Havarikommissionen
Accident Investigation Board Denmark

BULLETIN

Serious incident

2-3-2017

involving

BOMBARDIER INC. DHC-8-202

OY-GRO

and

RUNWAY SNOW CLEARING VECHICLES

ECCAIRS Release 5

Certain report data are generated via the EC common aviation database

FOREWORD

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the safety investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The safety investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

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BULLETIN

General

File number:	HCLJ510-2017-324
UTC date:	2-3-2017
UTC time:	16:38
Occurrence class:	Serious incident
Location:	Kangerlussuaq (BGSF)
Injury level:	None

Aircraft

Aircraft registration:	OY-GRO
Aircraft make/model:	BOMBARDIER INC. DHC-8-202
Current flight rules:	Instrument Flight Rules (IFR)
Operation type:	Commercial Air Transport Passenger Airline
Flight phase:	Take-off
Aircraft category:	Fixed Wing Aeroplane Large Aeroplane
Last departure point:	Greenland (Denmark) BGSF (SFJ): Kangerlussuaq
Planned destination:	Greenland (Denmark) BGSS (JHS): Sisimiut
Aircraft damage:	None
Engine make/model:	PRATT & WHITNEY (CANADA) PW100 FAMILY (123D)

Vehicles

At the time of the serious incident, three runway snow clearing vehicles (two snow clearing sweepers and one loader) were operating on the runway.

SYNOPSIS

Notification

All times in this report are UTC.

Air Traffic Control (ATC) at Kangerlussuaq (BGSF) notified the Aviation Unit of the Danish Accident Investigation Board (AIB) of the serious incident on 2-3-2017 at 18:20 hours.

The AIB notified the Danish Transport, Construction and Housing Authority (DTCHA), the Canadian Transportation Safety Board (TSB), the European Aviation Safety Agency (EASA), the Directorate-General for Mobility and Transport (DG MOVE) on 3-3-2017.

The AIB notified the International Civil Aviation Organization (ICAO) on 8-3-2017.

Summary

OY-GRO departed from an engaged runway at BGSF without an ATC take-off clearance.

To the AIB, the following combined conditions had an influence on the sequence of events:

- The actual flight was approximately one hour behind the scheduled time of departure.
- An over-motivated flight crew acted from their expectations rather than the factual reality.
- Runway downslope prevented the flight crew from spotting the three runway snow clearing vehicles.
- Soft safety barriers like the applied ATC phraseology and the flight crew standard operating procedures on use of landing lights did not provoke or raise the attention of the flight crew in such a way that their decision making process changed.

The serious incident occurred in daylight and under visual meteorological conditions (VMC).

FACTUAL INFORMATION

History of the flight

The serious incident occurred on runway 27 at BGSF.

Scheduled time of departure was at 15:35 hours.

The flight crew of OY-GRO got taxi instructions by Sondrestrom Tower (TWR) on lining up the aircraft on runway 27 via taxiway A. The flight crew of OY-GRO read back the taxi instructions.

Sondrestrom TWR instructed three runway snow clearing vehicles to vacate runway 27.

The flight crew of OY-GRO lined up the aircraft on runway 27 and completed the before take-off checklist. The flight crew was in doubt about whether or not a take-off clearance had been issued but agreed that the aircraft was cleared for take-off.

The flight crew of OY-GRO had no visual contact with the three runway snow clearing vehicles on runway 27.

OY-GRO started its take-off roll.

The student air traffic controller at Sondrestrom TWR observed that OY-GRO had started its take-off roll and pointed it out to the instructor air traffic controller. For a short while, the instructor air traffic controller considered an instruction on aborting the take-off roll of OY-GRO, but noticed that OY-GRO started rotating.

When OY-GRO rotated, the horizontal separation to the nearest runway snow clearing vehicle on the runway was approximately 900 meters.

The vertical separation, when OY-GRO passed overhead the nearest runway snow clearing vehicle on the runway, was approximately 300 feet.

See appendix 1.

Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal			
Serious			
None	3	26	

Damage to aircraft

There were no damages to aircraft.

Other damage

There were no other damages.

Personnel information

The commander

a. License and medical certificate

The commander (47 years) was the holder of a valid Danish Airline Transport Pilot License (ATPL (A)).

The ATPL contained the following type ratings: B737 300-900/IR and DHC8/IR. The type rating DHC8/IR was valid until 30-11-2017.

The PART-FCL medical certificate class 1 was valid until 4-4-2017.

b. Operator training

- On 10-11-2016, the commander performed a combined Operator Proficiency Check (OPC)/License Proficiency Check (LPC). The OPC was valid until 31-5-2017. The LPC was valid until 30-11-2017.
- On 20-11-2016, the commander performed Cockpit Resource Management training (CRM). The CRM training was valid until 30-11-2019.

c. Flying experience

	Last 24 hours	Last 90 days	Total
All types	5	124	14800
This type	-	-	-
Landings this type	-	-	-

d. Duty time and rest period

For duty time and rest periods from 23-2-2017 until 2-3-2017 - see appendix 2.

Be observant that the presented duty and rest periods refer to Greenlandic local time at Nuuk.

The first officer

a. License and medical certificate

The first officer (44 years) was the holder of a valid Commercial Pilot License (CPL (A)).

The CPL contained the following type ratings: DHC8 CO-PILOT and IR(A) ME. The type ratings were valid until 30-6-2017.

The PART-FCL medical certificate class 1 was valid until 14-9-2017.

b. Operator training

- On 3-5-2016, the first officer performed a combined OPC/LPC. The OPC was valid until 31-12-2016. The LPC was valid until 30-6-2017.
- On 5-11-2016, the first officer performed the latest OPC. The OPC was valid until 30-6-2017.
- On 2-10-2016, the first officer performed CRM training. The CRM training was valid until 2-10-2019.

c. Flying experience

	Last 24 hours	Last 90 days	Total
All types	05:13	145	3494
This type	05:13	145	2681
Landings this type	-	-	-

d. Duty time and rest period

For duty time and rest periods from 23-2-2017 until 2-3-2017 - see appendix 2.

Be observant that the presented duty and rest periods refer to Greenlandic local time at Nuuk.

Scheduled flight sectors

On the day of the serious incident, the total number of scheduled flight sectors within the flight duty period was seven.

Aircraft information

General information

Registration:	OY-GRO
Type:	Dash 8
Model:	202
Manufacturer:	Bombardier Aerospace, Canada
Serial number:	482
Year of manufacture:	1997
Engine manufacturer:	Pratt & Whitney Canada Inc.
Engine type:	PW123D
Propellers:	Hamilton Standard Division, 14F-23
Airworthiness review certificate:	Valid until 30-3-2018

Operations Manual - part B (extract)

2.1.6.1.9 Use of landing and taxi lights
The use of suitable external lights is recommended for as long as possible in order to make the aircraft more conspicuous to ATC and other aircraft.

As a general rule, the taxi lights are to be used when the aircraft is moving under its own power. This indicates to ground personnel and other aircraft that it is moving. As soon as the aircraft is stopped at a holding point or to give way to other aircraft, the taxi light should be switched off.

The landing lights are generally to be used from the beginning of the takeoff roll until the passenger signs are switched of, and again when passenger signs are switched back on and no later than when descending below 5.000 feet. However, when weather conditions are such that the use of the landing lights can cause pilot disorientation, the lights may be switched off.

On final approach, after receiving landing clearance, the taxi lights should be switched on in order to indicate to other aircraft that you are landing and as a reminder that landing clearance has been received. At the same time, the taxi light can function as a "flare" light (illuminating the touchdown area when the landing lights won't).

2.1.6.1.10 Before take-off
Before take-off checklist

BEFORE TAKEOFF			
1	**Ground Range Lights**	**CHECKED**	L
2	**Caution and Warning Lights**	**CLEAR**	P
3	**Cabin Secure**	**RECEIVED**	RP
4	**Flight Controls**	**CHECKED**	RP
5	**Bleed Air**	**MIN/ON/OFF**	RP

Meteorological information

Terminal aerodrome forecast (TAF)

bgsf 021658z 0218/0324 25006kt 4000 -sn bkn020 tempo 0218/0307 8000 bkn025 becmg 0307/0310 06008kt 9999 nsw bkn060 becmg 0310/0313 sct060 tempo 0313/0324 bkn080=

bgsf 021344z 0213/0318 31010kt 9999 bkn018 tempo 0213/0221 4000 -sn bkn013 becmg 0221/0223 few015 bkn030 tempo 0223/0318 -sn bkn018=

Aviation routine weather report (METAR)

bgsf 021650z auto 26006kt 7000ndv -sn few002/// bkn023/// bkn031/// m09/m12 q1004=

bgsf 021620z auto 25006kt 9999ndv -sn few018/// bkn021/// bkn025/// m09/m11 q1004=

Communication

The flight crew of OY-GRO was in radio contact with Sondrestrom TWR (118.300 MHz).

The drivers of the runway snow clearing vehicles were in radio contact with Sondrestrom TWR (via the local Frequency Modulation (FM) channel).

Via the FM channel, Sondrestrom TWR retransmitted ATC voice communication between Sondrestrom TWR and aircraft to aerodrome vehicles.

The AIB obtained involved ATC voice recordings. The recordings were of good quality and useful to the AIB safety investigation.

Aerodrome information

ICAO aerodrome chart - see appendix 3.

Flight recorders

Solid State Cockpit Voice Recorder (SSCVR)

At the time of reporting to the AIB, it was no longer possible for the AIB to secure relevant SSCVR data.

Quick Access Recorder (QAR)

The AIB retrieved relevant data from the aircraft QAR. The QAR data were useful to the AIB safety investigation.

AIB safety investigation

The sequence of events

Time	Communication and aircraft operation
At 16:36:04 hours Flight crew of OY-GRO to Sondrestrom TWR	*XXXX, request taxi*
At 16:36:11 hours Sondrestrom TWR to flight crew of OY-GRO	*XXXX, line up runway 27 via taxiway A*
At 16:36:18 hours Flight crew of OY-GRO to Sondrestrom TWR	*Line up runway 27 via taxiway A, XXXX*
At 16:36:25 hours Sondrestrom TWR to loader on runway	*Loader, you are to vacate the runway* (translated into English by the AIB)
At 16:36:25 hours (an approximate time and an AIB premise)	OY-GRO started taxiing toward the runway

Time	Communication and aircraft operation
At 16:36:31 hours Loader to Sondrestrom TWR	*Loader vacating the runway via D* (translated into English by the AIB)
At 16:36:33 hours Sondrestrom TWR to snow clearing sweepers	*Sweeper 6 and 5, you are to vacate the runway* (translated into English by the AIB)
At 16:36:53 hours Sondrestrom TWR to snow clearing sweepers	*Sweeper 6 and 5, you are to vacate the runway* (translated into English by the AIB)
At 16:36:58 hours Snow clearing sweeper 5 to Sondrestrom TWR	*Sweeper 5, vacating the runway* (translated into English by the AIB)
At 16:37:00 hours Snow clearing sweeper 6 to Sondrestrom TWR	*Sweeper 6, vacating the runway* (translated into English by the AIB)
At 16:37:07 hours Snow clearing sweeper 6 to Sondrestrom TWR	*Sweeper 6, may I vacate the runway via the fire access road?* (translated into English by the AIB)
At 16:37:12 hours Sondrestrom TWR to snow clearing sweeper 6	*No, you are to vacate the runway via D* (translated into English by the AIB)
At 16:37:13 hours Snow clearing sweeper 6 to Sondrestrom TWR	*Okay, I'll vacate via D* (translated into English by the AIB)
At 16:37:50 hours (an approximate time and an AIB premise)	OY-GRO in take-off position on runway 27
At 16:37:57 hours (an approximate time and an AIB premise)	The flight crew of OY-GRO initiated the take-off

Time	Communication and aircraft operation
At 16:38:32 hours (an approximate time and an AIB premise)	QAR data presented OY-GRO to be airborne

Flight crew performance effectiveness

In order to perform an objective post-incident analysis, the AIB in cooperation with the flight safety department of the Danish Air Force used the Fatigue Avoidance Scheduling Tool (FAST) software to determine if flight crew fatigue may have contributed to the sequence of events.

Input data were:

- Duty periods (scheduled)
- Rest periods (scheduled and flight crew reported)
- Sleep quantity (flight crew reported)
- Sleep quality (assumed to be good).

The performance effectiveness of the commander - see appendix 4.

The performance effectiveness of the first officer - see appendix 5.

Be observant that the presented duty and rest periods refer to Greenlandic local time at Nuuk.

Additional information

ICAO Doc 9870 AN/463

Manual of the prevention of runway incursions (extract).

6.3.10 All aircraft lights should be used to help controllers and other pilots to see the aircraft. Fixed navigation lights and taxi light should be on whenever the aircraft is moving. Landing lights should be turned on when cleared for take-off.

Advisory Circular 120-74B

On 30-7-2012, the Federal Aviation Administration (FAA) issued an Advisory Circular (AC No: 120-74B on “Flightcrew Procedures During Taxi Operations” (extract).

Use of Exterior Aircraft Lights to Make the Aircraft More Conspicuous

(2) Exterior Lights. To the extent possible and consistent with aircraft equipage, operating limitations, and flightcrew procedures, pilots should illuminate exterior lights as follows.

> *(e) Takeoff. Turn on all lights, including landing lights, when takeoff clearance is received, or when commencing takeoff roll at an airport without an operating control tower.*

ICAO Doc 4444

Procedures for Air Navigation Services (extract).

12.2 General

12.2.9 Words in square parentheses indicate optional additional words or information that may be necessary in specific instances.

12.3 ATC phraseologies

Clearance to enter runway and await take-off clearance	*f) LINE UP [WAIT]*

Operations Manual - part A (extract)

7.5.2 Maximum Daily FDP – without extension

(a) The maximum basic daily FDP without the use of extensions for acclimatized crew members shall be in accordance with the following table:

Acclimatised crew members

Start of FDP at reference time	1 – 2 sectors	3 sectors	4 sectors	5 sectors	6 sectors	7 sectors	8 sectors	9 sectors	10 sectors
0600-1329	13:00	12:30	12:00	11:30	11:00	10:30	10:00	09:30	09:00
1330-1359	12:45	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00
1400-1429	12:30	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00
1430-1459	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00	09:00
1500-1529	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00	09:00
1530-1559	11:45	11:15	10:45	10:15	09:45	09:15	09:00	09:00	09:00
1600-1629	11:30	11:00	10:30	10:00	09:30	09:00	09:00	09:00	09:00
1630-1659	11:15	10:45	10:15	09:45	09:15	09:00	09:00	09:00	09:00
1700-0459	11:00	10:30	10:00	09:30	09:00	09:00	09:00	09:00	09:00
0500-0514	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00	09:00
0515-0529	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00	09:00
0530-0544	12:30	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00
0545-0559	12:45	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00

8.3.3.1.4 ATC clearance

All ATC clearance and altimeter settings shall be read back. Reception and read back shall be monitored by the other pilot, who shall repeat the significant parts of the instructions. In case of disagreement between the pilots or any doubt concerning the message, a repeat shall be requested.

When changing stations it is recommended to give the new station a short review of valid clearance if considered relevant.

ANALYSIS

In general

The licenses and qualifications held by the flight crew, the technical status of the aircraft, and the actual weather conditions had, in the AIB's opinion, no influence on the sequence of events.

By using a generic fatigue evaluation tool and taking into consideration the actual duty and rest periods and the flight crew reported sleep quantity, the AIB considers the flight crew to be well-rested in the morning on 2-3-2017. With reference to the output data of the fatigue evaluation tool, the flight crew neither suffered from accumulated nor acute fatigue.

The take-off roll of OY-GRO

On 2-3-2017, the scheduled duty period of the flight crew was 10:30 hours.

At the time of the serious incident, the actual flight was approximately one hour behind the scheduled time of departure.

The AIB finds it possible that the flight crew of OY-GRO eagerly tried to catch up on time in order not to exceed the maximum daily duty period of 10:30 hours (seven sectors), which might mentally have provoked the flight crew to act from their expectations rather than the factual reality (over-motivation).

Combined elements of the below human factor topics most likely affected the flight crew mutual communication and decision making process and led to the take-off from an engaged runway:

- Over-motivation
- Bias
- Motivational judgement
- Complacency
- Goal conflicts
- Workload and stress.

The downslope at the far end of runway 27 prevented the flight crew - when lining up the aircraft on runway 27 - from spotting the three runway snow clearing vehicles. To the flight crew, the runway seemed free.

Soft safety barriers

The applied ATC phraseology was in accordance with ICAO Doc 4444.

However, the AIB finds that use of the optional additional word "*WAIT*" in this particular case (an engaged runway) would have made the ATC lineup clearance more attention-demanding. An attention-demanding clearance might have strengthened the situational awareness of the flight crew.

Sondrestrom TWR did not retransmit ATC voice communication between Sondrestrom TWR and the runway snow clearing vehicles to aircraft in the air or on the ground.

To the AIB, there is delicate balance between securing situational awareness on the one hand and balanced and not least relevant ATC voice communication on the other hand, and the AIB fully accepts that specific situational assessment, because general areas of weakness are:

- Use of phraseology
- Use of native language
- Mixed ATC voice communication blurring flight safety related messages.

At the time of the serious incident, the operator's standard operating procedures on use of landing lights did not reflect for instance ICAO and FAA recommended practices at controlled aerodromes, meaning "*landing lights on*" is equal to "*take-of clearance is received*".

The recommended ICAO and FAA practices on use of landing lights strengthen external and internal local safety barriers like:

- Making the aircraft and the intentions of a flight crew more conspicuous to flight crews of other aircraft and to air traffic controllers or to Aerodrome Flight Information Service operators
- Making the take-off clearance or the runway free information physically visual to the flight crew itself.

CONCLUSIONS

OY-GRO departed from an engaged runway at BGSF without an ATC take-off clearance.

To the AIB, the following combined conditions had an influence on the sequence of events:

- The actual flight was approximately one hour behind the scheduled time of departure.
- An over-motivated flight crew acted from their expectations rather than the factual reality.
- Runway downslope prevented the flight crew from spotting the three runway snow clearing vehicles.
- Soft safety barriers like the applied ATC phraseology and the flight crew standard operating procedures on use of landing lights did not provoke or raise the attention of the flight crew in such a way that their decision making process changed.

PREVENTIVE ACTIONS

The AIB safety investigation did not reveal systemic flight safety lapses. For that reason, the AIB did not issue safety recommendations.

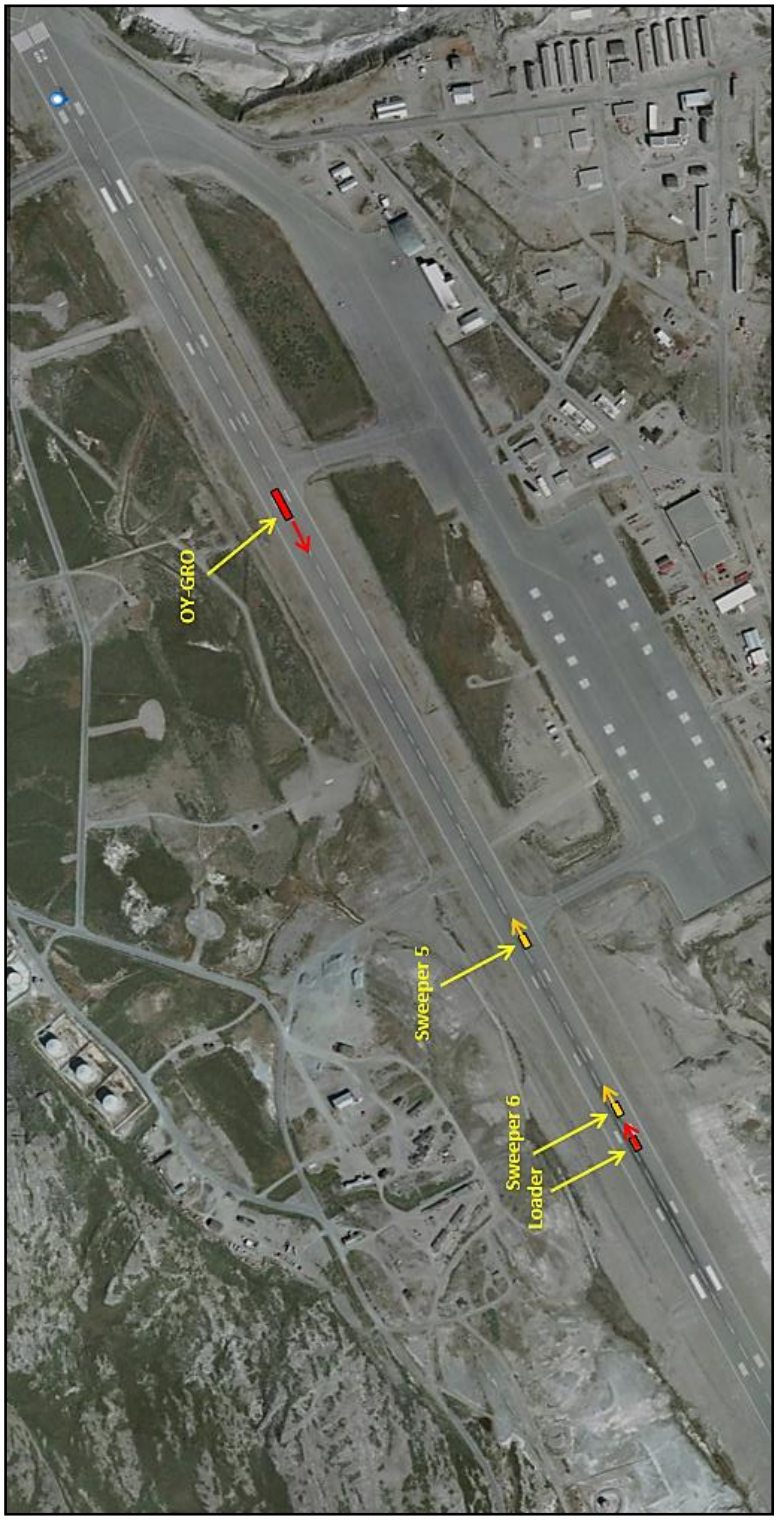
However, due this serious incident the operator launched the following preventive actions:

- The operator pointed out flight crew responsibility of securing SSCVR data for safety investigation purposes.
- The operator defined a need of a procedure for securing flight crew mutual acknowledgement of ATC clearances.
- The operator implemented a new procedure (Dash 8) on use of landing, taxi and wing inspection lights.
- The operator re-evaluated turnaround procedures.

APPENDIX 1

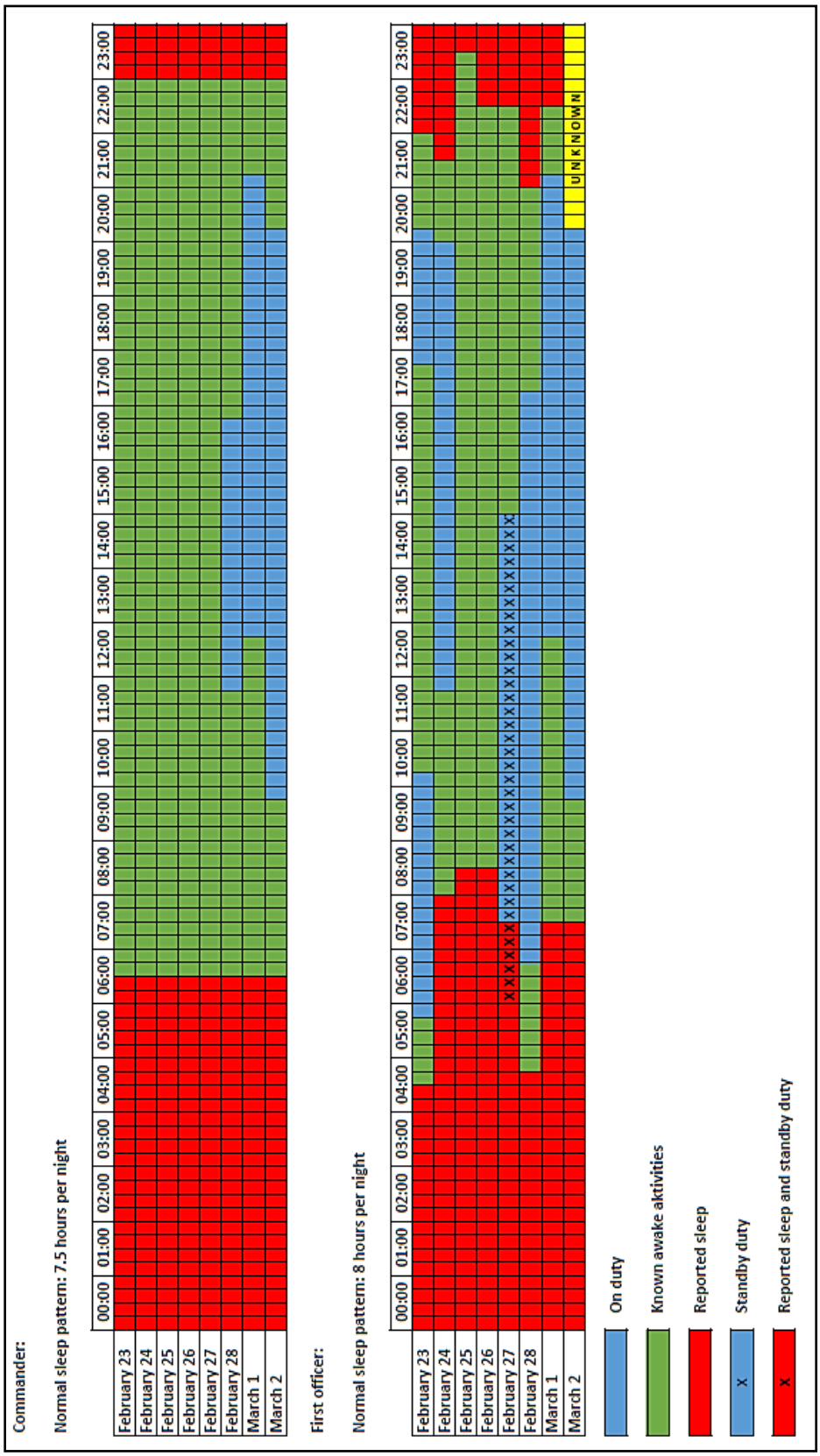
Return to history of flight

Be observant that the illustrated aircraft, the vehicles, and the horizontal separation are not to scale.



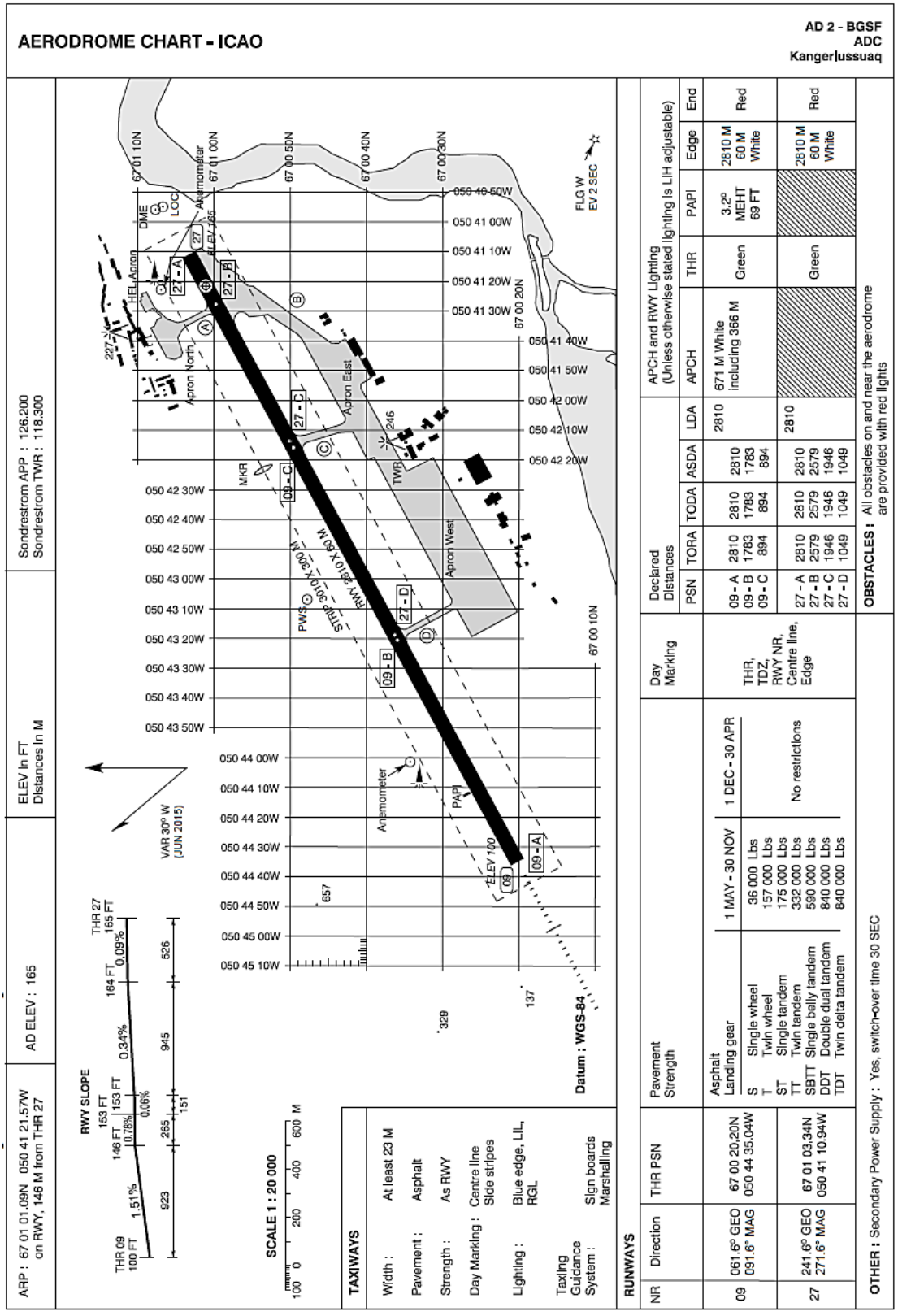
APPENDIX 2

Return to the commander Return to the first officer



APPENDIX 3

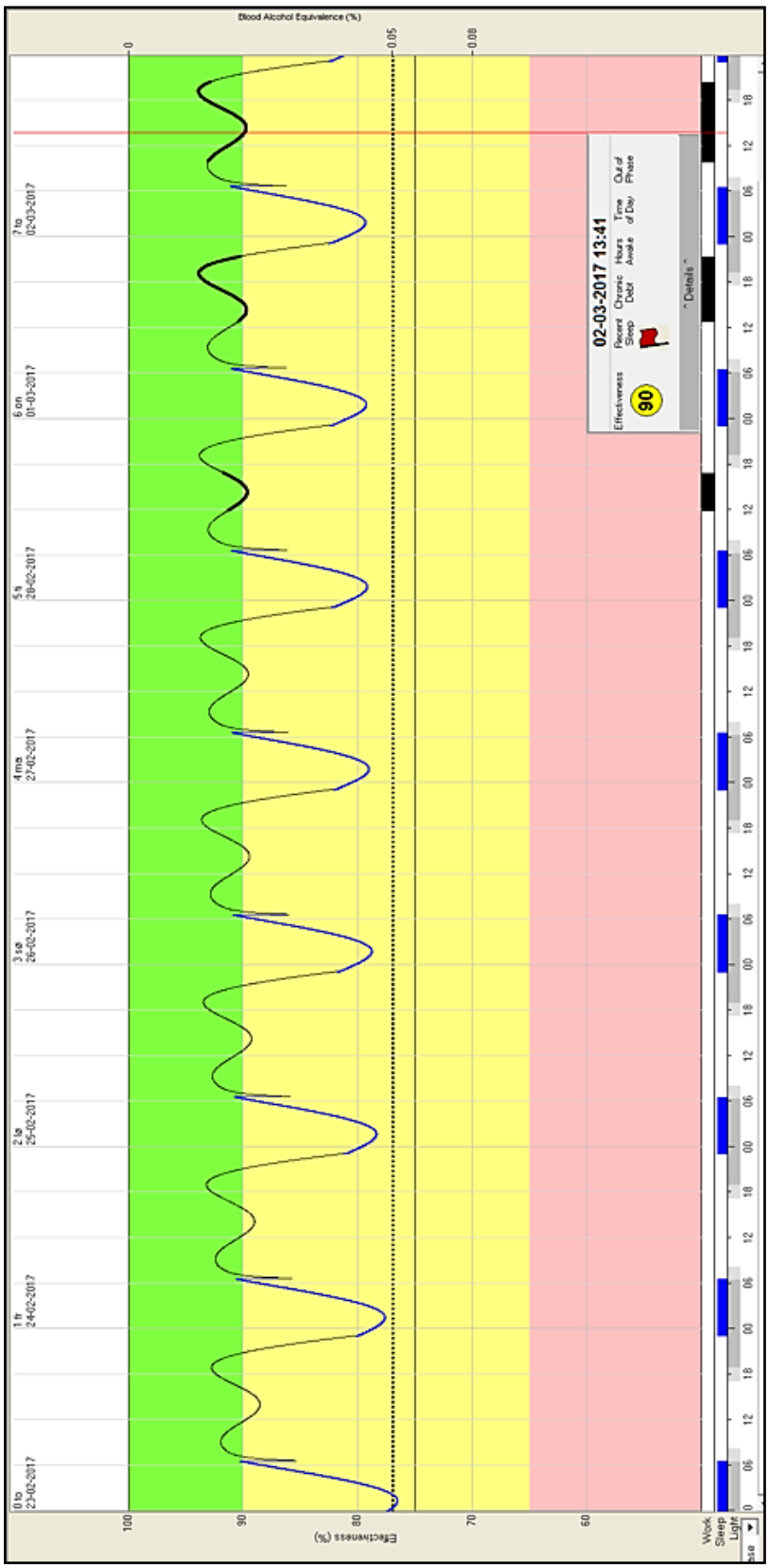
Return to aerodrome information



NR	Direction	THR PSN	Pavement Strength			Day Marking	Declared Distances					APCH and RWY Lighting (Unless otherwise stated lighting is LIH adjustable)				
			Asphalt Landing gear	1 MAY - 30 NOV	1 DEC - 30 APR		PSN	TORA	TODA	ASDA	LDA	APCH	THR	PAPI	Edge	End
09	061.6° GEO 091.6° MAG	67 00 20.20N 050 44 35.04W	S Single wheel T Twin wheel ST Single tandem TT Twin tandem SBTT Single belly tandem DDT Double dual tandem TDT Twin delta tandem	36 000 Lbs 157 000 Lbs 175 000 Lbs 332 000 Lbs 590 000 Lbs 840 000 Lbs 840 000 Lbs	No restrictions	THR, TDZ, RWY NR, Centre line, Edge	09 - A 09 - B 09 - C	2810 1783 894	2810 1783 894	2810 1783 894	2810	671 M White including 366 M	Green	3.2° MEHT 69 FT	2810 M 60 M White	Red
27	241.6° GEO 271.6° MAG	67 01 03.34N 050 41 10.94W					27 - A 27 - B 27 - C 27 - D	2810 2579 1946 1049	2810 2579 1946 1049	2810 2579 1946 1049	2810		Green		2810 M 60 M White	Red

APPENDIX 4

[Return to flight crew performance effectiveness]



APPENDIX 5

Return to flight crew performance effectiveness