of technique is most commonly used to survey a particular facet of attitude. In the safety context, this often means a study of the Safety Culture within a ATM service provider organisation. Safety Culture is defined by Reason[9] as 'Shared values (what is important) and beliefs (how things work) that interact with an organisation's structures and control systems to produce behavioural norms (the way we do things around here)'.

6.3.3.2.2 It will be necessary for the planner of this kind of survey to decide at the outset which elements of the ATM service provider population are to be the subject of this study. A generic study could be used to survey the workforce. However, there is usually greater merit in developing separate studies for management, operational and technical elements of the organisation. ANSPs may wish to focus such a study on a specific part of the population such as the ATC controllers at a particular unit.

6.3.3.2.3 Given that the real value in using this technique is to be able to monitor change (hopefully improvement) over time it is important to develop a questionnaire which is sufficiently comprehensive and relevant to stand the test of time such that it is not necessary to make many successive changes. This means

[9] Reason J, *'Managing The Risks Of Organisational Accidents'*, Ashgate, London, 1997.

that a key aspect of the planning process is the design of a suitable safety attitude questionnaire.

6.3.3.2.4 Questionnaire Development. It is necessary to be clear about the survey objectives and the types of information required before the questionnaire is developed. Questions concerning beliefs, attitudes or opinions are relatively difficult to construct given the underlying complexity compared with questions on knowledge or behaviours. Guidance on the design of questionnaires is provided at Annex C, however, ATM service providers without embedded human factors expertise may be advised to seek specialist external assistance in planning such a survey regime from the outset.

### 6.3.3.3 Who is to survey it?

6.3.3.3.1 The scope and scale of the attitude study should determine the most suitable option for the way the survey is to be administered. A small scale survey based on a relatively simple form of questionnaire could be administered locally by the safety team within an ANSP organisation. However, administration of this type of survey and, in particular the analysis of results, can be a particularly complex and specialist task which may require the close involvement of specialist human factors expertise.

6.3.3.3.2 ANSPs which do not have direct access to such expertise would be advised to engage the assistance of external expertise from government research bodies, academic institutions or specialist contractors as appropriate.

### 6.3.3.4 How is the survey to be conducted?

6.3.3.4.1 The survey technique is normally questionnaire based, although other specialist techniques involving, for example, the sorting of suitably worded cards can be used. The underlying principle is, however the same.

6.3.3.4.2 Such surveys are normally carried out on a strictly confidential basis. The individuals who are surveyed are not identified individually and are invited to submit their responses anonymously and in confidence. The organisational basis for this no-blame arrangement will need to be set up at the planning stage and the necessary details publicised well in advance to all those who will be affected.

### 6.3.3.5 How are the survey results to be analysed and used?

6.3.3.5.1 It is important that the intended use of survey results is identified at the planning stage in order to ensure that the most appropriate data collection and analysis techniques are selected.

6.3.3.5.2 Arrangements should be put in place at the planning stage for the results from such surveys to be collected and recorded centrally for subsequent analysis by SM staff.

## 6.3.4 Data Collection and Analysis Techniques

6.3.4.1 The technique requires nominated individuals to respond in confidence to a set of carefully selected written questions which are designed to elicit information concerning their attitude to a range of relevant ATM safety issues. Space may also be provided for the individual to provide, on a voluntary

basis, additional narrative amplifying comments relating to ATM safety and offer personal opinion regarding remedial actions.

6.3.4.2 The data from completed questionnaires may be stored merely in paper form or entered into a suitable data base system. Such systems can be very complex and may be suited to only the largest ANSPs with substantial data analysis resources. The analysis of anything other than the most basic such survey is likely to require the close involvement of specialist human factors staffs.

### 6.3.5 **Derivation and Dissemination of Findings**

6.3.5.1 The derivation and dissemination of findings from safety attitude surveys, together with the process of feedback is similar to that described earlier for other survey techniques. It is desirable that the derivation of findings from such studies should lead to tangible recommendations for action which are focussed not only on the unsafe acts and workplace issues but again on the organisational issues which may underpin them. The breadth and depth of potential findings may be such that a form of structured brainstorming may be an effective means of deriving properly focussed remedial recommendations. Guidance on the conduct of brainstorming may be found at Annex E.

6.3.5.2 The findings from safety attitude studies can be disseminated in a number of ways:

- Management Action Reports. Findings can be consolidated into a straightforward narrative report with firm recommendations for remedial action to be approved by those with the authority and responsibility to implement safety improvements. It is important that this process forms a part of the organisations normal management activity and it is, therefore recommended that the outcome of each TSS activity is consolidated into a specific Safety Survey Action Report which shows recommendations together with approval and implementation status. An example format for such a report is at Annex A. A summary of TSS results should also form part of the Annual Safety Survey Report to Senior Management as illustrated at Annex B. Such reports need to be retained in order to provide a key audit trail in support of ESARR 3 compliance and it is likely that they will become a key item of interest by Regulators during the conduct of formal safety regulatory audits.

- Safety Awareness Material. Findings can be used in Safety Awareness material for ANSP personnel. Such material is likely to take the form of leaflets, CDs, safety posters and possibly entries on safety-related intranet pages. Where dealing with internal awareness for ANSP personnel, simple Pie Charts or Histograms can be particularly effective at showing results. It is important, however, for the continued workforce confidence in the value of the system, that such material also indicates the overall results from attitude surveys, explains what is being done as a result and shows management commitment to resource continuous improvement.

- Management Presentations. The findings from TSS can provide useful material for inclusion in periodic management presentations and briefings to ANSP personnel whether physical, web-based or in video form.

### 6.3.6 **Feedback**

6.3.6.1 The outcome of safety attitude surveys should be fed back into the overall Safety Survey process as it may be used to trigger other forms of TSS such as bespoke studies, or may assist in focussing aspects of the annual PSS programme.

6.3.6.2 TSS results can also provide both qualitative and quantitative feedback concerning the safety arguments and assumptions which underpin safety cases and associated safety assessments. In these ways TSS is part of a closed-loop system which informs other parts of the SMS.

# CHAPTER 7
# GENERIC SAFETY SURVEY TECHNIQUES

## *7.1* General Description

7.1.1 Some of the Safety Survey data collection and analysis techniques are common to all survey types and, some guidance has already been provided on their selection and use within earlier Chapters.

7.1.2 Because these techniques are so widely applicable they merit explanation in these guidelines. In order to avoid extensive repetition within chapters 4-6, each of the following techniques are examined separately and, for ease of reference, are presented as separate Annexes at the end of this document as follows:

- Generic Data Collection Techniques
    - Questionnaires – Annex C,
    - Interviewing – Annex D
- Generic Data Analysis Techniques
    - Brainstorming – Annex E
    - Basic Analysis Of Data From ATM Safety Surveys – Annex F

# Section Two – Examples

# (Level 3)

# CHAPTER 8
# SCOPE OF THE EXAMPLES

## 8.1 Scope of the Examples

8.1.1 A number of practical examples of the effective use of Safety Surveys were identified during a 'Best Practice' review which preceded the production of these guidelines. A brief description of these examples is provided in the following Chapters which respectively cover PSS, CSS and TSS types of Safety Survey.

8.1.2 The examples include Survey activities drawn from areas outside of ATM where a survey method or technique of particular relevance was identified. The examples listed do not identify the specific organisations involved by name. ATM Service providers may find the example descriptions of interest in further developing their own Safety Survey regimes.

# CHAPTER 9
# PERIODIC SAFETY SURVEY EXAMPLES

## *9.1* Examples Of The Inspection Approach

### 9.1.1 Example #1 – Small ANSP

9.1.1.1 The ESARR 3 Safety Survey remit is discharged at one ANSP through an Integrated Safety and Quality Management System (ISQMS). Although the organisational functions of Safety and Quality are combined in this organisation, separate surveys are conducted in each discipline using different survey teams. The organisation's principal means of meeting the ESARR 3 remit is through the conduct of a dedicated programme of periodic surveys. A dedicated 'Safety Survey Team10' moves around the organisation in accordance with a predetermined schedule.

9.1.1.2 These safety inspections are timetabled with an annual programme developed to provide coverage of the entire organisation. They are conducted in accordance with a laid down set of procedures using written documentation such as checklists together with lists of survey questions and can involve both the use of questionnaires and scrutiny of in-use documentation.

9.1.1.3 The ANSP has established criteria for the people who conduct such inspections in terms of both their age and experience, including familiarity with the associated ATM systems and attendance of a formal 'auditing' course.

9.1.1.4 Observations and incompatibilities, etc, identified during the Safety Inspection are categorised into: Major incompatibility/Minor incompatibility/Finding/ Observation, etc, and timescales are required to be set for remedial action in accordance with the priority of each category.

### 9.1.2 Example #2 – Large ANSP

9.1.2.1 This large ANSP has written procedures which require each of its units to develop a Safety Survey plan which over a year, or longer period if required, is to cover all safety-related activities of the unit. The procedures and associated guidance are quite general in nature and, although they provide an example list of areas to be covered: Training & Awareness, Engineering Management', Local Airspace, etc, they also provide the opportunity to vary in degree of detail and depth of checking depending on the needs of the particular circumstance'.

9.1.2.2 The ANSP's procedures require the results of such surveys to be recorded formally in a concise manner and reported partly in order to provide a basis for checking the effectiveness of the surveying system.

### 9.1.3 Example #3 – Military ATC and Air Defence Organisation

[10] In Practice the local term 'Audit Team' is used to describe these individuals and the surveys are referred to as Audits. As Volume 1 of these guidelines explains, the term 'survey' should s used in this context as it relates to an internal activity as distinct from Audit which is an external activity conducted by safety regulators.

9.1.3.1 As part of its SMS, this military ATC/AD organisation carries out inspection-type surveys of safety arrangements at each of its control units on an annual basis. These are carried out both internally within each control Unit, and externally, by a dedicated team operating on behalf of the relevant headquarters. These survey activities are seen as important means of discharging 'Duty of Care' responsibilities by the senior individuals who have formal delegated responsibility for the safe conduct of operations within the organisation.

9.1.3.2 The Safety Surveys are carried out in accordance with written procedures documented in a Safety Management Manual (SMM) which aim to provide comprehensive coverage of all ATC/AD activities. In each case, they specifically address Organisation & Procedures, Personnel & Training, Equipment Safety and the functioning of the SMS. Adverse findings are categorised and are prioritised for remedial action, the progress of which is monitored by Unit Commanders through a local Safety Management Committee.

9.1.3.3 The outcome of internal Unit Safety Surveys is copied routinely to the headquarters SM staff and, together with information from the external Safety Surveys and Safety Monitoring activity, is summarised in an annual report which is presented at very Senior Management level.

9.1.3.4 Such surveys are conducted in addition to a number of other formal military inspections which examine, for example, adequacy of documentation, etc, and may be considered to be the military equivalent of an external regulatory audit.

## 9.2 Examples OF The 'Safety Review ' Approach

### 9.2.1 Example #1 – Large ANSP

9.2.1.1 This large ANSP adopts a corporate approach to Safety Survey activity under the aegis of a central Directorate of Safety and Quality (DS&Q). The intention of this approach is to provide overall confirmation of SM performance within the organisation and ensure consistency across divisions.

9.2.1.2 Each Unit and separate Directorate within the ANSP is required to send documentary evidence of the results of all SM activity conducted to a central server. This includes evidence relating to: Performance Monitoring & Reporting, Safety Improvement, Training, Safety Awareness and Safety Assurance arrangements. This evidence is collated centrally by DS&Q on a continuous basis where it is then used on a regular basis to assess the effectiveness of the SMS. This information is supplemented with feedback from Divisions and Units gained during DS&Q visits throughout the year.

9.2.1.3 Every 18 months, the safety evidence from a particular unit, for example, is gathered together and scrutinised by a Review Board under the chairmanship of the Director of Safety & Quality. The Review Board includes specialist representatives from a number of Divisions, including QA staff. Such scrutiny allows an assessment to be made of the SM performance of the unit concerned and any shortfalls and/or emerging best practices to be identified. Such evidence would include, for example, the reports raised as a result of other Safety Survey activity carried out at the unit. Direct feedback is provided to the unit in the form of a verbal debrief and a written summary of observations made.

9.2.1.4 Regular feedback is provided directly to Divisions/Units to enable best practice improvements to be implemented. Summaries of the assurance gained are provided to the ANSP Safety Steering Group and are also included in an annual Safety Report which is provided to the Chief Executive.

# CHAPTER 10
# CONTINUOUS SAFETY SURVEY EXAMPLES

## 10.1 Examples Of 'Over The Shoulder Observation' Survey

### 10.1.1 Example #1 – Military ATC/Air Defence Organisation

10.1.1.1 This military ATC and Air Defence (AD) organisation conducts regular proficiency evaluations of individual control and surveillance staff. Such evaluations take the form of 'over the shoulder' observation periods where individuals are evaluated in accordance with a taxonomy which covers a range of skills and attributes.

10.1.1.2 The surveys are carried out by an external team of dedicated evaluators[11] and control personnel are required to have been evaluated within a set chronological period in order to retain their approval to operate. The taxonomies require the evaluator to observe and record, among other things, threats and errors which could have an impact on the safe conduct of operations. For example the evaluator will be required to grade an ATC controller's reaction to errors and the extent of self-correction, his or her use of equipment together with any associated mishandling, and, for airfield controllers, handling of potential threats such as vehicles and the correct operation of runway barriers/cables, etc. Military AD controllers are similarly assessed for their degree of situational awareness and effective system management.

10.1.1.3 It is relatively easy for evaluators to pick up adverse safety trends during the study of individual performance in this way and consistent areas of safety concern can be taken up with Unit management. Similarly, however, this process highlights good safety practices which are effective barriers to potentially unsafe situations and this form of survey therefore provides positive feedback on the effectiveness of in-place safety arrangements.

10.1.1.4 The Standards Evaluation (STANEVAL) process within the military AD organisation can include dedicated periods of evaluation of team performance. The external team of evaluators is co-opted to observe operations at a Unit, often during particularly busy periods such as military exercises, in order to evaluate team performance. The object is both to assist Unit staff in identifying key areas of weakness and also to spread best practice.

10.1.1.5 The outcome of such periods is summarised, together with recommendations in a report which is normally left with the the Unit rather than being distributed externally. Best practice observed at one Unit is passed on by the STANEVAL Team during subsequent such visits to other Units. The military SM organisation makes use of the output from this observational survey process to tailor its training and safety awareness activities. As an example, feedback from a series of observation periods highlighted consistent weakness in the application of a particular type of radar service which had both operational and safety

[11] For military ATC personnel this is an ATC Examining Board and for military AD personnel this is a Standards Evaluation (STANEVAL) team.

implications. As a result changes were made to the training provided and the issue was publicised in safety awareness material.

### 10.1.2 Example#2 – Nuclear Power Industry

10.1.2.1 A very effective 'Over the Shoulder' Survey method is in use within the nuclear industry and is known as the 'Behavioural Safety Scheme. The scheme is centred upon each installation on the basis that 10% of the workforce, drawn from a wide variety of specialisations, are selected as Behavioural Safety Observers.

10.1.2.2 The introduction of the system followed a thorough process of 'buy-in' by both senior management and the Trade Unions. The system operates on a totally 'no-blame' basis where those being observed are not named and observers are identified only by a reference number.

10.1.2.3 The observers receive a period of specific induction training which covers safety awareness together with observation and elicitation techniques. During training, the observers are encouraged to engage positively with those being observed and are taught how to do this in a way which elicits, for example, the safety consequences of observed procedural violations and the safety benefits of activity which constitutes an effective barrier to hazards. They are taught to 'get inside the mind' of the person who, for example, has been observed committing a violation in order to identify underlying factors.

10.1.2.4 The scheme is applied in the context of both 'Functional' safety (in this case nuclear) and 'health& safety' or the risk of industrial accidents such as falls trips etc causing harm to employees. The same basic observational techniques are, however, applied by the observers of nuclear power station operators in the main control room and manual labourers elsewhere on site.

10.1.2.5 The observers are each required to conduct just one or two observations per month. The areas for observation may be self-selected or can be nominated by an appropriate Section Leader. Routine planning meetings are held at which Team Leaders can choose some specific tasks or activities to be observed. For example, the manager of a team which is about to conduct a specific or unusual activity may request that it is the subject of a Behavioural Safety Observation. Managers and Supervisors are set performance targets related to the number of observations carried out within their areas of responsibility each month and this encourages wide adoption.

10.1.2.6 Each period of observation lasts for a nominal 15-20 minutes and, at any given time there are therefore a number of observations in progress around the installation. This continuous approach means that individuals become used to the presence of observers.

10.1.2.7 Each observer carries a small A5 booklet of blank observation check sheets with 'tick boxes' covering a range of topics including, for example:

- Leadership - Briefings and effective hazard communication.
- Procedures - Procedural communication, adherence to procedures.
- Equipment – Use and condition of specialist equipment.

- Potential for Harm– Concentration and the extent to which individuals may be placed in harms way.

10.1.2.8 The observer is required to tick items arranged under these headings as contributing either positively or negatively toward safety. The front of the form allows positive feedback on the effectiveness of barriers to harm etc and allows good practice to be identified as such. The reverse of the form allows potentially unsafe aspects to be listed and categorised according to a set taxonomy of 'Obstacles To Safe Working':

- Inexperience
- Over Familiarity
- Inadequate Procedures
- Production Incentives/Peer Pressure
- Work Station/Equipment Design
- Personal Limitations (Fatigue etc)
- Culture ('always done it this way 'etc)
- Personal Choice (time-saving violations etc)

10.1.2.9 The process encourages direct dialogue between the observers and those observed in the form of a balanced 'debrief' of positive and negative observations. The completed forms are collected centrally and entered in a simple database where trends can be used to steer safety initiatives under the guidance of the local safety committee.

10.1.2.10 The outcome of this continuous survey activity is summarised periodically using simple pie-charts which indicate the extent to which, for example, procedural or workstation issues account for the most numerate adverse observations together with guidance on mitigation and remedial action.

10.1.2.11 Operation of the scheme and the associated programme of training is vested in a nominated Behavioural Safety Coordinator who is drawn from the workforce and enjoys both trust and high credibility amongst his peers. Periodic coaching sessions and workshops are held for observers dealing with specific safety themes; it is normal practice to include some 'non-believers' in the workshops to assist in spreading the appropriate cultural message about this activity.

10.1.2.12 Administration of this scheme has attracted considerable praise both externally and within the workforce which recognises its practicality and worth. One specific positive example of the scheme improving safety was quoted: Observations revealed that a number of workers were carrying out procedures with reference to personal 'little black books', (notebook summaries of procedures) rather than referring to the configuration-controlled written procedures themselves. The discovery and removal of this bad practice was seen as a very positive outcome.

## 10.2 Examples Of The Self –Assessment Proforma Approach

### 10.2.1 EXAMPLE 1 – Military AD Organisation

10.2.1.1 This military AD organisation uses a post-activity safety assessment proforma to survey, on a continuous basis, the extent to which safety-related equipment failures may have affected control activities. Although this is linked to the Safety Monitoring process, this is a proactive survey method which requires control staffs to make judgements on the potential safety significance of failures which occur during normal operations and which do not give rise to incidents.

10.2.1.2 The survey proformas are administered on a daily basis and are printed on the reverse side of an existing log-sheet used at the workstation. Controllers are required to indicate, by merely ticking boxes, whether any safety-related failures occurred whilst they had aircraft under control and, if so, which equipment items were affected.

10.2.1.3 Data from this CSS process collected for a period of over a year assisted technical staff in determining the extent to which certain types of failures were safety-rated and provided quantitative data which was subsequently used in developing safety targets for future equipment.

# CHAPTER 11
## TARGETED SAFETY SURVEY EXAMPLES

## *11.1* Targeted Safety Survey Examples

### 11.1.1 Example #1 – Small ANSP

11.1.1.1 This small ANSP carried out a bespoke study as a result of direct feedback from controllers about workload when carrying out certain tasks in a particular Terminal Manoeuvring Area (TMA). A specialist observer from the Safety & Quality Dept observed many hundreds of hours of TMA control activity and recorded instances where intervention by the controller was necessary in order to resolve conflictions which would otherwise have resulted in losses of separation. The data was then analysed and, using some contour-mapping software, a map representation of airspace 'high-spots' was produced.

11.1.1.2 Further analysis led to a proposed realignment of Standard Arrival and Departure routes. This study highlights the potential benefits of this kind of targeted study and is seen locally as a very positive example of Safety Management in action.

11.1.1.3 Such surveys are conducted by specialist safety staff within the Safety & Quality Dept at this ANSP and are seen as a very credible means of showing the value of this department to the ANSP operational and technical communities

### 11.1.2 Example #2 – large Multi-Unit ANSP

11.1.2.1 Most of the subordinate Units within this large ANSP organisation used bespoke surveys as the predominant form for the Safety Surveys conducted at unit level.

11.1.2.2 A particular topic is chosen as the subject for study on the basis of a number of potential triggers. Such studies are triggered by incident trends, by organisational change (where they are used to provide additional assurance that earlier safety assessments of the change were correct), by adverse observations raised during other SM activities or merely from informal feedback from staff or external ‘customers’. A particular example for study was airfield signs.

11.1.2.3 Such studies are invariably conducted by experienced ATC personnel, such as watch managers in addition to their normal duties. Other less-experienced staff members are co-opted onto Survey Teams and this is seen as good for their personal development and for the fostering of a positive approach to SM.

# ANNEX A

## EXAMPLE SAFETY SURVEY ACTION REPORT

### SAFETY SURVEY ACTION REPORT

| Reference: | Unit/Survey/Ser No. | Surveyor/Team Leader: | Date of Survey: |
|---|---|---|---|
| | | | |

**Survey Finding** **Category*: A/B/C**

| |
|---|
| |

**Signed (Surveyor):** **Date:** **Acknowledged*** **Unit Rep (where appropriate)** **Date:**

| |
|---|
| |

**Proposed Remedial Action**

| |
|---|
| |

**Accepted (Line Manager):** **Date:** **Noted (Safety Manager):** **Date:**

| |
|---|
| |

**Action Complete**

| |
|---|
| |

**Declared (Line Manager):** **Date:** **Accepted (Safety Manager):** **Date:**

| |
|---|
| |

***Notes:**

* See overleaf

**Safety Survey Observation Categories**

Survey observations should be categorized as follows:

**A** Requires immediate remedial action. Safety of ATM Operation is in serious jeopardy until effective measures are in place.

**B** Signifies a significant shortfall with safety implications. Remedial action is to be staffed and implemented as soon as possible, not later than 1 month.

**C** ATM safety could be affected. Remedial measures are to be staffed and implemented within 3 months.

**Acknowledgement**

Acknowledgement is provided at the time of survey and is limited to a declaration of understanding of the finding.

**Remedial Action**

Remedial action may be registered at the time of survey or after further investigation.

**This Action Sheet should be retained on file as a permanent record and may be inspected by Regulatory Auditors.**

# ANNEX B

## EXAMPLE ANNUAL SAFETY SURVEY REPORT TO SENIOR MANAGEMENT

**SUGGESTED FORMAT OF ANNUAL SAFETY SURVEY REPORT TO ANSP SENIOR MANAGEMENT (CHIEF EXECUTIVE)**

**Executive Summary**

**1. Safety Survey Activity Since Last Annual Report**

**1.1 Number and Scope of Periodic Safety Surveys**

**1.2 Number and Scope of Continuous Safety Surveys**

**1.3 Number and Scope of Targeted Safety Surveys**

**2. Summary of Safety Survey Findings**

**2.1 Safety Management System (SMS) Issues**

- SM Policy Issues.
- Safety Case Issues.
- Safety Training issues
- Regulatory Audit issues.
- Safety Trends
    - Incident Trends (year on year comparison).
    - Open Occurrence Reporting Trends

## 2.2 Organisational Issues

- Safety impact of organisational changes, contractorizations, funding arrangements etc.

## 2.3 Procedural Issues

- Safety impact of changes in operating/maintenance procedures
- Airspace issues.
- Traffic Loading issues.

## 2.4 Personnel & Training Issues

- Manning levels
- Personnel qualification and competence issues
- Training issues.

## 2.5 Equipment Issues

- Functional failure and reliability trends.
- Hardware issues.
- Software issues

## 2.6 Other Relevant Issues

- External agencies, stakeholder issues etc (As required)

## 3 Conclusion

## 4. Summary of Safety Survey Recommendations (See Table Overleaf)

| Open Recommendations | | | | | | |
|---|---|---|---|---|---|---|
| **Serial** | **Survey Type/Date** | **Recommendation** | **Category A/B/C[12]** | **Responsible Appointment/Agency** | **Current Status** | **Remarks** |
| 1 | PSS 02/04/06 | A configuration control process is adopted to prevent unserviceable headsets remaining in the terminal operations room. | C | Technical Manager | Open | Nil |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| **Closed Recommendations** | | | | | | |
| 2 | CSS 12/02/06 | Action is taken to display the correct coordinates of Airway 0D03 on all operational display consoles | B | Operations Manager | Closed | Software map update implemented 15/02/06 |
| | | | | | | |



[12] **A** Requires immediate remedial action. Safety of ATM Operation is in serious jeopardy until effective measures are in place. **B** Signifies a significant shortfall with safety implications. Remedial action is to be staffed and implemented as soon as possible, not later than 1 month. **C** ATM safety could be affected. Remedial measures are to be staffed and implemented within 3 months

# ANNEX C

## QUESTIONNAIRE DESIGN

### Introduction

- Questionnaires are relevant to TSS and may also be relevant to the self-assessment element of CSS. Questionnaires could be used in conjunction with inspection methods in conducting PSS and provide a seemingly simple means of eliciting information. In many ATM situations a questionnaire can serve as the main or only practical source of information collection. However, despite the apparent simplicity, constructing a successful questionnaire can be time consuming and loaded with biases and ambiguities while the results can be rife with the potential for misinterpretation.

- Developing a good questionnaire can be thought of as asking questions with a purpose [13] rather than simply asking ad-hoc and ill-formed questions in the hope of obtaining some useful information. Guidance is given in this Annex on how to construct and test an ANSP questionnaire to be used in support of a Safety Survey that will be based upon these principles.

- Before a questionnaire is constructed it is essential that those involved consider the following critical issues:

  - The type of survey data or information required;

  - How the survey data or information will be used.

- Other high-level design objectives are that a survey questionnaire should:

  - be related explicitly to particular analysis objectives;

  - be understood by the survey respondents;

  - ask for factual information or attitudes that respondents can recall from memory or retrieve from records;

  - avoid response bias or other negative influences on respondents' decision processes;

  - be formatted in a way that makes them useful to the surveyor as well as respondents;

  - be formatted in a way that minimizes entry errors.

- There are many excellent detailed sources of information on the development of questionnaires for different purposes and a long treatise on this topic is beyond the scope of these guidelines which need to be

[13] Taylor-Powell E.: Questionnaire Design: Asking Questions with a Purpose, University of Wisconsin, May 1998.

ATM-specific. However, an excellent and practical method of questionnaire development and evaluation can be found in the Questionnaire Appraisal System (QAS)14 and a number of useful annotated references are given at the end of this Annex.

## General Guidance

- This section gives some general guidance on how questionnaires can successfully be developed to support the Safety Survey Data Collection process. Phrasing questions to obtain the required information is a challenge; there are three general issues to consider:
    - The characteristics of the people the questions are intended for;
    - The main aim and objectives of the questionnaire;
    - The relative order of the questions.
- A questionnaire can help to obtain information about what people do, what they have, what they think, know feel or want. Broadly, four different types of information can be categorised, namely: Knowledge, Beliefs, Behaviour and Attributes, and any one or a combination of these types can be included in a questionnaire.

### Knowledge

- Knowledge refers to what people know; how well they understand something. This type of question asks about what people know. Knowledge questions offer choices such as correct vs. incorrect vs. accurate vs. inaccurate. They may ask what respondents believe is true or factual, or about awareness. Examples of knowledge type questions could be:
    - What is the major causal factor contributing to Airprox (C) reports?
    - The most effective organisational safety measure is promotion of a no-blame culture.
    - The maximum ATCO shift should be 2 hours.

### Beliefs, Attitudes or Opinions

- Beliefs, Attitudes or Opinions belong to psychological states, the perceptions people hold including their thoughts, feelings, idea, judgements or ways of thinking. These questions may elicit the respondent's perceptions of past, present or future reality, their feelings about a subject or their opinions. For example:
    - Do you favour or oppose the monitoring of ATCO normal operations?

[14] Willis G. B, and Lesser J. T.: Questionnaire Appraisal System, Research Triangle Institute, QAS-99, August 1999.

- In your opinion, does random drug testing of ATM Engineering staff contribute to safety?
- What do you consider is the biggest challenge facing ATM in the next five years?

### Behaviour

- Behaviour is about asking people questions about what they have done in the past, do now or plan to do in the future. For example:
- Have you ever attended a training course on Safety Surveying?
- Do you file optional occurrence reports?
- How are you using the information provided in safety bulletins?

### Attributes

- Attributes deal with what people are and what they have. Attributes are a person's personal or demographic characteristics e.g. age, education, occupation or income. Attribute questions ask people about who they are rather than what they do. For example:
  - How long have you been involved with ATM?
  - How many hours do you work on-console per week?
  - What percentage of your time on shift do you spend doing administrative paperwork?
- The surveyor needs to be clear about the survey objectives and the types of information required before the questionnaire is developed. Questions concerning beliefs, attitudes or opinions are relatively difficult to construct given the underlying complexity compared with questions on knowledge or behaviours. If a survey using a questionnaire does not elicit the required type of information then it is probably because the wrong questions were asked.

## Asking the Questions

- There are many things to consider when framing questions for a questionnaire to obtain the correct information and avoid misunderstandings. If a survey doesn't obtain the required information it's probably because the right question wasn't asked in the first place. To help with framing clear and unambiguous questions, some general guidance is provided here.
- **Use appropriate wording** and adapt questions to the vocabulary of the intended respondents without patronising them. It is vitally important to

avoid any ambiguity or confusion when framing the questions. For example, use of the phrase 'operational hours' might infer different things to Operational or Technical staff.

- **Avoid the use of abbreviations or jargon** which may not be understood or may be misinterpreted by the intended respondents. Even the use of well know abbreviations can have different meanings dependent upon the context of use or can be interpreted differently by respondents with different backgrounds. For example, does the acronym ATM mean Air Traffic Management, Asynchronous Transfer Mode or Automated Teller Machine?

- **Be specific** when setting a question to avoid misunderstanding and subsequent misinterpretation. For example, a question about 'experienced' ATCO or Technical staff should specify exactly what is meant by the term 'experienced' e.g. more than x years fully trained or from joining the ANSP. Another example is to avoid use of vague terms such as 'regularly', 'majority' or 'often' as these terms can mean different things to different people.

- **Include all necessary information** to ensure that respondents have enough to answer the question being asked. For example, the question: "Do you agree with the proposal to increase the maximum hours on console?" assumes that the respondent knows how much time the proposed increase will be (minutes might not be as important as hours). It might be useful to provide a brief statement to summarize the proposal in more detail.

- **Avoid over specified questions** when it would entail an unreasonable degree of recall from the respondent. For example, asking Technical staff to state exactly how many times a specific Maintenance Procedure was used in the proceeding year might be unreasonable. It may be better to provide a range to select from such as: 0 – 5, 6 – 10, 11 – 15 etc.

- **Avoid time consuming or demanding questions** as these will often result in the questionnaire being discarded or being returned incomplete. Always try to limit the demand to a tick in a box and never ask for more than simple written answers of a few comments at most.

- **Use mutually exclusive categories** to ensure that only one answer is possible from a selection if a single response is required. For example, for the question: "How did you find out about X?" If the possible responses are: Internet, Magazine, at Home or at Work; the respondent might have heard about X at Work via the Internet therefore more than one answer is correct.

- **Avoid assumptions** on physical capabilities, gender, race etc. as these may not hold true for all respondents and could even cause offence.

- **Avoid bias in questions** to ensure that people respond in a way that reflects their true opinions. Avoid unethical and leading questions that imply the respondent should have certain behaviour e.g.: "Most ATCO have at some time controlled aircraft after having consumed alcohol – have you?" Also, avoid loaded questions without both positive and

negative responses e.g.: “The level of Technical support is: Satisfactory, Good, Excellent”.

- **Avoid multiple questions** to avoid ‘linked’ responses. For example, the question: “Did the Safety Survey training course help to identify ways to improve safety and increase your understanding of the subject?” It would be better to ask about ‘safety improvement’ and ‘safety understanding’ separately.

- **Choose Closed or Open-ended questions** as appropriate. Open-ended questions allow respondents to provide their own thoughts but this does require more time and effort. In addition, open-ended questions are often harder to analyze. In contrast, closed questions allow respondents to select either single or multiple responses therefore the list must be exhaustive and mutually exclusive if it requires a single response.

## Formatting the Questionnaire

- After the questions have been selected, it is necessary to make a number of decisions relating to the format of the questionnaire such as its appearance, length and the ordering of questions. To help with this, some general guidance on the questionnaire formatting is provided here.

- **Begin with an introduction** to include the purpose of the questionnaire and explains how any obtained information will be used. This introduction should make clear any confidentiality issues and provide assurances to the potential respondents where necessary. The introduction should make clear the approximate time that the questionnaire will take to complete. It is always a good idea to provide a covering letter if the questionnaire will not be administered in person.

- **Start off with easier questions** to avoid giving the impression that the questionnaire will be overly taxing or take too long to complete. It is helpful to make the opening questions as interesting as possible to encourage the respondent to complete the questionnaire.

- **Address important topics early** in the questionnaire rather than late as the respondents concentration may wane as they rush towards the end of the task. It is usually best to place simple demographic questions at the end of the questionnaire (e.g. age, sex etc.).

- **Arrange questions to flow naturally** and group questions on a specific topic together. Generally, it is best to start with general questions then move onto specifics. Uses the same types of questions on a specific topic i.e. don’t mix multiple choices with open-ended questions as it breaks the flow.

- **Be consistent** and ensure that numbered responses mean the same throughout the questionnaire (e.g. 0 = Bad, 10 = Good). Put listed response choices consistently in either ascending or descending order as appropriate.

- **Filter or screen questions** to avoid wasting time and to make it clear who should answer the questions. For example, a survey may be required for both Operational and technical staff but some questions may only be

relevant to Technical Staff. There are three basic filtering methods (which may be combined):

- Use arrows to guide respondents;
- Indent all questions that may be screened;
- Use boxes to direct past questions that don't need to be answered.

- **Provide instructions and transitional statements** on how to answer questions and to transition between topics. Instructions on answering questions are usually placed in parentheses immediately following each question while transitional statements are used to enhance continuity between topics.
- **Layout questions carefully** using an easy to read typeface. Ensure that questions do not straddle two pages between the question and answer. Distinguish instructions, questions and answers by using different typefaces or fonts.

## Pre-Testing the Questionnaire

- Pre-testing a questionnaire is an important step in refining a questionnaire and in particular identifying ambiguities and potential confusion before it is used to undertake a survey. Individual questions should be examined carefully as well as the overall structure. As a minimal checklist, the following questions need to be answered during pre-testing:
  - Does each question measure what is intended?
  - Do respondents understand all the words?
  - Are questions interpreted the same by all respondents?
  - Does each closed question have an answer that applies to each respondent?
  - Does any question introduce a potential for bias?
  - Does the questionnaire motivate people to take the time to answer it?
- Questionnaires can initially be pre-tested on colleagues and reviewed to see if the wording and instructions are clear and unambiguous as well as establishing if the questionnaire will accomplish the aim of the survey. It is always a good idea to then refine the questionnaire by pre-testing it on a representative respondent (e.g. ATCO or Technician).

## Annotated References

- There are numerous helpful books and general articles on the topic of questionnaire development. What follows is a selection of annotated references which have been selected for their practical value to a relatively inexperienced ATM Safety Surveyor with little knowledge of pure research methods.

Leedy, Paul, D.: Practical Research Planning and Design, 5th Ed., Macmillan Publishing, 1993.

*This book by Leedy provides an excellent introduction to questionnaire design issues and is ideally suited for self-instruction.*

Taylor-Powell E.: Questionnaire Design: Asking Questions with a Purpose, University of Wisconsin, May 1998.

*This report provides a very readable and practical introduction to questionnaire construction upon which this Annex was based.*

Willis G. B, and Lesser J. T.: Questionnaire Appraisal System, Research Triangle Institute, QAS-99, August 1999.

*This report provides a useful method of Pre-testing or evaluating the design of a questionnaire.*

Oppenheim.: Questionnaire Design, Continuum International Publishing Group – Academi, 2000.

*Despite a rather dull appearance, this book is an excellent introduction to questionnaire design with a lot of practical advice and examples.*

Frazer. L. and Lawley. M.: Questionnaire Design and Administration: A Practical Guide, John Wiley & Sons Australia, 2001.

*This concise guide presents an easy-to-follow sequence of steps and checklists, as well as many annotated examples of questionnaires, enabling any reader to more efficiently and effectively prepare questionnaires and conduct surveys.*

# ANNEX D

## INTERVIEW TECHNIQUES

### Introduction

- The interview technique is a systematic collection of verbal information. It consists in asking about users opinions and attitudes to get basic information with prepared questions asked by the interviewer. The answers are recorded either in writing or as sound recordings. The interviews can be structured or unstructured. The terms structured interviews implies that the content of the interview, in terms of the questions and their sequence, is predefined. Because of the structuring, the interview offers the opportunity for more systematic collection of data. The unstructured interview is more free, and the interviewee develops the themes proposed by the interviewer.

- Interviews can be used at any stage during a comprehensive task analysis activity. They can usefully be applied early on in an investigation for collecting basic information about the situation. An interview with the user will provide a deeper understanding of the requirements for the system and of the user tasks involved. It can also assist in finding out more about individual user perceptions.

- In order to encourage frank answers, the participant should be assured that his contribution will remain confidential. If any recording is made, the interviewer should also assure that this will remain confidential. Newman and Lamming (1995) describe a number of elements of a successful interview:

    - Determine some basic domain knowledge before the interview so that time is efficiently utilized during the interview.

    - Clearly state to the interviewee the purpose of the interview at the outset;

    - Enumerate all user activities with general and follow-up specific questions;

    - Find out how user activities are performed;

    - Trace interconnections with other users;

    - Uncover issues that determine and affect the performance of the user tasks;

    - Follow up on exceptions, the unusual activities which are unlikely to occur during observation.

### Types of Interview

#### Unstructured Interview

- In an unstructured interview, the respondent must develop the theme proposed by the interviewer. The investigator does not impose a

questionnaire and must follow the thoughts and reactions of the respondent. Unstructured interviews are good for investigating potential emotional and/or sensitive personal issues and in the ATM context may be a useful means of establishing the day to day safety concerns of operations and technical staff.

**Semi-Structured Interview**

- Semi-structured interviews should only be carried out in a situation where broad issues may be understood, but the range of respondents' reactions to these issues is not known or suspected to be incomplete. This type of interview is mostly applicable in situations where both qualitative and quantitative feedback are required.

**Structured Interview**

- Structured interviews are useful in situations where the respondents range of replies may be estimated and there is a need to clarify details, opinions or ideas. Structured interviews work well when the assessment goals are clear. In the ATM context, structured interviews will often be a useful means of gathering specific data as part of a TSS. Structured interviews could also be included in the PSS process and may be useful in gathering some meaningful statistics on specific aspects of ATM safety. Generally, individuals are more likely to be forthcoming and provide useful information in a structured interview setting than with a written questionnaire. This process is therefore more efficient from the point of view of the interviewee although the process is more time-consuming for the surveyor.

## General Advantages

- Interview techniques are useful for identifying possible areas for more detailed analysis.
- Interviews are easy to conduct and direct, the unstructured interview can generate interesting points, statistical analysis can be run on the users answers.
- The data collected provides information about general rules and principles and is faster than observational techniques.
- Interview techniques are useful for investigating events which occur infrequently.
- The interviews can be recorded for a future analysis.

## General Disadvantages

- Respondents are not committed to give correct answers and may often be influenced by what they believe the interviewer requires, or what they themselves wish to portray.
- The interviewer may need to acquire domain knowledge in order to know what questions to ask.

- There is a range of considerable bias due to the understanding by the users of the questions, and the subjective collected information might be misleading or inaccurate.

- The critical aspects are the choice of the place for the interview and how to conduct it.

## Analyzing the Data

- The means of collecting and recording data through interviews and the possible pitfalls are well documented elsewhere but in terms of subsequent analysis, it is essential that you have a complete and accurate record of what was said. Do not rely on your memory (it can be very selective!) and either tape record the conversation (preferably) or take copious notes. If you are taking notes, write them up straight after the interview so that you can elaborate and clarify. If you are using a tape recorder, transcribe the exact words onto paper.

- However you record the data, you should end up with a hard copy of either exactly what was said (transcript of tape recording) or nearly exactly what was said (comprehensive notes). It may be that parts of the interview are irrelevant or are more in the nature of background material, in which case you need not put these into your transcript but do make sure that they are indeed unnecessary. You should indicate omissions in the text with short statements.

- Content analysis consists of reading and re-reading the transcripts looking for similarities and differences in order to find themes and to develop categories. Having the full transcript is essential to make sure that you do not leave out anything of importance by only selecting material that fits your own ideas. There are various ways that you can mark the text:

    - **Coding paragraphs** – This is where you mark each paragraph with a topic/theme/category with an appropriate word in the margin.

    - **Highlighting paragraphs/sentences/phrases** – This is where you use highlighter pens of different colours or different coloured pens to mark bits about the different themes. Using the example above, you could mark the bits relating to childcare and those relating to pay in a different colour, and so on. The use of coloured pens will help you find the relevant bits you need when you are writing up.

- With both the above methods you may find that your categories change and develop as you do the analysis. What is important is that you can see that by analysing the text in such a way, you pick up all the references to a given topic and don't leave anything out. This increases the objectivity and reduces the risk of you only selecting bits that conform to your own preconceptions.

- You then need to arrange the data so that all the pieces on one theme are together. There are several ways of doing this:

    - **Cut and put in folders approach.** Make several copies of each transcript (keeping the master safe) and cut up each one according to what is being discussed (your themes or categories). Then sort them into folders, one for each category, so that you have all together what each interviewee said about a given theme. You can then compare and look for

similarities/differences/conclusions etc. Do not forget to mark each slip of paper with the respondent's name, initials or some sort of code or you won't be able to remember who said what. Several copies may be needed in case one paragraph contains more than one theme or category. This is time consuming and messy at first, but easier in the long run especially if you have a lot of data and categories.

- **Card index system.** Each transcript must be marked with line numbers for cross-referencing purposes. You have a card for each theme or category and cross-reference each card with each transcript so that you can find what everyone has said about a certain topic. This is quicker initially but involves a lot of referring back to the original transcripts when you write up your results and is usually only suitable for small amounts of data.

- **Computer analysis.** If you have access to a computer package that analyses qualitative data (e.g. NUDIST) then you can use this. These vary in the way they work but these are some of the basic common principles. You can upload your transcripts created in a compatible word-processing package and then the software allows you to mark different sections with various headings/themes. It will then sort all those sections marked with a particular heading and print them off together. This is the electronic version of the folders approach! It is also possible to use a word-processing package to cut and paste comments and to search for particular words.

- There is a great danger of subjective interpretation. You must accurately reflect the views of the interviewees and be thorough and methodical. You need to become familiar with your data. You may find this a daunting and stressful task or you may really enjoy it – sometimes so much that you can delay getting down to the next stage which is interpreting and writing up!

## Annotated References

- There are numerous helpful books and general articles on the topic of Interviewing. What follows is a selection of annotated references which have been selected for their practical value to a relatively inexperienced ATM Safety Surveyor with little knowledge of pure research methods.

Foddy. W.: Constructing Questions for Interviews and Questionnaires: Theory and Practice in Social Research, Cambridge University Press, 1994.

*A classic text on the construction of valid and reliable questions for interviews and questionnaires. In particular, good examples of the problems that can arise when framing questions.*

Drever. E.: Using Semi-structured Interviews in Small-scale Research: A Teacher's Guide, The SCRE Centre, 2003.
*A concise but useful guide to desiging, conducting and interpreting the results of semi-structured interviews. The coverage of semi-structured interview management is particularly useful to surveyors.*

# ANNEX D

## BRAINSTORMING

### Introduction

- Brainstorming has been identified as a useful technique for ANSP staff to use for the analysis of data collected during the data collection phase of a Safety Survey. The term 'brainstorming' is used to here in its broadest sense to cover any informal approach to group data collection and guidance on one common brainstorming technique is given here.

- Brainstorming is an excellent way of developing many creative solutions to a problem such as identifying potential safety hazards for ANSP operations or maintenance activities. Brainstorming works by focusing on a problem, and then coming up with numerous and sometimes radical solutions. Ideas should deliberately be as broad and wide-ranging as possible and should be developed as fast as possible. Brainstorming is a lateral thinking process designed to help the participants break out of their thinking patterns into new ways of looking at things.

- Group brainstorming can be very effective as it uses the experience and creativity of all members of the group. When individual members reach their limit on an idea, another member's creativity and experience can take the idea to the next stage. Therefore, group brainstorming tends to develop ideas in more depth than individual brainstorming.

- Brainstorming in a group can be risky for individuals. Valuable but strange suggestions may appear stupid at first sight. Because of this, sessions need to be chaired strongly so that less creative people do not suppress ideas and leave group members feeling embarrassed.

- To run a group brainstorming session effectively, some general points to note are as follows:

    - Define the problem you want solved clearly, and lay out any criteria to be met;

    - Keep the session focused on the problem;

    - Ensure that no one criticizes or evaluates ideas during the session. Criticism introduces an element of risk for group members when putting forward an idea. This stifles creativity and cripples the free running nature of a good brainstorming session;

    - Encourage an enthusiastic, uncritical attitude among members of the group. Try to get everyone to contribute and develop ideas, including the quietest members of the group;

    - Let people have fun brainstorming. Encourage them to come up with as many ideas as possible, from solidly practical ones to wildly impractical ones. Welcome creativity;

  - Ensure that no train of thought is followed for too long;
  - Encourage people to develop other people's ideas, or to use other ideas to create new ones;
  - Appoint one person to note down ideas that come out of the session. A good way of doing this is to use a flip chart. This should be studied and evaluated after the session;

- Where possible, participants in the brainstorming process should come from as wide a range of disciplines as possible. This brings a broad range of experience to the session and helps to make it more creative.

### Brainstorming Process

- In order to brainstorm, a chalkboard, white-board or software documentation tool is required. The brainstorm session organiser should focus on writing ideas on the board.
- Brainstorming works best when you have a larger group of varied people. If you are a department in an ANSP, invite people from other divisions to participate. Try to get as varied a group as possible to participate - this will result in the widest and most creative range of ideas.
- For a systematic approach to brainstorming, the following broad steps should be followed:
  - Define the Problem;
  - Set a Time Limit;
  - Brainstorm;
  - Select Top Solutions;
  - Set Solution Criteria;
  - Rank Solutions;
  - Choose Solution;
- **Define the Problem** note that the word "problem" is not necessarily negative - your problem could be "We need to ensure safety-related information is seen by all operators before each shift" or "How can we mitigate the physical hazards involved in the replacement of large-screen displays". Write out your problem concisely and make sure that everyone understands the problem and is in agreement with the way it is worded. There is no need to put a lot of restrictions on your problem at this time.
- **Set a Time Limit** Give yourselves a time limit - we recommend around 25 minutes, but experience will show how much time is required. Larger groups may need more time to get everyone's ideas out.

- **Brainstorm** Everyone must shout out solutions to the problem while one person writes them down. There must be ABSOLUTELY NO CRITICIZING OF IDEAS. No matter how daft, how impossible or how silly an idea is, it must be written down. Laughing is to be encouraged. Criticism is not. Why? Because you want to encourage the free flow of ideas and as soon as participants of the brainstorming session begin to fear criticism of their ideas, they'll stop generating ideas. Moreover, ideas that first seem silly may prove to be very good or may lead to ideas that are very good.

- **Select Top Solutions** Once your time is up, select the five ideas which you like best. Make sure everyone involved in the brainstorming session is in agreement.

- **Set Solution Criteria** Write down about five criteria for judging which ideas best solves your problem. Criteria should start with the word "should", for example, "it should be cost effective", "it should be legal", "it should be possible to finish before July 15", etc.

- **Rank Solutions** Give each idea a score of 0 to 5 points depending on how well it meets each criterion. Once all of the ideas have been scored for each criterion, add up the scores.

- **Define the Problem** The idea with the highest score will best solve your problem. But you should keep a record of all of your ideas and their scores in case your best idea turns out not to be workable.

## Annotated References

- There are numerous helpful books and general articles on the topic of Brainstorming. What follows is a selection of annotated references which have been selected for their practical value to a relatively inexperienced ATM Safety Surveyor with little knowledge of pure research methods.

Barker. A.: 30 Minutes to Brainstorm Great Ideas (30 Minutes S.), Kogan Page, 1997.

*An informative, albeit concise, book providing the essential rules of brainstorming and offering some other practical techniques that can help to generate new ideas.*

# ANNEX F

## BASIC ANALYSIS OF DATA FROM ATM SAFETY SURVEYS

### Introduction

- This Annex will provide some general guidance on the use of basic statistical analysis techniques that can be used to make sense (or information) out of the data collected from an ANSP during a Safety Survey of any type. The techniques are not covered in great detail here and some useful references are given at the end of the Annex for surveyors that require more detailed knowledge of statistical techniques used for the analysis of quantitative data.

### Variables

- Constant reference is made in statistics to the term '*variable*'. A variable is a characteristic of interest that varies from one item to another and may take any one of a specified set of values or attributes. Variables are usually classified as quantitative or qualitative. For example, consider a study of ATCOs at an ANSP. We may be interested in the age of an ATCO and length of time as fully qualified ATCO. Each characteristic is a quantitative variable because the data that each generates is numerical – for instance, an ATCO may be 34 years of age and has been fully qualified for seven years. Quantitative variables generate quantitative data.

- On the other hand, qualitative variables generate non-numerical or qualitative data. For instance, 'nationality of ATCO' is a qualitative variable because nationality can be classified as Danish, Belgian, French etc.

### Measurement Scales

- Many people are confused about what type of analysis to use on a set of data and the relevant forms of pictorial presentation or data display. This decision should be based on the scale of measurement of the data. These scales are nominal, ordinal and numerical.

- A **Nominal Scale** is a scale where:

    - Data can be classified into non-numerical or named categories;

    - The order in which categories can be written or asked is arbitrary.

- For example, a questionnaire may contain a question about the respondent's nationality and could be posed as:

Top of Form

| | | | |
|---|---|---|---|
| Are you? | British | [ ] | |
| | American | [ ] | |
| | German | [ ] | |
| | French | [ ] | |
| | Other | [ ] | please state [ ] |

- Bottom of Form

- The variable here is 'nationality' and the categories of response are non-numerical. As these categories can be listed in any order, apart from 'Other' which would be placed last in the list, the scale of measurement is nominal.

- An **Ordinal Scale** is a scale where:
    - Data can be classified into non-numerical or named categories;
    - An inherent order exists among the response categories.

- Ordinal scales are used in questions that ask for ratings of quality (e.g. very good, good, fair, poor, very poor) and agreement (e.g. strongly agree, agree, disagree, strongly disagree). For example, ANSP Technical Staff may be asked their views on the accuracy of defect reporting, according to a scale of 1 to 5 where:

    5 = Very good

    4 = Good

    3 = Average

    2 = Poor

    1 = Very poor

- The variable here is 'quality of defect reporting' and the response set is non-numerical and ordered. Hence the scale of measurement is ordinal. The allocation of numbers (codes) to each possible response category is purely arbitrary – you can allocate any numbering you wish.

- These code numbers have no arithmetical meaning. You cannot say, for example, that Good (code 4) is twice Poor (code 2) because on another coding it is not twice. A problem with ratings scales is that the difference or distance between '5 = Very good' and '4 = Good' is not necessarily the same as the difference or distance between '2 = Poor' and '1 = Very poor'. Indeed, people's perceptions of what constitutes 'Very good' may also differ from one person to another

depending on their expectations and experiences of, in this example, defect reporting.

- A **Numerical Scale** is a scale where:
    - Numbers represent the possible response categories;
    - There is a natural ranking of the categories;
    - Zero on the scale has meaning;
    - There is a quantifiable difference within categories and between consecutive categories.
- For example, consider the following question that might be asked of Operational and Technical Staff:

    How many hours did you work last week?

    0 but under 10 [ ]

    10 but under 20 [ ]

    20 but under 30 [ ]

    30 but under 40 [ ]

## Organizing Data

- Once raw survey data has been collected it needs to be organized to make sense of any emergent trends and this can be achieved in two stages.
- The first step is to tabulate all the responses to each question for each respondent in a **data sheet** using the coded values. It is advisable to construct this on a simple spreadsheet using, for example, MS Excel, for example:

| Respondent | Question 1 | Question 2 | Question 3 | Question 4 | Question 5 |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 3 | 2 | 43 |
| 2 | 2 | 2 | 1 | 3 | 28 |
| 3 | 2 | 2 | 1 | 3 | 39 |
| 4 | 1 | 2 | 1 | 6 | 23 |
| 5 | 2 | 3 | 4 | 2 | 32 |
| 6 | 1 | 2 | 1 | 4 | 24 |
| 7 | 2 | 3 | 2 | 2 | 30 |
| 8 | 1 | 3 | 4 | 1 | 30 |
| 9 | 2 | 3 | 3 | 2 | 21 |
| 10 | 2 | 3 | 5 | 1 | 28 |

**Table D.4-1: Example Tabulated Data Sheet**

- The above example data sheet has only 10 respondents to keep the example simple but tabulation is most useful for survey data collection from a large number of respondents. Respondent 1 answered questions 1, 2 and 5 as follows:

  Question 1 (gender) Response: 02 = male

  Question 2 (rating of workload) Response: 03 = high

  Question 5 (age) Response: 43 = 43

- The second step for organizing data is to construct a **summary sheet**. This summary sheet will be an amended version of the original question sheet (either questionnaire or interview schedule) and contains:
  - a brief overview of the data collection process, including:
    - data collection method
    - sample size and sampling method
    - number of responses
    - geographical coverage
    - time frame for data collection
  - a count for each response alongside each question;

- the percentage equivalents.

- To illustrate a summary sheet, a sample of a summary questionnaire is given below and refers to the example data on the tabulated data sheet in Table D.4-1 above.

**Summary of a Questionnaire on 'ATCO Attitudes'**

Based on 10 questionnaires returned from a random sample

from 50 ATCOs taken in February 2005.

1. Are you:

| | | |
|---|---|---|
| Male | 7 | 70% |
| Female | 3 | 30% |

2. Would you rate your average workload as:

| | | |
|---|---|---|
| Low | 0 | 00% |
| Average | 4 | 40% |
| High | 6 | 60% |

- At the top of the example summary sheet there is a statement that tells us how many questionnaires were returned, how many were issued, the sampling method and when the data was collected.. A count has been made of the responses for Questions 1 and 2 and written opposite each response, together with the percentage equivalents.

## Summarizing Data

- So far we have collated the survey data, made some counts and determined percentages. The next step is to summarise the data, if possible, with one or two **summary statistics**. Summary or descriptive statistics describe the original data set (the set of responses for each question) by using just one or two numbers – typically an average and a measure of dispersion.

- The following are the most common and useful statistical measures for summarising basic survey data:

    - **Mode** is the most frequently occurring value, although it is not often used.

- **Median** is the middle value.
- **Mean** is found by adding the values and dividing by the number of values.
- **Quartiles** (Q1 and Q3) are the 25% and 75% values respectively and are measures of **dispersion** about the **median**.
- **Standard deviation** is a measure of the **dispersion** about the **mean**; a small standard deviation implies the data are tightly bunched about the mean, whereas a large standard deviation implies the data are widely scattered about the mean.

- The different types of data, nominal, ordinal and numerical, can be summarised by different summary statistics. The table below shows the types of averages and measures of dispersion for each type.

| Data | Average | Dispersion |
|---|---|---|
| Nominal | Mode | |
| Ordinal | Mode | |
| | Median | |
| | Mean | |
| Numerical | Mode | |
| | Median | Quartiles |
| | Mean | Standard deviation |

**Table D.5-1: Data Types and Summary Measures**

- For example, with nominal data it is only possible to show the number or percentage of people or items falling within each category. It is also possible to state which category includes the highest number of counts – the most popular category or modal category.

- For numerical data, all three averages and their associated measures of dispersion can be determined. However, the mode tends to be of little interest with this type of data and may be ignored in most situations. It may be necessary to use a graphical technique such as a **cumulative frequency curve** to determine the median and quartiles.

- The mean and standard deviation can be determined using the following formula:

$$\text{St Dev} = \sqrt{\frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2}$$

- The term in square brackets is the **arithmetic mean**. The approach to the calculation is to find the variance and then take the square root to obtain the standard deviation. For example, using the following data set:

| Annual salary | Number of respondents |
|---|---|
| Less than €8,000 | 6 |
| €8,000 but less than €12,000 | 12 |
| €12,000 but less than €16,000 | 10 |
| €16,000 but less than €20,000 | 6 |
| €20,000 but less than €24,000 | 4 |
| €24,000 and above | 2 |

**Table D.5-2: Example Data Summary Sheet**

- This can be re-written with closed classes and the units in €000s to eliminate the zeroes as below. Three columns of calculations are required as shown.

| | Freq. | Mid Pt. | | |
|---|---|---|---|---|
| | *f* | *x* | *fx* | $fx^2$ |
| 4 but less than 8 | 6 | 6 | 36 | 216 |
| 8 but less than 12 | 12 | 10 | 20 | 200 |
| 12 but less than 16 | 10 | 14 | 140 | 1,960 |
| 16 but less than 20 | 6 | 18 | 108 | 1,944 |
| 20 but less than 24 | 4 | 22 | 88 | 1,936 |
| 24 but less than 28 | 2 | 26 | 52 | 1,352 |
| **Total** | **40** | | **544** | **8,608** |

**Table D.5-3: Tabulated Variance Calculation**

$$\text{Variance} = \frac{8{,}608}{40} - \left[\frac{544}{40}\right]^2$$

$$= 215.2 - (13.6)^2$$

$$= 215.2 - 184.96$$

$$= 30.24$$

$$\text{Standard Deviation} = \sqrt{30.24}$$

$$= 5.5$$

- The mean salary of respondents is €13,6000 per annum with a standard deviation of €5,500. (The results have been multiplied by 1,000 to get the correct units for the data.) To find the median and quartiles first determine the percentage cumulative frequencies and then draw a cumulative frequency curve and read off:
    - 25% value to get the lower quartile Q1;
    - 50% value to get the median;
    - 75% value to get the upper quartile Q3

| | *f* | *cf* | *%cf* |
|---|---|---|---|
| 4 but less than 8 | 6 | 6 | 15 |
| 8 but less than 12 | 12 | 18 | 45 |
| 12 but less than 16 | 10 | 28 | 70 |
| 16 but less than 20 | 6 | 34 | 85 |
| 20 but less than 24 | 4 | 38 | 95 |
| 24 but less than 28 | 2 | 40 | 100 |
| **Total** | **40** | | |

**Table D.5-4: Percentage Cumulative Frequency**

- The percentage cumulative frequencies are then plotted to correspond with the upper class limits. From the graph (not drawn here) the following approximate results are obtained:

| | | |
|---|---|---|
| Q1 | = | €8,700 |
| Median | = | €12,800 |
| Q3 | = | €17,300 |

- All the summary statistics described so far have used the results as presented on the summary sheet. An alternative approach is to use the raw data as presented on the data sheet. However, if you are going to use this approach the data ideally should be on a spreadsheet where the in-built statistical functions can be used. These functions for Microsoft Excel are as follows:

| Summary Statistic | Excel Function |
|---|---|
| Arithmetic mean | =AVERAGE(cell range of data) |
| Median | =MEDIAN(cell range of data) |
| Mode | =MODE(cell range of data) |
| Standard deviation | =STDEVP(cell range of data) |
| Q1 | =QUARTILE(cell range of data,1) |
| Q3 | =QUARTILE(cell range of data,3) |

**Table D.5-4: Statistical Spreadsheet Functions**

- Other techniques for summarizing survey data are **cross-tabulation** and **correlation coefficient**. Correlation coefficient calculation is a relatively sophisticated technique that is commonly used to see if there is a linear relationship between two variables; however this technique it is not addressed further in these guidelines although a useful reference is given at the end of this Annex.

- A cross-tabulation is a matrix in which all categories representing one variable are presented in rows, and all categories representing another variable are presented in columns. Although cross-tabulations can be constructed for any type of data they are particularly useful for analysing nominal and ordinal data. Cross-tabulation can be analysed on two levels:

    - Inspect the table to see if there are any patterns or cells with small and/or large cell frequencies. If there is, make a statement to reflect this pattern

or possible relationship. If there is no obvious pattern, with frequencies being fairly even spread across the cells, then there is probably no relationship between the two variables.

- o Test the independence of the two variables using a chi-square test. This is a sophisticated technique and is not addressed further in these guidelines although a useful reference is given at the end of this Annex.

- For example, consider the questionnaire on ATCOs Attitudes (introduced in D.4.5. above) it may appear that an ATCO's opinion of their workload is dependent upon the gender of the respondent. This hypothesis may be investigated by constructing a cross-tabulation for the two variables 'Gender' (Question 1) and 'Opinion of Workload' (Question 2).

- A table is constructed by first counting how many responses fall into each cell – this is called the **cell frequency**. Row totals, column totals and a grand total are inserted as well. This is a time-consuming process and requires care, but invariably leads to valuable information about the relationship between the two variables. A cross-tabulation table with the summary data from Table D.4-1 added would look like the following:

| **Gender (Q1)** | **Opinion of Workload (Q2)** | | | **Total** |
|---|---|---|---|---|
| | Low (1) | Average (2) | High (3) | |
| Female (1) | 0 | 2 | 1 | **3** |
| Male (2) | 0 | 2 | 5 | **7** |
| **Total** | **0** | **4** | **6** | **10** |

Table D.5-5: Cross Tabulation Example

- If we consider the above table, it would appear that most males (5 out of 7) consider their workload to be high, whereas most females (2 out of 3) believe their workload to be average. This seems to indicate that the opinion of workload is dependent on the gender of respondent (Note: for this small sample), or, there is a relationship between the two variables - gender and opinion of workload.

- The data analysis could be continued by investigating the following hypotheses:

  - Is 'opinion of workload' dependent on 'salary'?
  - Is 'opinion of workload' dependent on 'age'?
  - Is 'salary' dependent on 'workload'?
  - Is 'salary' dependent on 'age'?

- It is possible to cross tabulate every question with every other question. This produces so much information that the result will be 'information overload' and you simply get very confused. You have to be selective about what you cross-tabulate.

- With cross-tabulations do not use percentages, only use the actual frequencies. This is because the calculation of a percentage can be based on either row totals, or column totals, or the grand total. In other words, three percentages are possible for each cell.

## Annotated References

- There are numerous helpful books and general articles on the topic of statistical data analysis. What follows is a selection of annotated references which have been selected for their practical value to a relatively inexperienced ATM Safety Surveyor with little knowledge of statistical methods.

  Cramer. D. and Bryman. A.: Quantitative Data Analysis using SPSS, Routledge, an imprint of Taylor & Francis Books Lt, 2001.

  *Best-selling textbook provides a non-technical approach to quantitative data analysis and a user-friendly introduction to the widely used SPSS for Windows. Assumes no previous familiarity with either statistics or computing, but take readers step-by-step through techniques, including: Correlation; Simple and multiple regression; Multivariate analysis of variance and covariance; Factor analysis. Also includes exercises for further practice and cover issues such as sampling, statistical significance, conceptualisation and measurement and the selection of appropriate tests.*

## References

Safety Surveys in ATM – A Review Of Best Practice, (DAP-SAF/IANS) Issue 1 dated 28 January 2005.

EUROCONTROL Safety Regulatory Requirement - ESARR 3 Use of Safety Management Systems by ATM Service Providers.

Reason, J.: 'Managing the risks of organisational accidents' (Ashgate, London, 1997)'

Auditing the ISO 19011 Way, British Standards Institution, 2003

Leedy, P. D, 'Practical Research Planning and Design', 5th Ed., New York, Macmillan Publishing, 1993.

# GLOSSARY AND LIST OF KEY ABBREVIATIONS

| | | |
|---|---|---|
| ACM | Accident Causation Model | |
| AIRPROX | Aircraft Proximity Incident Report | |
| ANSP | Air Navigation Service Provider | |
| ATC | Air Traffic Control | |
| ATCO | Air Traffic Control Officer | |
| ATM | Air Traffic Management | |
| EATM | European ATM | |
| ECAC | European Civil Aviation Conference | |
| ESARR | EUROCONTROL Safety Regulatory Requirement | |
| ICAO | International Civil Aviation Organisation | |
| Inspection | The physical examination of arrangements for the conduct and support of ATM including scrutiny of arrangements for the management of safety and which may also include the verbal and/or written questioning of staff. | Original |
| LOSA | Line Operations Safety Audit | |
| MOR | Mandatory Occurrence Report | |
| NOSS | Normal Operations Safety Survey | |
| Observation | The accurate watching and recording of activity relating to ATM safety as it occurs, particularly with regard to cause and effect | Original |
| QA | Quality Assurance | |
| QMS | Quality Management System | |
| Safety | Freedom from unacceptable risk of harm. | ESARR 3 |

| | | |
|---|---|---|
| Safety Assurance | All planned and systematic actions necessary to provide adequate confidence that a product, a service, an organisation or a system achieves acceptable or tolerable safety | ESARR 3 |
| Safety Monitoring | A systematic action conducted to detect changes affecting the ATM System with the specific objective of identifying that acceptable or tolerable safety can be met . | ESARR 3 |
| Safety Regulatory Audit | A systematic and independent examination conducted by the ATM safety regulator to determine whether processes and related results comply with required arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives. | EAM 3 / GUI 2 |
| Safety Review | The retrospective examination of general and/or specific arrangements for the safe conduct and support of ATM including detailed scrutiny of documented SM activity. | Original |
| Safety Survey | A systematic review, to recommend improvements where needed, to provide assurance of the safety of current activities, and to confirm conformance with applicable parts of the Safety Management System. | ESARR 3 |
| Self-Assessment | The estimation of the extent and/or quality of factors which influence ATM safety positively or negatively, by individuals responsible for providing an ATM service or associated support. | Original |
| SISG | Safety Improvement Sub-Group | |
| SM | Safety Management | |
| SMM | Safety Management Manual | |

| | | |
|---|---|---|
| SMS | Safety Management System | |
| SRC | Safety Regulatory Commission | |
| SSAP | Strategic Safety Action Plan | |
| Staff Survey | The systematic gathering of information, verbally or in writing, from internal staff and/or personnel from external organisations relating to specific aspects of ATM safety. | Original |
| Study | The dedication of investigative effort to acquiring information and knowledge of specific ATM arrangements together with the development of conclusions and, where appropriate, recommendations for further action | Original |
| System | A combination of physical components, procedures and human resources organised to perform a function. | ESARR 3 |