Accident Investigation Board
Denmark

Final Report

HCLJ510-2011-33
(HCLJ510-000704)

Accident to Piaggio Avanti P180
Registration N108GF
South of BGSF, Greenland
On 16 October 2009

The final report is available at the AIB web site at http://www.AIB.dk

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FOREWORD

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This report reflects the opinion of the Accident Investigation Board Denmark regarding the circumstances of the accident and its causes and consequences.

In accordance with the provisions of Danish law and pursuant to Annex 13 of the International Civil Aviation Convention, the investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability. The investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than that of preventing future accidents.

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

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GLOSSARY OF ABBREVIATIONS

ACC	Area Control Centre
AFIS	Aerodrome Flight Information Service
AIB	Accident Investigation Board, Denmark
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATD	Actual Time of Departure
ATO	Actual Time Overhead
ATP	Airline Transport Pilot
ATPL	Airline Transport Pilot's License
AUW	All Up Weight
BI	Basic Index
BOW	Basic Operating Weight
CTA	Control Area
DCPC	Direct Controller Pilot Communication
DME	Distance Measurement Equipment
DN	Down
EASA	European Aviation Safety Agency
EET	Estimated Elapsed Time
EFB	Electronic Flight Bag
ELT	Emergency Location Transmitter
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETO	Estimated Time Overhead
FAR	Federal Aviation Regulation
FDR	Flight Data Recorder
FIC	Flight Information Center
FIR	Flight Information Region
FL	Flight Level
FMS	Flight Management System
FOB	Fuel On Board
FPL	ATS Flight Plan
FPM	Feet per Minute
FWD	Forward
FAA	Federal Aviation Administration
GP	Glide Path
GPS	Global Positioning System
GAA	Greenland Airport Authority
hPa	Hektopascal
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules

ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ISA	International Standard Atmosphere
L	Liter
LAM	Landing Mass
LAW	Landing Weight
LLZ	Localizer
MAPt	Missed Approach Point
MCC	Movement Control Centre
MCDU	Multipurpose Control and Display Unit
MHz	Megahertz
MNPS	Minimum Navigation Performance Specifications
MSL	Mean Sea Level
MTOM	Maximum Take-off Mass
NAT	North Atlantic
NDB	Non Directional Radio Beacon
NM	Nautical Mile
NTSB	National Transportation Safety Board, USA
OCA(H)	Obstacle Clearance Altitude (Height)
OFP	Operational Flight Plan
PA	Pressure Altitude
POH	Pilot’s Operating Handbook
RA	Radio Altimeter
RCC	Rescue Coordination Centre
RNAV	Area Navigation
RPM	Revolutions per Minute
RVSM	Reduced Vertical Separation Minima
SAR	Search and Rescue
SPL	Supplementary Flight Plan
SSR	Secondary Surveillance Radar
STD	Scheduled Time of Departure
TCAS	Traffic Alert and Collision Avoidance System
TIF	Trip Fuel
TOF	Take-Off Fuel
TOM	Take-Off Mass
TOW	Take-Off Weight
TWR	Tower
UNL	Unlimited
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omni Directional Radio Range
ZFM	Zero Fuel Mass

ZFW	Zero Fuel Weight

FINAL REPORT

HCLJ510-2011-33 **(HCLJ510-000704)**	**Accident**		
Aircraft:	Piaggio Avanti P180	Registration:	N108GF
Engines:	2 – PT6A-66	Flight:	Ferry flight, IFR
Crew:	1 – Minor injuries	Passengers:	None
Place:	South of Kangerlussuaq (Sondrestromfjord, BGSF), Greenland	Date & Time:	16.10.2009, at 15:40 UTC

All time references are UTC.

Synopsis

The Danish Accident Investigation Board (AIB) received the notification from Sondrestrom Rescue Co-ordination Center (RCC) on 16.10.2009 at 16:10 hrs.

The National Transportation Safety Board (NTSB), USA, the European Aviation Safety Agency (EASA), the International Civil Aviation Organization (ICAO), and the Agenzia nazionale per la sicurezza del volo (ANSV), Italy were notified.

The accident flight was a part of a ferry flight from Kuwait to USA. The flight departed from Keflavik, Iceland with planned destination Narsarsuaq, Greenland. The commander did not get visual contact with the runway on the instrument approach to Narsarsuaq and the flight diverted towards Kangerlussuaq, Greenland. During the flight towards Kangerlussuaq, the amount of fuel became critical low and the aircraft landed on the Greenlandic icecap. The aircraft was destroyed during the landing attempt. The commander suffered minor injuries.

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

Summary

After the flight was airborne from BIKF, the flight was restricted by ATC to cruise at FL200 instead of FL280. The lower flight altitude and the power setting used resulted in a reduction of the final reserve to approximately zero minutes. At that time the commander was not concerned about the final reserve because the flight to BGBW was only a two hours flight and as the aircraft before take-off from BIKF had fuel for more than three hours and 40 minutes of flight.

During the approach to BGBW the flight never came below the clouds and was in IMC during the entire final approach. The most likely cause was that the aircraft was not following the NDB + DME 07 approach procedure descent profile. Consequently the commander did not get visual contact during the approach and he had to make a missed approach.

During the diversion to the alternate aerodrome, BGSF the flight was altitude restricted by ATC to FL190. One engine was intentionally stopped during the diversion to BGSF. The consequence was a reduction of the aircraft range. A shallow descent was initiated approximately 57 minutes before ETA over BGSF. The shallow descent profile did consume more fuel than a steeper descent profile. The commander decided to

make a precautionary landing in the terrain. The aircraft was destroyed during the landing attempt on the rugged and bumpy surface of the icecap.

1. Factual information

1.1 History of the flight (For more details see Appendix 5.1)

The accident flight was an IFR ferry flight from Kuwait (OKBK) to Denton (KDTO), Texas with technical landings at Antalya (LTAI), Vienna (LOWW), Stornoway (EGPO), Keflavik (BIKF) and with planned technical landings at Narsarsuaq (BGBW), Goose Bay (CYYR) and Bangor (KBGR). The aircraft was scheduled for technical maintenance at KDTO. The commander was the only occupant on board the flight.

The aircraft was refueled at BIKF 1030/40 hrs. with 240 US Gallons Jet A1 fuel. The aircraft refueling system indicated full tanks after refueling. After refueling at BIKF, the fuel on board (FOB) was approximately 2860 lbs.

The flight from BIKF towards BGBW

Keflavik Air Traffic Control (ATC) cleared N108GF to BGBW via FLOSI dct 64N30W dct 62N40W dct NA initially at FL270 and at a cruise Mach number 0.66. Keflavik ATC changed the clearance to cruise at Mach number 0.63. The flight departed BIKF on the 16.10.2009 at 1058/1103 hrs.

After take-off N108GF contacted Keflavik Approach (119.300 MHz) and reported that the flight was at 3300 ft climbing to FL270 and that the flight was heading northwest towards FLOSI. Approach informed the commander that the flight was identified on radar. After a few minutes, N108GF was instructed by Approach to contact Reykjavik ATC on the frequency 119.700 MHz. [The last radio contact with Keflavik Approach was approximately at time 11:06 hrs.].

The cruse method used from BIKF towards BGBW was Recommended Cruise Power 1800 RPM (see Appendix 5.6.7).

[The Danish AIB has not been able to recover the radio communication from the time N108GF was instructed to contact Reykjavik ATC at approximately 11:06 hrs. until the time N108GF contacted Sondrestrom Flight Information Center (FIC) at 13:01 hrs.].

The flight was instructed to descent and cruise at FL200 near the reporting point FLOSI.

An airliner cruising at high altitude was relaying the radio communication from N108GF to Gander Radio. Gander Radio was out of radio range and could not hear N108GF. At 12:50:12 hrs, the airliner at high altitude transmitted the position report received from N108GF; the flight passed 62N 040W at time 12:13 hrs, and was cruising at FL200, the estimated time overhead Narsarsuaq NDB (NA) was 13:43 hrs. The destination was BGBW.

N108GF arrived overhead NA NDB at 13:41 hrs. and started the descent from approximately 9,000 ft. in the holding pattern. After one turn in the holding pattern the flight followed the NDB + DME 07 approach

procedure [base turn] down to approximately 6,000 ft. before turning inbound to NA. The flight descended on the inbound leg in a tailwind condition up to of approximately 15 knots. The flight was in clouds and there was no visual contact with terrain, the sea or the runway before the Missed Approach Point (MAPt). Consequently, a missed approach procedure was performed. Following the missed approach, the flight diverted towards the destination alternate aerodrome, Kangerlussuaq (BGSF).

The flight from BGBW towards BGSF

N108GF was in radio contact with Sondrestrom FIC at 13:58:20 hrs. The commander informed Sondrestrom FIC that he could not land at BGBW. The commander requested a direct route to BGSF and stated that he probably could reach BGSF. The commander requested FL280 or FL300 in order to reach BGSF as he was "low on fuel". Sondrestrom FIC informed the flight that it could climb to and maintain FL190 and that Sondrestrom FIC would contact Gander Air Traffic Control (ATC) in order to obtain a higher flight level. The commander stated that if he did not get a higher flight level he would not make it to BGSF.

The initial cruise method used from BGBW area towards BGSF was Recommended Cruise Power 1800 RPM (see Appendix 5.6.7).

Sondrestrom FIC asked the commander if he would declare an emergency in order to have priority to climb to a higher flight level; but the commander did not reply.

Sondrestrom FIC informed Gander ATC that the flight N108GF was unable to land at BGBW and that the flight would divert to BGSF. Furthermore, that the flight was operating with minimum fuel and that the requested flight level was 280.

At 14:03:26 hrs, Gander ATC responded that FL280 was unavailable and asked Sondrestrom FIC to "stand by". [Gander ATC did not respond on the phone again until 14:04:03 hrs.].
Sondrestrom FIC continued to inform Gander ATC on the phone about the situation. Sondrestrom FIC informed Gander ATC that the flight would not be able to reach BGSF and that the flight was in an emergency situation.
At 14:04:03 hrs, Gander ATC asked Sondrestrom FIC on the phone "are you still here?" Sondrestrom FIC acknowledged and was informed by Gander ATC that they were unable to accept the flight above FL190.

Sondrestrom FIC informed Sondrestrom Rescue Co-ordination Centre (RCC) about the flight [N108GF] in distress at 14:05 hrs.

Sondrestrom FIC contacted N108GF and asked for the estimated time of arrival (ETA) overhead BGSF. The commander expressed that he would not be able to reach BGSF. However, he estimated BGSF at time 15:48 hrs. Sondrestrom suggested the commander to consider to land at Nuuk Aerodrome (BGGH) [BGGH had a 950 x 30 meters runway and was located between BGBW and BGSF]. Sondrestrom FIC asked the commander if he was able to land on a thousand meters runway. The commander informed Sondrestrom that he was unable to land on a thousand meters runway [BGGH].

Sondrestrom FIC contacted N108GF and asked if it was able to climb to FL300 after passing 63°30'N. The commander informed Sondrestrom that he would start to climb now and he "was out of FL190 climbing to FL300". The commander added that the aircraft was "picking up" a lot of ice at FL190.

Sondrestrom FIC contacted Gander ATC and informed Gander that the flight N108GF was climbing up into Gander CTA. Gander informed Sondrestrom that he was unable to issue a clearance to climb due to air traffic. The conflicting air traffic was a formation of five F16 cruising at FL270 approaching the position 61N 40W. The formation would be heading east towards Iceland. Gander informed Sondrestrom that there should not be any other conflicting air traffic on the track from BGBW to BGSF.

Sondrestrom FIC contacted N108GF again an informed the commander that he had been in contact with Gander ATC. Gander was unable to issue a clearance to climb to FL300; but if required in order to reach BGSF he could climb and maintain FL300. The commander was informed that the only air traffic in the area was at 61°N 40°W at FL270 heading for Iceland. The commander told Sondrestrom that he was climbing to FL300; but that he was not sure if he could reach BGSF.

Sondrestrom FIC made phone contact to Sondrestrom Approach at 14:15:58 hrs. The FIC informed Approach that there was a serious situation in progress concerning a P180 [N108GF] from BIKF to BGBW. The flight could not land at BGBW and was diverting to BGSF. The flight was operating on "minimum fuel" and it was climbing without clearance from Gander ATC to FL300. Sondrestrom FIC informed Sondrestrom Approach that it was possible that the flight was unable to reach BGSF and that Approach should "call out the cavalry".

At 14:20:09 hrs, N108GF informed Sondrestrom that the flight was leveling out at FL320 and that the predicted amount of landing fuel at BGSF was 61 lbs. The commander added that he considered climbing to FL340.

The commander [N108GF] informed Sondrestrom FIC that he was descending [from FL320] to FL300 and that he had stopped one engine. Sondrestrom acknowledged and asked the commander for a revised ETA for BGSF. The commander replied that he was estimating BGSF in 57 minutes and added if he could reach the aerodrome. The estimated landing fuel was at that time 100 lbs.

N108GF contacted Sondrestrom FIC. The commander expressed his doubt about being able to reach BGSF. The predicted landing fuel was 30 lbs. The commander informed Sondrestrom that with a rate of descent of 400 ft. pr. minute he should be able to make it but he was not sure that there was enough fuel to land the aircraft. Sondrestrom asked what the remaining distance was to BGSF and the commander replied 173 NM and according to the Flight Management System (FMS) the ETA was in 48 minutes.

N108GF made radio contact with Sondrestrom Approach at 15:21:20 hrs. The commander informed Approach that he only had 115 lbs. fuel left and that he was not sure if he was able to reach BGSF. He informed Approach that he was 88 NM from BGSF and he was passing 13.900 ft. in a slow descent [shallow descent].

Approach asked the commander to inform him if he was going to make a landing in the terrain as he needed the information for the helicopter search and rescue operation (SAR). The commander replied that he was going to land in the terrain. He informed Approach that he only had 92 lbs. remaining fuel and that the aircraft barely could maintain 9,000 ft.

At 15:29:10 hrs, the SAR helicopter OY-HGW [AS 350 B3] asked Sondrestrom Tower for a startup clearance from the apron.

At 15:31:28 hrs, a Dash 7 operating on a scheduled flight made radio contact with Sondrestrom Approach and was instructed to maintain radio silence and to continue the flight at FL170. The Dash 7 crew informed Approach that their flight was close to the flight in distress. Approach then informed the Dash 7 flight crew that the last known position of N108GF was 65° 55'N 49° 30'W and that the flight in distress was at 8,000 ft. descending.

At 15:32:26 hrs, Approach called N108GF. The commander replied but the controller was only able to hear a broken transmission. The altitude was reported to be 6,700 ft. and the distance to BGSF was 62 NM. The rest of the transmission was unreadable. Approach informed N108GF that they were losing radio contact but there was a Dash 7 in the area that could relay the radio communication. Approach then asked the Dash 7 crew to get an update on the position of N108GF. The Dash 7 crew asked N108GF of the present position - if time permitted. The Dash 7 crew informed Approach that N108GF was 60 NM from BGSF at an altitude of 6,200 ft.

At 15:35:49 hrs, Sondrestrom Approach asked the Dash 7 crew to The Dash 7 crew relayed the request to the flight in distress.

The Dash 7 crew informed Approach that N108GF reported its position as 66N 49W and that there was no time to activate the ELT. The commander reported that he was landing at that position.

The precautionary landing on the icecap

N108GF made an approach and landing on the icecap with the left engine stopped and the left propeller feathered. The right engine was running and producing power. The landing gear was in the retracted position and the flaps were in middle position. The commander was hampered by the white surface on the icecap making the flare and landing difficult. At the contact with the terrain, numerous pieces separated from the aircraft. The accident occurred at 15:40 hrs. under VMC and in daylight.

The search and rescue

At 16:40 hrs, the SAR commander reported that the accident aircraft [N108GF] was located at the position 66 08N 49 55W. At the same time, the SAR commander received the latest weather information: Poor weather was moving into the area with rain and snow and the visibility would drop.

The SAR helicopter landed 30 meters from the accident site at 16:50 hrs. The police officer, the nurse, and the firefighter continued on foot to the wreckage and found the commander [N108GF] alive inside the cockpit/cabin section. The rescue team opened the cabin door and the commander could leave the cabin.

The SAR helicopter was airborne at approximately 17:15 hrs. and the SAR commander managed to avoid the poor weather that was moving into the area.

The SAR helicopter landed at BGSF at 17:59 hrs.

1.2 Injuries to persons

Injuries	Crew	Passengers	Other
Fatal			
Serious			
Minor/None	1		

1.3 Damage to aircraft (see Appendix 5.12)

The aircraft was destroyed.

1.4 Other damage

There was no other damage.

1.5 Personnel information

1.5.1 Licenses and ratings

The commander was a 42 years male. The commander was carrying an US ATP license. The license was issued by FAA 25 April 2007. The instrument rating was issued September 1998. The last medical examination was on September 2009 and the medical license was a class one license.

1.5.2 Flight experience – the commander

	Last 24 hours	Last 90 days	Total
All types	Unknown	Unknown	Unknown
This type	9.5	96	105.5
Landings this type	Unknown	Unknown	Unknown

1.6 Aircraft information (see Appendix 5.6)

1.6.1 General aircraft information

Registration:	N108GF
Type:	Piaggio
Model:	P.180 Avanti
Manufacturer:	Piaggio Aero Industries SpA, Italy
Serial number:	1086
Year of manufacture:	2004

Engine manufacturer:	P & W Canada
Engine type:	Two PT6A-66
Propellers:	Two variable pitch, Hartzell five blades propeller
Aircraft total flight hours:	1035:50 hrs.
Aircraft total flight cycles:	716 cycles
MTOM:	12,100 lbs.
BOW:	8,400 lbs.
BI:	Unknown
Certificate of airworthiness:	Issued 09.04.2008
Minimum Navigation Performance Specification (MNPS):	Not Approved
Reduced Vertical Separation Minima (RVSM):	Approved

The Piaggio P.180 Avanti was a light business aircraft with canards and two wing mounted turboprop engines in a push configuration. The minimum numbers of crew was one pilot seated in the left seat. The maximum persons on board were 11 persons including the crew.

1.6.2 Fuel

1.6.2.1 Fuel System

From aircraft Manufacture Serial Number 1036 and later the total fuel capacity was 1597 L (421.9 US Gallons) and the total usable fuel capacity was 1583 L (418.2 US Gallons).
Each engine was fed by its own fuel system consisting of four interconnected tanks. The left and right fuel systems were independent except during the pressure refueling operations. A cross feed valve between the left and right fuel systems was controlled through the rotary knob in the cockpit. The cross feed valve should always be maintained in OFF position except during the single engine operations and/or fuel balancing.

1.6.2.2 Refueling

Before the accident flight, the aircraft was refueled at BIKF with a total of 240 US Gallons Jet A1. The temperature of the uplifted fuel was 8° C. According to the fueling personnel, the aircraft fuel tanks were refueled using the "refuel panel & single-point pressure refueling". [The refueling system indicated full after the refueling.]
According to the commander the FOB after the refueling was 2860 lbs.

1.6.3 Flight Management System (FMS)

1.6.3.1 The aircraft was equipped with a Universal Flight Management System.

The control display unit (MCDU) model was a UNS 1, 4” FPCDU, P/N 1117-11 and S/N 3738.

Input to the FMS
FMS received information from e.g.:

- NDB (Selected by the pilot)
- VOR (Selected by the pilot)
- DME (Selected by the pilot)
- ILS (Selected by the pilot)

- GPS (Automatic time and position)
- Operational Flight Plan (OFP) (Manually entered by the pilot)
- Fuel On Board (FOB) (Manually entered by the pilot)
- Fuel Flow (FF) (Manually entered by the pilot)
- Navigation database (Input by data loading)

Output from the FMS
FMS could display different pages selected by the pilot using the MCDU:

- E.g. the route, inserted by the pilot, with way points and the associated ETO or ATO.
- E.g. the route inserted by the pilot, with way points and estimated remaining FOB overhead the way points as well as the estimated remaining fuel overhead the destination aerodrome.

1.6.3.2 The aircraft Navigation Database was a world wide database. The capacity of the memory in the FMS system was limited. The operator had chosen the Navigation Database "package" including only aerodromes with a runway length of minimum 4,000 feet (1,219 meters). The only aerodromes in Greenland with a runway length of 4,000 feet or more were: Narsarsuaq (BGBW), Kangerlussuaq (BGSF) and Thule Air Force Base (BGTL).

1.6.4 Flight Planning

1.6.4.1 There was not recovered any Operational Flight Plan (OFP) or any Mass and Balance calculation at the accident site. No copies were available after the accident.

1.6.4.2 Before the flight, the commander was using an Electronic Flight Bag (EFB) to create the OFP and the ATS flight plan (FPL). The meteorological information was retrieved from Universal Weather database. The database supplied actual wind information as well as the weather information. The EFB was not used during the flight.

1.6.5 Technical status

There were no technical remarks or notes in the aircraft log book. No technical issues were reported during the flight from BIKF towards BGSF.

1.7 Meteorological information (see Appendix 5.7)

1.7.1 General

A deep low pressure area (969 hPa) was moving from the Labrador Strait towards the Southeast of Greenland. The warm and cold fronts were moving up towards the Denmark Strait. The humid air mass at the southern part of Greenland resulted in precipitation both as rain and as rain/snow.

1.7.2 En route weather from BIKF towards the planned destination aerodrome, BGBW

At first, the flight from BIKF towards BGBW was in frontier clouds with a top at FL200. The zero degree was at FL080. From FL080 to FL200, there was a possibility of light to moderate icing. At the western part of Denmark Strait, the flight passed the cold front and was in clear weather with cumulus clouds with a top around FL070-FL100. When the flight approached the coastline the flight entered solid clouds with at top

of FL240 stretching down to 3000-5000 feet MSL. From FL160 to 4000 feet, there was a possibility of moderate icing. Below FL120 moderate topographic turbulence could be expected. The en route winds and temperature were:

Flight Level	Wind direction	Wind velocity	Average velocity	Temperature
FL300	200°-220°	60-150 kts	120 kts	-42°C dropping to -48°C
FL240	200°-220°	50-130 kts	100 kts	-28°C dropping to -42°C

1.7.3 En route weather from BGBW towards the destination alternate aerodrome, BGSF

The flight from BGBW area towards BGSF was most of the time in frontier clouds. The zero degree was at 3000 feet dropping to MSL. From FL140 down to MSL, there was a possibility of light to moderate icing. Below FL120, moderate topographic turbulence should be expected. The en route winds and temperature were:

Flight Level	Wind direction	Wind velocity	Temperature
FL300	200°	30 kts	-48°C to -53°C
FL240	200°	25 kts	-43°C
FL180	200°	20 kts	-30°C

1.7.4 The weather reports at the planned destination, Narsarsuaq (BGBW)

```
161000 TAF-FC bgbw 161018z 1610/1619 24010kt 9999 sct030 bkn055 becmg
1610/1612 8000 -rasn bkn035 tempo 1612/1619 2800 snra sct009 bkn012=


160950 METAR bgbw 160950z 22008kt 120v260 9999 ovc055 07/m00 q0988 rmk 8sc=
161050 METAR bgbw 161050z 24007kt 9999 sct030 ovc055 06/m00 q0989 rmk 3sc
8sc=
161150 METAR bgbw 161150z 24002kt 9999 sct030 ovc055 07/m00 q0991 rmk 3sc
8sc=
161250 METAR bgbw 161250z 23014kt 9999 -ra bkn030 ovc050 04/02 q0993 rmk
5sc 8sc=
161350 METAR bgbw 161350z 33002kt 9999 -ra ovc030 05/02 q0994 rmk 8sc=
161450 METAR bgbw 161450z vrb04kt 9999 -ra sct013 ovc034 05/03 q0995 rmk
4sc 8sc=
161529 SPECI bgbw 161529z 21016kt 180v250 9999 -ra sct018 ovc031 04/01
q0996 rmk 3sc 8sc=
```

1.7.5 The weather reports at the destination alternate, Kangerlussuaq (BGSF)

```
160500 TAF-FT bgsf 160500z 1606/1706 08012kt 9999 sct100 tempo 1606/1610
15020g30kt becmg 1616/1618 26012kt bkn040 tempo 1618/1623 7000 -rasn sct015
bkn024 tempo 1623/1706 2800 sn bkn014=


160950 METAR bgsf 160950z 26007kt 200v300 9999 sct090 02/m02 q0984=
161050 METAR bgsf 161050z 28008kt 9999 bkn090 02/m02 q0985=
161150 METAR bgsf 161150z 25009kt 9999 bkn090 02/m02 q0986=
161250 METAR bgsf 161250z 27009kt 9999 bkn100 03/m02 q0987=
161350 METAR bgsf 161350z 28010kt 9999 sct070 bkn100 03/m01 q0988=
161450 METAR bgsf 161450z 28010kt 9999 sct070 bkn100 03/m01 q0990=
161550 METAR bgsf 161550z 26006kt 9999 sct030 bkn045 03/m00 q0991=
```

1.7.6 The weather reports at Nuuk (BGGH)

```
160800 TAF-FC bggh 160820z 1608/1617 18010kt 9999 bkn060 becmg 1612/1614
25010kt vcsh bkn020 tempo 1614/1617 28015kt 4000 -shsnra sct009 bkn012=
160900 TAF-FC bggh 160900z 1609/1618 18010kt 9999 bkn060 becmg
1612/161425010kt vcsh bkn020 tempo 1614/1617 28015kt 4000 -shsnra sct009
bkn012=
160900 TAF-FC AMD bggh 161100z 1611/1618 20010kt 9999 bkn015 bkn060 tempo
1611/1614 bkn014 becmg 1612/1614 25010kt vcsh tempo 1614/1617 28015kt 4000
-shsnra sct009 bkn012=
161200 TAF-FC bggh 161200z 1612/1621 20010kt 9999 bkn015 bkn060 tempo
1612/1614 bkn014 becmg 1612/1614 25010kt vcsh tempo 1614/1618 28015kt 4000
-shsnra sct009 bkn012 tempo 1618/1621 28015kt 4000 -shsn sct009 bkn012=
161200 TAF-FC AMD bggh 161430z 1614/1621 20010kt 8000 -sn sct008 bkn020
tempo 1614/1621 1200 sn bkn008=
161500 TAF-FC bggh 161500z 1615/1623 19010kt 8000 -sn sct008 bkn020 tempo
1615/1623 28015kt 1000 sn vv004=

160850 METAR bggh 160850z 16007kt 9999 bkn068 03/m01 q0983=
160950 METAR bggh 160950z 19004kt 9999 bkn068 02/m01 q0984=
161050 METAR bggh 161050z 20008kt 9999 bkn014 bkn068 02/m00 q0986=
161150 METAR bggh 161150z 26004kt 220v290 9999 bkn018 03/01 q0987=
161250 METAR bggh 161250z 18011kt 9999 few008 sct022 bkn040 02/01 q0989=
161350 METAR bggh 161350z 19011kt 9999 few008 ovc040 02/m01 q0990=
161405 SPECI bggh 161405z 19012kt 4000 -sn sct008 ovc020 02/m00 q0991=
161422 SPECI bggh 161422z 19010kt 2000 -sn ovc010 01/m00 q0991=
161447 SPECI bggh 161447z 18009kt 1300 sn vv006 00/m00 q0992=
161450 METAR bggh 161450z 18008kt 1300 sn vv006 00/m00 q0992=
161550 METAR bggh 161550z 18007kt 1200 sn vv010 00/m00 q0993=
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1.7.4 There was no record indicating that the commander had received a meteorological briefing before departure from BIKF.

1.8 Aids to navigation

1.8.1 The primary means of navigation was the FMS.

1.8.2 The instrument approach procedure at BGBW was the NDB + DME 07. The procedure was based on the NDB NA 359 KHz and the DME NQ CH 55y (111.850 MHz). Both aids were available at the time of the approach (see Appendix 5.10.3).

1.8.3 The instrument approach procedure at BGSF was a LLZ / DME + MKR 09. The procedure was based on the NDB SF 382 KHz, the LLZ ISF 109.550 MHz, and the DME ISF CH 32y and the MKR. All the aids were available at the time of the flight (see Appendix 5.10.5).

1.8.4 There was no ACC radar service available over Greenland on the route from BGBW towards BGSF. There was a Secondary Surveillance Radar System (SSR) at BGSF. The system was available at the time of the flight. The SSR system required that the aircraft transponder system was operating in order to be visible to the SSR.

1.9 Communication

1.9.1 General

The commander on N108GF was in radio contact with ATS units in Iceland, Canada, and in Greenland.

1.9.2 Gander, Canada

The Danish AIB received transcript of the radio communication between N108GF, other aircraft and Gander Radio and phone communications between Gander ATC, Gander Radio and Sondrestrom FIC. The transcript was useful to the investigation.

1.9.3 Reykjavik, Iceland

The Danish AIB received copies of the radio communication between N108GF, other aircraft and Keflavik Tower and Approach. There was no time reference on the recordings. The copies of the communications were of good quality and useful to the investigation. The communication between N108GF and Reykjavik ACC was not available to this investigation.

1.9.4 Kangerlussuaq, Greenland

The Danish AIB received copies of the radio communication between N108GF, other aircraft and Sondrestrom FIC and Sondrestrom Approach and phone communications between Gander ATC, Reykjavik ATC, Narsarsuaq AFIS, Sondrestrom Approach and Sondrestrom FIC. The time reference used on the recordings was UTC. The copies of the communications were of good quality and useful to the investigation.

1.9.5 Narsarsuaq, Greenland (see Appendix 5.9)

The Danish AIB received copies of the radio communication between N108GF and Narsarsuaq AFIS and phone communications between Narsarsuaq AFIS and Sondrestrom FIC. The time reference used on the recordings was UTC minus one hour. The copies of the communications were of good quality and useful to the investigation.

1.9.5.1 The Danish AIB faced some difficulties in obtaining the recorded radio communication data from BGBW AFIS. The Greenland Airport Authority (GAA) had the responsibility of the recording system under their jurisdiction and was requested to provide the communication data after the accident. Unfortunately GAA discovered that their replay system was malfunctioning and the process halted until 11-11-2010.

1.10 Aerodrome information

1.10.1 The planned destination aerodrome, Narsarsuaq (BGBW)

Narsarsuaq was located in an area with fjords and mountains. The runway surface was asphalt with the dimension 1830 x 45 meters. Aerodrome Elevation was 112 ft. The lowest published OCA(H) for NDB+DME runway 07 was 1500(1490) ft. (see Appendix 5.10.3).

The destination aerodrome, BGBW had no RNAV (GPS) approach procedure available.

1.10.2 The planned destination alternate aerodrome, Kangerlussuaq (BGSF)

Kangerlussuaq was located in an area with fjords and mountains. The runway surface was asphalt with the dimension 2810 x 60 meters. Aerodrome Elevation was 165 ft. The lowest published OCA(H) for LLZ/DME+MKR runway 09 was 450(350) ft. (see Appendix 5.10.5).

1.10.3 Nuuk aerodrome (BGGH)

Nuuk was located in an area with fjords and mountains. The runway surface was asphalt with the dimension 950 x 30 meters. Aerodrome Elevation was 283 ft. The lowest published OCA(H) for LLZ/DME runway 23 was 630(350) ft. (see Appendix 5.10.4).

1.11 Flight recorders

Not required and none installed.

1.12 Wreckage and impact information (see Appendix 5.12)

1.12.1 General

The onsite investigation was focused on the aircraft fuel system. During the flight the amount of fuel became critical and the commander decided to make a precautionary landing on the icecap. There were no technical malfunctions reported or suspected. It was not feasible to get lifting equipment brought to the accident site on the Greenlandic icecap.

1.12.2 The accident site

The accident site was located on the Greenlandic icecap 56 NM south-southeast of BGSF at the position 66° 08'N 049° 55'W. The elevation was approximately 3,500 ft. The icecap was covered with white snow. The surface was rugged and bumpy with a variation of approximately +/- one meter. There were no crevasses in the icecap at the accident site. The area was surrounded by mountains.

1.12.3 The wreckage

The aircraft was broken up into three major sections and numerous minor pieces. The major sections were the cockpit/cabin section, the wing/engine section and the tail section. The cockpit/cabin section was found approximately 50 meters from first impact. The wing/engine section was found approximately 40 meters from first impact. The tail section was found approximately 20 meters from first impact. There were numerous minor pieces from the aircraft at the accident site. Most of these were located along the track from first impact to the cockpit/cabin section.

The cockpit/cabin section

The cockpit/cabin section had been sliding on the icecap until it impacted a one meter high ice formation. After the impact, the cockpit/cabin section turned over the nose and ended up in the opposite direction of the track banking approximately 60° to the left.

The cockpit/cabin section was torn open where the wing/engine section had been attached to the cockpit/cabin section. The cockpit/cabin section was almost intact on the inside but it was substantially damaged on the outside. Inside the cabin section some of the passenger service units were damaged and

hang loose from the ceiling. The onboard toilet was broken up and the toilet fluid had left the toilet system.
The cabin door located at the left forward part of the cabin could be operated.
The landing gear was found retracted.
The canards were torn off the cockpit/cabin section.

The wing/engine section
The wing/engine section was found upside down and pointing in the opposite direction of the track.
The wing/engine section was torn open where the cockpit/cabin section and where the tail section had been attached. The left wing was substantially damaged. The right wing was destroyed. The outer part of the right wing – which was a part of the right wing fuel tank – was separated from the rest of the wing approximately one meter from the right engine. The remaining inner right wing tank next to the fuselage was opened and examined. The tank was found empty and dry.
The left wing tank – which was almost intact – was opened and examined in two different areas. The tank was found empty and dry.
It was not possible to examine neither the integral fuselage tanks nor the fuselage collector tanks, due to lack of lifting equipment at the accident site.
The flaps were found in "MID" position.
Both propellers were damaged. The left propeller suffered minor damage. The left propeller was found feathered and showed no signs of rotation.
The right propeller was destroyed. All the right propeller blades were sheared off at the middle and showed signs of high power. All of the outer halves of the blades were missing and they were never found.
The engines could not be inspected for damage. An investigation of the engine was not possible due to lack of lifting equipment.

The tail section
The tail section was found upside down.
The tail section was torn open where it had been attached to the wing/engine section. The tail section was destroyed.

Minor debris were scattered from first contact with the surface to the point where the cockpit/cabin section came to rest.

The following settings were found in the cockpit:

- Gear UP
- Flaps MID
- Throttle LH MAX PWR
- Throttle RH MAX PWR
- Propeller LH CUT OFF
- Propeller RH MAX RPM
- L start ON
- R start ON
- L IGN NORMAL
- R IGN NORMAL

• L F/W valve	CLOSED	
• L pump main	OFF	
• Cross feed	ON	
• R F/W valve	CLOSED	
• R pump main	OFF	
• LH ALT	1013	3560 ft.
• RH ALT	?	?580 ft.
• Air speed LH	90	
• Air speed RH	0	
• COM 1	ON	FRQ no indication
• COM 2	OFF	
• NAV 1	ON	FRQ no indication
• NAV 2	OFF	
• ADF	OFF	
• ATC TX	ALT	CODE no indication

1.13 Medical and pathological information

None

1.14 Fire

There was no fire.

1.15 Survival aspects

The accident was survivable.

1.15.1 The cockpit and passenger cabin

The cockpit/cabin section was severely damaged on the outside; but on the inside only minor damaged was observed in the cockpit and the forward part of the passenger cabin. The cockpit and the forward passenger cabin structure remained almost intact during the accident. The aft part of the passenger cabin was separated from the wing/engine section and did not remain intact.

1.15.2 The restrain

The commander was the only person on board the aircraft. He was seated in the left cockpit seat. During the landing the commander was using his seatbelts. The type of seatbelt was the “H” type. The seat and the seatbelt remained intact during the accident and the commander was able to release the seatbelt and leave the cockpit following the accident.

1.15.3 The environment

There were no post-accident fire and no post chemical exposure to the commander. After the aircraft came to rest it was banking approximately 60° to the left making the cabin door difficult but possible to exit. The

door was opened during the rescue operation. There was no major debris in the cabin section. Some of the Passenger Service Units were loosened during the accident; but they did not prevent the commander from moving around in the cabin.

1.15.4 The acceleration

The aircraft landing speed could not be determined as no flight data recorder data was available. Assuming that the ground speed at the first impact with the icecap was 110 kt (56.6 m/s) and the distance from that point to where the cockpit/cabin section came to rest was 50 meters, the time traveled would be approximately 1.77 seconds. The average acceleration on the path was approximately -3.26 G; however intermediate accelerations would have been considerately more negative for short periods of time. The acceleration in the two other axes would have been oscillating as the aircraft was sliding on the rough surface.

1.15.5 The post-accident

The post-accident was survivable.

The accident site was on the Greenlandic icecap where the weather changes rapidly in October. The accident site was only accessible by helicopter. A helicopter rescue operation was dependent of the terrain at the site, the distance from the base of the operation to the site, and the weather and light conditions. Furthermore a helicopter rescue operation would be depending on the availability of suitable equipment and crew.

The accident was survivable to the point just after the accident. The commander was conscious and had only suffered minor injuries; but he was affected by the accident. The ELT was not activated before the accident, it did not activate during the accident and it was not activated after the accident. The elevation at the accident site was approximately 3,500 ft. The weather observations at BGSF (56 NM to the North had an elevation 165 ft.) indicated: at 15:50 hrs. wind speed 6 kt, temperature +3° C; at 16:12 hrs. wind speed 7 kt, rain, temperature +3° C; at 16:16 hrs. wind speed 7 kt, drizzle, temperature +2° C; at 16:47 hrs. wind speed 9 kt, snow, temperature +2° C; at 16:50 hrs. wind speed 9 kt, snow, temperature +2° C; at 17:00 hrs. wind speed 9 kt, snow and rain, temperature +1° C; at 17:13 hrs. wind speed 7 kt, rain, temperature +1° C; at 17:50 hrs. wind speed 9 kt, rain, temperature +1° C.

The temperature, wind speed, and precipitations at the accident site was not recorded; however it could be assumed that the temperature would have been approximately 7° C less than the observed temperature at BGSF.

The assumed temperature and wind speed could be computed to an equivalent still air temperature using the wind chill factor. The equivalent still air temperature outside the cockpit/cabin section would have been approximately -11° C.

There was no arctic survival equipment on board the aircraft. The only protection against the freezing temperature was the commander's own clothing and seeking protection from the outside environments. The commander stayed inside the cabin; thereby he reduced the effect of the wind chill factor and he avoided the precipitations.

The preparation for the search and rescue operation started when Sondrestrom FIC informed Sondrestrom Approach about the flight in distress at 14:15:58 hrs. At time 15:28:42 hrs, the commander reported that he

was going to land in the terrain. The SAR helicopter was ready and asked for startup at time 15:29:10 hrs. The SAR operation was hampered by the poor weather conditions. Consequently the helicopter had to navigate around the bad weather. The SAR commander located the accident aircraft at 16:40 hrs. and returned to BGSF with the commander of N108GF at 17:59 hrs. The post-accident was survivable as the commander did not suffer serious injuries and the commander was not exposed to the freezing temperatures for more than one hour and 42 minutes (from 15:40 hrs. to 17:22 hrs.).

1.16 Tests and research

None

1.17 Organizational and management information

1.17.1 The operator

The aircraft was operated by an operator located in Kuwait. The operator had two P-180 aircraft in charter operation. The accident flight was operated under FAR Part 91 (see Appendix 5.17).

1.17.2 The airspace

The airspace over Greenland was within Sondrestrom FIR UNL / GND airspace class G. The airspace over Greenland and that part of the North Atlantic airspace was under ATC control above FL195. This area above FL195 was divided into two airspaces; The Gander Oceanic CTA UNL / FL195 airspace class A and Reykjavik CTA UNL / FL195 airspace class A (see Appendix 5.10.1). The Gander ATC was located in Canada and the Reykjavik ATC was located in Iceland. The Sondrestrom Flight Information Centre was not an Air Traffic Control unit; but a Flight Information Service unit. Sondrestrom FIC area of operation was Sondrestrom FIR. Sondrestrom FIC was located in Greenland.

1.17.3 Separation between aircraft

There was no ACC radar service available over Greenland or over the western part of the Denmark Strait. The separation between aircraft was achieved by assigning the aircraft different flight levels (vertical separation) or keeping the aircraft separated by a distance (longitudinal separation).

The vertical separation minima between IFR air traffic were 1,000 ft from GND to FL410 (Reduced Vertical Separation Minima) and 2,000 ft above FL410. The vertical separation was achieved by clearing the aircraft different flight levels.

The longitudinal separation was in general achieved by clearing the aircraft on a route defined by specific waypoints e.g. N64W30, N62W40, NA and assigning the aircraft a specific airspeed e.g. Mach .63 (Mach Number Technique). The longitudinal separation was not defined in NM but with time between aircraft. When using the Mach Number Technique the minimum time between aircraft could be from 10 minutes down to 5 minutes depending on the speed of the individual aircraft.

1.17.4 The North Atlantic Minimum Navigation Performance Specifications Airspace

The airspace above FL285 in Sondrestrom FIR was within the North Atlantic Minimum Navigation Performance Specifications Airspace (NAT MNPS Airspace). The vertical dimension of the NAT MNPS Airspace was between FL285 and FL420 (i.e. in terms of normally used cruising levels, from FL290 to FL410 included). Aircraft must not fly across the North Atlantic within MNPS Airspace, nor at flight levels 290 to 410 included anywhere within the NAT Region, unless they are in possession of the appropriate Approval(s) issued by the State of Registry or the State of the Operator.

For the most part in the North Atlantic, Direct Controller Pilot Communications (DCPC) and Radar Surveillance are unavailable. Aircraft separation assurance and hence safety are nevertheless ensured by demanding high standards of horizontal and vertical navigation performance/accuracy and of operating discipline. Within NAT MNPS Airspace a formal Approval Process by the State of Registry of the aircraft or the State of the Operator ensures that aircraft meet defined MNPS Standards and that appropriate crew procedures and training have been adopted.

1.17.5 Regulation for Civil Aviation (BL) within Denmark, Faeroe Islands and Greenland

The Danish Public Transport Authority [the former Danish Civil Aviation Administration] had issued BL's concerning the establishment of radio communication and recording of radio communication. Some of these BL's are; BL 3-42, BL 7-21, BL 7-22 and BL 7-23. Not all of the BL's are translated into English.

The BL 7-23 Para 7.2:

"The license holder shall always allow the Civil Aviation Administration – Denmark and the Danish Aircraft Accident Investigation Board access to the recorded material when requested by the authority in question".

None of the above BL's describes a reasonable time limit from the time of the request of useful data to the time of availability of data for the investigation.

1.18 Additional information

1.18.1 ADS-B network

An Automatic Dependent Surveillance-Broadcast (ADS-B) network covering the North Atlantic airspace between Iceland, Greenland and Canada are under development and test. The system is a satellite and ground based system with ground stations located in Faroe Island, Iceland, Greenland and Canada. The ADS-B network should, when becoming operational, be able to display the air traffic to the air traffic controllers with a small tolerance and with a fast update. The ADS-B network should in time result in reduction of the required lateral separation minima between aircraft operating over the North Atlantic, and thereby increase the air traffic capacity of the North Atlantic airspace. The benefit for the operators' [airlines] should be increased safety and reduced fuel and time consummation.

1.18.2 The geography of Greenland

Greenland is the largest island in the World. It covers 2,175,600 KM^2 or the area of Sweden, Germany, France, Spain, and Great Brittan together or more than three times the size of Texas. The icecap covers approximately 85% of Greenland.

The distance between aerodromes with long runways in Greenland was considerable. There were only three aerodromes with 4,000 feet (1,219 meters) or longer runways. To the northwest was Thule Air Force Base

(BGTL), to the west was Kangerlussuaq (BGSF) and to the south was Narsarsuaq (BGBW). The distance between the aerodromes was:

Great Circle Distance	BGSF	BGBW
BGTL	660 NM	1038 NM
BGSF		378 NM

The 14 aerodromes in Greenland were as follows:

Name	ICAO	Runway length	Runway surface
Ilulissat	BGJN	845 meters	Asphalt
Kangerlussuaq	BGSF	2810 meters	Asphalt
Kulusuk	BGKK	1199 meters	Gravel
Maniitsoq	BGMQ	799 meters	Asphalt
Narsarsuaq	BGBW	1830 meters	Asphalt
Nerlerit Inaat	BGCO	1000 meters	Gravel
Nuuk	BGGH	950 meters	Asphalt
Paamiut	BGPT	799 meters	Asphalt
Qaanaaq	BGQQ	900 meters	Gravel
Sisimiut	BGSS	799 meters	Asphalt
Thule USAF	BGTL	3047 meters	Asphalt
Upernavik	BGUK	799 meters	Asphalt
Uummannaq	BGUQ	900 meters	Gravel
Aasiaat	BGAA	799 meters	Asphalt

There was no instrument precision approach system (e.g. ILS) available at any of the civil aerodromes in Greenland.

1.19 Useful or effective investigation techniques

None

2. Analysis

2.1 The ATS Flight Plan

The ATS Flight Plan (FPL) destination aerodrome was Narsarsuaq (BGBW) and the destination alternate aerodrome was Kangerlussuaq (BGSF). The Estimated Time of Departure (ETD) was 11:00 hrs. The flight time (EET) from BIKF to BGBW was one hour and 59 minutes (see Appendix 5.1.2).

The flight did require an destination alternate aerodrome in accordance with FAR Part 91 because the weather forecast indicated that the visibility at the destination aerodrome could be less than 3 statute miles (4.8 KM) at the Estimated Time of Arrival (ETA) +/- one hour (see Appendix 5.17). The destination alternate aerodrome, BGSF was suitable as an alternate aerodrome. The ATS FPL reflected a reasonable flight planning.

The Supplementary Flight Plan (SPL) stated that the Endurance (E) was two hours and 44 minutes (see Appendix 5.1.2).

The two hours and 44 minutes endurance appeared to be the EET of one hour and 59 minutes plus 45 minutes of final reserve (holding). The actual endurance before take-off was more than two hour and 44 minutes. The ATS SPL did not reflect a reasonable planning. The FPL and the SPL did not have any influence on the events leading up to the accident and it did not have any influence on the succeeding Search and Rescue operation.

2.2 ACC radar service

There was no ACC radar service available over Greenland or over the western part of the Denmark Strait. The separation between aircraft was achieved by assigning the aircraft different flight levels (vertical separation) or keeping the aircraft separated by a distance (longitudinal separation). The vertical separation minima between IFR air traffic were 1,000 ft from GND to FL410 and 2,000 ft above FL410 (Reduced Vertical Separation Minima).

The longitudinal separation was in general achieved by clearing the aircraft on a route defined by specific waypoints e.g. N62W40 and assigning the aircraft a specific airspeed e.g. Mach .63 (Mach Number Technique). The longitudinal separation was not defined in NM but in time between aircraft. When using the Mach Number Technique the minimum time between aircraft could be from 10 minutes down to 5 minutes depending on the speed of the individual aircraft.

Aircraft cruising at a speed of e.g. 480 kts would require a minimum separation between aircraft from 80 NM to 40 NM. Compared with the longitudinal radar separation minima of approximately 5 NM over most countries, the separation minima over Greenland was considerable larger. The large separation minima compared with small separation minima will in general reduce the air traffic capacity of that airspace. The reduced air traffic capacity within the NAT MNPS Airspace with a high air traffic demand could result in delays, aircraft not operating at the optimum route, aircraft not operating at the optimum flight level or not operating at the optimum air speed. All of which would result in additional fuel consumption. The lack of radar service over Greenland resulted in N108GF was not cleared to fly at the optimum route, at the optimum flight level or at the optimum air speed.

Pilots operating in the North Atlantic Airspace should consider the possibility of not being able to fly at the optimum route, at the optimum flight level or at the optimum air speed and they should continuously monitor the deviation from the current planning. Should the current planning no longer fulfill the requirements a re-planning fulfilling the requirements must be made and appropriate action taken.

2.3 The NAT MNPS Airspace

The airspace above FL285 in Sondrestrom FIR was within the North Atlantic Minimum Navigation Performance Specifications Airspace (NAT MNPS Airspace). The vertical dimension of the NAT MNPS Airspace was between FL285 and FL420 (i.e. in terms of normally used cruising levels, from FL290 to FL410 included). Aircraft must not fly across the North Atlantic within MNPS Airspace, nor at flight levels 290 to 410 included anywhere within the NAT Region, unless they are in possession of the appropriate

Approval(s) issued by the State of Registry or the State of the Operator. The accident aircraft, N108GF was not approved to operate within the NAT MNPS Airspace.

The lack of suitable radar service in Sondrestrom FIR made the requirement of the NAT MNPS Airspace necessary.

2.4 The FOB before take-off from BIKF

The aircraft was refueled at BIKF 1030/40 hrs. with 240 US Gallons Jet A1 fuel. The temperature of the uplifted fuel was 8° C. The aircraft refueling system indicated full tanks after refueling. After refueling at BIKF, the fuel on board (FOB) was approximately 2860 lbs.

The Aircraft Manufacture stated that the maximum useable fuel capacity was 418.3 US Gallons (1583 Liters). According to the commander the FOB after refueling the aircraft at BIKF was 2860 Lbs. (1.297 Kg).

Depending on the specific gravity of the fuel the mass of the maximum fuel capacity would vary. The Jet A1 fuel is a mixture of a large number of different hydrocarbons. The specific gravity of Jet A1 fuel varies with the mixture of the hydrocarbons and the fuel temperature. The specific gravity of Jet A1 fuel could be between 0.775 Kg/Liter and 0.840 Kg/Liter.

The aircraft arrived at BIKF with approximately 1,380 lbs. of remaining cold fuel. Additionally the fuel uplifted at BIKF had a temperature of 8 °C. After the refueling to the maximum fuel capacity of 418.3 US Gallons and if the FOB actually was 2860 lbs.; the specific gravity would have been approximately 0.819 Kg/Liter which cannot be excluded.

Before departure from BIKF, the FOB was sufficient for:

- taxi and take-off from BIKF
- climb to FL280
- cruise at FL280 using **Maximum Range Power 1800 RPM** in ISA temperature conditions
- descent and approach at the destination aerodrome BGBW
- perform a go-around
- climb to FL280
- cruise at FL280 using Maximum Range Power 1800 RPM in ISA temperature conditions
- and arrive overhead BGSF with a final fuel reserve (holding) of approximately 40 minutes of flight.

Before Take-off from BIKF, the final fuel reserve (holding) was approximately 40 minutes of flight if the flight was operated at FL280 using **Maximum Range Power 1800 RPM** in ISA temperature conditions (see Appendix 5.1.3).

OR

Before departure from BIKF, the FOB was sufficient for:

- taxi and take-off from BIKF
- climb to FL280
- cruise at FL280 using **Recommended Cruise Power 1800 RPM** in ISA temperature conditions
- descent and approach at the destination aerodrome BGBW
- perform a go-around
- climb to FL280
- cruise at FL280 using Recommended Cruise Power 1800 RPM in ISA temperature conditions
- and arrive overhead BGSF with a final fuel reserve (holding) of approximately 11 minutes of flight.

Before Take-off from BIKF, the final fuel reserve (holding) was approximately 11 minutes of flight if the flight was operated at FL280 using **Recommended Cruise Power 1800 RPM** in ISA temperature conditions (see Appendix 5.1.3).

OR

Before departure from BIKF, the FOB was sufficient for:

- taxi and take-off from BIKF
- climb to FL200
- cruise at FL200 using **Recommended Cruise Power 1800 RPM** in ISA temperature conditions
- descent and approach at the destination aerodrome BGBW
- perform a go-around
- climb to FL200
- cruise at FL200 using Recommended Cruise Power 1800 RPM in ISA temperature conditions
- and arrive overhead BGSF with a final fuel reserve (holding) of approximately zero minutes of flight.

Before Take-off from BIKF, the final fuel reserve (holding) was approximately zero minutes of flight if the flight was operated at FL200 using **Recommended Cruise Power 1800 RPM** in ISA temperature conditions (see Appendix 5.1.3).

The FAR Part 91 required a final reserve (holding) of 45 minutes (see Appendix 5.17.1). Before take-off from BIKF the FOB was not sufficient to commence the flight in accordance with FAR Part 91 even if operated at FL280 using Maximum Range Power 1800 RPM (see Appendix 5.6.8).

2.5 The actual cruise method from BIKF towards BGBW

The actual cruise method used from BIKF towards BGBW was Recommended Cruise Power 1800 RPM [and not Maximum Range Power 1800 RPM] (see Appendix 5.6.7).

If the flight was planned using this cruise method at FL280, the final reserve would only be approximately 11 minutes (see Appendix 5.1.3). After the aircraft would have reached the planned Top of Climb [FL280] and started on the level flight using Recommended Cruise Power 1800 RPM, the FOB was insufficient to continue the flight to BGBW as required according to FAR Part 91.

The “Recommended Cruise Power 1800 RPM” was used because it was the routinely used cruise power setting.

2.6 The ATC altitude restriction toward the destination BGBW

At 12:50:12 hrs, the airliner at high altitude transmitted the position report received from N108GF; the flight passed 62N 040W at time 12:13 hrs, and was cruising at FL200, the estimated time overhead Narsarsuaq NDB (NA) was 13:43 hrs.

Fuel and time from BIKF to BGBW using Recommended Cruise Power (see Appendix 5.1.3).

Cruising Flight Level	Time h:m	Fuel used	Final Reserve
FL280	2:34	1874 Lbs.	0:11 / 139 Lbs.
FL200	2:29	1914 Lbs.	0:00 / 2 Lbs.

The AIB has not been able to determinate why the flight was not cleared to cruise at the filed FL280 but instead was cleared to cruise at FL200. However, the reconstructed flight planning indicated less head wind at FL200 than at FL280 decreasing the flight time from BIKF towards BGBW with five minutes but increasing the fuel used by approximately 40 Lbs. As the flight was restricted by ATC to cruise at FL200 instead of FL280 and was using Recommended Cruise Power 1800 RPM, the final reserve was decreased by approximately 11 minutes to approximately zero minutes (see the above table).

Fuel and time from BIKF to BGBW cruising at FL200 (see Appendix 5.1.3).

Cruise method	Time h:m	Fuel used	Final Reserve
Recommended Cruise Power	2:29	1914 Lbs.	0:00 / 2 Lbs.
Maximum Range Power	3:11	1826 Lbs.	0:18 / 158 Lbs.

The reconstructed flight planning indicated time and fuel used from BIKF to BGBW at FL200 using Recommended Cruise Power was 2:29 h:m and 1914 Lbs. and the time and fuel used from BIKF to BGBW using Maximum Range Power was 3:11 h:m and 1826 Lbs.

By changing the cruise method from Recommended Cruise Power to Maximum Range Power the flight could have been saving approximately 88 Lbs. of fuel enroute from BIKF to BGBW and increased the Final Reserve Fuel to 18 minutes (see the above table).

At that time the commander was not concerned about the final reserve because the flight to BGBW was only a two hours flight and as the aircraft before take-off from BIKF had fuel for more than three hours and 40 minutes of flight. The flight was operating over the North Atlantic and over Greenland where the distances between aerodromes were considerable, where there were no precision approach systems at any civil aerodromes, and where the weather conditions for long periods of time could drop below the operating minima.

The commander was not fully aware about the situation of the geographic flight environment.

The flight from BIKF toward BGBW did not fulfill the FAR Part 91 FOB requirements and no appropriate action was taken.

2.7 The flight progress

	ETO 62N40W	ATO 62N40W	ETO NA	ATO NA
ATC FPL	12:34		13:02	
Reconstructed OFP	12:44		13:14	
Actual Position Report		12:13	13:43	13:41

According to the original FPL (see Appendix 5.1.2) the estimated time overhead 62N 40W should have been approximately 12:34 hrs. and according to the reconstructed flight planning (see Appendix 5.1.3) the estimated time overhead 62N 40W should have been approximately 12:44 hrs. But according to the position report the actual time overhead 62N 40W was 12:13 hrs. The AIB has not been able to determinate the reason for these discrepancies.

According to the original FPL (see Appendix 5.1.2) the estimated time overhead NA should have been approximately 13:02 hrs. and according to the reconstructed flight planning (see Appendix 5.1.3) the estimated time overhead NA should have been approximately 13:14 hrs. But according to the position report the estimated time overhead NA was 13:43 hrs. The AIB has not been able to determinate the reason for these discrepancies.

2.8 The actual weather at BGBW

The commander (N108GF) made radio contact with Narsarsuaq AFIS at 13:21:42 hrs. The aircraft was at the time 100 NM from the aerodrome. The commander asked for a weather update. Narsarsuaq AFIS informed the commander of the present weather; the wind direction was 150° and the wind speed was 8 kts. The visibility was 10 km in light rain. The clouds were broken at 3,000 feet and overcasted at 5,000 feet. The temperature was 5° C and the Dew point was 2° C. The air pressure was 993 hPa (QNH).

The weather observation at BGBW indicated a visibility of 10 km and a cloud base at 3,000 ft (height) or more than 1,200 ft above the OCH of 1790 ft. The weather information at BGBW should not have been leading to any concern regarding a successful approach and landing.

2.9 The approach at BGBW

N108GF arrived overhead NA NDB at 13:41 hrs. and started the descent from approximately 9,000 ft in the holding pattern. After one turn in the holding pattern the flight followed the NDB + DME 07 approach procedure [base turn] down to approximately 6,000 ft before turning inbound to NA. The flight descended on the inbound leg in a tailwind condition up to of approximately 15 knots. The flight was in clouds and there was no visual contact with terrain, the sea or the runway before the Missed Approach Point (MAPt). Consequently a missed approach procedure was performed. Following the missed approach the flight diverted towards the destination alternate aerodrome, Kangerlussuaq (BGSF).

There was no instrument precision approach system available at any of the civil aerodromes in Greenland. The destination aerodrome, BGBW had no RNAV (GPS) approach procedure available.

The NDB non precision approach had a lateral tolerance larger than the precision approach e.g. the ILS approach. The tolerance of a RNAV (GPS) approach would be better than an NDB approach but not as good as an ILS approach. The RNAV (GPS) procedure does not require any ground based equipment and would therefore be suitable in areas as e.g. Greenland.

With reference to the NDB + DME 07 approach procedure (see Appendix 5.10.3) the aircraft should start the descend from 3,600 ft at DME NQ 9 NM towards the MAPt at 1,800 ft (DME NQ 4 NM). Assuming a TAS of 130 kt with a tail wind of 15 kt the time from DME 9 NM to DME 4 NM would be approximately 2:04 m:s resulting in a required rate of descent of approximately 870 feet per minute.

However; if the altitude at DME NQ 9 NM was 6,000 ft the required rate of descent would be approximately 2,032 feet per minute and the approach would not have been considered as a stabilized approach.

Due to the lack of radar data it cannot be determined what kind of descent profile the aircraft actually followed during the final approach. The flight never came below the clouds and was in IMC during the entire final approach to BGBW. The most likely cause was that the aircraft was not following the NDB + DME 07 approach procedure descent profile.

2.10 The ATC altitude restriction toward the alternate BGSF

The commander requested FL280 or FL300 in order to reach BGSF as he was “low on fuel”. Sondrestrom FIC informed the flight that it could climb to and maintain FL190 and that Sondrestrom FIC would contact Gander Air Traffic Control (ATC) in order to obtain a higher flight level. The commander stated that if he did not get a higher flight level he would not make it to BGSF.

Sondrestrom FIC asked the commander if he would declare an emergency in order to have priority to climb to a higher flight level; but the commander did not reply.

The airspace over Greenland was within Sondrestrom FIR UNL / GND airspace class G. The airspace over Greenland and that part of the North Atlantic airspace was under ATC control above FL195. This area above FL195 was divided into two airspaces; The Gander Oceanic CTA UNL / FL195 airspace class A and Reykjavik CTA UNL / FL195 airspace class A (see Appendix 5.10.1).

Sondrestrom FIC could only assign N108GF the maximum flight level within its area of competence. That maximum flight level was FL190.

The commander on N108GF requested a flight level above FL195. As the airspace above FL195 was within Gander ATC, it would require a clearance from Gander to climb and to cruise above FL195. The aircraft was in VHF radio communication with Sondrestrom FIC and not within VHF radio range of Gander. To get a clearance to climb N108GF Sondrestrom FIC had to make phone contact to Gander ATC asking for the clearance.

The reconstructed flight planning (Appendix 5.1.3 “Maximum Range Power 1800 RPM ISA FL280”) indicated that the diversion from BGBW to BGSF required 721 lbs. of fuel. The reconstructed actual flight (Appendix 5.1.4) indicated that the FOB at the time of the missed approach at BGBW was 780 lbs. These reconstructions have a tolerance and shall not be taken for granted. However, it cannot be excluded that the flight could have arrived safely at BGSF if the flight had been climbing to FL280 or above immediately after the missed approach at BGBW. The commander was aware that the aircraft range had become critical and he requested a higher flight level to ensure that he could reach the alternative aerodrome.

2.11 The fuel emergency

Sondrestrom FIC informed Gander ATC that the flight N108GF was unable to land at BGBW and that the flight would divert to BGSF. Furthermore, that the flight was operating with minimum fuel and that the requested flight level was 280.

At 14:03:26 hrs, Gander ATC responded that FL280 was unavailable and asked Sondrestrom FIC to “stand by”. [Gander ATC did not respond on the phone again until 14:04:03 hrs.].
Sondrestrom FIC continued to inform Gander ATC on the phone about the situation. Sondrestrom FIC informed Gander ATC that the flight would not be able to reach BGSF and that the flight was in an emergency situation.

Gander ATC did not respond as expected to the emergency situation. The flight in distress should have been given priority to climb but it did not get it. After Sondrestrom FIC had asked for a higher flight level to the flight in distress, the Gander ATC controller was putting down the phone to check if any higher flight levels were available (14:03:26 hrs.). Gander ATC picked up the phone again at time 14:04:03 hrs. The Gander ATC controller never heard at that time that the flight was in an emergency situation therefore he did not respond as expected.

During the diversion to the alternate aerodrome, BGSF the flight was altitude restricted by ATC to FL190.

N108GF did not declare a fuel emergency; however Sondrestrom FIC became aware that N108GF actually was in a fuel emergency situation and acted accordingly.

2.12 The availability of BGGH

Sondrestrom suggested the commander to consider to land at Nuuk Aerodrome (BGGH) [BGGH had a 950 x 30 meters runway and was located between BGBW and BGSF]. Sondrestrom FIC asked the commander if he was able to land on a thousand meters runway. The commander informed Sondrestrom that he was unable to land on a thousand meters runway [BGGH].

The aircraft Navigation Database was a world wide database. The operator had chosen the Navigation Database “package” including only aerodromes with a runway length of minimum 4,000 feet (1,219 meters). The only aerodromes in Greenland with a runway length of 4,000 feet or more were: BGBW, BGSF and BGTL.

There was no information about BGGH in the on board Navigation Database as BGGH runway length was less than 4,000 feet. The commander knew that he did not have any information about a “1,000 meters runway” in the Navigation Database.

The aircraft would have been able to land on 950 meters dry runway in good weather conditions (see Appendix 5.6.10). The visibility and cloud base at BGGH was dropping from 2,000 meters and overcasted at 1,000 ft at time 14:22 hrs. to 1,300 meter and vertical visibility 600 ft at time 14:50 hrs. The published minimum OCA(H) for BGGH LLZ/DME runway 23 was 630(350) ft. The commander did not have the latest weather information on BGGH. It was possible to land at BGGH; but the commander had no experience on the aerodrome and he had no information on the aerodrome. The commander would not operate on BGGH without having the appropriate information on the aerodrome.

2.13 The climb without ATC clearance

The commander informed Sondrestrom that he would start to climb now and he “was out of FL190 climbing to FL300”. The commander added that the aircraft was “picking up” a lot of ice at FL190. Sondrestrom informed the commander that he would contact Gander ATC and inform them that the flight was climbing to FL300.

The commander started a climb without any ATC clearance. The aircraft would increase the possibility to reach BGSF if cruising at a higher altitude and at an altitude where the aircraft was not exposed to icing. In the emergency situation the commander took the appropriate action when he was trying to save fuel by climbing to a higher flight level.

2.14 The conflicting air traffic

Sondrestrom FIC contacted Gander ATC and informed Gander that the flight N108GF was climbing up into Gander CTA. Gander informed Sondrestrom that he was unable to issue a clearance to climb due to air traffic. The conflicting air traffic was a formation of five F16 cruising at FL270 approaching the position 61N 40W. The formation would be heading east towards Iceland. Gander informed Sondrestrom that there should not be any other conflicting air traffic on the track from BGBW to BGSF.

The distance between 61N40W and BGBW was 158 MN. N108GF was north of BGBW and the distance between the formation and N108GF was more than 158 NM. The formation and N108GF was on diverging tracks. The AIB was not aware of any other conflicting air traffic within Gander CTA and found no reason why the flight in distress was not cleared to climb to at least FL260 at an early stage of the flight towards BGSF.

2.15 The preparation of personnel

Sondrestrom FIC made phone contact to Sondrestrom Approach at 14:15:58 hrs. Sondrestrom FIC informed Sondrestrom Approach that it was possible that the flight was unable to reach BGSF and that Approach should “call out the cavalry”.

The information to Sondrestrom Approach was timely and made the preparation for the Search and Rescue, the fire fighters, the police, and the medical staff possible. Sondrestrom FIC realized that it was possible

that the aircraft would not reach the aerodrome or that the landing on the aerodrome could require assistance from fire and rescue personnel.

2.16 The SAR equipment and personnel

At 14:17 hrs, RCC informed the "National Airline" Movement Control Centre (MCC) that there was a possibility for the need of a SAR operation and that their service could be required.

The Search and Rescue services are described in AIP Greenland (see Appendix 5.10.2). The coordinating body was RCC; but RCC did not have equipment suitable for Search and Rescue. The Search and Rescue operation was based on suitable and available equipment and personnel provided by the operators and/or the military. RCC needed to arrange suitable equipment and personnel as soon as possible, and contacted the "National Airline" at the earliest possible time.

2.17 The cruise at FL320

At 14:20:09 hrs, N108GF informed Sondrestrom that the flight was leveling out at FL320 and that the predicted amount of landing fuel at BGSF was 61 lbs. The commander added that he considered climbing to FL340.

The maximum range is not necessarily achieved by flying at the maximum altitude. However the P180 aircraft would increase the Specific Air Range by increasing the altitude (see Appendix 5.6.12). The climb to a higher altitude would be an investment even though the climb initially consumes more fuel than the cruise.

The example below assumes a climb from FL200 to FL310 followed by at descent back to FL200 in ISA condition.

	Time	Fuel	Distance
Climb from FL200 to FL310	11 Minutes	85 Lbs	37 NM
Descent from FL310 to FL200	08 Minutes	65 Lbs	45 NM
Total	19 Minutes	150 Lbs	82 NM

Should the distance of the 82 NM have been flown at FL200 (instead of the above climb followed by a descent) the fuel consumption would have been:

	TAS	FF	Time	Fuel	Distance
Cruise at FL200	346	778 PPH	14 Minutes	184 Lbs	82 NM

The climb to and cruise at FL320 was saving fuel and increased the aircraft range. The commander knew that the aircraft would increase the range if cruising at a higher altitude.

2.18 The single engine cruise

The commander [N108GF] informed Sondrestrom FIC that he was descending [from FL320] to FL300 and that he had stopped one engine.

Depending on the circumstances shutting down one engine will in general not increase the aircraft range. When operating with one engine out the asymmetric power will require a rudder input. This rudder input

will create additional drag resulting in an increase of the total required power. The P180 Specific Air Range was best at high altitude; but operating with one engine out the aircraft would not be able to maintain the high altitude. The typical cruise characteristic would be:
"One Engine Out Cruise" at FL250 with a total Fuel Flow of 360 PPH and a KTAS of 209 Kts. This would result in a Specific Air Range of 0.581 NM/Lbs. of fuel.
"Recommended Cruise Power" at FL350 with a total Fuel Flow of 554 PPH and a KTAS of 358 Kts. This would result in a Specific Air Range of 0.646 NM/Lbs. of fuel.
Shutting down one engine during flight resulted in a reduced aircraft range. The commander thought that he would increase the aircraft range by shutting down one engine, but instead the aircraft range was decreased.

2.19 The shallow descent

At 14:54:37 hrs, Sondrestrom FIC asked the commander to confirm that he had started the descent. The commander confirmed that he had started a slow [shallow] descent in order to maintain the speed and added that the rate of descent was 300 ft pr. minute.

The aircraft was beginning the descent approximately 57 minutes before the ETO BGSF.

The aircraft "One Engine Inoperative Service Ceiling" at an AUW of 9,000 Lbs. and in ISA condition was approximately 30,000 ft (see Appendix 5.6.3). The aircraft should have been able to fly with one engine inoperative maintaining FL300; but the aircraft did descent below 30,000 ft in a shallow descent.

The Pilot Operating Handbook (POH) describes two kinds of descent profiles (see Appendix 5.6.9). One with a rate of descent of 1500 FPM and one with a rate of descent of 3000 FPM. Using the two examples from the POH and adding the required additional cruise distance to the 3000 FPM descent profile, the fuel and time used would be as follows:
The examples below assume a descent from FL350 to 4000 ft in ISA condition.

Rate of descent 1500 FPM	Time	Fuel	Distance
	21 Minutes	196 Lbs	120 NM

Rate of descent 3000 FPM	Time	Fuel	Distance
	11 Minutes	67 Lbs	58 NM

When using the high rate of descent (3000 FPM) the additional cruse distance at FL350 was 62 NM.

	TAS	FF	Time	Fuel	Distance
Cruise at FL350	364	554 PPH	10 Minutes	94 Lbs	62 NM
Descent			11 Minutes	67 Lbs	58 NM
Total			21 Minutes	161 Lbs	120 NM

The examples above shows that the most fuel saving descent profile was to maintain a high altitude followed by a 3000 FPM descent. The shallow descent profile did consume more fuel than a steeper descent profile. The commander did choose a shallow descent instead of maintaining a high altitude. The

commander thought that the shallow descent of 300 FPM would extend the aircraft range, but instead the aircraft range was decreased.

2.20 The two options

At 15:13:15 hrs, Sondrestrom FIC asked N108GF how the flight was progressing. The commander informed Sondrestrom that he needed to "ditch the aircraft" and he asked for the direction to the sea.

At this time the commander did not think that it was possible to reach BGSF. The second best thing was to make a precautionary landing; but the terrain below could be unsuitable for the landing. A water landing (ditching) could be a better solution than landing in the terrain. The commander was considering a water landing (ditching) instead of landing in the terrain.

The commander asked for the direction of the sea as he did not want to land in the mountains. Sondrestrom informed the commander that there was no sea on the route the aircraft was flying. Sondrestrom informed the commander that the fjord was west of the aircraft position and that the fjord was stretching [to northeast] all the way up to BGSF. Sondrestrom added that there was no sea close to the aircraft position.

After been given the information about the distance to the sea compared with the distance to BGSF the commander was left with only two options; to cross the mountains to get to BGSF; or to make a precautionary landing on the icecap.

2.21 The FMS predicted landing fuel

Sondrestrom asked the commander to confirm that the flight did not have enough fuel to continue to BGSF. The commander confirmed and added that the remaining fuel in left fuel tank was 15 lbs. and the remaining fuel in right fuel tank was 120 lbs. He added that he was slowly descending leaving FL180 at a rate of 300 ft pr. minute and with a remaining distance to SF of 100 NM. The commander was uncertain if he could reach BGSF.

The Specific Air Range at FL290 compared with the Specific Air Range at FL200 would in general be better at FL290 on this aircraft type. The shallow descent would prolong the time the aircraft was descending in low altitude and thereby reducing the aircraft range (see example in Appendix 5.6.12). The FMS would not take the shallow descent (resulting in increasing fuel flow and decreasing true airspeed) into consideration and would therefore predict lesser and lesser landing fuel as the shallow descent was progressing. The commander was using the FMS to predict the landing fuel at BGSF and he was flying the aircraft in a shallow descent thinking that it would increase the range of the aircraft. During the shallow descent the FMS would predict a misleading landing fuel [more] at the destination alternate aerodrome.

2.22 The safe altitude

Approach contacted N108GF and asked for the present altitude. The commander replied that he was 76 NM from BGSF and the altitude was 10,500 ft. Approach informed the commander that the safe altitude in the area was FL110 or around 10,000 ft. Approach suggested to keep a good lookout and asked if the flight was in Visual Meteorological Condition (VMC) or in Instrument Meteorological Condition (IMC). The commander replied that he was in VMC and the flight was between layers.

The flight was over the icecap at that time and in VMC. The terrain from the icecap towards BGSF would change to mountainous area before the fjord and BGSF. Approach informed the commander [N108GF] about the minimum safe altitude in order to assist him obtaining the terrain clearance.

2.23 The decision for a precautionary landing

Approach asked the commander to inform him if he was going to make a landing in the terrain as he needed the information for the helicopter search and rescue operation (SAR). The commander replied that he was going to land in the terrain. He informed Approach that he only had 92 lbs. remaining fuel and that the aircraft barely could maintain 9,000 ft.

The commander had to make a difficult decision. If he continued towards BGSF he had to cross some mountains and some valleys with very little remaining fuel. The flight was in VMC, and the commander could see what appeared as reasonable flat terrain. The commander decided to make a precautionary landing in the terrain.

It was not possible to determinate the reason why the commander stated “that the aircraft barely could maintain 9,000 ft”. Even operating the aircraft with “one engine out” at the actual aircraft mass the aircraft should be able to maintain approximately 30,000 ft (see Appendix 5.6.3).

2.24 The SAR operation began

At 15:29:10 hrs, the SAR helicopter OY-HGW [AS 350 B3] asked Sondrestrom Tower for a startup clearance from the apron. Tower approved the startup and informed the SAR commander that the last known position of N108GF was 65° 55’N 49° 30’W and that the flight was passing 9,000 ft and that the aircraft would land in the terrain. On board the SAR helicopter was the combined Dash 7 & AS 350 commander, one firefighter, one nurse and one police officer.

The SAR helicopter was airborne before the flight in distress had made the precautionary landing. The weather at the predicted search area could change to the worse making the rescue operation impossible for hours or days. There was an uncertainty how long time the search could take and it was uncertain in what condition the commander would be after the landing. The success of the Search and Rescue operation was depending on an early start. The SAR commander decided that the SAR operation should start when it became clear that N108GF would be landing in the terrain.

2.25 VHF radio communication

At 15:31:28 hrs, a Dash 7 operating on a scheduled flight made radio contact with Sondrestrom Approach and was instructed to maintain radio silence and to continue the flight at FL170. The Dash 7 crew informed Approach that their flight was close to the flight in distress.

Between BGSF and the flight in distress were mountains making the VHF radio communication difficult or impossible when the aircraft was flying at a low altitude. The location of the Dash 7 at FL170 in the vicinity of N108GF could be used as a communication platform making the radio communication possible between the Dash 7 and N108GF all the way down to ground level. Sondrestrom Approach and the flight crew on

the Dash 7 were aware of the radio communication problem coming up between N108GF and Sondrestrom Approach.

At 15:32:26 hrs, Approach called N108GF. The commander replied but the controller was only able to hear a broken transmission. The altitude was reported to be 6,700 ft and the distance to BGSF was 62 NM. The rest of the transmission was unreadable.

The terrain/mountains came between the Sondrestrom radio antenna and the N108GF radio antenna and were making direct VHF radio communication impossible.

The Dash 7 crew informed N108GF about the terrain, the valleys, the ice and the mountains in the area. They asked the commander if he still had power and if he was sure that the terrain below him was ice and not clouds.

As anticipated the Dash 7 was in the position close to N108GF and at FL170 making VHF communication possible to both Sondrestrom Approach and N108GF.

The commander on N108GF was not familiar with the nature of the area where he was going to make the precautionary landing. The Dash 7 crew was operating in that area on a daily basis and they were familiar with the area south of BGSF. The Dash 7 crew informed N108GF about the area of the intended precautionary landing in order to increase the chance of a successful landing in the area.

2.26 The ELT

At 15:35:49 hrs, Sondrestrom Approach asked the Dash 7 crew to ask N108GF to turn on the Emergency Locater Transmitter (ELT). The Dash 7 crew relayed the request to the flight in distress.
The Dash 7 crew informed Approach that N108GF reported its position as 66N 49W and that there was no time to activate the ELT. The commander reported that he was landing at that position.

At this time N108GF was in the “landing circuit” to the icecap in a mountainous area. There was no time to activate the ELT. The concentration was focused on flying and landing the aircraft.

According to the SPL the aircraft was carrying VHF and ELBA emergency radios.

The ELT was not activated before the accident, it did not activate during the accident and it was not activated after the accident.

The fact that the ELT was not activated at all was not revealed.

2.27 The precautionary landing configuration

N108GF made an approach and landing on the icecap with the left engine stopped and the left propeller feathered. The right engine was running and producing power. The fuel cross feed valve was open. The landing gear was in the retracted position and the flaps were in middle position. The commander was

hampered by the white surface on the icecap making the flare and landing difficult. At the contact with the terrain, numerous pieces separated from the aircraft.

According to the “Landing Emergencies, Landing Without Engine Power” it may be required to land with [landing] gear up (see Appendix 5.6.13). The procedure appears unclear. It is reasonable to land on the water with the landing gear retracted, but it can be discussed if it is reasonable to land on the icecap with the landing gear retracted.

According to the normal landing procedure the flaps should be selected to MID position when flying in icing conditions (se Appendix 5.6.13).

The landing area was white and did not have distinct contours while flying above the terrain. But the surface was rugged and bumpy. As the aircraft came in contact with the surface with the landing gear in the up position the landing gear could not absorb much energy. The cockpit/cabin section, the wing/engine section and the tail section of the aircraft did absorb energy to a point where some of the parts came apart. The aircraft was destroyed during the landing attempt on the rugged and bumpy surface of the icecap.

2.28 The SAR operating weather conditions

The SAR helicopter commander reported that the visibility and cloud ceiling made it impossible to fly directly from BGSF to the last known position of N108GF. The SAR commander suggested starting a SAR helicopter from BGGH (15:41 hrs.). [The SAR helicopter was equipped with satellite communication equipment].

The cloud base / cloud ceiling at the BGSF area at the time of the accident was approximately 4,000 feet MSL. Between the accident site and BGSF were some mountaintops above 4,000 feet MSL. If the SAR operation from BGSF was unsuccessful a SAR operation originating from BGGH could be successful.

The SAR commander tried successfully to navigate around the bad weather by flying through the “Paradisdalen” (Paradise Valley).

Some of the valleys bottoms were at or near MSL making it possible to navigate under VMC; however at some point of the flight the helicopter should climb up to the accident site at approximately 3,500 feet MSL. The SAR commander became aware that the only possibility was to operate the helicopter below the cloud ceiling in the valleys as the ceiling would prevent flying over the mountains. The knowledge of the area made it possible for the SAR commander successfully to navigate around and below the poor weather.

2.29 The deteriorating weather conditions at the accident site

At 16:40 hrs, the SAR commander reported that the accident aircraft [N108GF] was located at the position 66 08N 49 55W. At the same time, the SAR commander received the latest weather information: Poor weather was moving into the area with rain and snow and the visibility would drop.

The last reported position was 66N 49W and the wreckage was found at 66 08N 49 55W. The distance between those two positions was 23.8 NM. The wreckage appeared as “black spots” on a “white surface” making it possible for the SAR commander to see the accident aircraft in the distance.

At 16:47 hrs, the SAR commander reported that they might not be able to return as the weather condition was deteriorating and they had a limited amount of fuel. The commander requested that the next helicopter would bring some extra fuel.

The accident site was surrounded by mountains. With a dropping cloud ceiling it would not be possible to fly the helicopter out of the area. The helicopter was not approved for IFR operation in icing conditions. If the helicopter had to stay on the icecap for a prolonged period of time the engine had to be started and the helicopter had to be checked to ensure proper operation. If the helicopter would be stranded on the icecap for a prolonged period of time it would be required that some extra fuel had to be flown in before the return flight. The fuel on board the SAR helicopter was limited but not below limit for the return flight.

2.30 The rescue of the commander

The SAR helicopter landed 30 meters from the accident site at 16:50 hrs. The police officer, the nurse, and the firefighter continued on foot to the wreckage and found the commander [N108GF] alive inside the cockpit/cabin section. The rescue team opened the cabin door and the commander could leave the cabin. Some of the pilot’s personal documents and some of the aircraft documents were recovered. At the same time the weather situation was deteriorating with low clouds and poor visibility moving into the area.

The SAR helicopter was airborne at approximately 17:15 hrs. and the SAR commander managed to avoid the poor weather that was moving into the area.

The SAR commander was faced with the possibility that the SAR operation would be stranded on the icecap. The clouds were beginning to close the escape routes at the mountain passes surrounding the accident site. The SAR commander decided that as little time as possible should be spend at the accident site to ensure that the SAR mission would not be stranded on the icecap.

2.31 The SAR return flight to BGSF

At 17:22 hrs, the SAR commander informed RCC that the commander from N108GF was alive and on board the SAR helicopter and the helicopter would return to BGSF. The flight would follow the edge of the icecap. The endurance was one hour and 15 minutes and they were five persons on board.

The SAR helicopter landed at BGSF at 17:59 hrs.

The SAR helicopter departed the accident site before the cloud ceiling was closing down at the area. The helicopter could fly in the valleys and along the icecap at a low altitude and clear of the low clouds.

2.32 The flight documentation

There was not recovered any Operational Flight Plan or any Mass and Balance calculation at the accident site. No copies were available after the accident.

The commander was using an Electronic Flight Bag (EFB) to create the Operational Flight Plan (OFP) and the ATS flight plan. The EFB was not used during the flight.

The OFP was the general basis for any flight planning both before the flight and during the flight. It was also the basis for the ATS Flight Plan.

The EFB could present the output data in various formats; E.G. only the basic time and fuel requirement; or a complete OFP including each Waypoint with all the ETO/ATO, fuel and distance information.

A complete OFP including each planned waypoint with all the ETO/ATO, fuel and distance information would have increased the flight crew situational awareness.

2.33 The operator

The aircraft was operated by an operator located in Kuwait. The operator had two P 180 aircraft in charter operation. The accident flight was operated under FAR Part 91 (see Appendix 5.17).

The operator was a small operator with a limited capacity.

2.34 The airspace over Greenland

The airspace over Greenland was within Sondrestrom FIR UNL / GND airspace class G. The airspace over Greenland and that part of the North Atlantic airspace was under ATC control above FL195. This area above FL195 was divided into two airspaces; The Gander Oceanic CTA UNL / FL195 airspace class A and Reykjavik CTA UNL / FL195 airspace class A (see Appendix 5.10.1).

The airspace over Greenland was managed by three different countries and by several ATS units. Aircraft flying over the area would not always be in radio contact with the ATC unit controlling the aircraft. The coordination and control of the air traffic was managed by the use of radio communication and by the use of telephones. This method is used by ATS in a majority of areas around the world.

It is the opinion of the Danish AIB that this type of communication could lead to misunderstandings and omissions. Important information during the phone communication between Gander ATC and Sondrestrom FIC was lost.

2.35 The delay of recorded communication data

The Danish AIB faced some difficulties in obtaining the recorded radio communication data from BGBW AFIS. The Greenland Airport Authority (GAA) had the responsibility of the recording system under their jurisdiction and was requested to provide the communication data after the accident. Unfortunately GAA discovered that their replay system was malfunctioning and the process halted until 11-11-2010.

The quality and fast availability of the communication data are vital to any investigation. It will add factual information to the investigation and contribute in leading the investigation in the right direction. It is the

opinion of the Danish AIB that any information contributing to the investigation should be available with a minimum of delay.

3. Conclusions

3.1 Findings

3.1.1 The flight crew was properly licensed.

3.1.2 The aircraft did not have any technical issues prior to the accident.

3.1.3 The ATS FPL reflected a reasonable flight planning.

3.1.4 The ATS SPL did not reflect a reasonable flight planning.

3.1.5 The lack of radar service over Greenland resulted in N108GF was not cleared to fly at the optimum route, at the optimum flight level or at the optimum air speed.

3.1.6 The accident aircraft, N108GF was not approved to operate within the NAT MNPS Airspace.

3.1.7 After refueling at BIKF, the fuel on board (FOB) was approximately 2860 lbs.

3.1.8 Before Take-off from BIKF, the final fuel reserve (holding) was approximately 40 minutes of flight if the flight was operated at FL280 using Maximum Range Power 1800 RPM in ISA temperature conditions.

3.1.9 Before Take-off from BIKF, the final fuel reserve (holding) was approximately 11 minutes of flight if the flight was operated at FL280 using Recommended Cruise Power 1800 RPM in ISA temperature conditions.

3.1.10 Before Take-off from BIKF, the final fuel reserve (holding) was approximately zero minutes of flight if the flight was operated at FL200 using Recommended Cruise Power 1800 RPM in ISA temperature conditions.

3.1.11 Before take-off from BIKF the FOB was not sufficient to commence the flight in accordance with FAR Part 91 even if operated at FL280 using Maximum Range Power 1800 RPM.

3.1.12 After the aircraft would have reached the planned Top of Climb [FL280] and started on the level flight using Recommended Cruise Power 1800 RPM, the FOB was insufficient to continue the flight to BGBW as required according to FAR Part 91.

3.1.13 As the flight was restricted by ATC to cruise at FL200 instead of FL280 and was using Recommended Cruise Power 1800 RPM, the final reserve was decreased by approximately 11 minutes to approximately zero minutes.

3.1.14 At the time the commander was not concerned about the final reserve because the flight to BGBW was only a two hours flight and as the aircraft before take-off from BIKF had fuel for more than three hours and 40 minutes of flight.

3.1.15 The commander was not fully aware about the situation of the geographic flight environment.

3.1.16 By changing the cruise method from Recommended Cruise Power to Maximum Range Power the flight could have been saving approximately 88 Lbs. of fuel enroute from BIKF to BGBW and increased the Final Reserve Fuel to 18 minutes.

3.1.17 The flight from BIKF toward BGBW did not fulfill the FAR Part 91 FOB requirements and no appropriate action was taken.

3.1.18 The estimated time overhead 62N 40W should have been approximately 12:44 hrs. But according to the position report the actual time overhead 62N 40W was 12:13 hrs.

3.1.19 The estimated time overhead NA should have been approximately 13:14 hrs. But according to the position report the estimated time overhead NA was 13:41 hrs.

3.1.20 The weather observation at BGBW indicated a visibility of 10 km and cloud base at 3,000 ft (height) or more than 1,200 ft above the OCH of 1790 ft.

3.1.21 The weather information at BGBW should not have been leading to any concern regarding a successful approach and landing.

3.1.22 The flight never came below the clouds and was in IMC during the entire final approach to BGBW. The most likely cause was that the aircraft was not following the NDB + DME 07 approach procedure descent profile.

3.1.23 Sondrestrom FIC could only assign N108GF the maximum flight level within its area of competence. That flight level was FL190.

3.1.24 It cannot be excluded that the flight could have arrived safely at BGSF if the flight had been climbing to FL280 or above immediately after the missed approach at BGBW.

3.1.25 The Gander ATC controller never heard at that time that the flight was in an emergency situation therefore he did not respond as expected.

3.1.26 During the diversion to the alternate aerodrome, BGSF the flight was altitude restricted by ATC to FL190.

3.1.27 N108GF did not declare a fuel emergency; however Sondrestrom FIC became aware that N108GF actually was in a fuel emergency situation and acted accordingly.

3.1.28 The commander would not operate on BGGH without having the appropriate information on the aerodrome.

3.1.29 In the emergency situation the commander took the appropriate action when he was trying to save fuel by climbing to a higher flight level.

3.1.30 The AIB was not aware of any other conflicting air traffic within Gander CTA and found no reason why the flight in distress was not cleared to climb to at least FL260 at an early stage of the flight towards BGSF.

3.1.31 Sondrestrom FIC realized that it was possible that the aircraft would not reach the aerodrome or that the landing on the aerodrome could require assistance from fire and rescue personnel.

3.1.32 RCC needed to arrange suitable equipment and personnel as soon as possible, and contacted the “National Airline” at the earliest possible time.

3.1.33 The climb to and cruise at FL320 was saving fuel and increased the aircraft range.

3.1.34 Shutting down one engine during flight resulted in a reduced aircraft range.

3.1.35 The shallow descent profile did consume more fuel than a steeper descent profile.

3.1.36 The aircraft should have been able to fly with one engine inoperative maintaining FL300; but the aircraft did descent below 30,000 ft in a shallow descent.

3.1.37 After been given the information about the distance to the sea compared with the distance to BGSF the commander was left with only two options; to cross the mountains to get to BGSF; or to make a precautionary landing on the icecap.

3.1.38 During the shallow descent the FMS would predict a misleading landing fuel [more] at the destination alternate aerodrome.

3.1.39 The terrain from the icecap towards BGSF would change to mountainous area before the fjord and BGSF.

3.1.40 The commander decided to make a precautionary landing in the terrain.

3.1.41 The success of the Search and Rescue operation was depending on an early start.

3.1.42 The location of the Dash 7 at FL170 in the vicinity of N108GF could be used as a communication platform making the radio communication possible between the Dash 7 and N108GF all the way down to ground level.

3.1.43 The commander on N108GF was not familiar with the nature of the area where he was going to make the precautionary landing.

3.1.44 The terrain/mountains came between the Sondrestrom radio antenna and the N108GF radio antenna and were making direct VHF radio communication impossible.

3.1.45 The Dash 7 crew informed N108GF about the area of the intended precautionary landing in order to increase the chance of a successful landing in the area.

3.1.46 The ELT was not activated before the accident, it did not activate during the accident and it was not activated after the accident.

3.1.47 The landing gear was in the retracted position and the flaps were in middle position.

3.1.48 The aircraft was destroyed during the landing attempt on the rugged and bumpy surface of the icecap.

3.1.49 The accident was survivable.

3.1.50 The post-accident was survivable.

3.1.51 The knowledge of the area made it possible for the SAR commander successfully to navigate around and below the poor weather.

3.1.52 The wreckage appeared as “black spots” on a “white surface” making it possible for the SAR commander to see the accident aircraft in the distance.

3.1.53 The fuel on board the SAR helicopter was limited but not below limit for the return flight.

3.1.54 The SAR commander decided that as little time as possible should be spend at the accident site to ensure that the SAR mission would not be stranded on the icecap.

3.1.55 The SAR helicopter departed the accident site before the cloud ceiling was closing down at the area.

3.1.56 There was not recovered any Operational Flight Plan or any Mass and Balance calculation at the accident site. No copies were available after the accident.

3.1.57 The Danish AIB faced some difficulties in obtaining the recorded radio communication data from BGBW AFIS.

3.2 Factors

3.2.1 As the flight was restricted by ATC to cruise at FL200 instead of FL280 and was using Recommended Cruise Power 1800 RPM, the final reserve was decreased by approximately 11 minutes to approximately zero minutes.

3.2.2 At the time the commander was not concerned about the final reserve because the flight to BGBW was only a two hours flight and as the aircraft before take-off from BIKF had fuel for more than three hours and 40 minutes of flight.

3.2.3 The flight never came below the clouds and was in IMC during the entire final approach to BGBW. The most likely cause was that the aircraft was not following the NDB + DME 07 approach procedure descent profile.

3.2.4 During the diversion to the alternate aerodrome, BGSF the flight was altitude restricted by ATC to FL190.

3.2.5 Shutting down one engine during flight resulted in a reduced aircraft range.
3.2.6 The shallow descent profile did consume more fuel than a steeper descent profile.
3.2.7 The commander decided to make a precautionary landing in the terrain.
3.2.8 The aircraft was destroyed during the landing attempt on the rugged and bumpy surface of the icecap.

3.3 Summary

After the flight was airborne from BIKF the flight was restricted by ATC to cruise at FL200 instead of FL280. The lower flight altitude and the power setting used resulted in a reduction of the final reserve to approximately zero minutes. At the time the commander was not concerned about the final reserve because the flight to BGBW was only a two hours flight and as the aircraft before take-off from BIKF had fuel for more than three hours and 40 minutes of flight.
During the approach to BGBW the flight never came below the clouds and was in IMC during the entire final approach. The most likely cause was that the aircraft was not following the NDB + DME 07 approach procedure descent profile. Consequently the commander did not get visual contact during the approach and he had to make a missed approach.
During the diversion to the alternate aerodrome, BGSF the flight was altitude restricted by ATC to FL190. One engine was intentionally stopped during the diversion to BGSF. The consequence was a reduction of the aircraft range. A shallow descent was initiated approximately 57 minutes before ETA over BGSF. The shallow descent profile did consume more fuel than a steeper descent profile. The commander decided to make a precautionary landing in the terrain. The aircraft was destroyed during the landing attempt on the rugged and bumpy surface of the icecap.

4. Safety recommendations

4.1 Safety initiatives during the investigation

4.1.1 None.

4.2 Safety recommendations

4.2.1 The Danish AIB faced some difficulties in obtaining the recorded radio communication data from BGBW AFIS. The Greenland Airport Authority (GAA) had the responsibility of the recording system under their jurisdiction and was requested to provide the communication data after the accident. Unfortunately GAA discovered that their replay system was malfunctioning and the process halted until 11-11-2010.

The quality and fast availability of the communication data are vital to any investigation. It will add factual information to the investigation and contribute in leading the investigation in the right direction. It is the opinion of the Danish AIB that any information contributing to the investigation should be available with a minimum of delay.

The Danish Accident Investigation Board recommends that the Danish Public Transport Authority ensure that recordings of radio communication between aircraft and air traffic service units are available to the investigation with a minimum delay. (REC DENM-2012-06).

5. Appendices

5.1.1 History of the flight

The accident flight was an IFR ferry flight from Kuwait (OKBK) to Denton (KDTO), Texas with technical landings at Antalya (LTAI), Vienna (LOWW), Stornoway (EGPO), Keflavik (BIKF) and with planned technical landings at Narsarsuaq (BGBW), Goose Bay (CYYR) and Bangor (KBGR). The aircraft was scheduled for technical maintenance at KDTO. The commander was the only occupant on board the flight.

The flight departed OKBK on the 15.10.2009 at 0420/30 hrs and arrived at LTAI on the 15.10.2009 at 0730/35 hrs. The aircraft log indicated that the fuel used was 2050 lbs. The aircraft was refueled at LTAI 0745/50 hrs with 1302 liter Jet A1.

The flight departed LTAI on the 15.10.2009 at 0830/35 hrs and arrived at LOWW on the 15.10.2009 at 1119/29 hrs. The aircraft log indicated that the fuel used was 1985 lbs. The aircraft was refueled at LOWW 1219/30 hrs. with 1153 liter Jet A1.

The flight departed LOWW on the 15.10.2009 at 1230/40 hrs. and arrived at EGPO on the 15.10.2009 at 1545/50 hrs. The aircraft log indicated that the fuel used was 2280 lbs.

The aircraft was refueled at EGPO on the 16.10.2009 with 1293 liter of Jet A1. The flight departed EGPO on the 16.10.2009 at 0810/15 hrs. and arrived at BIKF on the 16.10.2009 at 0945/50 hrs. The aircraft log indicated that the fuel used was 1480 lbs.

The aircraft was refueled at BIKF 1030/40 hrs. with 240 US Gallons Jet A1 fuel. The temperature of the uplifted fuel was 8° C. The aircraft refueling system indicated full tanks after refueling. After refueling at BIKF, the fuel on board (FOB) was approximately 2860 lbs.

The flight from BIKF towards BGBW

The commander contacted Keflavik Ground at 10:54 hrs. and requested the route clearance. Keflavik Air Traffic Control (ATC) cleared N108GF to BGBW via FLOSI dct 64N30W dct 62N40W dct NA initially at FL270 and at a cruise Mach number 0.66. The assigned squawk code was 3515. The commander stated that he was unable to cruise at Mach number 0.66 at FL270 and he said the maximum Mach number at FL270 was 0.63. Keflavik ATC changed the clearance to cruise at Mach number 0.63.

The flight received instructions to taxi to runway 20 via taxiway N and to hold short of runway 20 (at 10:58 hrs.). The flight was instructed to contact Keflavik Tower on the radio frequency 118.300 MHz. The commander contacted the tower and was informed that the wind was 160° at 25 kts gusting to 30 kts. The tower cleared N108GF for take-off and instructed the commander to make radio contact with Keflavik Approach on the radio frequency 119.300 MHz after the flight was airborne. The flight departed BIKF on the 16.10.2009 at 1058/1103 hrs. At 11:03 hrs, Keflavik Tower informed Keflavik Approach that the aircraft was airborne.

After take-off N108GF contacted Keflavik Approach (119.300 MHz) and reported that the flight was at 3300 ft climbing to FL270 and that the flight was heading northwest towards FLOSI. Approach informed the commander that the flight was identified on radar. After a few minutes, N108GF was instructed by Approach to contact Reykjavik ATC on the frequency 119.700 MHz. [The last radio contact with Keflavik Approach was approximately at time 11:06 hrs.].

The cruse method used from BIKF towards BGBW was Recommended Cruise Power 1800 RPM (see Appendix 5.6.7).

[The Danish AIB has not been able to recover the radio communication from the time N108GF was instructed to contact Reykjavik ATC at approximately 11:06 hrs. until the time N108GF contacted Sondrestrom Flight Information Center (FIC) at 13:01 hrs.].

The flight was instructed to descent and cruise at FL200 near the reporting point FLOSI.

Gander ATC contacted Sondrestrom FIC at 11:59:24 hrs. and informed FIC that N108GF was estimating the position 62N 40W at time 12:38 hrs; and that the aircraft was cruising at FL200 with the airspeed Mach 0.63.

Reykjavik ATC made phone contact with Gander ATC at 12:09:27 hrs. Reykjavik informed Gander that the commander had informed him that the estimated time overhead [62N] 40W was 12:13 hrs. Gander asked at what airspeed N108GF was cruising; and he was told that the aircraft was assigned by Icelandic ATC to cruise at Mach 0.63. Gander questioned the estimate that would bring the aircraft 25 minutes early at 40W. Reykjavik ATC had a computer estimate for 40W at 12:40 hrs; and Gander ATC had a computer estimate for 40W at 12:38 hrs.

An airliner cruising at high altitude was relaying the radio communication from N108GF to Gander Radio. Gander Radio was out of radio range and could not hear N108GF. At 12:50:12 hrs, the airliner at high altitude transmitted the position report received from N108GF; the flight passed 62N 040W at time 12:13 hrs, and was cruising at FL200, the estimated time overhead Narsarsuaq NDB (NA) was 13:43 hrs. The destination was BGBW. Gander Radio asked the airliner to relay a message to N108GF; when the N108GF was within radio range of Sondrestrom FIC he should contact them on the radio frequency 121.3 MHz (12:50:43 hrs.).

At 12:51:39 hrs, Gander Radio made radio contact with the airliner cruising at high altitude asking them to relay a message to N108GF. Gander asked N108GF to maintain his radiofrequency (127.9 MHz) as the flight shortly would be within radio range.

At 12:55:40 hrs, Gander ATC forwarded the ATC clearance for N108GF to Gander Radio. Gander ATC cleared N108GF to descent out of controlled airspace and to report FL195 descending. N108GF should make radio contact with Narsarsuaq on radio frequency 121.3 MHz before leaving controlled airspace.

At 12:58:01 hrs, Gander Radio made radio contact with N108GF. Gander informed the flight that the descent clearance was available when he was ready. Gander ATC cleared N108GF to descent out of controlled airspace, and to report leaving FL195, and to make radio contact with Sondrestrom Information on the radiofrequency 121.3 MHz before leaving controlled airspace in order to receive traffic information.

N108GF was instructed by Gander to contact Sondrestrom FIC before commencing the descent into uncontrolled airspace. The flight made radio contact at 13:01 hrs. and informed Sondrestrom that he was cruising at FL200 and that the destination was BGBW. The revised estimated time overhead NA was 13:41. The flight was informed that the transition level was FL110 and the QNH was 993 hPa. The commander was instructed to report passing FL195 descending.

At 13:03:00 hrs, Gander Radio made radio contact with N108GF asking him for the estimated time overhead NA [Narsarsuaq NDB]. The commander replied that he was estimating NA at time 13:41 hrs.

At 13:03:03 hrs, Narsarsuaq AFIS was informed by Sondrestrom FIC that the revised estimated time overhead NA was 13:41 hrs.

At 13:05:50 hrs, Gander contacted the flight asking for the actual time the flight had passed overhead 62N 40W. The commander replied that according to the FMS he passed 62N 40W at time 12:13 hrs. and that he currently had an 80 knots headwind.

The actual time overhead 62N 40W was passed on from Gander Radio to Gander ATC (13:08:04 hrs.). Gander ATC would have the time overhead 62N 40W at 12:13 hrs. confirmed. Gander Radio confirmed the time overhead as 12:13 hrs. but he was not sure if it should have been 13:13 hrs. instead. Gander Radio made a comment that the previous estimate for 62N 40W was 12:15 hrs. when N108GF passed 30W. Gander ATC asked Gander Radio to contact N108GF and confirm the estimated time overhead Narsarsuaq Airport.

At 13:09:14 hrs, Gander Radio made radio contact with N108GF asking for the estimated time overhead Narsarsuaq Aerodrome. The commander replied that the estimated time was 13:40 hrs.

The commander contacted Sondrestrom FIC and requested a weather conditions update at the destination but there was not issued a new weather report. Sondrestrom FIC informed the commander that the weather report was only updated once each 50 minutes passed the hour. FIC suggested the commander to try to make radio contact with Narsarsuaq AFIS on the frequency 119.1 MHz to get updated information (13:19 hrs.); however, Sondrestrom FIC informed the commander that he could be out of radio range of Narsarsuaq AFIS.

At 13:19:43 hrs, Gander ATC contacted Sondrestrom FIC by phone asking if N108GF had made radio contact with him. Sondrestrom confirmed that N108GF was in radio contact with the FIC. Gander informed Sondrestrom that the actual time N108GF passed 40W was 12:13 hrs. and that the flight was estimating the aerodrome very late. Gander added that he had been given the flight descent clearance. Gander asked if he

had received the estimated time overhead Narsarsuaq. Sondrestrom replied that he had the estimated time and that he was in radio contact with N108GF.

The commander (N108GF) made radio contact with Narsarsuaq AFIS at 13:21:42 hrs. The aircraft was at the time 100 NM from the aerodrome. The commander asked for a weather update. Narsarsuaq AFIS informed the commander of the present weather; the wind direction was 150° and the wind speed was 8 kts. The visibility was 10 KM in light rain. The clouds were broken at 3,000 feet and overcasted at 5,000 feet. The temperature was 5° C and the Dew point was 2° C. The air pressure was 993 hPa (QNH).

Sondrestrom FIC made radio contact with the commander asking if he had started the descent from FL200. The commander replied that he would start the descent in about 5 minutes (13:24 hrs.).

At 13:27:45 hrs, the commander made radio contact with Gander Radio and reported that he was ready to leave the controlled airspace. Gander asked the commander to report when the flight was passing FL195. The commander reported shortly after that he was passing FL195. Gander instructed the commander to make radio contact with Sondrestrom Information on the frequency 121.3 MHz.

N108GF reported to Sondrestrom FIC that he was descending through FL195 at time 13:28 hrs. Sondrestrom FIC requested the commander to report when the aircraft was 25 NM from BGBW.

At 13:35 hrs, the commander was instructed by Sondrestrom FIC to contact Narsarsuaq AFIS on the radio frequency 119.1 MHz.

The commander (N108GF) made radio contact again with Narsarsuaq AFIS at time 13:35:47 hrs. The flight was at 11,000 feet and at 28 DME [from NQ]. Narsarsuaq AFIS informed the commander about the wind; the wind direction was 110° and the wind speed was 3 kts. The commander was informed that there was no local air traffic reported at that time and that the commander could start the approach on his own discretion. The commander asked for the cloud ceiling and he was informed that the cloud ceiling was; broken at 3,300 feet and overcasted at 4,500 feet.

[There was no radar system available at the Narsarsuaq Area; consequently there were no objective data to document the position of the aircraft during the approach to BGBW. The following information is based on interview and radio communication only].

N108GF arrived overhead NA NDB at 13:41 hrs. and started the descent from approximately 9,000 ft in the holding pattern. After one turn in the holding pattern the flight followed the NDB + DME 07 approach procedure [base turn] down to approximately 6,000 ft before turning inbound to NA. The flight descended on the inbound leg in a tailwind condition up to of approximately 15 knots. The flight was in clouds and there was no visual contact with terrain, the sea or the runway before the Missed Approach Point (MAPt). Consequently, a missed approach procedure was performed. Following the missed approach, the flight diverted towards the destination alternate aerodrome, Kangerlussuaq (BGSF).

At 13:56:46 hrs, the commander reported to Narsarsuaq AFIS that “he could not get into this place”. He was informed that the present cloud ceiling was approximately 3,000 feet; but the commander stated that the cloud ceiling was too low and that he was in a climb. He then asked for a high altitude and stated that he would divert to BGSF, and that he “just had enough fuel to get there”. The commander was instructed by Narsarsuaq AFIS to contact Sondrestrom on the radiofrequency 121.3 MHz and to request them for the highest possible altitude.

The flight from BGBW towards BGSF

After N108GF had made a missed approach at BGBW, the flight was diverting towards BGSF. The AFIS operator at BGBW informed Sondrestrom FIC about the flight by phone at 13:57:38 hrs. The flight was then handed over to Sondrestrom FIC.

N108GF was in radio contact with Sondrestrom FIC at 13:58:20 hrs. The commander informed Sondrestrom FIC that he could not land at BGBW. The commander requested a direct route to BGSF and stated that he probably could reach BGSF. The commander was informed that the direct route to BGSF was via the ATS Route W21. The commander requested FL280 or FL300 in order to reach BGSF as he was “low on fuel”. Sondrestrom FIC informed the flight that it could climb to and maintain FL190 and that Sondrestrom FIC would contact Gander Air Traffic Control (ATC) in order to obtain a higher flight level. The commander stated that if he did not get a higher flight level he would not make it to BGSF.

The initial cruse method used from BGBW area towards BGSF was Recommended Cruise Power 1800 RPM (see Appendix 5.6.7).

Sondrestrom FIC asked the commander if he would declare an emergency in order to have priority to climb to a higher flight level (14:01:20 hrs.). The commander asked Sondrestrom FIC to stand by while he was checking the amount of fuel and the aircraft range. At the same time, Sondrestrom FIC was on the phone with Gander ATC (14:01:55 hrs.).

Sondrestrom FIC informed Gander ATC that the flight N108GF was unable to land at BGBW and that the flight would divert to BGSF. Furthermore, that the flight was operating with minimum fuel and that the requested flight level was 280 (14:01.55 hrs.).

At 14:03:26 hrs, Gander ATC responded that FL280 was unavailable and asked Sondrestrom FIC to “stand by”. [Gander ATC did not respond on the phone again until 14:04:03 hrs.].
Sondrestrom FIC continued to inform Gander ATC on the phone about the situation. Sondrestrom FIC informed Gander ATC that the flight would not be able to reach BGSF and that the flight was in an emergency situation.

During the phone call to Gander ATC, Sondrestrom FIC contacted the flight by the radio. The commander confirmed that he would not be able to reach BGSF unless he was cruising at FL280 (14:03:51 hrs.).

At 14:04:03 hrs, Gander ATC asked Sondrestrom FIC on the phone “are you still here?” Sondrestrom FIC acknowledged and was informed by Gander ATC that they were unable to accept the flight above FL190.

Gander ATC suggested Sondrestrom FIC to ask Reykjavik ATC for higher flight level when the flight crossed “the border” between Gander CTA and Reykjavik CTA at 63°30’N.

Sondrestrom FIC informed Sondrestrom Rescue Co-ordination Centre (RCC) about the flight [N108GF] in distress at 14:05 hrs.

Sondrestrom FIC phoned Reykjavik ATC and informed ATC about the emergency situation. Sondrestrom asked if Reykjavik could accept the flight at a higher flight level than FL190 after the flight had passed 63° 30’N (14:06:53 hrs.). Sondrestrom informed Reykjavik that the flight would route direct from BGBW to BGSF via ATS route W21.

Sondrestrom FIC contacted N108GF and asked for the estimated time of arrival (ETA) overhead BGSF (14:07:44 hrs.). The commander expressed that he would not be able to reach BGSF. However, he estimated BGSF at time 15:48 hrs. (14:08:09 hrs.). Sondrestrom suggested the commander to consider to land at Nuuk Aerodrome (BGGH) [BGGH had a 950 x 30 meters runway and was located between BGBW and BGSF]. Sondrestrom FIC asked the commander if he was able to land on a thousand meters runway. The commander informed Sondrestrom that he was unable to land on a thousand meters runway [BGGH] (14:08:35 hrs.).

The commander informed Sondrestrom that he would climb to FL300 (14:09:38 hrs.). The commander requested Sondrestrom FIC to inform Gander that he would not be able to reach BGSF if the flight had to stay at FL190. Sondrestrom asked the commander if the aircraft was equipped with Traffic Collision and Avoidance System (TCAS) and the commander informed Sondrestrom that the aircraft was TCAS equipped (14:10:29 hrs.).

At the same time as Sondrestrom FIC was talking to the flight he was in phone contact with Reykjavik ATC and he was also getting in contact with Gander ATC (14:10:35). Reykjavik informed Sondrestrom that there were no air traffic at FL240 but there was traffic at FL250 with destination BGSF. Sondrestrom suggested Reykjavik to descent that air traffic as the flight needed to climb to FL300. Sondrestrom informed Reykjavik that the flight was 200 lbs. short of fuel in order to reach BGSF. Reykjavik informed Sondrestrom that he had no air traffic at FL300 and if the flight was in an emergency situation he could climb at his own discretion (14:10:48 hrs.). Sondrestrom FIC informed Reykjavik to consider the flight at FL300 after it had crossed the boundary between Gander CTA and Reykjavik CTA at 63°30’N (14:11:32 hrs.).

Sondrestrom FIC contacted N108GF and asked if it was able to climb to FL300 after passing 63°30’N. The commander informed Sondrestrom that he would start to climb now and he “was out of FL190 climbing to FL300”. The commander added that the aircraft was “picking up” a lot of ice at FL190 (14:11:55 hrs.). Sondrestrom informed the commander that he would contact Gander ATC and inform them that the flight was climbing to FL300 (14:12:41 hrs.).

Sondrestrom FIC contacted Gander ATC and informed Gander that the flight N108GF was climbing up into Gander CTA. Gander informed Sondrestrom that he was unable to issue a clearance to climb due to air

traffic. The conflicting air traffic was a formation of five F16 cruising at FL270 approaching the position 61N 40W. The formation would be heading east towards Iceland. Gander informed Sondrestrom that there should not be any other conflicting air traffic on the track from BGBW to BGSF.

Sondrestrom FIC contacted N108GF again an informed the commander that he had been in contact with Gander ATC. Gander was unable to issue a clearance to climb to FL300; but if required in order to reach BGSF he could climb and maintain FL300. The commander was informed that the only air traffic in the area was at 61°N 40°W at FL270 heading for Iceland (14:14:25 hrs.). The commander told Sondrestrom that he was climbing to FL300; but that he was not sure if he could reach BGSF (14:15:02 hrs.).

Sondrestrom FIC made phone contact to Sondrestrom Approach at 14:15:58 hrs. in progress concerning a P180 [N108GF] from BIKF to BGBW. The flight could not land at BGBW and was diverting to BGSF. The flight was operating on "minimum fuel" and it was climbing without clearance from Gander ATC to FL300. Sondrestrom FIC informed Sondrestrom Approach that it was possible that the flight was unable to reach BGSF and that Approach should "call out the cavalry". FIC informed Approach the flight initially estimated BGSF at 15:24 hrs. and that he would update Approach with a new estimate after the flight had reached FL300. Approach was informed that the type of aircraft was a P180 and that the flight had departed from BIKF.

At 14:17 hrs, RCC informed the "National Airline" MCC that there was a possibility for the need of a SAR operation and that their service could be required.

Sondrestrom FIC contacted Reykjavik ATC and informed them that the flight was climbing to FL300 within Gander CTA (14:19:47 hrs.). At the same time the flight made radio contact with Sondrestrom FIC. At 14:20:09 hrs, N108GF informed Sondrestrom that the flight was leveling out at FL320 and that the predicted amount of landing fuel at BGSF was 61 lbs. (14:20:09 hrs.). The commander added that he considered climbing to FL340. Sondrestrom informed the commander that he would coordinate the new information with Reykjavik ATC. Sondrestrom then informed the commander of the latest weather observation for BGSF from 13:50 hrs; Wind 280° at 10 knots, Visibility was 10 km., Scattered clouds at 7000 ft, Broken clouds at 10.000 ft, Temperature was 3° C, Dew point was -1° C and the air pressure (QNH) was 988 hPa. Sondrestrom FIC asked the commander of his present position (14:20:56 hrs.).

At approximately the same time the police was contacted by the Fire and Rescue Service and was informed about the flight in distress. The police was informed that the flight was on its way from BGBW towards BGSF. The police contacted Narsarsuaq AFIS at 14:26:20 hrs. and was informed that the flight was just able to reach BGSF and that the AFIS operator was not sure if the runway at BGGH was long enough for the flight to land. The police was also informed that there was one person on board the aircraft.

Sondrestrom FIC asked the commander to confirm that he was the only person on board. The commander confirmed that he was alone (14:27:13 hrs.). Sondrestrom informed the commander that he could remain on his radio frequency all the way towards BGSF until he could reach Sondrestrom Approach on the radio.

At 14:31 hrs, the police decided to set up a Command Centre.

RCC contacted the MCC. RCC informed the MCC that there were two AS 350 helicopters available at BGSF. RCC then asked if there were any helicopter pilots available at BGSF. The MCC replied at 14:32 hrs. that there was no helicopter pilots available at BGSF.

Sondrestrom FIC asked the commander on N108GF to report when he was passing 63° 30'N. The commander replied that he did not know (14:34:30 hrs.).

Sondrestrom RCC made a phone call to the MCC asking them to send a helicopter pilot from BGGH to BGSF. However, the scheduled flight was just about to depart from BGGH and it was not possible to arrange the transportation that late (14:38 hrs.).

The commander [N108GF] informed Sondrestrom FIC that he was descending [from FL320] to FL300 and that he had stopped one engine (14:38:48 hrs.). Sondrestrom acknowledged and asked the commander for a revised ETA for BGSF. The commander replied that he was estimating BGSF in 57 minutes and added if he could reach the aerodrome. The estimated landing fuel was at that time 100 lbs. (14:39:06 hrs.). Sondrestrom informed the commander that a helicopter pilot was on his way to BGSF to man the helicopter stationed in BGSF (14:40:02 hrs.).

The commander informed Sondrestrom FIC about his flight. The flight had been rerouted and assigned a lower flight level en-route to BGBW and he had to descent to FL200. The flight had a 100 kt headwind at that flight level and the weather situation at BGBW had deteriorated (14:40:09 hrs.).

Reykjavik ATC contacted Sondrestrom FIC in order to get an update on the flight. Sondrestrom informed Reykjavik that the flight was at FL300 with one engine shut down and with an ETA on BGSF at 15:36 hrs. Reykjavik asked for a position report and was informed that the flight passed 62°N 46°W at time 14:22 hrs. and he was instructed to report 63° 30'N next (14:41:56 hrs.).

Sondrestrom FIC contacted N108GF and asked for an estimate for 63° 30'N. The commander informed Sondrestrom that his present position was 63° 49'N 47° 34'W (14:43:13 hrs.). Sondrestrom instructed the flight to report when the aircraft had 90 miles to BGSF.

The police contacted Sondrestrom Rescue Coordination Center (RCC) at 14:45:44 hrs. The police informed RCC that they had established a Command Centre. The police was informed by RCC that the search and rescue would be coordinated by RCC. The police was informed that the ETA was 15:36 in approximately 50 minutes.

RCC personnel became aware that a combined Dash 7 & AS 350 [helicopter] commander already was at BGSF; but he was assigned to fly a scheduled Dash 7 flight out of BGSF on the same day.

N108GF contacted Sondrestrom FIC. The commander expressed his doubt about being able to reach BGSF. The predicted landing fuel was 30 lbs. (14:50:55 hrs.). Sondrestrom informed the commander that firefighters, ambulance, and the police were ready. RCC was still working on having the helicopter pilot

flown in to BGSF (14:51:43 hrs.). The commander informed Sondrestrom that with a rate of descent of 400 ft pr. minute he should be able to make it but he was not sure that there was enough fuel to land the aircraft (14:52:11 hrs.). Sondrestrom asked what the remaining distance was to BGSF and the commander replied 173 NM and according to the Flight Management System (FMS) the ETA was in 48 minutes (14:52:40 hrs.).

Reykjavik ATC contacted Sondrestrom FIC to inform about the Supplementary Flight Plan Information (SPL). Reykjavik informed that the aircraft was white and blue and was carrying maritime survival equipment on board. Reykjavik suggested sending the SPL by e-mail to Sondrestrom (14:53:40 hrs.).

At 14:54:37 hrs, Sondrestrom FIC asked the commander to confirm that he had started the descent. The commander confirmed that he had started a slow [shallow] descent in order to maintain the speed and added that the rate of descent was 300 ft pr. minute.

Sondrestrom FIC informed the flight that Sondrestrom Approach had cleared the flight to descent at his own discretion into controlled airspace (14:57:07 hrs.).

At 14:58 hrs, RCC contacted the MCC and informed them that the combined Dash 7 & AS 350 commander was at BGSF and he could be ready for the SAR operation. RCC would like to keep the commander on stand by for a possible SAR operation. The MCC would contact the Operation Manager to see if that was possible. At approximately the same time RCC was informed that an AS 350 helicopter [OY-HGW] at BGSF was serviceable and could be ready for a SAR operation.

Reykjavik ATC contacted Sondrestrom FIC to check if the SPL information was received. Sondrestrom confirmed that they had received the SPL and they could inform Reykjavik about the aircraft position. The latest information from time 14:52 hrs. was that the aircraft was slowly descending at a distance of 170 NM to Kangerlussuaq. The ETA overhead SF was 15:40 hrs.

At 15:13:15 hrs, Sondrestrom FIC asked N108GF how the flight was progressing. The commander informed Sondrestrom that he needed to “ditch the aircraft” and he asked for the direction to the sea. Sondrestrom asked the commander to confirm that the flight did not have enough fuel to continue to BGSF. The commander confirmed and added that the remaining fuel in left fuel tank was 15 lbs. and the remaining fuel in right fuel tank was 120 lbs. He added that he was slowly descending leaving FL180 at a rate of 300 ft pr. minute and with a remaining distance to SF of 100 NM. The commander was uncertain if he could reach BGSF. Sondrestrom read back the information to the commander.

Sondrestrom FIC instructed N108GF to report 90 NM to SF (15:14:25 hrs.). The commander asked for the direction of the sea as he did not want to land in the mountains. Sondrestrom informed the commander that there was no sea on the route the aircraft was flying. Sondrestrom informed the commander that the fjord was west of the aircraft position and that the fjord was stretching [to northeast] all the way up to BGSF. Sondrestrom added that there was no sea close to the aircraft position (15:14:50 hrs.).

At 15:15:19 hrs, N108GF asked Sondrestrom FIC how far west of his position was the sea. The commander was informed that the aerodrome (BGSF) was closer to his position than the fjord.

Sondrestrom FIC contacted N108GF and instructed the commander to make radio contact with Sondrestrom Approach on frequency 126.200 MHz (15:20:08 hrs.). The commander read back the instruction and added that the ATC controller change of route and change to the low cruise flight level [FL200] had brought him in this situation. Sondrestrom FIC acknowledged (15:20:24 hrs.). The commander asked for the frequency again and was informed that the frequency was 126.200 MHz (15:21:03 hrs.).

N108GF made radio contact with Sondrestrom Approach at 15:21:20 hrs. The commander informed Approach that he only had 115 lbs. fuel left and that he was not sure if he was able to reach BGSF. He informed Approach that he was 88 NM from BGSF and he was passing 13.900 ft in a slow descent [shallow descent]. The commander asked Approach for a 5 NM final approach to runway 09. Sondrestrom Approach acknowledged and informed the commander that he could expect a straight in approach for runway 09 as number one without any delay. Approach informed the commander about the weather situation; Wind 280° 10 kts., Visibility was more than 10 km., Scattered clouds at 7,000 ft, Broken clouds at 10,000 ft, Temperature 3° C, Dew point -3° C, The air pressure (QNH) was 990 hPa equal to 29.26 Inches Hg and the runway conditions was dry runway with good braking action. The commander acknowledged.

Sondrestrom Approach asked N108GF if it had a transponder code. The commander replied that he was operating on one generator so he would like to save the transponder. Approach asked him to turn the transponder on when he was within 30 NM of BGSF (15:22:44 hrs.).

Approach contacted N108GF and asked for the present altitude. The commander replied that he was 76 NM from BGSF and the altitude was 10,500 ft (15:26:10 hrs.). Approach informed the commander that the safe altitude in the area was FL110 or around 10,000 ft. Approach suggested to keep a good lookout and asked if the flight was in Visual Meteorological Condition (VMC) or in Instrument Meteorological Condition (IMC). The commander replied that he was in VMC and the flight was between layers (15:26:21 hrs.).

Approach asked N108GF of the exact position of the flight and the commander replied his present position was N65° W49° (15:28:02 hrs.). Approach was not sure about the reply and asked again about the position of the flight and the commander replied 65° 55’N 49° 30’W (15:28:19 hrs.).

Approach asked the commander to inform him if he was going to make a landing in the terrain as he needed the information for the helicopter search and rescue operation (SAR). The commander replied that he was going to land in the terrain. He informed Approach that he only had 92 lbs. remaining fuel and that the aircraft barely could maintain 9,000 ft (15:28:42 hrs.).

At 15:29:10 hrs, the SAR helicopter OY-HGW [AS 350 B3] asked Sondrestrom Tower for a startup clearance from the apron. Tower approved the startup and informed the SAR commander that the last known position of N108GF was 65° 55’N 49° 30’W and that the flight was passing 9,000 ft and that the

aircraft would land in the terrain. On board the SAR helicopter was the combined Dash 7 & AS 350 commander, one firefighter, one nurse and one police officer.

N108GF made radio contact with Sondrestrom Approach and informed Approach that the flight was 68 NM from BGSF at 8,700 ft and he was still in VMC but the condition was changing quickly (15:29:43 hrs.). Approach asked the commander of his exact position and informed him that the SAR helicopter was airborne (15:29:57 hrs.). The commander asked Approach about the elevation of the terrain. Approach asked the commander to "stand by" as he was checking the elevation (15:30:14 hrs.). Approach informed the commander that according to the tower maps the elevation was approximately 5,000 ft. However, there could be some mountain tops a little higher (15:30:46 hrs.). The commander informed Approach that he had 65 NM to BGSF (15:30:57 hrs.). At 15:31:07 hrs, Approach asked the commander if he was flying over ice or over land. The commander answered that he could not tell but it was white.

The MCC called RCC on the phone and informed them that a helicopter pilot was on his way from Nuuk (BGGH) and the flight estimated to land at BGSF at 17:15 hrs. (15:30 hrs.).

At 15:31:28 hrs, a Dash 7 operating on a scheduled flight made radio contact with Sondrestrom Approach and was instructed to maintain radio silence and to continue the flight at FL170. The Dash 7 crew informed Approach that their flight was close to the flight in distress. Approach then informed the Dash 7 flight crew that the last known position of N108GF was 65° 55'N 49° 30'W and that the flight in distress was at 8,000 ft descending. The Dash 7 crew acknowledged and informed Approach that their present position was 65° 29'N 51° 28'W. Approach informed the Dash 7 crew that the flight in distress last known distance to BGSF was 68 NM presumably on ATS route W21.

At 15:32:26 hrs, Approach called N108GF. The commander replied but the controller was only able to hear a broken transmission. The altitude was reported to be 6,700 ft and the distance to BGSF was 62 NM. The rest of the transmission was unreadable. Approach informed N108GF that they were losing radio contact but there was a Dash 7 in the area that could relay the radio communication. Approach then asked the Dash 7 crew to get an update on the position of N108GF (15:33:14 hrs.). The Dash 7 crew asked N108GF of the present position - if time permitted. The Dash 7 crew informed Approach that N108GF was 60 NM from BGSF at an altitude of 6,200 ft. The Dash 7 crew informed N108GF that they were in the area and that they would assist him in any way they could (15:33:23 hrs.).

The Dash 7 crew informed N108GF about the terrain, the valleys, the ice and the mountains in the area (15:34:20 hrs.). They asked the commander if he still had power and if he was sure that the terrain below him was ice and not clouds.

At 15:35:49 hrs, Sondrestrom Approach asked the Dash 7 crew to ask N108GF to turn on the Emergency Locater Transmitter (ELT). The Dash 7 crew relayed the request to the flight in distress.

The SAR helicopter (OY-HGW) reported that they had departed BGSF [area] at 15:36:30 hrs.

The Dash 7 crew informed Approach that N108GF reported its position as 66N 49W and that there was no time to activate the ELT. The commander reported that he was landing at that position (15:36:55 hrs.). The Dash 7 crew informed Approach that they were standing by for further instructions.

The precautionary landing on the icecap

N108GF made an approach and landing on the icecap with the left engine stopped and the left propeller feathered. The right engine was running and producing power. The fuel cross feed valve was open. The landing gear was in the retracted position and the flaps were in middle position. The commander was hampered by the white surface on the icecap making the flare and landing difficult. At the contact with the terrain, numerous pieces separated from the aircraft. Then the tail section separated from the aircraft followed by the separation of the wing/engine section. The cockpit/cabin section continued to slide a few meters until it hit a one meter high ice formation. The cockpit/cabin section turned over the nose and came to rest in an opposite direction of the flight path. The cockpit/cabin section was lying on the side banking approximately 60° to the left. The aircraft came to rest after a slide on the icecap of approximately 50 meters. The accident occurred at 15:40 hrs. under VMC and in daylight.

The search and rescue

The commander [N108GF] was able to leave his seat and take position in the passenger section. There was no arctic survival equipment on board the aircraft. The only protection was the aircraft fuselage and the commanders own clothing. The ELT was not activated before the accident, it did not activate during the accident and it was not activated after the accident.

The SAR helicopter commander reported that the visibility and cloud ceiling made it impossible to fly directly from BGSF to the last known position of N108GF. The SAR commander suggested starting a SAR helicopter from BGGH (15:41 hrs.). [The SAR helicopter was equipped with satellite communication equipment].

The SAR commander tried successfully to navigate around the bad weather by flying through the “Paradisdalen” (Paradise Valley) (15:43 hrs.).

At 15:45 hrs, RCC informed the Command Centre that additional police officers, fire fighters and a medical doctor were ready at Nuuk.

At 15:47 hrs, RCC contacted MCC and was informed by MCC that the weather condition at BGGH was doubtful concerning a SAR helicopter operation from BGGH.

At 16:11 hrs, RCC informed MCC that additional helicopter support was required.

At 16:15 hrs, Sondrestrom FIC informed the SAR helicopter commander that according to the last radio communication between the Dash 7 crew and the commander on N108GF the aircraft position was 66N 49W. FIC informed that the last information was; that the surface below was white but it was unknown if it was clouds or ice; and there was not time enough to switch the ELT on.

At 16:24 hrs, the SAR commander reported that he estimated the “last known position” in 17 minutes and the remaining endurance was two hours. He would start the return flight within one hour. He also requested that the next helicopter would bring along extra fuel.

At 16:27 hrs, RCC contacted MCC and requested that the next helicopter should bring along extra fuel. But MCC stated that the weather conditions at BGGH were poor and it was not possible to operate a helicopter out of BGGH. Instead a helicopter crew would be transported in a King Air (OY-PCL) from BGGH to BGSF.

At 16:33 hrs, the SAR commander requested a weather forecast for BGSF and the area at the edge of the icecap.

At 16:35 hrs, the SAR helicopter was at the position 66N 50W and started the search for N108GF.

At 16:39 hrs, MCC informed RCC that the King Air carrying a helicopter pilot had arrived at BGSF.

At 16:40 hrs, the SAR commander reported that the accident aircraft [N108GF] was located at the position 66 08N 49 55W. At the same time, the SAR commander received the latest weather information: Poor weather was moving into the area with rain and snow and the visibility would drop.

At 16:47 hrs, the SAR commander reported that they might not be able to return as the weather condition was deteriorating and they had a limited amount of fuel. The commander requested that the next helicopter would bring some extra fuel.

The SAR helicopter landed 30 meters from the accident site at 16:50 hrs. The police officer, the nurse, and the firefighter continued on foot to the wreckage and found the commander [N108GF] alive inside the cockpit/cabin section. The rescue team opened the cabin door and the commander could leave the cabin. Some of the pilot’s personal documents and some of the aircraft documents were recovered. At the same time the weather situation was deteriorating with low clouds and poor visibility moving into the area.

At 17:04 hrs, RCC informed the Command Centre that the wreckage was located and it was decided to keep the King Air at BGSF on standby.

The SAR helicopter was airborne at approximately 17:15 hrs. and the SAR commander managed to avoid the poor weather that was moving into the area.

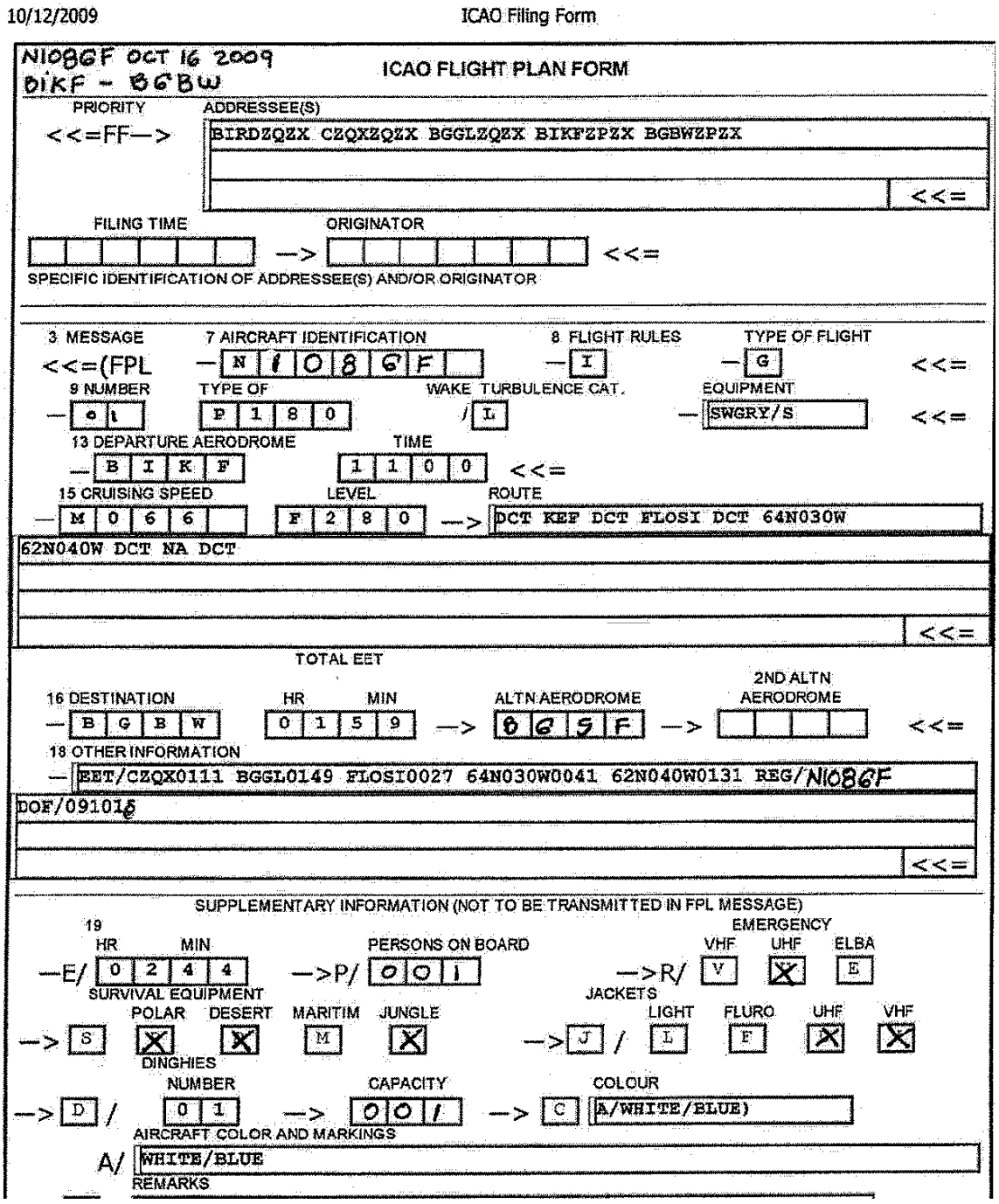
At 17:22 hrs, the SAR commander informed RCC that the commander from N108GF was alive and on board the SAR helicopter and the helicopter would return to BGSF. The flight would follow the edge of the icecap. The endurance was one hour and fifteen minutes and they were five persons on board.

The SAR helicopter landed at BGSF at 17:59 hrs.

The commander from N108GF was treated by the medical staff at BGSF and transported to BGGH in the King Air (OY-PCL). The commander was transported from BGGH to the hospital at Nuuk. The next day the commander was physically well enough to leave the hospital.

5.1.2 ATS Flight Plan

Filed ATS Flight Plan (Operator and name of the PIC left out)



10/12/2009 ICAO Filing Form

N108GF OCT 16 2009
BIKF - BGBW

ICAO FLIGHT PLAN FORM

PRIORITY <<=FF—>

ADDRESSEE(S)
BIRDZQZX CZQXZQZX BGGLZQZX BIKFZPZX BGBWZPZX <<=

FILING TIME

ORIGINATOR <<=

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR

3 MESSAGE <<=(FPL

7 AIRCRAFT IDENTIFICATION — N108GF

8 FLIGHT RULES — I

TYPE OF FLIGHT — G <<=

9 NUMBER — 01

TYPE OF — P180

WAKE TURBULENCE CAT. / L

EQUIPMENT — SWGRY/S <<=

13 DEPARTURE AERODROME — BIKF

TIME 1100 <<=

15 CRUISING SPEED — M066

LEVEL F280

ROUTE —> DCT KEF DCT FLOSI DCT 64N030W
62N040W DCT NA DCT <<=

TOTAL EET

16 DESTINATION — BGBW

HR 01 MIN 59

ALTN AERODROME — BGSF

2ND ALTN AERODROME <<=

18 OTHER INFORMATION — EET/CZQX0111 BGGL0149 FLOSI0027 64N030W0041 62N040W0131 REG/N108GF
DOF/091016 <<=

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGE)

19

E/ HR 02 MIN 44

P/ PERSONS ON BOARD 001

R/ EMERGENCY RADIO: VHF V, UHF X, ELBA E

S/ SURVIVAL EQUIPMENT: POLAR X, DESERT X, MARITIM M, JUNGLE X

J/ JACKETS: LIGHT L, FLURO F, UHF X, VHF X

D/ DINGHIES: NUMBER 01, CAPACITY 001, COLOUR C A/WHITE/BLUE)

A/ AIRCRAFT COLOR AND MARKINGS: WHITE/BLUE

REMARKS

5.1.3 Reconstructed Flight Planning

Note: Wind information used are "FL300 Fixed time prognostic cart valid 12 UTC 16 OCT 2009"

Note: The FOB after refueling was 2860. The assumed Taxi Fuel was 50 Lbs. The assumed Take-off Fuel was 2810 Lbs.

RECOMMENDED CRUISE POWER 1800 RPM ISA FL280

WPT	KTAS	ESAD	WC	GS	DIST	TIME	TOT FF	FUEL	FOB		UTC
BIKF									**2810**	**ATD**	**11:03**
TOC	**202**	**37**	**-43**	**159**	**29**	**11**	**927**	**170**	**2640**	**ETO**	**11:14**
FLOSI	**375**	**103**	**-44**	**331**	**91**	**16**	**742**	**204**	**2436**	**ETO**	**11:30**
64N30W	**375**	**86**	**-47**	**328**	**75**	**14**	**742**	**170**	**2267**	**ETO**	**11:43**
62N40W	**375**	**409**	**-102**	**273**	**298**	**65**	**742**	**809**	**1458**	**ETO**	**12:48**
TOD	**375**	**94**	**-64**	**311**	**78**	**15**	**742**	**185**	**1273**	**ETO**	**13:02**
NA	**338**	**90**	**-21**	**317**	**84**	**16**	**563**	**150**	**1123**	**ETO**	**13:18**
BGBW	**150**	**40**	**0**	**150**	**40**	**16**	**700**	**187**	**936**	**ETA**	**13:34**
Subtotal	335	858	-64	272	695	154		1874			
BGBW									**936**		**13:34**
TOC	**202**	**37**	**20**	**222**	**41**	**11**	**927**	**170**	**766**	**ETO**	**13:45**
TOD	**375**	**221**	**22**	**397**	**234**	**35**	**742**	**438**	**329**	**ETO**	**14:20**
BGSF	**316**	**100**	**10**	**326**	**103**	**19**	**600**	**190**	**139**	**ETA**	**14:39**
Subtotal	329	358	18	347	378	65		798			
Final reserve						**11**	**742**	**139**	**0**		
TOTAL	333	1216	**-39**	294	**1073**	**230,1**	**minutes**	**2810**			
						03:50	**hh:mm**				

Note: Wind information used are "FL180 Fixed time prognostic cart valid 12 UTC 16 OCT 2009"

Note: The FOB after refueling was 2860. The assumed Taxi Fuel was 50 Lbs. The assumed Take-off Fuel was 2810 Lbs.

RECOMMENDED CRUISE POWER 1800 RPM ISA FL200

WPT	KTAS	ESAD	WC	GS	DIST	TIME	TOT FF	FUEL	FOB		UTC
BIKF									**2810**	**ATD**	**11:03**
TOC	**171**	**20**	**-25**	**146**	**17**	**7**	**986**	**115**	**2695**	**ETO**	**11:10**
FLOSI	**346**	**110**	**-23**	**323**	**103**	**19**	**778**	**248**	**2447**	**ETO**	**11:29**
64N30W	**346**	**86**	**-45**	**301**	**75**	**15**	**778**	**194**	**2253**	**ETO**	**11:43**
62N40W	**346**	**355**	**-56**	**290**	**298**	**62**	**778**	**799**	**1454**	**ETO**	**12:44**
TOD	**346**	**118**	**-21**	**325**	**111**	**21**	**778**	**266**	**1188**	**ETO**	**13:04**
NA	**338**	**55**	**-27**	**311**	**51**	**10**	**630**	**105**	**1083**	**ETO**	**13:14**
BGBW	**150**	**40**	**0**	**150**	**40**	**16**	**700**	**187**	**896**	**ETA**	**13:30**
Subtotal	316	785	-36	279	695	149		1914			
BGBW									**896**		**13:30**
TOC	**109**	**20**	**10**	**119**	**22**	**11**	**927**	**115**	**781**	**ETO**	**13:41**
TOD	**346**	**282**	**9**	**355**	**289**	**49**	**778**	**634**	**147**	**ETO**	**14:29**
BGSF	**205**	**65**	**6**	**211**	**67**	**19**	**458**	**145**	**2**	**ETA**	**14:48**
Subtotal	279	367	8	288	378	79		894			
Final reserve						**0**	**778**	**2**	**0**		
TOTAL	303	1152	**-21**	282	**1073**	**228,3**	**minutes**	**2810**			
						03:48	**hh:mm**				

Note: Wind information used are "FL300 Fixed time prognostic cart valid 12 UTC 16 OCT 2009"

Note: The FOB after refueling was 2860. The assumed Taxi Fuel was 50 Lbs. The assumed Take-off Fuel was 2810 Lbs.

MAXIMUN RANGE POWER 1800 RPM ISA FL280

WPT	KTAS	ESAD	WC	GS	DIST	TIME	TOT FF	FUEL	FOB		UTC
BIKF									**2810**	**ATD**	**11:03**
TOC	**202**	**37**	**-43**	**159**	**29**	**11**	**927**	**170**	**2640**	**ETO**	**11:14**
FLOSI	**285**	**108**	**-46**	**239**	**91**	**23**	**468**	**178**	**2462**	**ETO**	**11:36**
64N30W	**285**	**91**	**-50**	**235**	**75**	**19**	**468**	**149**	**2312**	**ETO**	**11:55**
62N40W	**285**	**473**	**-106**	**179**	**298**	**100**	**468**	**777**	**1535**	**ETO**	**13:34**
TOD	**285**	**102**	**-69**	**216**	**78**	**21**	**468**	**168**	**1368**	**ETO**	**13:55**
NA	**338**	**90**	**-21**	**317**	**84**	**16**	**563**	**150**	**1218**	**ETO**	**14:11**
BGBW	**150**	**40**	**0**	**150**	**40**	**16**	**700**	**187**	**1031**	**ETA**	**14:27**
Subtotal	274	942	-72	202	695	206		1779			
BGBW									**1031**		**14:27**
TOC	**202**	**37**	**20**	**222**	**41**	**11**	**927**	**170**	**861**	**ETO**	**14:38**
TOD	**285**	**220**	**22**	**307**	**236**	**46**	**468**	**361**	**500**	**ETO**	**15:24**
BGSF	**316**	**100**	**3**	**319**	**101**	**19**	**600**	**190**	**310**	**ETA**	**15:43**
Subtotal	281	357	17	298	378	76		721			
Final reserve						**40**	**468**	**310**	**0**		
TOTAL	276	1298	**-48**	228	**1073**	**322,1**	**minutes**	**2810**			
						05:22	**hh:mm**				

Note: Wind information used are "FL180 Fixed time prognostic cart valid 12 UTC 16 OCT 2009"

Note: The FOB after refueling was 2860. The assumed Taxi Fuel was 50 Lbs. The assumed Take-off Fuel was 2810 Lbs.

MAXIMUM RANGE POWER 1800 RPM ISA FL200

WPT	KTAS	ESAD	WC	GS	DIST	TIME	TOT FF	FUEL	FOB		UTC
BIKF									**2810**	**ATD**	**11:03**
TOC	**171**	**20**	**-25**	**146**	**17**	**7**	**986**	**115**	**2695**	**ETO**	**11:10**
FLOSI	**268**	**113**	**-25**	**243**	**103**	**25**	**540**	**228**	**2467**	**ETO**	**11:35**
64N30W	**268**	**91**	**-48**	**220**	**75**	**20**	**540**	**184**	**2283**	**ETO**	**11:55**
62N40W	**268**	**379**	**-57**	**211**	**298**	**85**	**540**	**763**	**1519**	**ETO**	**13:19**
TOD	**268**	**121**	**-21**	**247**	**111**	**27**	**540**	**244**	**1276**	**ETO**	**13:46**
NA	**338**	**55**	**-27**	**311**	**51**	**10**	**630**	**105**	**1171**	**ETO**	**13:56**
BGBW	**150**	**40**	**0**	**150**	**40**	**16**	**700**	**187**	**984**	**ETA**	**14:12**
Subtotal	258	819	-39	219	695	191		1826			
BGBW									**984**		**14:12**
TOC	**171**	**20**	**11**	**182**	**21**	**7**	**1457**	**115**	**869**	**ETO**	**14:19**
TOD	**268**	**281**	**9**	**277**	**290**	**63**	**540**	**566**	**303**	**ETO**	**15:21**
BGSF	**300**	**65**	**6**	**306**	**66**	**13**	**669**	**145**	**158**	**ETA**	**15:34**
Subtotal	265	366	9	274	378	83		826			
Final reserve						**18**	**540**	**158**	**0**		
TOTAL	260	1185	**-25**	235	**1073**	**291,1**	**minutes**	**2810**			
						04:51	**hh:mm**				

5.1.4 Reconstructed actual Flight

Note: Reconstructed flight profile

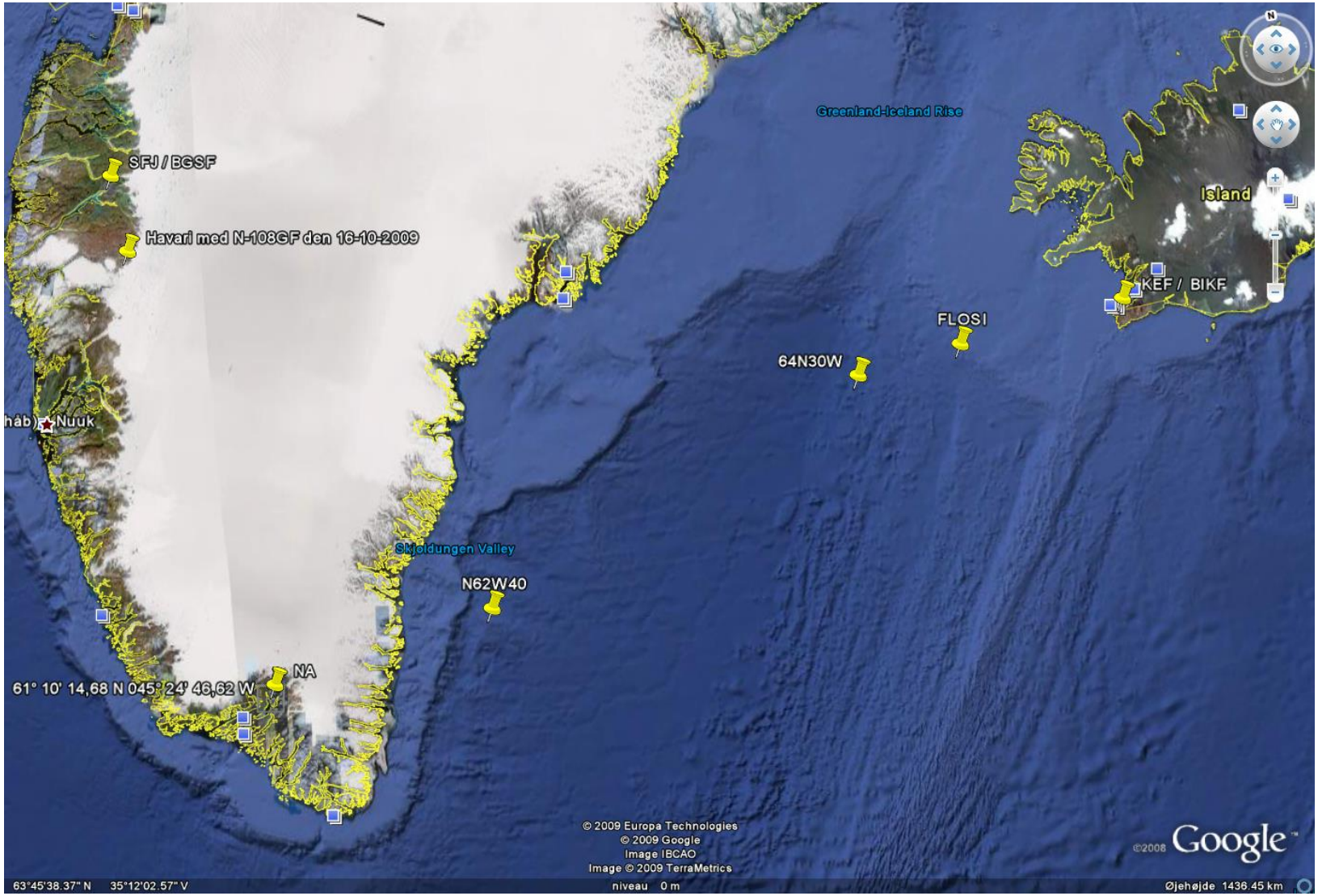
Note: The FOB after refueling was 2860. The assumed Taxi Fuel was 50 Lbs. The assumed Take-off Fuel was 2810 Lbs.

MIXED CRUISE POWER 1800 RPM ISA F200/A6800/F190/F320

	WPT	KTAS	ESAD	WC	GS	DIST	TIME	TOT FF	FUEL	FOB		UTC	FL		UTC
	BIKF									**2810**	**ATD**	**11:03**	**0**	**ATD**	**11:03**
	TOC	**202**	**37**	**-30**	**172**	**32**	**11**	**927**	**170**	**2640**	**ETO**	**11:14**	**280**		
	FLOSI	**375**	**96**	**-30**	**345**	**89**	**15**	**742**	**190**	**2450**	**ETO**	**11:29**	**280**		
	TOD	**375**	**52**	**-30**	**345**	**48**	**8**	**742**	**103**	**2346**	**ETO**	**11:37**	**280**		
	64N30W	**350**	**35**	**-80**	**270**	**27**	**6**	**450**	**45**	**2301**	**ETO**	**11:43**	**200**		
	62N40W	**346**	**388**	**-80**	**266**	**298**	**67**	**778**	**872**	**1430**	**ETO**	**12:50**	**200**	**ATO**	**12:13**
	TOD	**268**	**171**	**-80**	**188**	**120**	**38**	**540**	**345**	**1085**	**ETO**	**13:28**	**200**	**ATO**	**13:28**
	NA	**338**	**55**	**-80**	**258**	**42**	**10**	**630**	**105**	**980**	**ETO**	**13:38**	**68**	**RETO**	**13:41**
	BGBW	**140**	**40**	**0**	**140**	**40**	**17**	**700**	**200**	**780**	**ETA**	**13:55**	**23**		
	Subtotal	302	874	-62	240	695	173		2030						
	BGBW									**780**		**13:55**			
	TOC	**190**	**19**	**10**	**200**	**20**	**6**	**1100**	**110**	**670**	**ETO**	**14:01**	**190**		
	LVL FLT	**266**	**71**	**10**	**276**	**74**	**16**	**552**	**147**	**523**	**ETO**	**14:17**	**190**	**ATO**	**14:12**
	TOC	**233**	**31**	**-30**	**203**	**27**	**8**	**675**	**90**	**433**	**ETO**	**14:25**	**320**	**ATO**	**14:20**
	ONE ENG CR						**0**						**320**	**ATO**	**14:39**
	TOD				**216**	**35**	**19**	**333**	**105**	**328**	**ETO**	**14:44**	**320**	**ATO**	**14:39**
	6349N4734W				**216**	**14**	**4**	**333**	**22**	**305**	**ETO**	**14:48**		**ATO**	**14:43**
	DME SF 173				**216**	**35**	**10**	**333**	**54**	**251**	**ETO**	**14:57**		**ATO**	**14:52**
	DME SF 100				**209**	**73**	**21**	**333**	**116**	**135**	**ETO**	**15:18**	**180**	**ATO**	**15:13**
AV FF	**DME SF 88**				**90**	**12**	**8**	**172**	**23**	**115**	**ETO**	**15:26**	**139**	**ATO**	**15:21**
AV FF	**DME SF 76**				**144**	**12**	**5**	**172**	**14**	**101**	**ETO**	**15:31**	**105**	**ATO**	**15:26**
AV FF	**6555N4930W**				**120**	**4**	**2**	**172**	**6**	**95**	**ETO**	**15:33**		**ATO**	**15:28**
AV FF	**FOB Info**					**0**	**0**	**172**	**0**	**92**	**ETO**	**15:33**	**90**	**ATO**	**15:28**

AV													
FF	**DME SF 68**	**240**	**4**	**1**	**172**	**3**	**89**	**ETO**	**15:34**		**ATO**	**15:29**
AV													
FF	**DME SF 65**	**90**	**3**	**2**	**172**	**6**	**83**	**ETO**	**15:36**		**ATO**	**15:31**
AV													
FF	**DME SF 62**	**180**	**3**	**1**	**172**	**3**	**81**	**ETO**	**15:37**	**67**	**ATO**	**15:32**
AV													
FF	**DME SF 60**	**120**	**2**	**1**	**172**	**3**	**78**	**ETO**	**15:38**	**62**	**ATO**	**15:33**
AV													
FF	**Icecap**	**120**	**4**	**2**	**172**	**6**	**72**	**ETO**	**15:40**	**45**		
	APPR & LND	**120**	**10**	**5**	**400**	**33**	**39**	**ETA**	**15:45**	**35**	**ATA**	**15:40**
	BGBW-LND	180	**332**	**110,7**	**minutes**	**741**	**39**					
				01:50	**hh:mm**							
	BIKF-LND	217	**1027**	**284,1**	**minutes**	**2771**	**39**					
				04:44	**hh:mm**							
	Final reserve			**6**	**400**	**39**	**0**					
	TOTAL	217	**1027**	**289,9**	**minutes**	**2810**						
				04:49	**hh:mm**							

5.1.5 The route of the flight



5.6.1 Piaggio P.180 Avanti

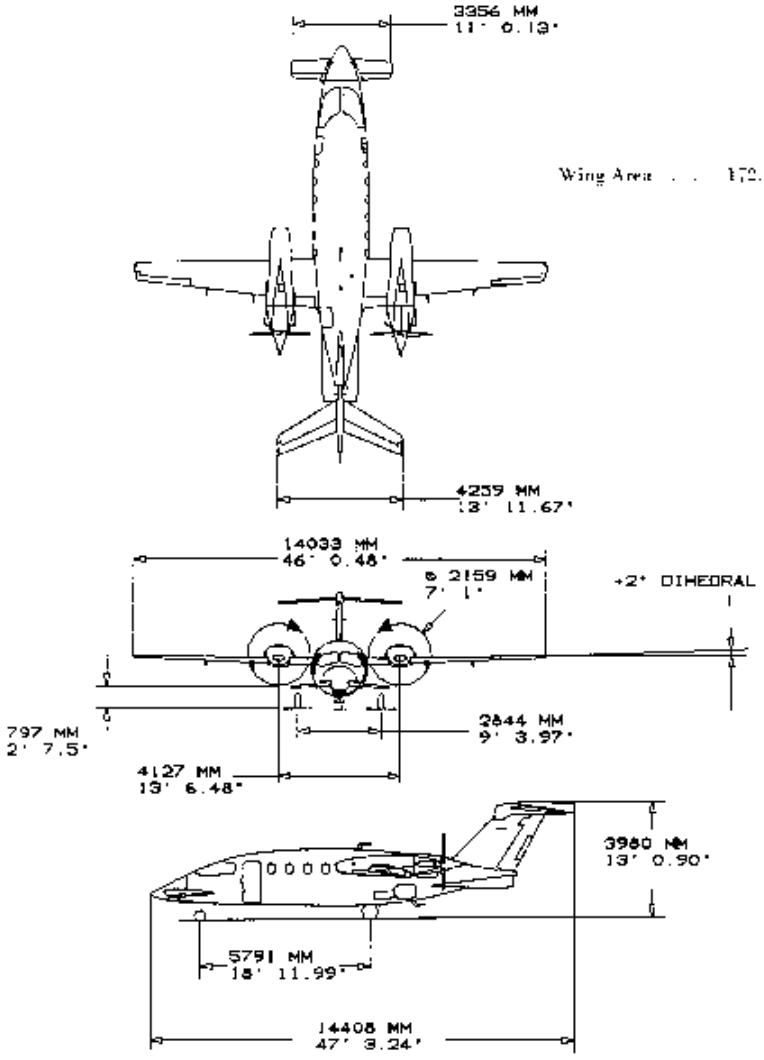


Figure 1-1. THREE VIEW

Accelerate go distance (POH)

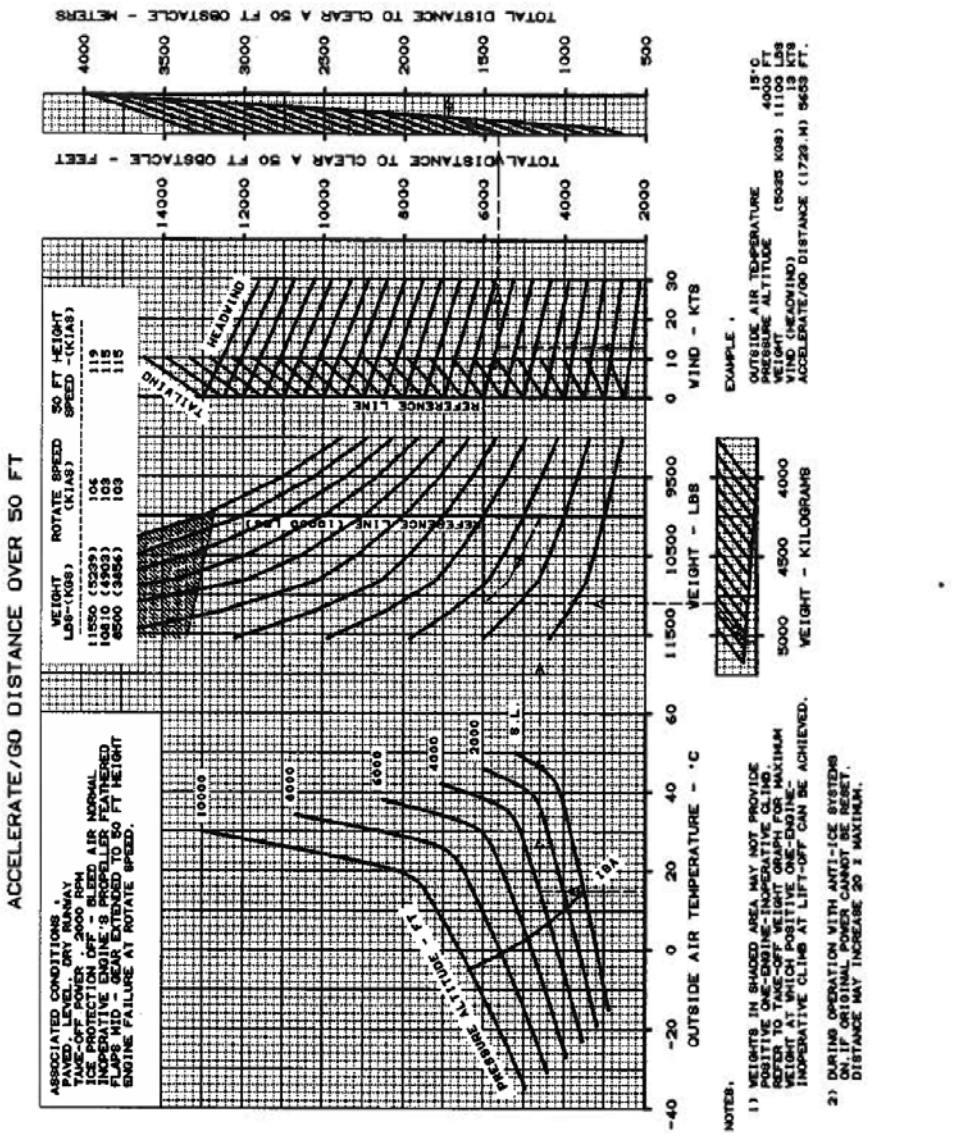


Figure 5-21. ACCELERATE AND GO DISTANCE OVER 50 FEET

5.6.2 One engine inoperative service ceiling (POH)

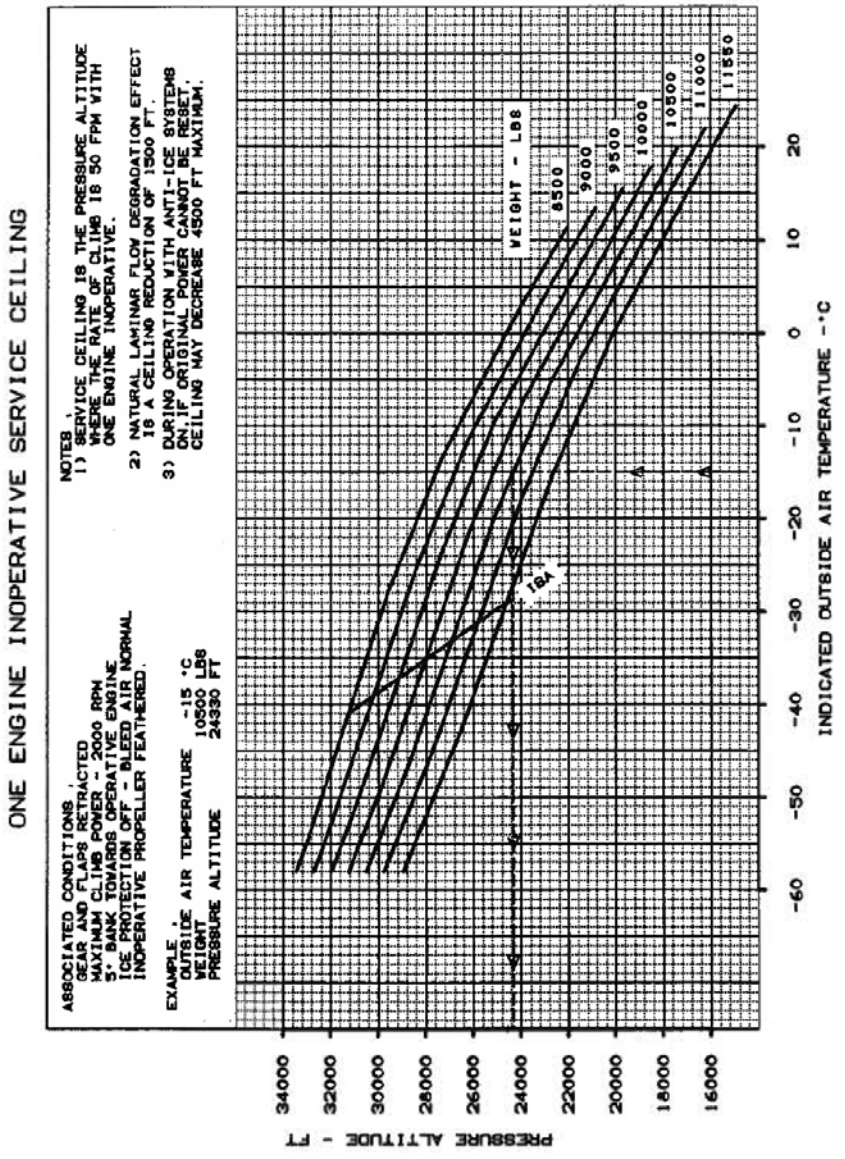


Figure 5-36. ONE ENGINE INOPERATIVE SERVICE CEILING - FLAPS RETRACTED

5.6.3 Time to climb (POH)

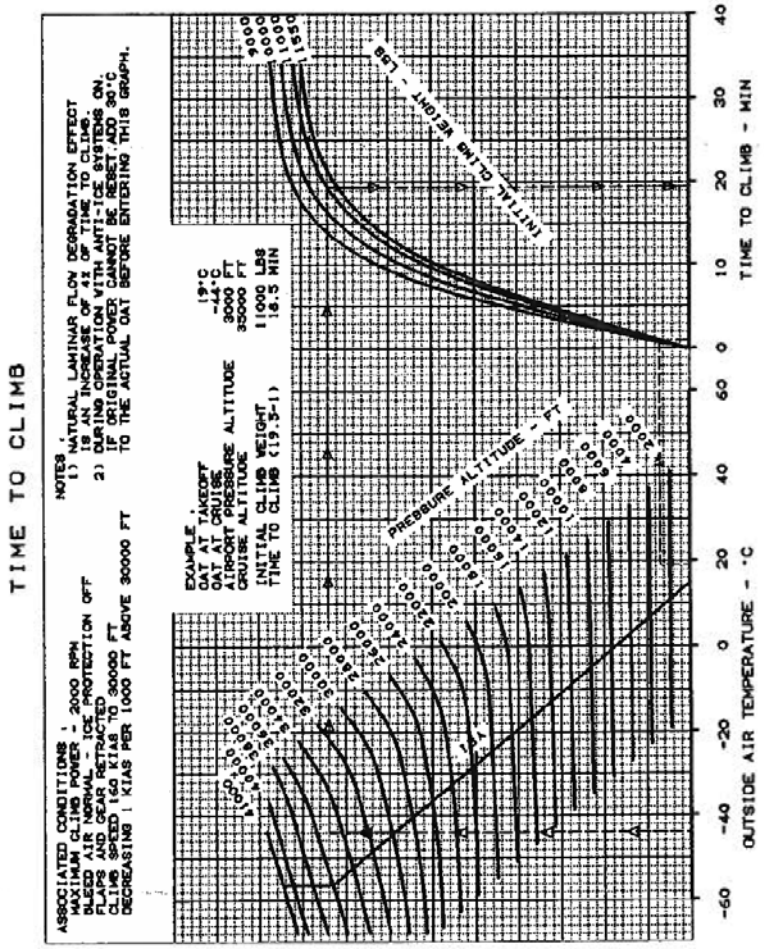


Figure 5-30. TIME TO CLIMB

5.6.4 Fuel to climb (POH)

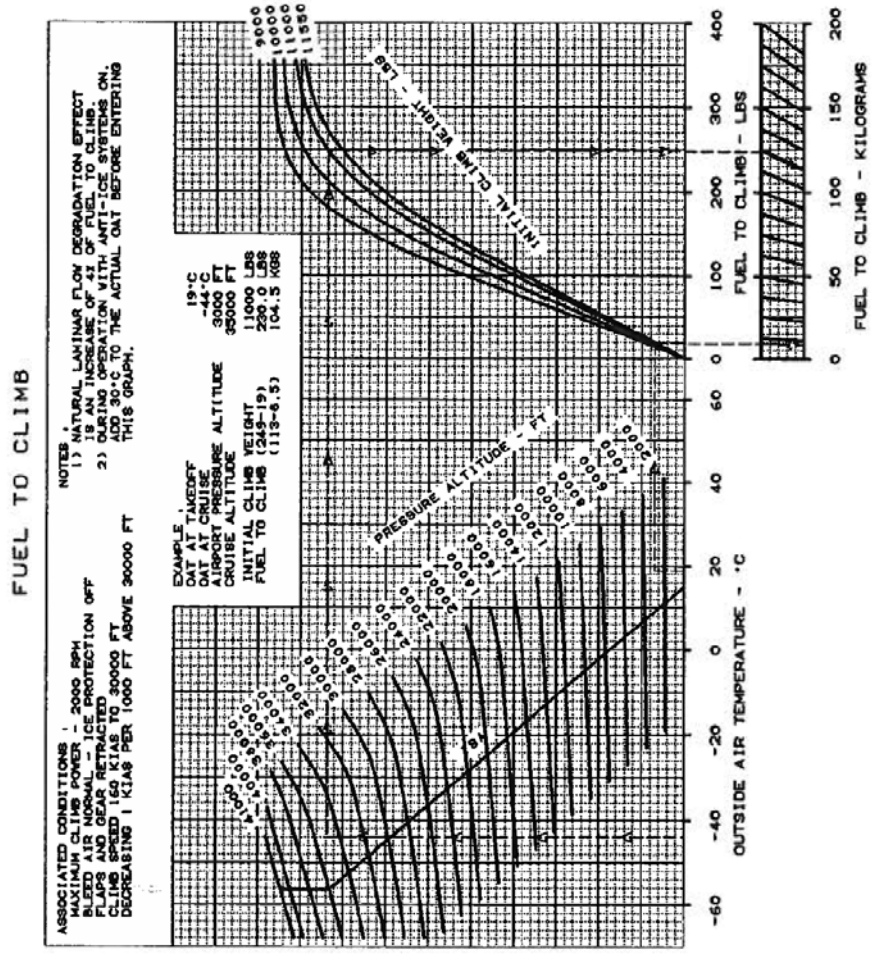


Figure 5-31. FUEL TO CLIMB

5.6.5 Distance to climb (POH)

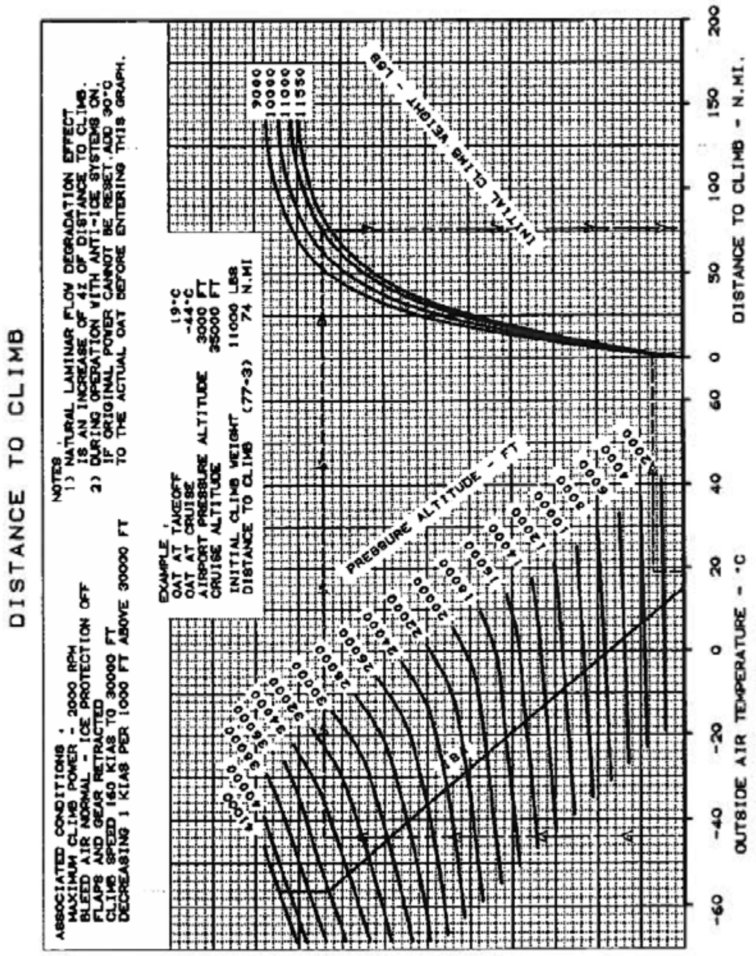


Figure 5-32. DISTANCE TO CLIMB

5.6.6 Recommended cruise power 1800 RPM ISA (POH)

RECOMMENDED CRUISE POWER
1800 RPM
ISA

PRESSURE ALTITUDE	IOAT		ENGINE TORQUE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						11000 LBS (4990 KG)		10000 LBS (4536 KG)		9000 LBS (4082 KG)	
FEET	°C	°F	LB · FT	LBS/HR	LBS/HR	TAS	IAS	TAS	IAS	TAS	IAS
0	21	70	1712	462	924	258	260	258	260	258	260
5000	12	54	1854	439	878	277	260	277	260	277	260
10000	4	39	1971	417	834	298	260	298	260	298	260
15000	-5	23	2077	399	798	321	260	321	260	321	260
20000	-13	8	2183	389	778	346	260	346	260	346	260
23000	-18	-1	2230	386	772	360	258	363	260	363	260
25000	-22	-7	2230	380	760	367	254	370	257	373	258
27000	-25	-13	2230	377	754	374	251	377	253	381	256
28000	-27	-17	2196	371	742	375	247	379	250	383	253
29000	-29	-20	2100	357	714	373	241	377	244	381	247
31000	-33	-28	1915	329	658	367	229	371	232	376	235
33000	-38	-36	1737	303	606	360	216	365	220	370	223
35000	-43	-45	1566	277	554	351	203	358	207	364	211
37000	-46	-50	1370	248	496	336	186	346	192	353	196
39000	-47	-53	1166	217	434	312	164	326	172	338	178
41000	-49	-57	972	188	376	—	—	—	—	316	158

NOTE 1
Natural Laminar Flow Degradation effect is a speed reduction of 5%, maintaining torque as indicated in the Table.

NOTE 2
During operation with Anti Icing systems on, torque may decrease 20%, true airspeed 30 knots and fuel flow 10%, approximately.
If original power is reset, fuel flow may increase approximately 30 LB/H/ENGINE, and speed remains unchanged.

Figure 5-47. RECOMMENDED CRUISE POWER - 1800 RPM - ISA

5.6.7 Maximum range power 1800 RPM ISA (POH)

MAXIMUM RANGE POWER
1800 RPM
ISA

PRESSURE ALTITUDE	IOAT		11000 LBS (4990 KG)				10000 LBS (4536 KG)				9000 LBS (4082 KG)			
			ENGINE TORQUE	FUEL FLOW PER ENGINE	AIR-SPEED		ENGINE TORQUE	FUEL FLOW PER ENGINE	AIR-SPEED		ENGINE TORQUE	FUEL FLOW PER ENGINE	AIR-SPEED	
					TAS	IAS			TAS	IAS			TAS	IAS
FEET	°C	°F	LB · FT	LBS/HR	KTS	KTS	LB · FT	LBS/HR	KTS	KTS	LB · FT	LBS/HR	KTS	KTS
0	20	68	1321	410	234	235	1230	397	231	232	1138	385	228	229
5000	10	51	1302	370	241	225	1215	358	238	222	1127	347	234	219
10000	1	33	1267	331	248	216	1186	322	245	212	1103	312	241	209
15000	-9	16	1212	295	256	206	1139	287	252	203	1065	278	248	199
20000	-18	-1	1146	263	264	196	1079	255	260	193	1011	247	256	190
23000	-24	-11	1129	248	269	190	1038	237	265	187	974	230	260	184
25000	-28	-18	1118	239	272	186	1031	228	268	183	948	218	264	180
27000	-32	-25	1102	231	276	182	1020	220	271	179	934	210	267	176
28000	-34	-28	1092	227	278	180	1013	217	273	177	930	206	269	174
29000	-35	-32	1085	223	280	178	1004	213	275	175	924	203	270	172
31000	-39	-39	1093	219	283	174	986	205	278	171	908	195	274	168
33000	-43	-45	1100	216	287	170	993	201	282	167	889	188	277	164
35000	-47	-52	1104	212	291	167	998	198	286	163	893	184	281	160
37000	-49	-56	1111	210	296	163	1005	195	291	160	901	181	285	156
39000	-48	-55	1118	210	303	159	1014	195	297	156	910	180	291	153
41000	-48	-54	—	—	—	—	—	—	—	—	917	179	297	149

NOTE 1
Natural Laminar Flow Degradation effect is a speed reduction of 5%, maintaining torque as indicated in the Table.

NOTE 2
During operation with Anti Icing systems on torque will decrease.
In order to maintain maximum range configuration do not reset power to original setting.
Fuel flow will remain about the same, but true airspeed may decrease approximately 6 knots.

Figure 5-61. MAXIMUM RANGE POWER - 1800 RPM - ISA

5.6.8 Time, Fuel and Distance to descent (1500 FPM and 3000 FPM) (POH)

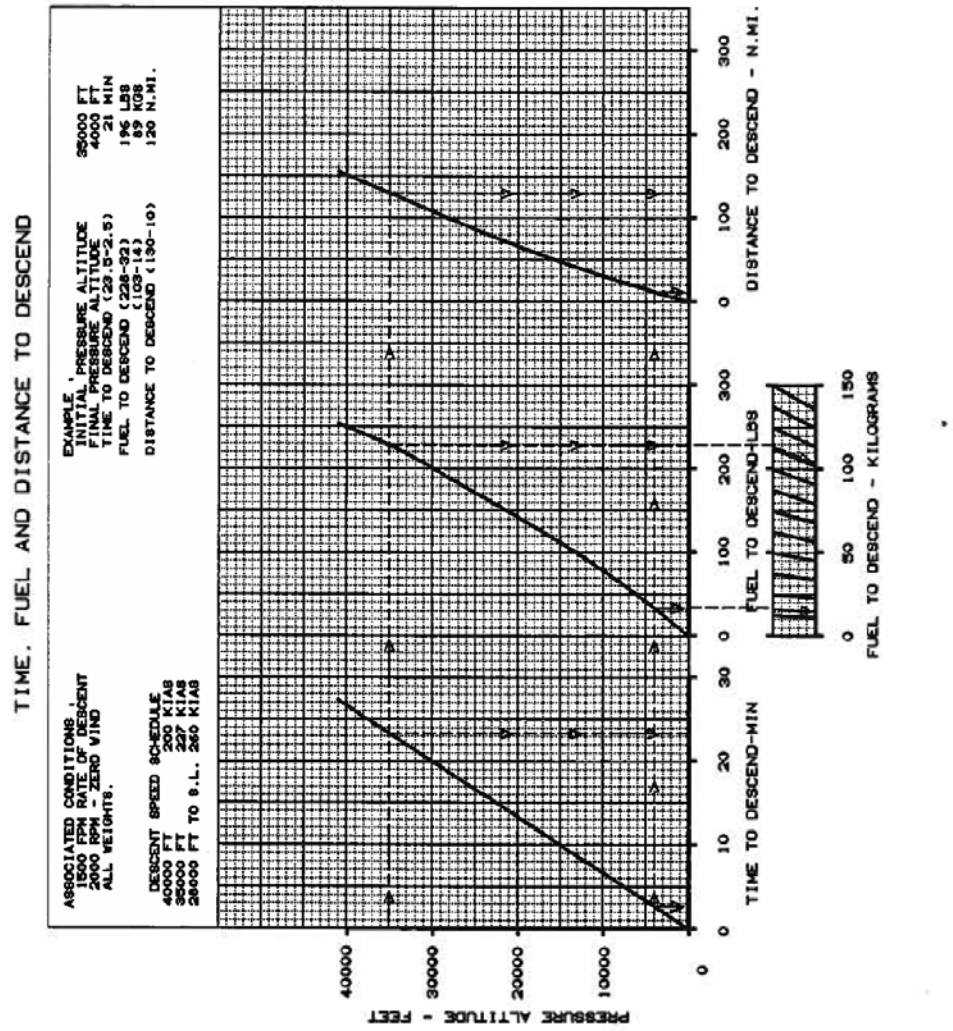


Figure 5-68. TIME, FUEL, DISTANCE TO DESCEND - 1500 FPM RATE OF DESCENT

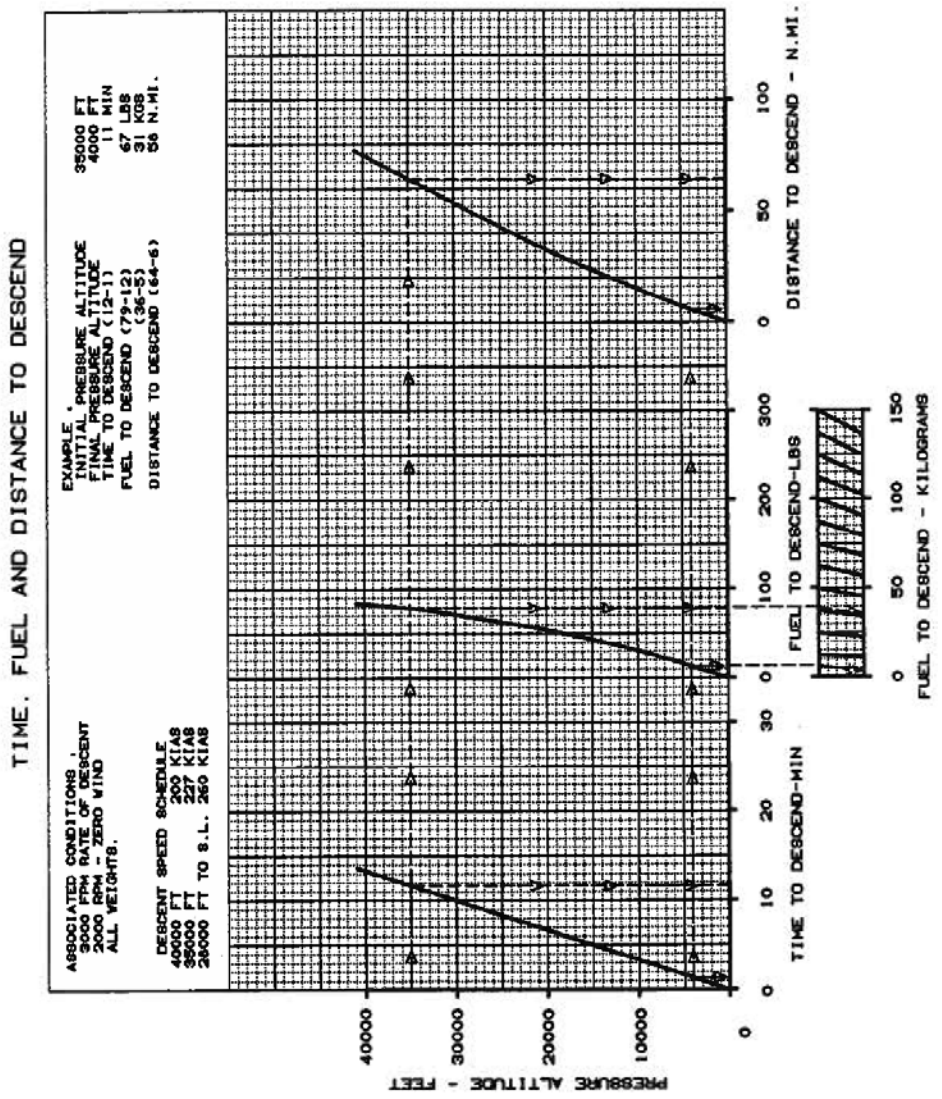


Figure 5-67. TIME, FUEL, DISTANCE TO DESCEND - 3000 FPM RATE OF DESCENT

5.6.9 Landing distance (POH)

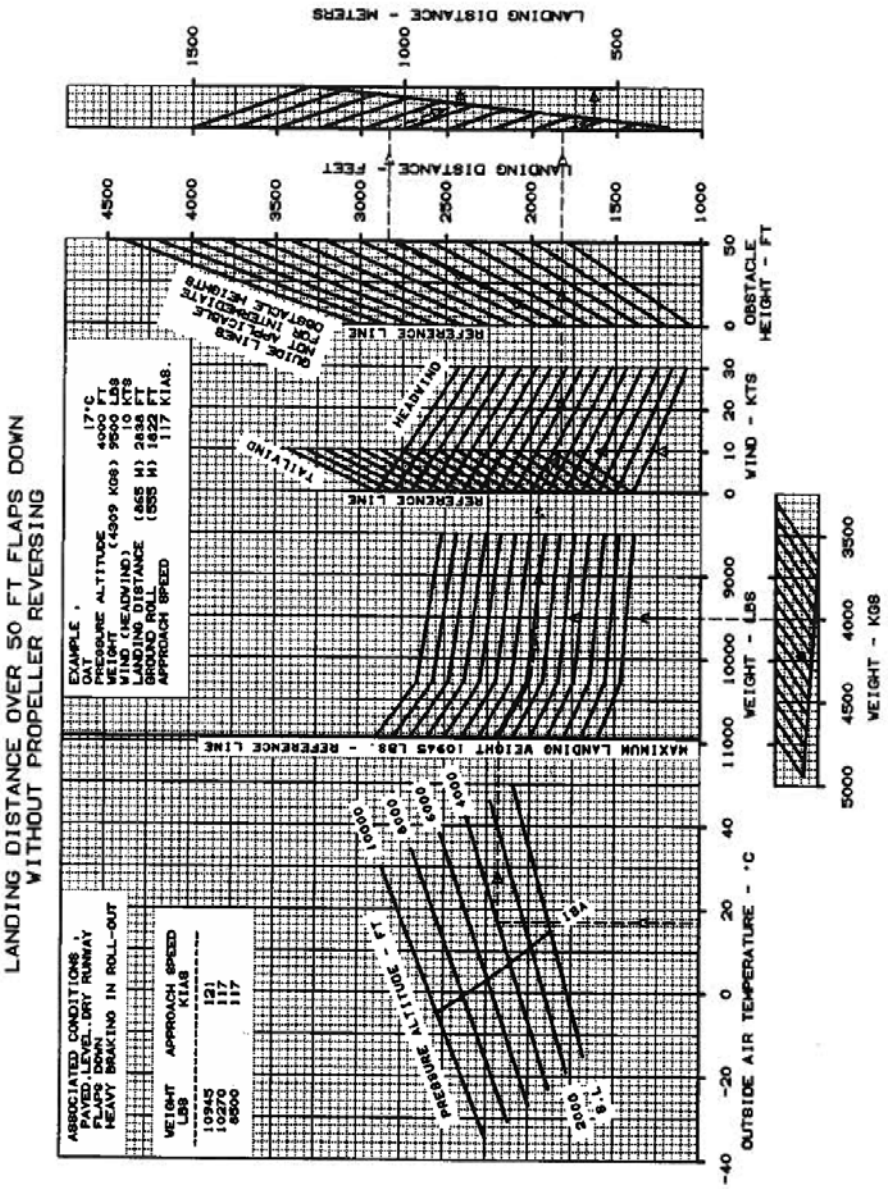


Figure 5-72. LANDING DISTANCE OVER 50 FEET WITHOUT PROPELLER REVERSING - FLAPS DOWN

5.6.10 Fuel system (POH)

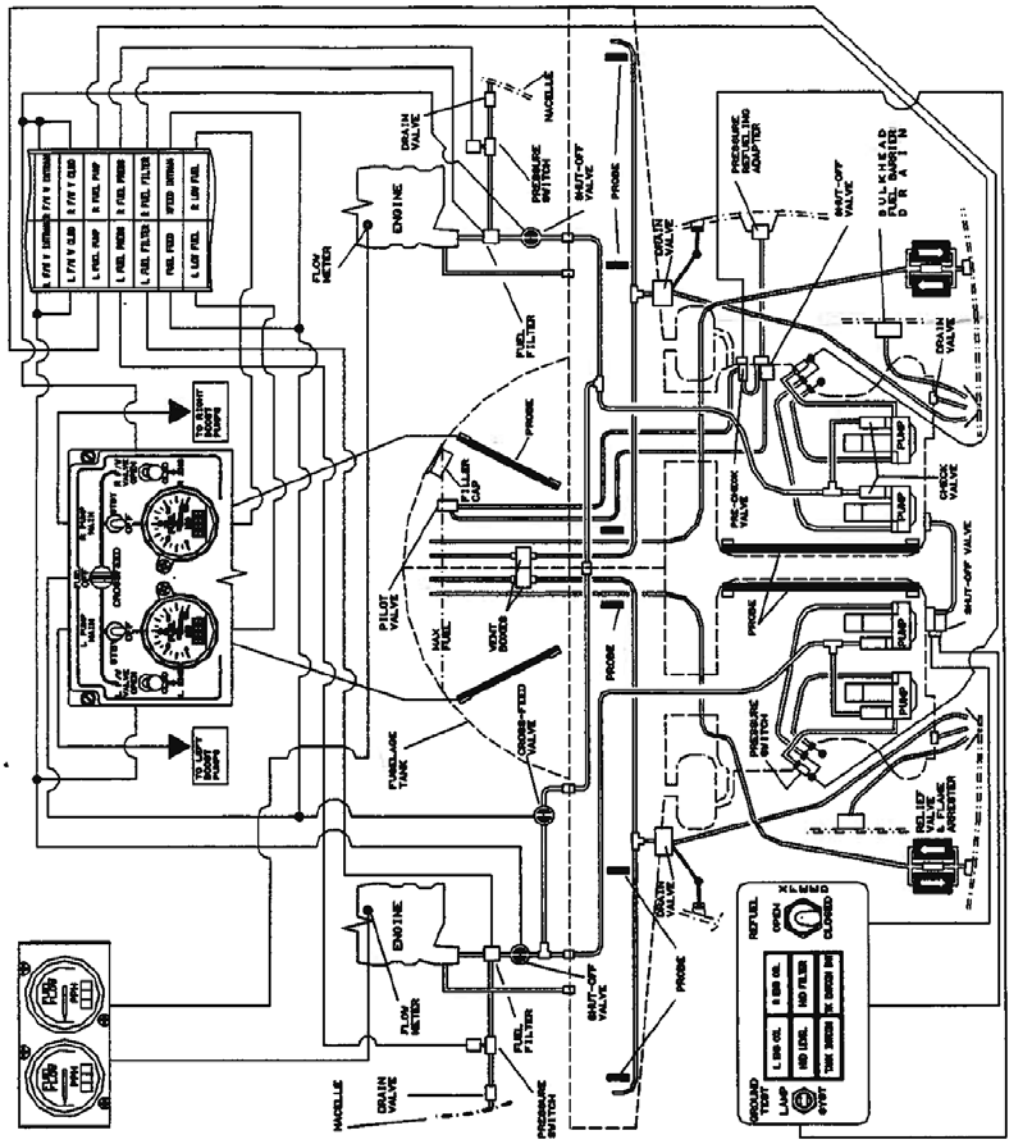


Figure 7-12. FUEL SYSTEM

5.6.11 Specific Air Range

Specific Air Range	Recommended Cruise Power 1800 RPM ISA		
	AUW 11000 Lbs	AUW 10000 Lbs	AUW 9000 Lbs
0 Feet			
Total Fuel Flow	924	924	924
KTAS	258	258	258
NM/Lbs	0,279	0,279	0,279
10000 feet			
Total Fuel Flow	834	834	834
KTAS	298	298	298
NM/Lbs	0,357	0,357	0,357
20000 Feet			
Total Fuel Flow	778	778	778
KTAS	346	346	346
NM/Lbs	0,445	0,445	0,445
29000 Feet			
Total Fuel Flow	714	714	714
KTAS	373	377	381
NM/Lbs	0,522	0,528	0,534
35000 Feet			
Total Fuel Flow	554	554	554
KTAS	351	358	364
NM/Lbs	0,634	0,646	0,657
37000 Feet			
Total Fuel Flow	496	496	496
KTAS	336	346	353
NM/Lbs	0,677	0,698	0,712
39000 Feet			
Total Fuel Flow	434	434	434
KTAS	312	326	338
NM/Lbs	0,719	0,751	0,779
41000 Feet			
Total Fuel Flow	376	376	376
KTAS	0	0	316
NM/Lbs	0,000	0,000	0,840

5.6.12 Normal & Emergency Procedures (POH)

4.2.11 DESCENT

1. Windshield heat - AS REQUIRED
2. Pressurization - CHECK
3. Environmental control system - CHECK

4.2.12 BEFORE LANDING

1. Seat belts and no smoking signs - ON
2. Condition levers - MAX RPM
3. Gear (below 180 KIAS) - DN; CHECK 3 GREEN
4. Flaps (below 170 KIAS) - MID
5. Autofeather (below 150 KIAS) - ARM, CHECK LIGHT
6. Landing lights (below 160 KIAS) - AS REQUIRED
7. Flaps on final (below 150 KIAS) - DN

CAUTION

When operating in icing conditions, the landing procedure must be performed with flaps MID and the approach speed, as compared with the flaps MID approach speed (Fig. 5-76), must be increased by 0 KIAS.

8. Autopilot/Steering - OFF
9. Cabin pressure barometric condition - CHECK

4.2.13 LANDING

Prior to reaching 50 ft. above landing surface:
1. Landing gear - CHECK DN (3 green lights)
2. Flaps - CHECK DN

CAUTION

When operating in icing conditions, the landing procedure must be performed with flaps MID and the approach speed, as compared with the flaps MID approach speed (Fig. 5-76), must be increased by 6 KIAS.

3. Approach speed - REFER to Section 5 of this Manual Fig. 5-72
4. Power - AS REQUIRED
5. Condition levers - CHECK MAX RPM

After touchdown:
6. Brakes - AS REQUIRED
7. Reverse - AS REQUIRED; engage reverse below 1900 prop RPM

NOTE

When landing at aft C.G. initiate flaps retraction before actuating reverse power. Avoid use of reverse below 20 KIAS approximately.

8. Condition levers - GROUND IDLE

3.2.6 LANDING EMERGENCIES

LANDING WITHOUT ENGINE POWER

CAUTION

With both generators inoperative only essential, battery and hot battery busses are fed, for approximately 30 minutes depending on loads and battery charge.

1. Airplane configured - Per MAXIMUM GLIDE Procedure (if altitude permits)

When landing site assured:

2. Approach Speed - INCREASE the flaps DN approach speed (Fig. 5-72) by 20 KIAS
3. Condition levers - CUT OFF
4. Fuel firewall shut-off valves - CLOSED
5. Fuel pumps switches - OFF

If gear is to be extended:

NOTE

For particular terrain conditions it may be required to land with gear up.

6. Gear - DN (PER EMERGENCY GEAR EXTENSION Procedure)

NOTE

Gear extension requires approximately 60 handpump strokes: this procedure requires normally 90 sec.

7. Emergency gear selector - PUSH
8. Hydraulic pump switch - HYD
9. Landing distance - INCREASE the flaps DN landing distance (Fig. 5-72) by approximately 125%

NOTE

When operating in sustained icing condition, assume the same procedure except approach speed which, as compared with the flaps MID approach speed (Fig. 5-76), must be increased by 15 KIAS.
The landing distance, as compared with the flaps MID landing distance (Fig. 5-76), must be increased approximately by 90%.

5.7 Meteorological information (in Danish and English)

5.7.1 Forecasts/Observations.

Keflavik:

```
160500 TAF-FT     bikf 160434z 1606/1706 17025kt 9999 sct012 bkn020 becmg
                       1609/1612 17025g35kt 3000 radz br bkn008 ovc012 becmg
                       1621/1624 23015kt becmg 1703/1706 29010kt=
160800 TAF-FT     bikf 160800z 1609/1709 16025g35kt 5000 -radz br few005
                       bkn010 ovc020 tempo 1612/1703 2000 radz br ovc005 becmg
                       1620/1623 25013kt becmg 1703/1706 9999 ra bkn010 ovc020=
161100 TAF-FT     bikf 161051z 1612/1712 15025g35kt 3000 radz br ovc005 becmg
                       1620/1623 25010kt becmg 1703/1706 9999 ra bkn010 ovc020=
161400 TAF-FT     bikf 161349z 1615/1715 15025g35kt 3000 radz br ovc005 becmg
                       1620/1623 25010kt becmg 1703/1706 9999 ra bkn010 ovc020
                       tempo 1706/1715 3000 radz br bkn005 ovc010=
161700 TAF-FT     bikf 161619z 1618/1718 18025kt 1000 radz fg ovc002 becmg
                       1622/1624 25010kt 5000 radz br sct005 bkn010 ovc015
                       becmg 1715/1718 27020kt 9999 shra sct015 bkn030=

161030 METAR      bikf 161030z 15026g37kt 4000 radz br ovc004 08/07 q1024=
161100 METAR      bikf 161100z 15023g33kt 3000 radz br ovc004 08/07 q1024=
161130 METAR      bikf 161130z 15023kt 3000 radz br ovc004 09/08 q1023=
161200 METAR      bikf 161200z 15025kt 3500 radz br ovc004 09/08 q1023=
161230 METAR      bikf 161230z 15023g33kt 3000 radz br bkn002 ovc004 09/08
                       q1023=
161300 METAR      bikf 161300z 16023g33kt 2500 radz br bkn002 ovc004 09/08
                       q1022=
161330 METAR      bikf 161330z 16025kt 3000 radz br bkn002 ovc005 10/09 q1022=
161400 METAR      bikf 161400z 16024kt 3000 radz br bkn002 ovc005 10/09 q1022=
161430 METAR      bikf 161430z 16024kt 3000 radz br ovc002 10/09 q1021=
161500 METAR      bikf 161500z 16023kt 2500 -radz br ovc002 10/09 q1021=
161530 METAR      bikf 161530z 16023g33kt 1000 r20/1300 -dz fg ovc002 10/09
                       q1020=
161600 METAR      bikf 161600z 17024kt 1000 r20/1000 -radz br ovc002 10/09
                       q1020=
161630 METAR      bikf 161630z 15022kt 1000 r20/1000 -radz fg ovc002 09/08
                       q1019=
161700 METAR      bikf 161700z 15023g33kt 1000 r20/1000 -radz fg ovc002 09/08
                       q1019=
```

Narssarssuaq:

```
160800 TAF-FC     bgbw 160800z 1608/1617 24010kt 9999 sct050 bkn070 becmg
                       1609/1611 8000 -rasn bkn040 tempo 1611/1617 2800 snra
                       sct009 bkn012=
161000 TAF-FC     bgbw 161018z 1610/1619 24010kt 9999 sct030 bkn055 becmg
                       1610/1612 8000 -rasn bkn035 tempo 1612/1619 2800 snra
                       sct009 bkn012=
161300 TAF-FC     bgbw 161300z 1613/1622 24008kt 9999 -ra sct030 bkn055 tempo
                       1613/1615 5000 ra bkn018 tempo 1615/1622 2800 snra
                       sct009 bkn012=
161600 TAF-FC     bgbw 161600z 1616/1623 24012kt 9999 -ra sct018 bkn030 tempo
                       1616/1623 21015g28kt 4000 ra vcfg bkn008=

160850 METAR      bgbw 160850z 20007kt 080v250 9999 few045 sct055 bkn070
                       08/m00 q0987 rmk 2sc 4ac 7ac=
160950 METAR      bgbw 160950z 22008kt 120v260 9999 ovc055 07/m00 q0988 rmk
                       8sc=
161050 METAR      bgbw 161050z 24007kt 9999 sct030 ovc055 06/m00 q0989 rmk 3sc
                       8sc=
161150 METAR      bgbw 161150z 24002kt 9999 sct030 ovc055 07/m00 q0991 rmk 3sc
                       8sc=
161250 METAR      bgbw 161250z 23014kt 9999 -ra bkn030 ovc050 04/02 q0993 rmk
```

```
                    5sc 8sc=
161350 METAR      bgbw 161350z 33002kt 9999 -ra ovc030 05/02 q0994 rmk 8sc=
161450 METAR      bgbw 161450z vrb04kt 9999 -ra sct013 ovc034 05/03 q0995 rmk
                    4sc 8sc=
161529 SPECI      bgbw 161529z 21016kt 180v250 9999 -ra sct018 ovc031 04/01
                    q0996 rmk 3sc 8sc=
161550 METAR      bgbw 161550z 21014g29kt 180v260 9999 ra bkn018 ovc030 04/01
                    q0996 rmk 5sc 8sc=
161650 METAR      bgbw 161650z 20022g33kt 9999 ra bkn015 ovc020 03/00 q0998
                    rmk 5sc 8sc=
161750 METAR      bgbw 161750z 22019kt 9999 rasn ovc015 03/01 q1001 rmk 8sc=
```

Kangerlussuak:

```
160500 TAF-FT     bgsf 160500z 1606/1706 08012kt 9999 sct100 tempo 1606/1610
                    15020g30kt becmg 1616/1618 26012kt bkn040 tempo
                    1618/1623 7000 -rasn sct015 bkn024 tempo 1623/1706 2800
                    sn bkn014=
161100 TAF-FT     bgsf 161100z 1612/1712 26008kt 9999 bkn100 becmg 1614/1616
                    bkn040 tempo 1616/1623 7000 -rasn sct015 bkn024 tempo
                    1623/1712 2800 sn bkn014=
161700 TAF-FT     bgsf 161700z 1618/1718 28010kt 8000 -sn sct012 bkn025 tempo
                    1618/1712 vrb08kt 1200 sn vv009 tempo 1712/1718 vrb08kt
                    9999 nsw sct020 bkn040=

160850 METAR      bgsf 160850z 05007kt 9999 sct090 05/m05 q0983=
160950 METAR      bgsf 160950z 26007kt 200v300 9999 sct090 02/m02 q0984=
161050 METAR      bgsf 161050z 28008kt 9999 bkn090 02/m02 q0985=
161150 METAR      bgsf 161150z 25009kt 9999 bkn090 02/m02 q0986=
161250 METAR      bgsf 161250z 27009kt 9999 bkn100 03/m02 q0987=
161350 METAR      bgsf 161350z 28010kt 9999 sct070 bkn100 03/m01 q0988=
161450 METAR      bgsf 161450z 28010kt 9999 sct070 bkn100 03/m01 q0990=
161550 METAR      bgsf 161550z 26006kt 9999 sct030 bkn045 03/m00 q0991=
161612 SPECI      bgsf 161612z 26007kt 9999 -ra sct020 bkn038 03/m00 q0991=
161616 SPECI      bgsf 161616z 26007kt 9999 -dz sct020 bkn044 02/00 q0991=
161647 SPECI      bgsf 161647z 25009kt 9999 -sn sct012 bkn020 02/00 q0992=
161650 METAR      bgsf 161650z 25009kt 9999 -sn sct012 bkn020 02/00 q0992=
161700 SPECI      bgsf 161700z 26009kt 9999 -snra sct018 bkn040 01/00 q0992=
161713 SPECI      bgsf 161713z 26007kt 9999 -ra sct018 bkn030 01/01 q0993=
161750 METAR      bgsf 161750z 26009kt 9999 -ra sct012 bkn020 01/01 q0993=
161829 SPECI      bgsf 161829z 26010kt 9999 -ra sct018 bkn045 01/01 q0994=
161850 METAR      bgsf 161850z 26009kt 9999 -dz sct020 bkn050 01/01 q0995=
```

Narsaq:

```
161150 METAR      bgns 161150z 14017kt 080v210 3100 +ra mifg bkn002 ovc008
                    05/03 q0990=
161220 METAR      bgns 161220z 12016kt 090v230 3100 ra mifg bkn002 ovc010
                    04/03 q0990=
161250 METAR      bgns 161250z 12021kt 100v160 5000 +ra vcfg bkn002 ovc025
                    04/03 q0991=
161320 METAR      bgns 161320z 12017kt 090v190 5000 +ra bkn002 ovc025 04/03
                    q0991=
161350 METAR      bgns 161350z 14016g26kt 110v170 5000 +ra bkn002 ovc025 04/03
                    q0992=
161420 METAR      bgns 161420z 16015kt 130v200 5000 +ra bkn002 ovc025 04/03
                    q0992=
161520 METAR      bgns 161520z 19011kt 6000 ra vcfg sct001 bkn005 ovc020 04/03
                    q0994=
161550 METAR      bgns 161550z 26018kt 8000 +ra bkn005 ovc020 03/03 q0995=
161620 METAR      bgns 161620z 28009kt 9999 -ra ovc010 03/03 q0998=
161650 METAR      bgns 161650z 27013kt 9999 -ra ovc010 03/03 q0999=
```

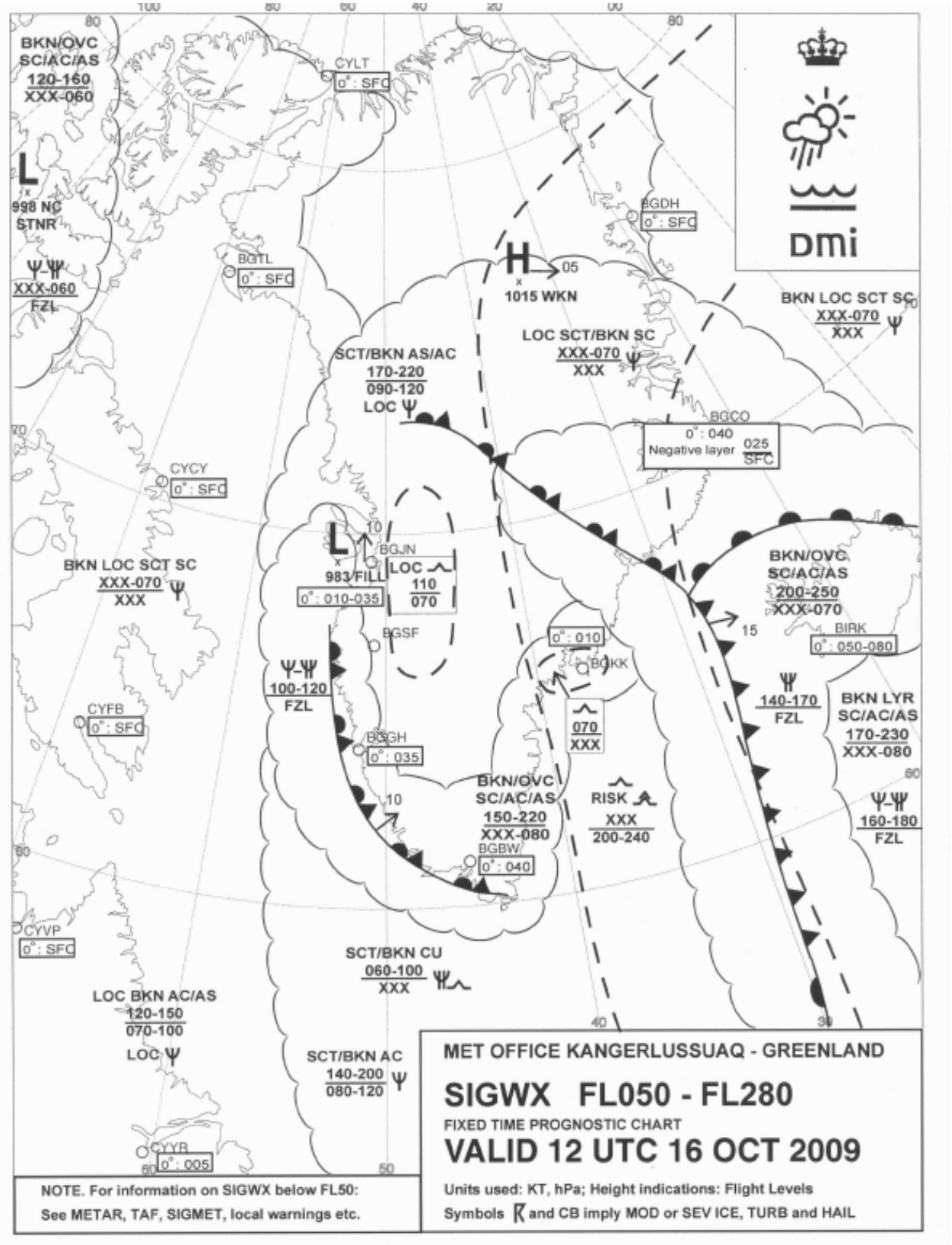
Nuuk:

```
160850 METAR      bggh 160850z 16007kt 9999 bkn068 03/m01 q0983=
```

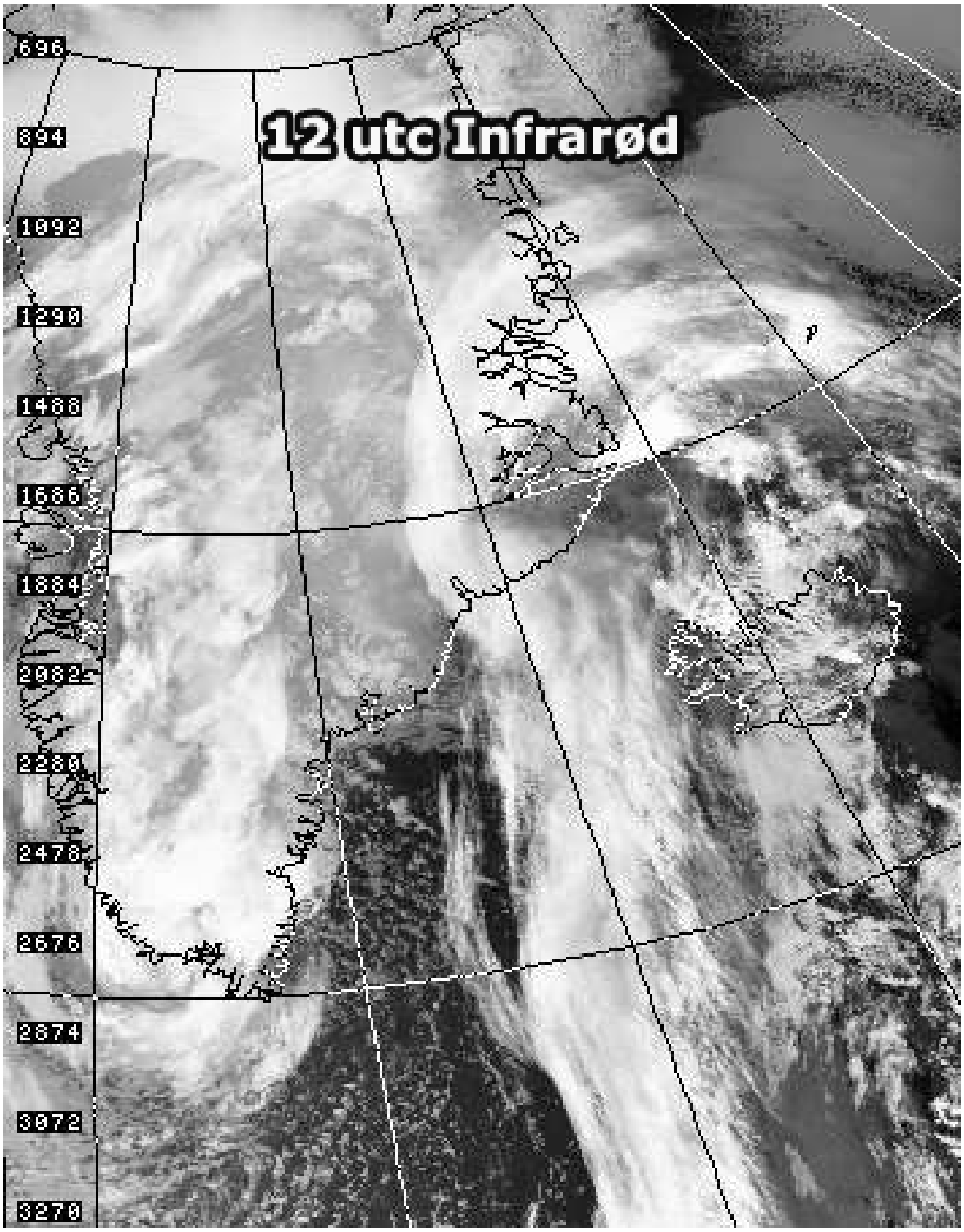
```
160950 METAR      bggh 160950z 19004kt 9999 bkn068 02/m01 q0984=
161050 METAR      bggh 161050z 20008kt 9999 bkn014 bkn068 02/m00 q0986=
161150 METAR      bggh 161150z 26004kt 220v290 9999 bkn018 03/01 q0987=
161250 METAR      bggh 161250z 18011kt 9999 few008 sct022 bkn040 02/01 q0989=
161350 METAR      bggh 161350z 19011kt 9999 few008 ovc040 02/m01 q0990=
161405 SPECI      bggh 161405z 19012kt 4000 -sn sct008 ovc020 02/m00 q0991=
161422 SPECI      bggh 161422z 19010kt 2000 -sn ovc010 01/m00 q0991=
161447 SPECI      bggh 161447z 18009kt 1300 sn vv006 00/m00 q0992=
161450 METAR      bggh 161450z 18008kt 1300 sn vv006 00/m00 q0992=
161550 METAR      bggh 161550z 18007kt 1200 sn vv010 00/m00 q0993=
161641 SPECI      bggh 161641z 17006kt 2000 sn vv010 00/m00 q0995=
161650 METAR      bggh 161650z 18006kt 1500 sn vv006 00/m00 q0995=
161750 METAR      bggh 161750z 26004kt 220v300 1500 -snra vv004 00/m00 q0997=

160800 TAF-FC     bggh 160820z 1608/1617 18010kt 9999 bkn060 becmg 1612/1614
                       25010kt vcsh bkn020 tempo 1614/1617 28015kt 4000
                       -shsnra sct009 bkn012=
160900 TAF-FC     bggh 160900z 1609/1618 18010kt 9999 bkn060 becmg 1612/1614
                       25010kt vcsh bkn020 tempo 1614/1617 28015kt 4000
                       -shsnra sct009 bkn012=
160900 TAF-FC AMD bggh 161100z 1611/1618 20010kt 9999 bkn015 bkn060 tempo
                       1611/1614 bkn014 becmg 1612/1614 25010kt vcsh tempo
                       1614/1617 28015kt 4000 -shsnra sct009 bkn012=
161200 TAF-FC     bggh 161200z 1612/1621 20010kt 9999 bkn015 bkn060 tempo
                       1612/1614 bkn014 becmg 1612/1614 25010kt vcsh tempo
                       1614/1618 28015kt 4000 -shsnra sct009 bkn012 tempo
                       1618/1621 28015kt 4000 -shsn sct009 bkn012=
161200 TAF-FC AMD bggh 161430z 1614/1621 20010kt 8000 -sn sct008 bkn020 tempo
                       1614/1621 1200 sn bkn008=
161500 TAF-FC     bggh 161500z 1615/1623 19010kt 8000 -sn sct008 bkn020 tempo
                       1615/1623 28015kt 1000 sn vv004=
```

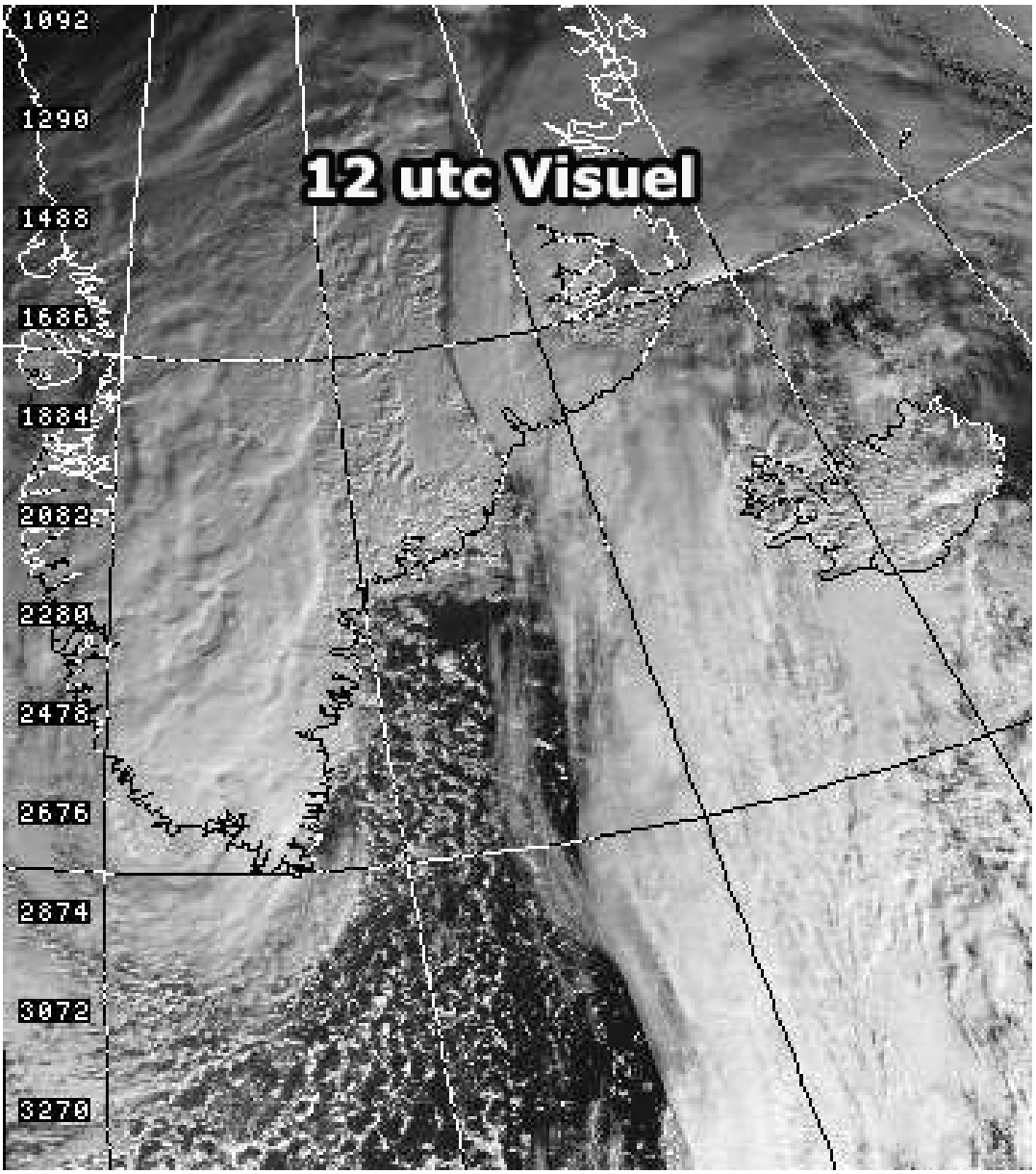
5.7.2 SIGWX FL050 – FL280



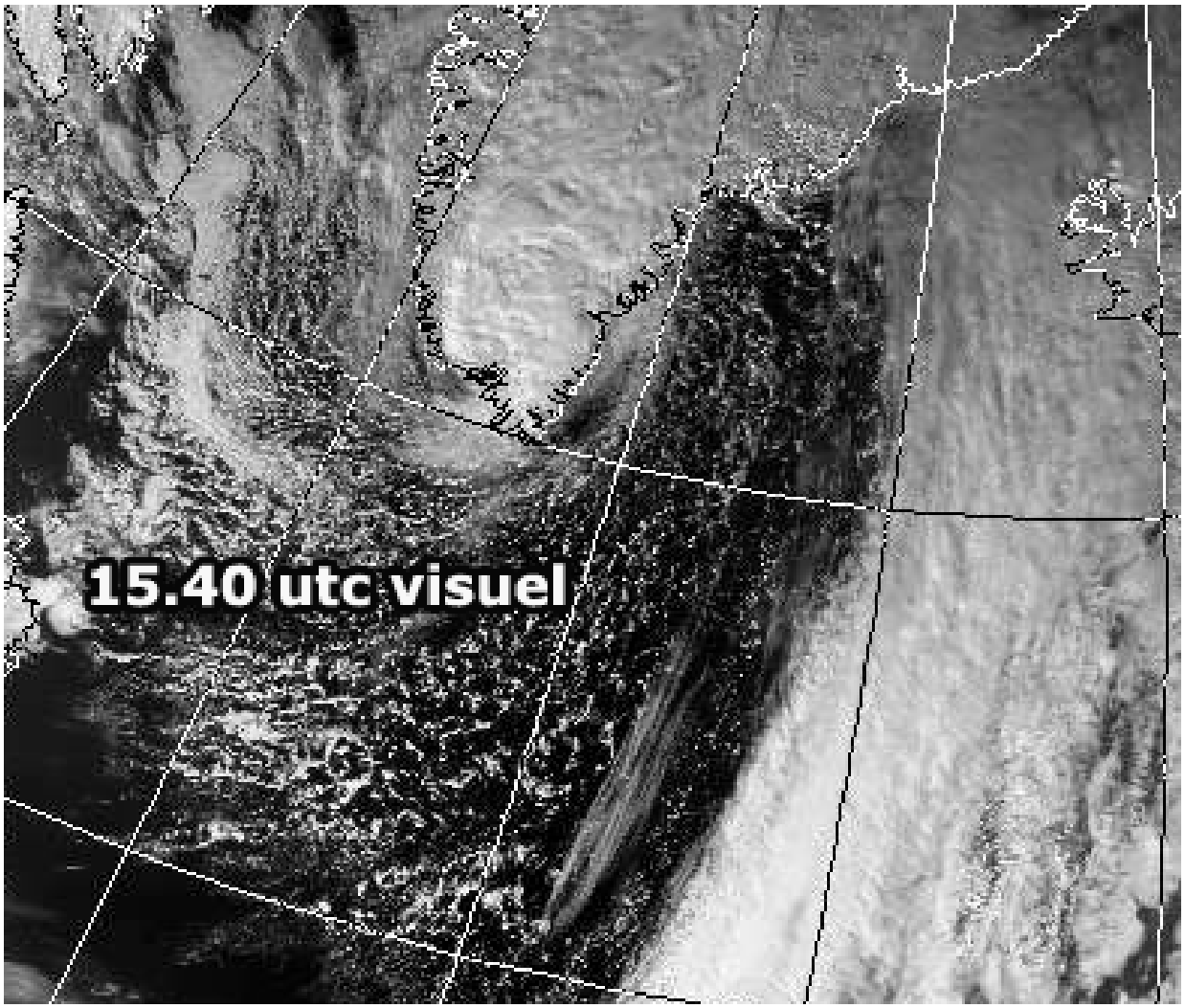
5.7.3 12:00 UTC Infrared



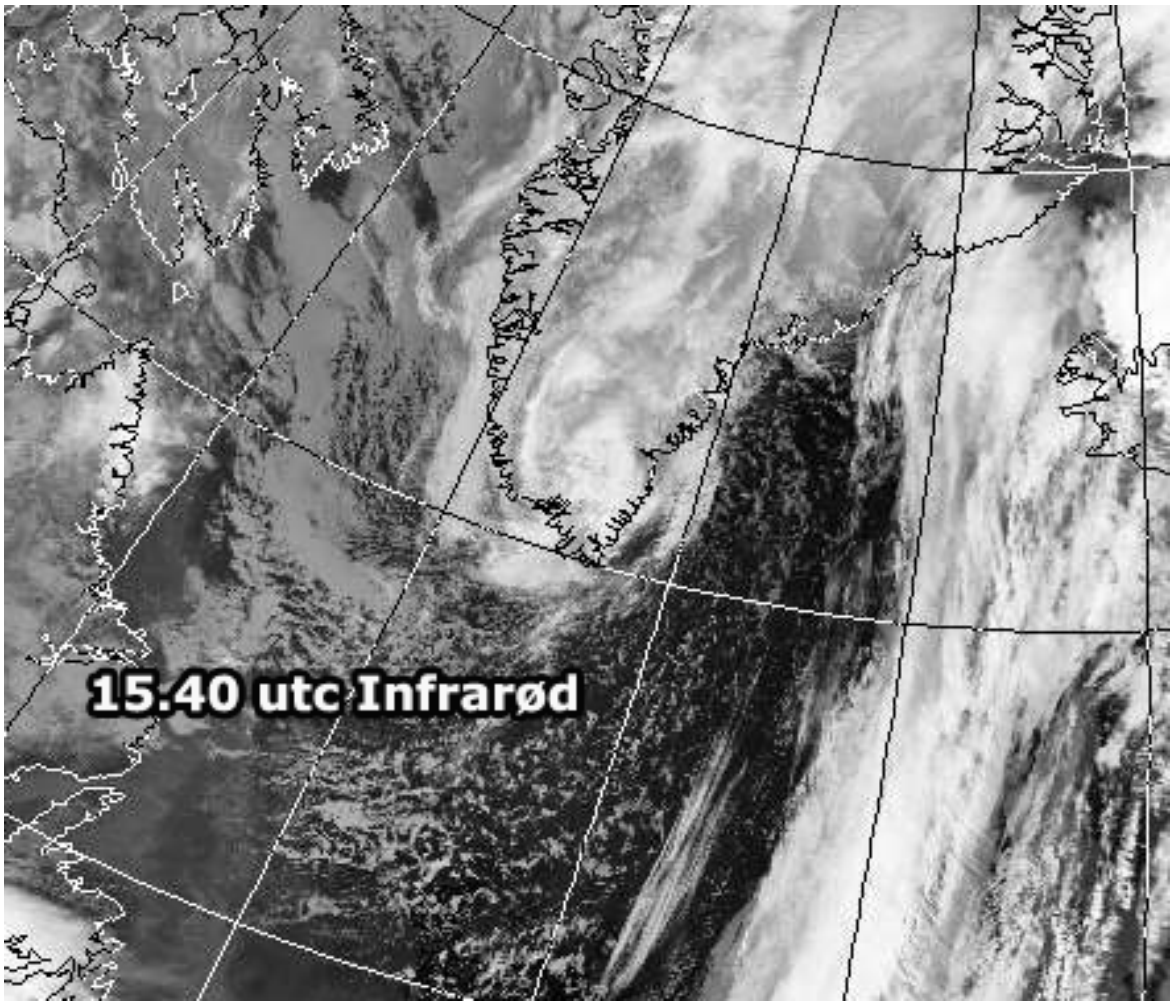
5.7.4 12:00 UTC Visual



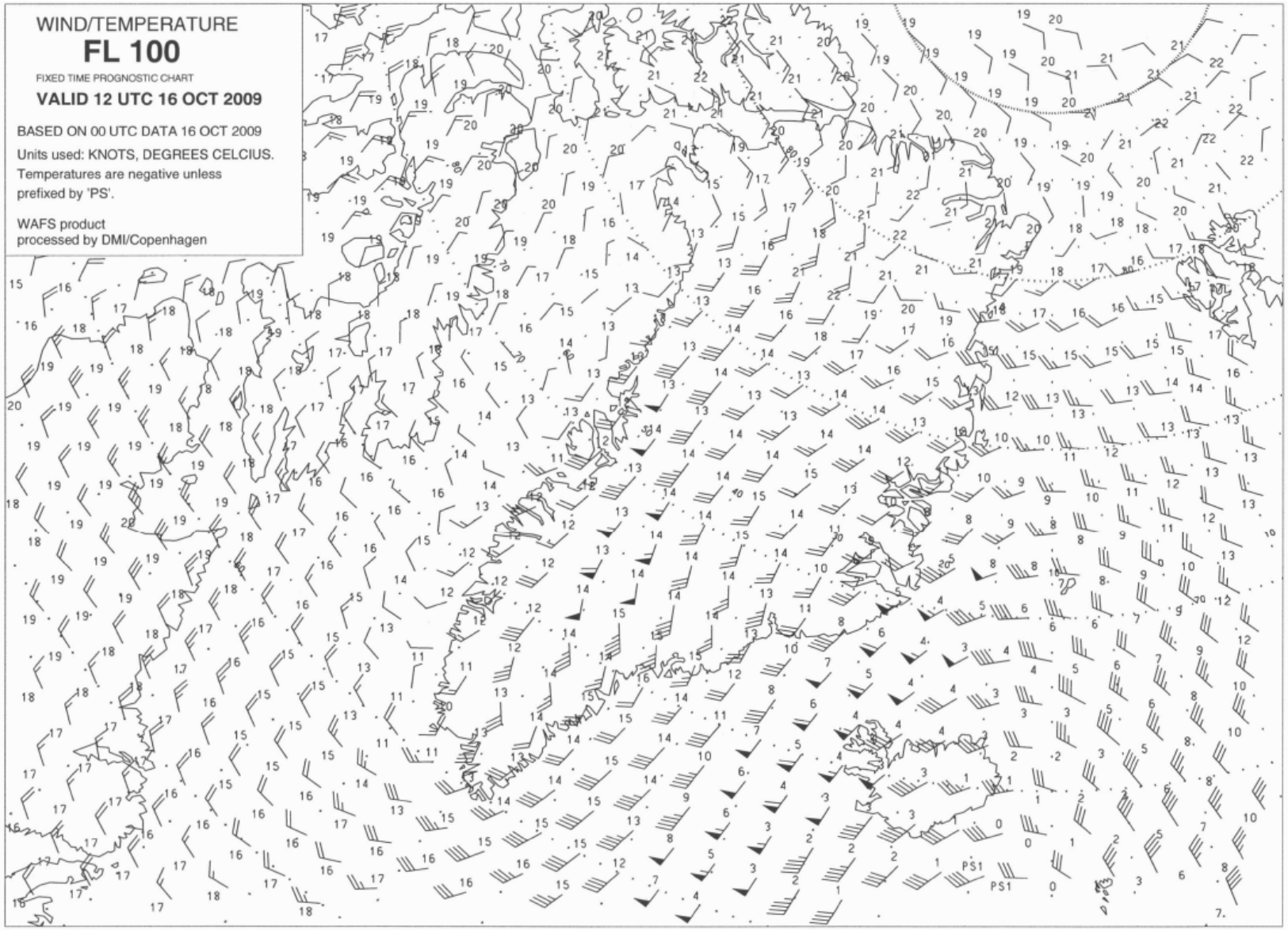
5.7.5 15:40 UTC Visual



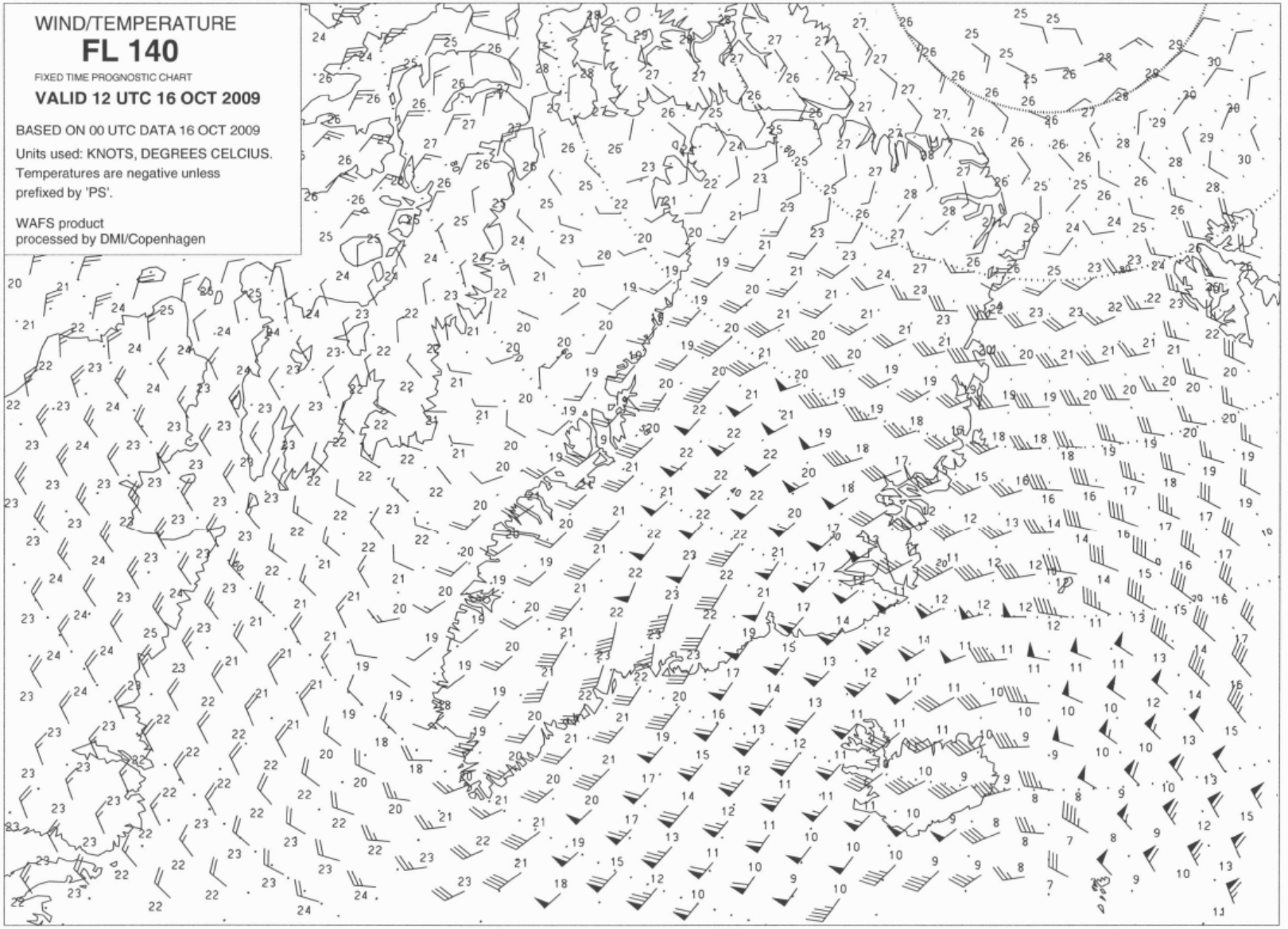
5.7.6 15:40 UTC Infrared



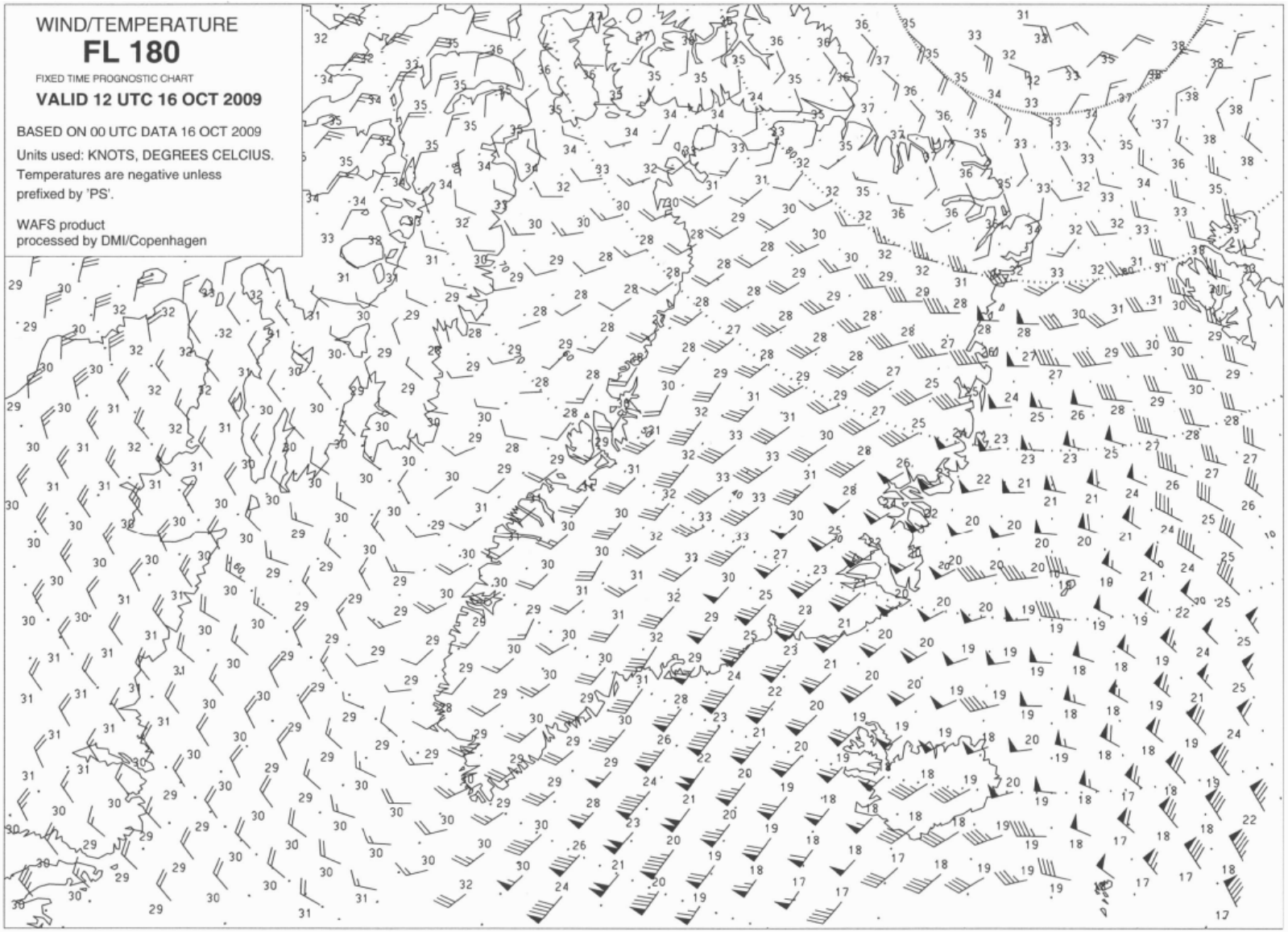
5.7.7 Fixed time prognostic chart FL100



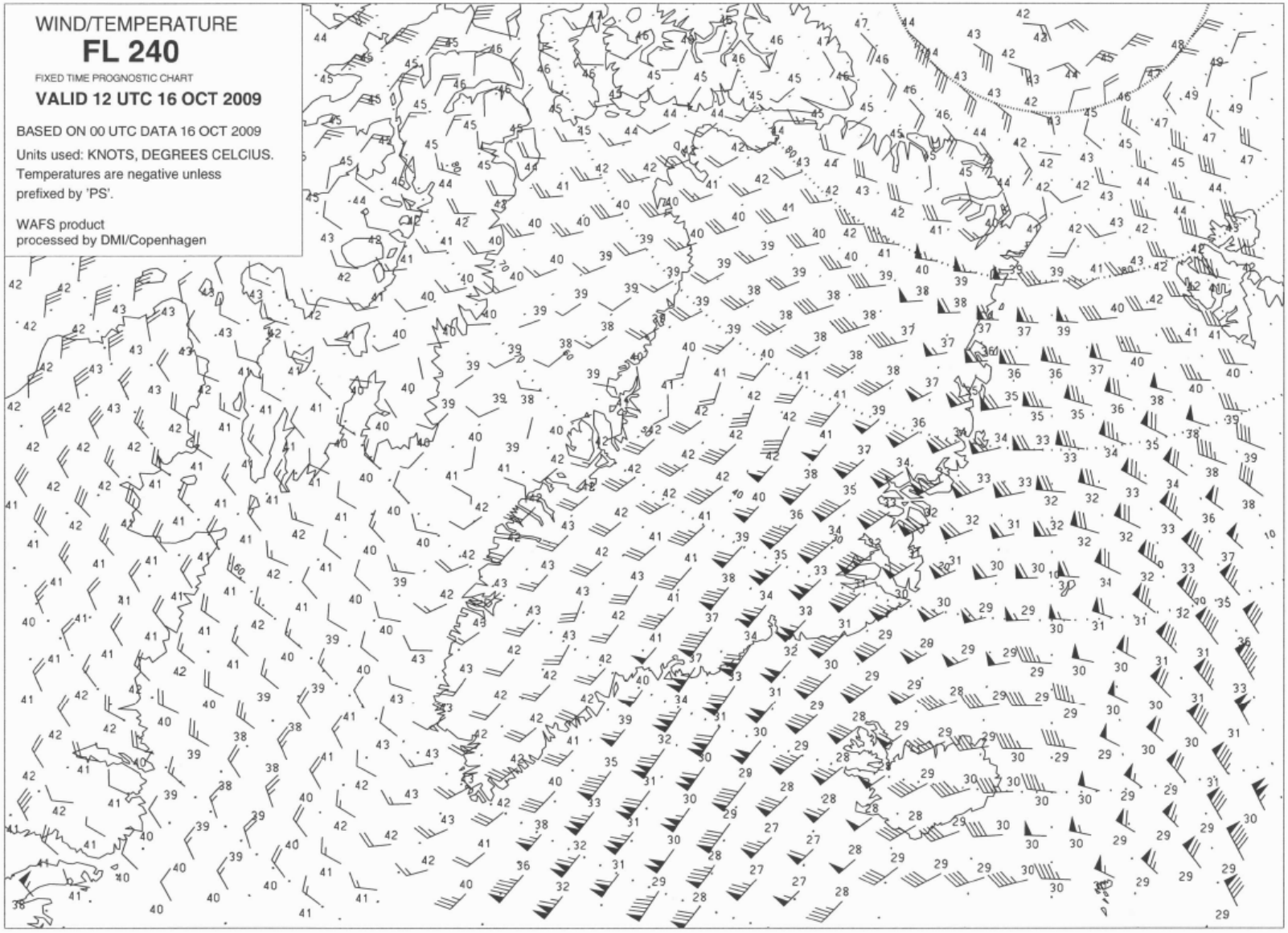
5.7.8 Fixed time prognostic chart FL140



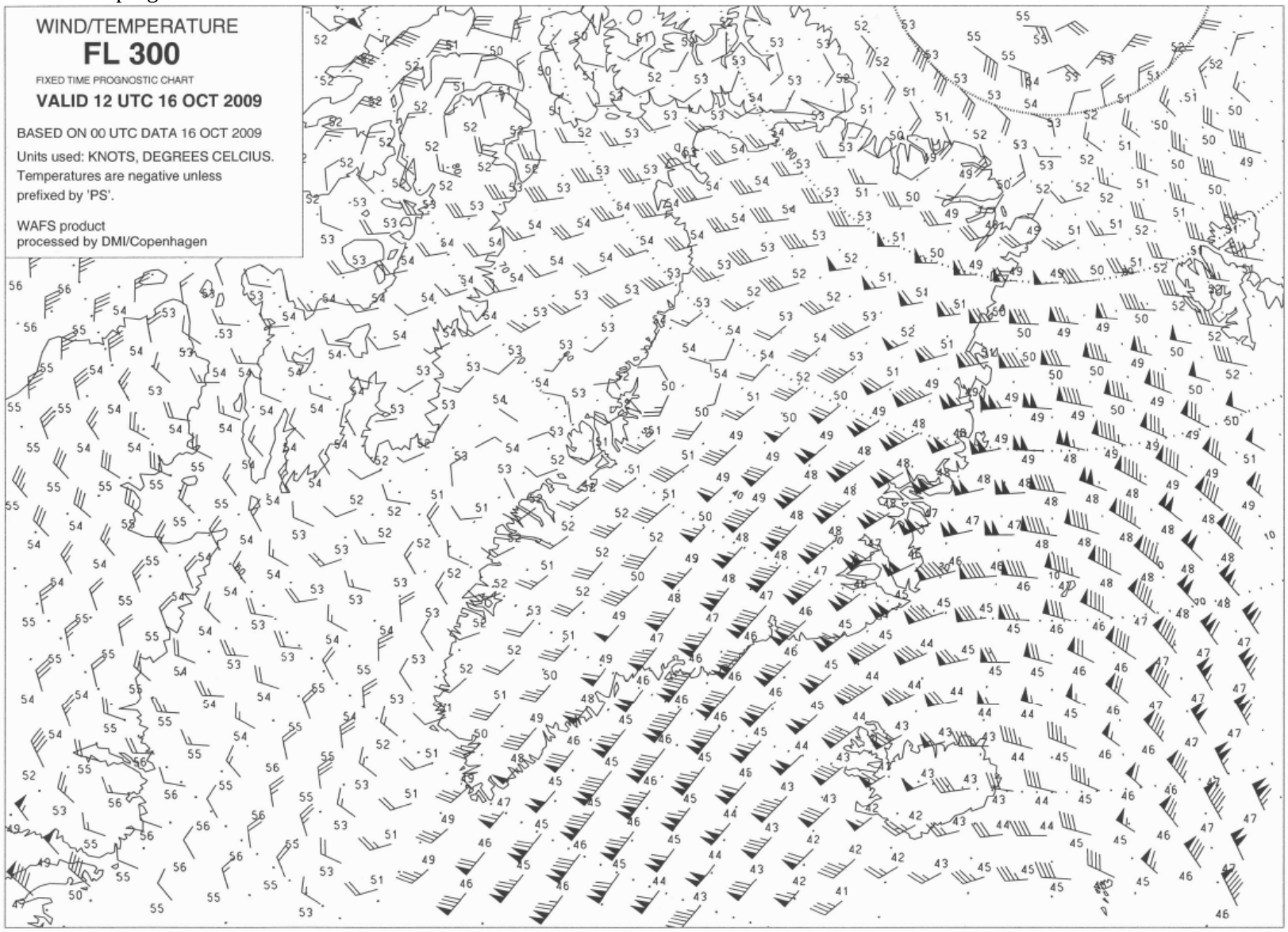
5.7.9 Fixed time prognostic chart FL180



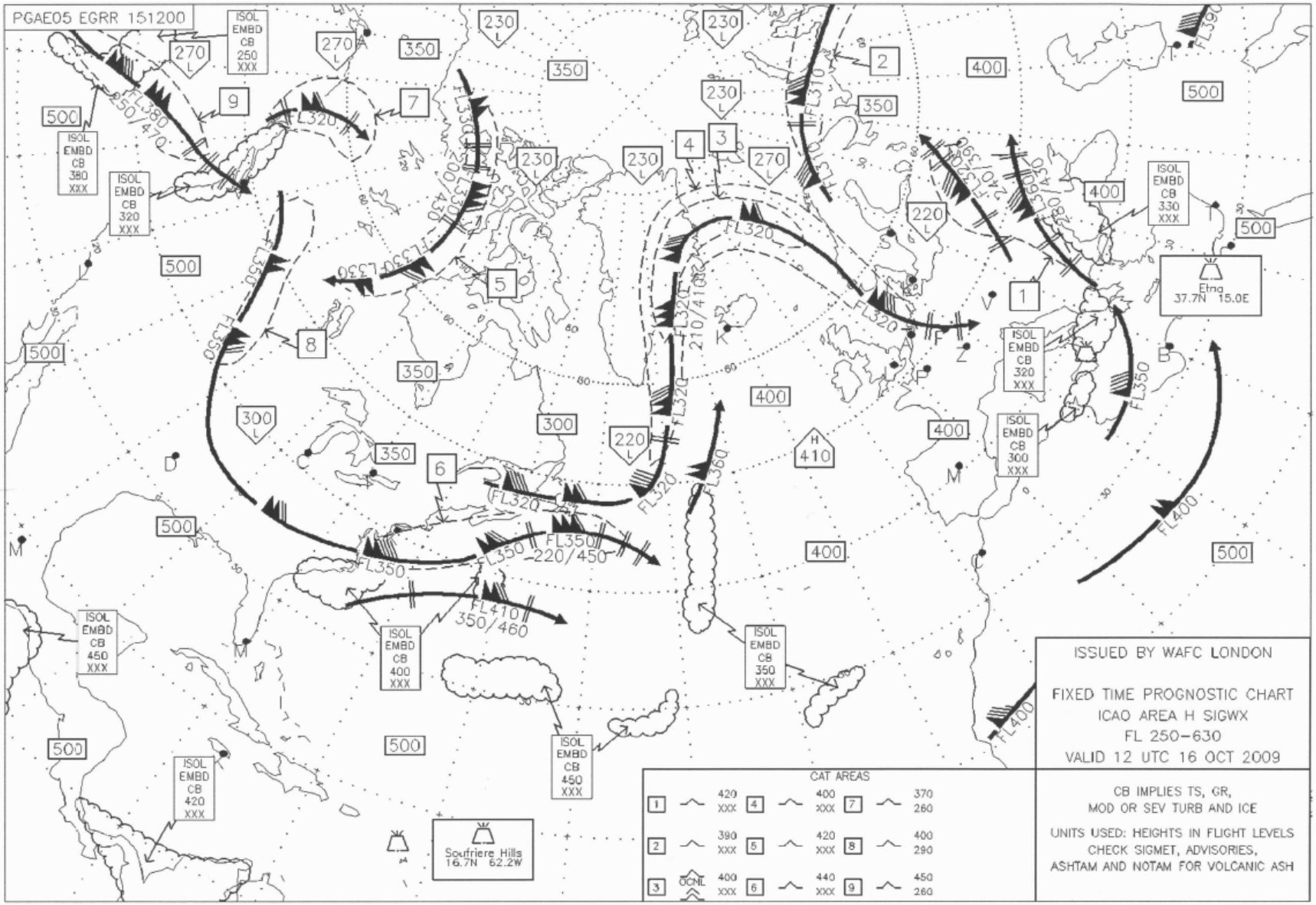
5.7.10 Fixed time prognostic chart FL240



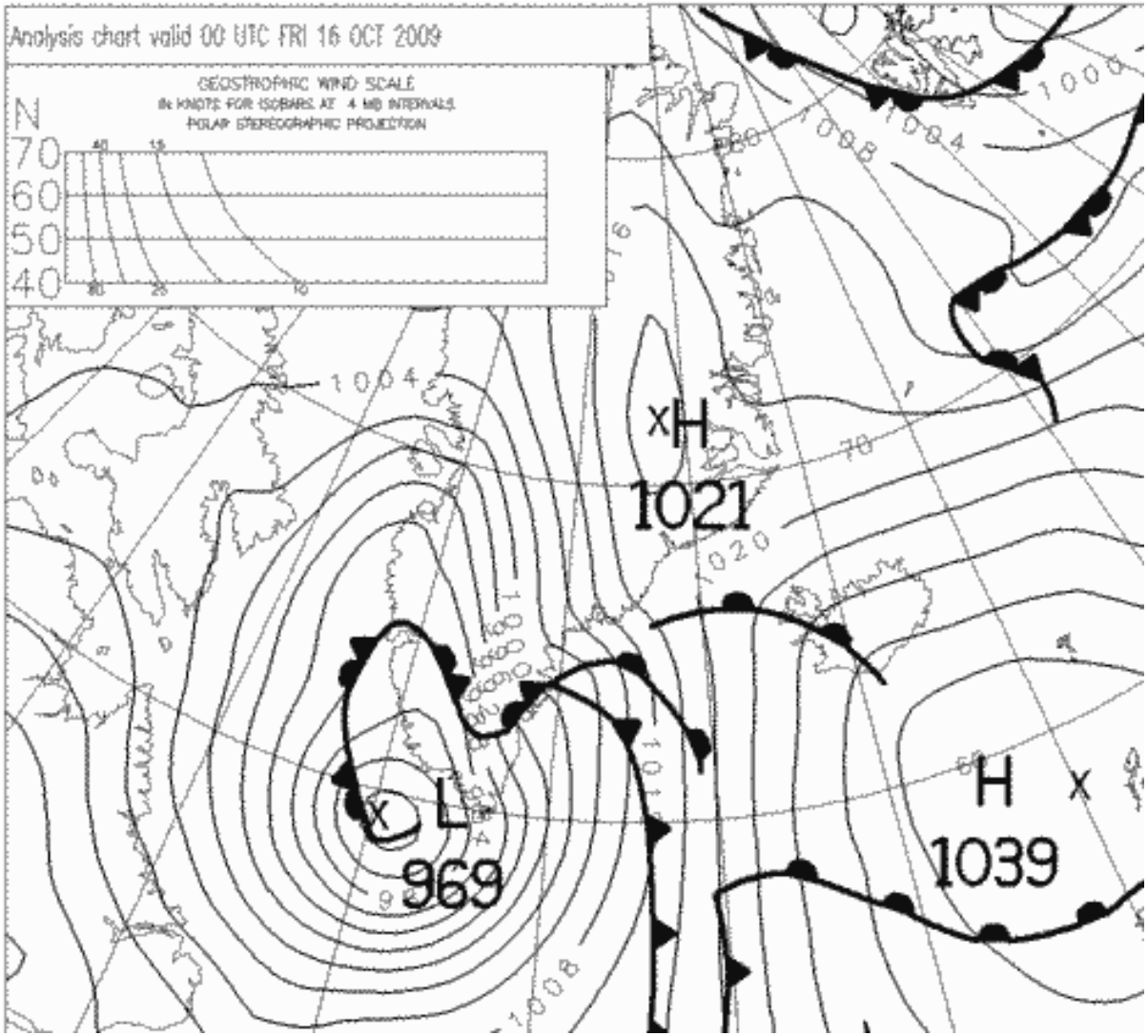
5.7.11 Fixed time prognostic chart FL300



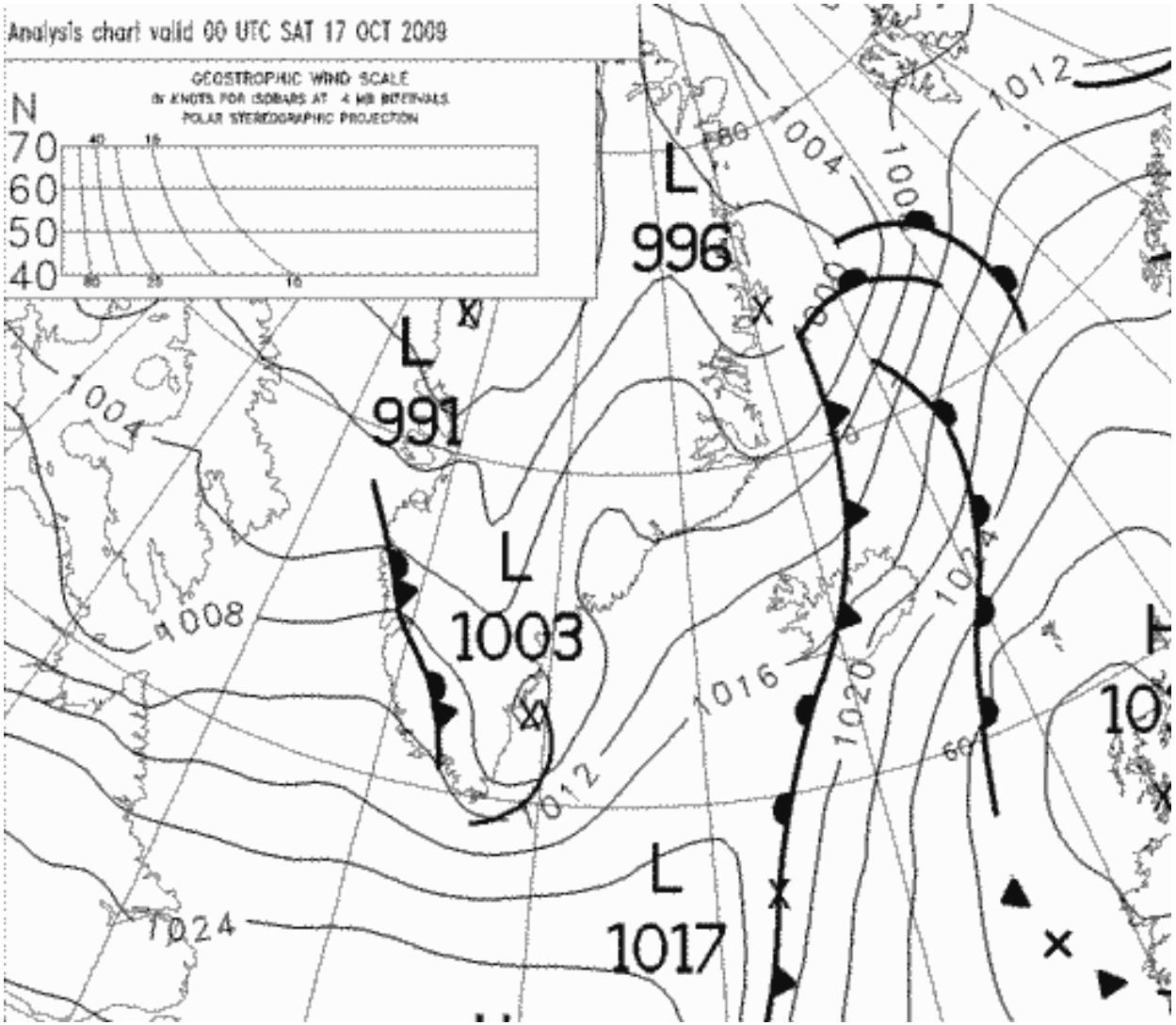
5.7.12 High level SIGWX valid 12 UTC



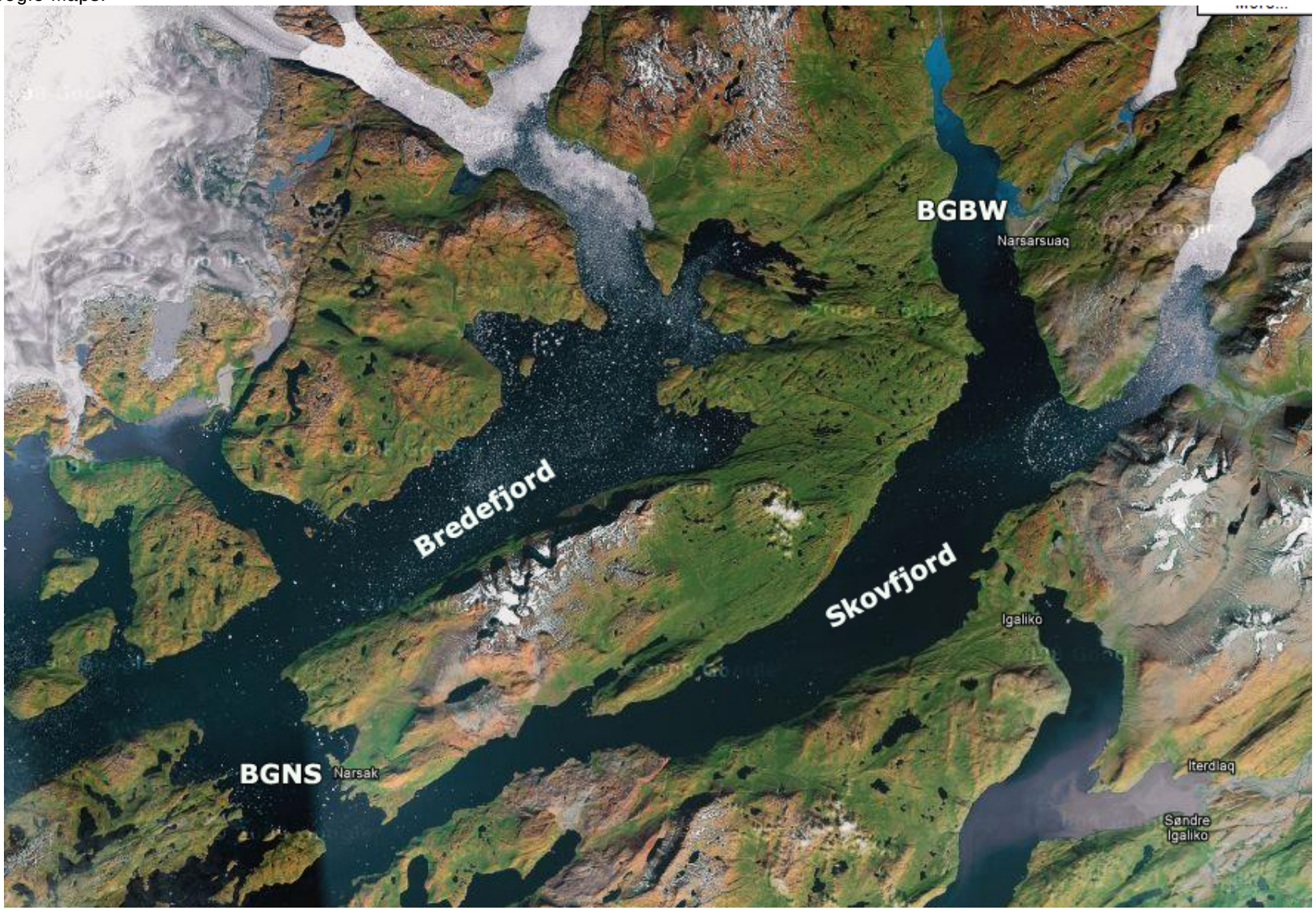
5.7.13 Analysis chart valid 00 UTC FRI 16 OCT 2009



5.7.14 Analysis chart valid 00 UTC SAT 17 OCT 2009

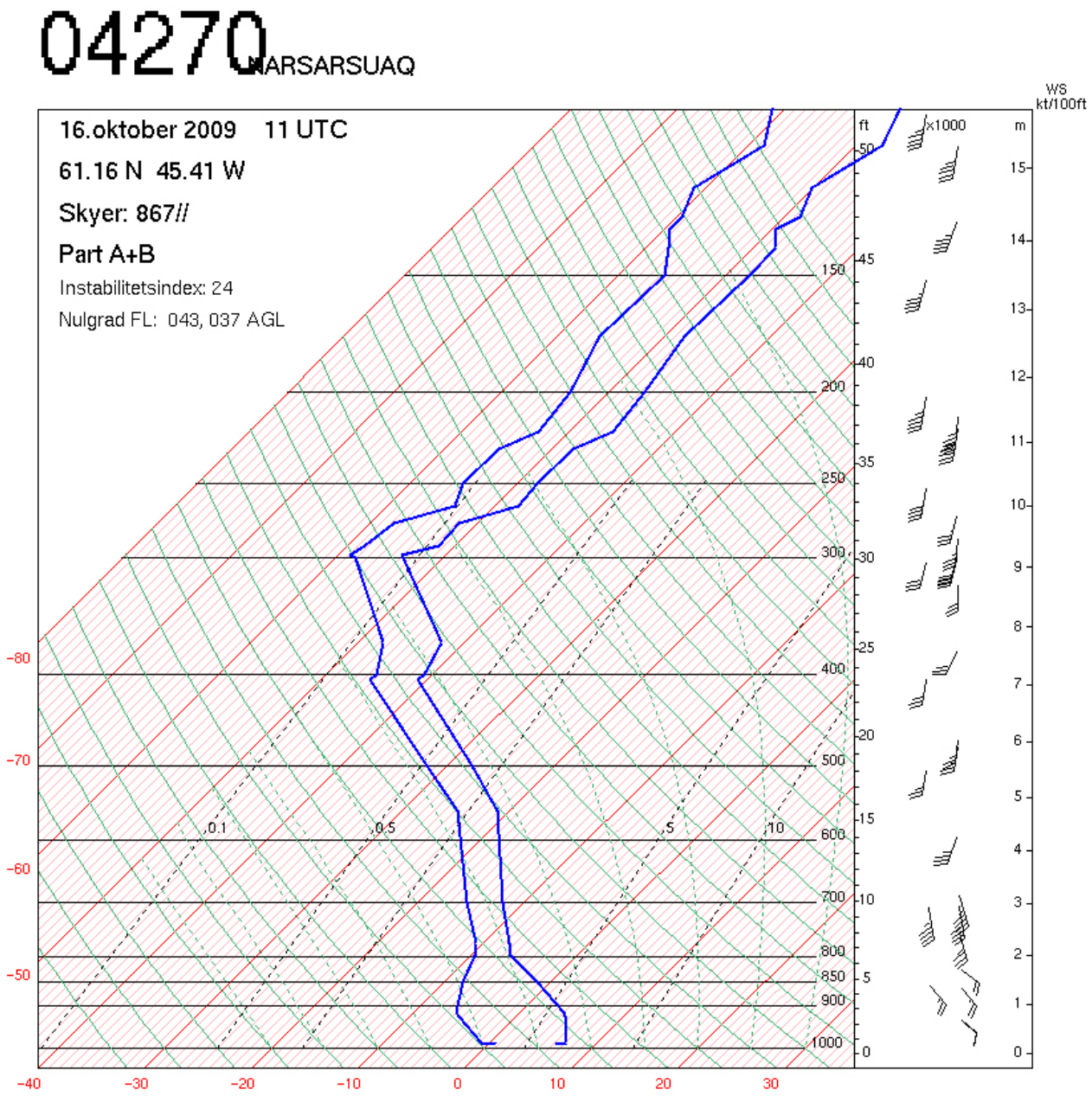


5.7.15 Map covering Narsaq (BGNS) and Narsarsuaq (BGBW) area.



5.7.16 Radio sonde Narsarsuaq 16 OCT 2009 11:00 UTC

Radiosondering fra BGBW 11 utc.



5.9 Communications

5.9.1 Narsarsuaq, Greenland

The Danish AIB received copies of the radio communication between N108GF and Narsarsuaq AFIS and phone communications between Narsarsuaq AFIS and Sondrestrom FIC. The time reference used on the recordings was UTC minus one hour. The copies of the communications were of good quality and useful to the investigation.

5.9.2 The Danish AIB faced some difficulties in obtaining the recorded radio communication data from BGBW AFIS. The Greenland Airport Authority (GAA) had the responsibility of the recording system under their jurisdiction and was requested to provide the communication data after the accident. Unfortunately GAA discovered that their replay system was malfunctioning and the process halted until 11-11-2010.

5.9.3 The request for the recorded communication data between N108GF and Narsarsuaq AFIS was sent to Copenhagen ACC on the 20.10.2009 at 1130 hrs. The Copenhagen ACC was authorized on behalf of the Danish AIB to collect the communication data and deliver the data to the AIB. During the process of listening through the communication data it became clear that there was no data from Narsarsuaq AFIS. Copenhagen ACC did collect communication data from Sondrestrom; but not from Narsarsuaq AFIS. The request for communication data from Narsarsuaq AFIS was reissued on the 12.11.2009 at 11:10 hrs. The Copenhagen ACC responded on the 12.11.2009 1200 hrs. ACC replied that all communication in Greenland on the 16.10.2009 was requested from Greenland and would arrive shortly by airmail. The communication data arrived at Copenhagen ACC. The communication was copied to a DVD; but Copenhagen ACC was not able to replay the DVD. The AIB was informed of the problems with the communication data on the 01.12.2009 at 0702 hrs. A period of troubleshooting began. AIB was informed on the 04.01.2010 at 1411 hrs. that the communication data could be replayed and that a list of the communications channels would be issued. The DVD arrived at the AIB Monday the 11.01.2010. The DVD contained many hours of recordings none of which was from Narsarsuaq AFIS.

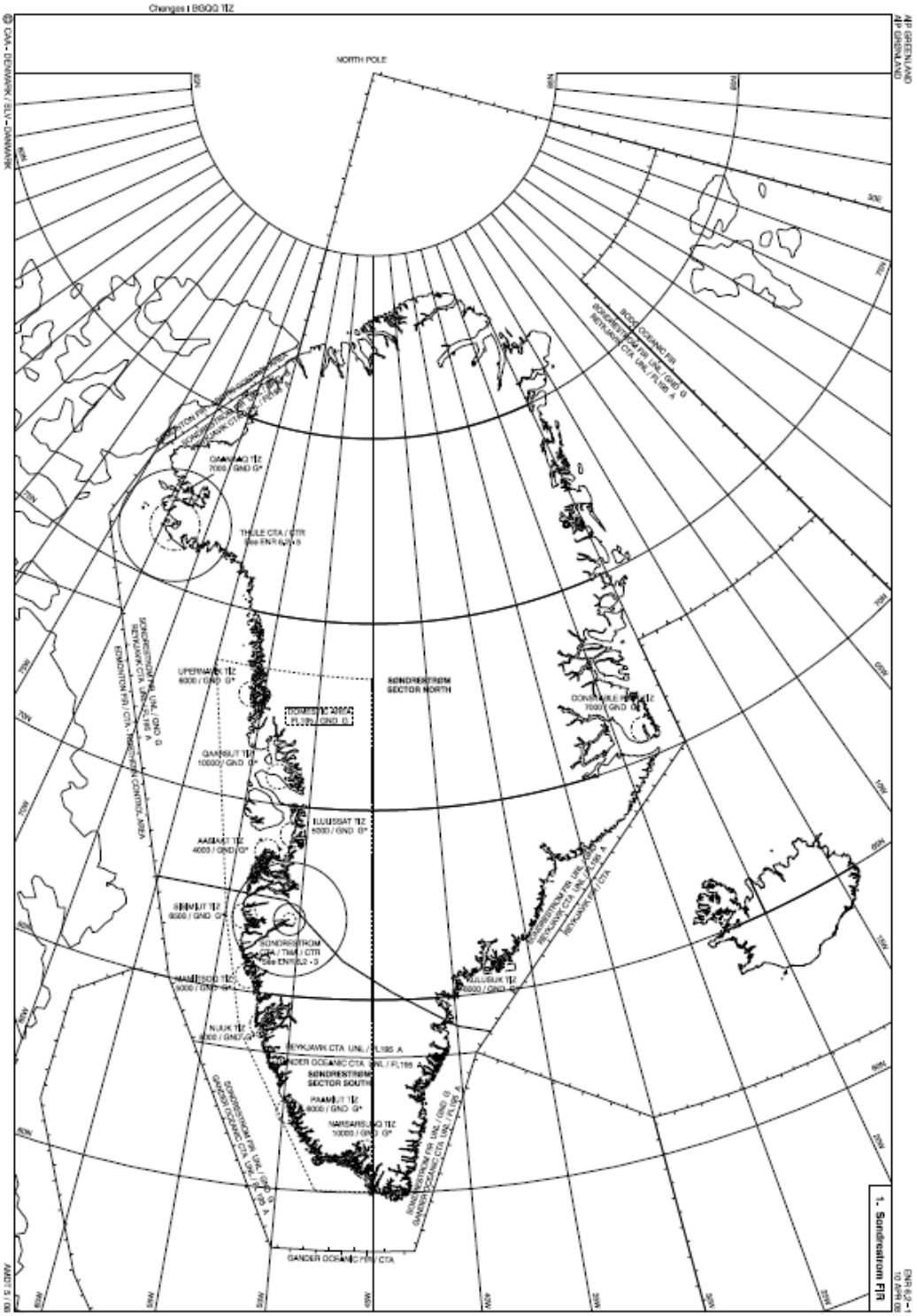
5.9.4 An AFIS operator at Narsarsuaq AFIS became aware that the AIB was interested in the communication between N108GF and BGBW AFIS. He contacted the AIB on the 12.01.2010 at 0645 hrs. The communication tape was send from BGBW to the AIB on the 14.01.2010 and arrived a few days later. The tape was a HP DDS-2 Data Cartridge, C5707A and the recordings were digital data format. The recorder type was a Nice Call NC 2000. The AIB was at first unable to find any re-player equipment in Denmark that could replay the communication.

5.9.5 The AIB contacted on the 05.02.2010 1041 hrs. the Greenland Airport Authority (GAA) as the recording system was under their jurisdiction. The GAA responded on the same day and replied that they would look into the matter. The GAA had the re-player equipment and was willing to make copies of the communication in a WAV format. It was agreed to send the tape to GAA on the 31.03.2010 and the tape was send on the 08.04.2010. The tape arrived at GAA on the 12.04.2010 and personnel began the process of retrieving the communication data. The expected processing time was one week. On the 10.05.2010 GAA informed AIB that they were having problems retrieving data from the tape. On the 20.05.2010 AIB

received a positive reply from GAA. Some communication data were already retrieved but the process was slow. On the 04.06.2010 AIB was informed by GAA that the process of retrieving the data was still ongoing and they expected that half of the data was retrieved. On the 29.06.2010 GAA informed AIB that their Nice Call player hard disk was malfunctioning and that there was a halt in the process. The AIB requested on the 05.07.2010 GAA to send that part of the communication data that already was recovered. The 5 of the approximately 10 CD arrived a few days later. The AIB listen to the communication data but found nothing related to the flight N108GF. On the 29.07.2010 GAA was informed that there were no relevant data on the 5 CD. GAA informed AIB that they still on the 17.08.2010 were in the process of recovering their recorder system. The AIB requested on the 18.10.2010 GAA to return the tape to the AIB and on the 25.10.2010 the tape was back at AIB.

5.9.6 The AIB contacted the representative of the manufacture of the recorder in Denmark. They received the tape on the 10.11.2010 and the retrieved recordings were ready and picked up by AIB the following day (11.11.2010). The copies of the communications were of good quality and useful to the investigation.

5.10.1 AIP Greenland ENR 6.2 – 1



5.10.2 AIP Greenland GEN 3.6

GEN 3.6 Search and Rescue Services

1. Responsible Services

1.1 The Search and Rescue Service in Greenland is provided by the following 3 Services:

- Rescue Coordination Centre (RCC) Søndrestrøm
- Maritime Rescue Coordination Centre (MRCC) Grønnedal
- The Police Authority in Greenland (Chief Constables Office)

1.2 Postal addresses:

RCC Søndrestrøm
NAVIAIR
P.O. Box 1005
DK-3910 Kangerlussuaq
Greenland
TEL: +299 84 12 01, or 84 11 35 and 84 10 34
FAX: +299 84 10 20
AFS: BGSFYCYX
E-mail: rcc@naviair.dk

MRCC Grønnedal
Greenland Command
DK-3932 Kangilinnguit
Greenland
TEL: +299 69 19 11
FAX: +299 69 19 49
AFS: BGGDYXYX
E-mail: iscomgl@glk.gl

Chief Constables Office
P.H. Lundsteensvej 1
P.O. Box 1006
DK-3900 Nuuk
Greenland
TEL: +299 32 14 48
FAX: +299 32 41 94
AFS: BGGHYCYX
E-mail: grpoliti@greennet.gl

1.3 Applicable ICAO documents

RCC Søndrestrøm conducts search and rescue services in accordance with the Standards and Recommended Practices provided in the following ICAO documents

Annex 12 Search and Rescue

DOC 7030 Regional Supplementary Procedures, NAT Region

DOC 9731 International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), VOL I - III

Differences from the International Standards and Recommended Practices are detailed in GEN 1.7.

1.4 Applicable national documents

BL 7-4 Search and Rescue Service
(extracts from Annex 12 - in Danish only)

SAR Grønland (in Danish only)

2. Areas of Responsibility

2.1 In incidents involving aircraft, RCC Søndrestrøm will initiate SAR operations and act as SAR-coordinator.

2.2 Search and Rescue operations will be carried out in close co-operation with the Maritime Rescue Centre Grønnedal and the Chief Constable in Nuuk. They may act as Rescue Sub Centres.

2.3 Danish ATS units or other appropriate services will act as alerting posts and may by agreement with RCC Søndrestrøm act as Rescue Sub Centre.

2.4 The vast dimensions of the Search and Rescue Area, the climate and nature, the scarcity of population and the communication problems necessitate not only a close co-operation between the various authorities in Greenland, but also prompt action from the nearest agency capable of rendering assistance

GEN 3.6 Eftersøgnings- og redningtjenester

1. Ansvarlige tjenester

1.1 Eftersøgnings- og redningstjenesten i Grønland ydes af følgende 3 tjenester:

- Redningscentralen (RCC) Søndrestrøm
- Søredningscentralen (MRCC) Grønnedal
- Politimesterembedet i Grønland

1.2 Postadresser:

RCC Søndrestrøm
NAVIAIR
Postboks 1005
3910 Kangerlussuaq
Grønland
TEL: 84 12 01, eller 84 11 35 og 84 10 34
FAX: 84 10 20
AFS: BGSFYCYX
E-post: rcc@naviair.dk

MRCC Grønnedal
Grønlands Kommando
3932 Kangilinnguit
Grønland
TEL: 69 19 11
FAX: 69 19 49
AFS: BGGDYXYX
E-post: iscomgl@glk.gl

Politimesterembedet i Grønland
P.H. Lundsteensvej 1
Postboks 1006
3900 Nuuk
Grønland
TEL: 32 14 48
FAX: 32 41 94
AFS: BGGHYCYX
E-post: grpoliti@greennet.gl

1.3 Gældende ICAO dokumenter

RCC Søndrestrøm udøver flyveredningstjeneste i overensstemmelse med de standarder og anbefalede fremgangsmåder angivet i efterfølgende ICAO dokumenter

Annex 12 Search and Rescue

DOC 7030 Regional Supplementary Procedures, NAT Region

DOC 9731 International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), VOL I - III

Afvigelser fra internationale standarder og anbefalede fremgangsmåder er beskrevet i GEN 1.7.

1.4 Gældende nationale dokumenter

BL 7-4 Flyveredningstjeneste
(uddrag af Annex 12)

SAR Grønland

2. Ansvarsområder

2.1 Ved hændelser omhandlende luftfartøjer, vil RCC Søndrestrøm iværksætte SAR-operation og fungere som SAR-koordinator.

2.2 Eftersøgnings- og redningsaktioner vil blive udført i snævert samarbejde med Søredningscentralen Grønnedal og politimesteren i Grønland, der vil kunne virke som redningsundercentraler.

2.3 Danske ATS-enheder eller andre berørte tjenester i Grønland virker som alarmeringsstationer og vil efter aftale med RCC Søndrestrøm kunne virke som redningsundercentral.

2.4 Eftersøgnings- og redningsområdets udstrækning, klimaet og naturen, den ringe befolkningstæthed samt kommunikationsvanskelighederne nødvendiggør ikke alene et snævert samarbejde mellem de forskellige myndigheder i Grønland, men også øjeblikkelig handling fra den nærmeste institution, som er i stand til at yde hjælp.

2.5 The Search and Rescue areas in Greenland are as follows:

RCC Søndrestrøm: Søndrestrøm Search and Rescue Region (SRR) see item 9, Search and Rescue Area. Chart.

MRCC Grønnedal: Søndrestrøm SRR. Grønnedal is acting as Maritime Rescue Coordination Centre, and special reporting and safeguarding areas for shipping to and from Greenland have been established.

The Chief Constables Office: The police in Greenland is responsible for search and rescue on land and in near-shore waters.

3. Types of Service

3.1 Aircraft suitable for SAR operations and located in Greenland will be available through SAR-Coordinator at RCC Søndrestrøm.

3.2 Danish military aircraft and sea rescue facilities suitable for SAR operations and located in Greenland will be available through SAR-Coordinator at MRCC Grønnedal.

3.3 Search and rescue facilities for land operations and coastal vessels suitable for SAR operations will be available through the Chief Constable in Greenland.

3.4 The table below indicates the location of possible SAR units/facilities.

2.5 Rednings- og eftersøgningsområder i Grønland er følgende:

RCC Søndrestrøm: Søndrestrøm rednings-og eftersøgningsregion (SRR), se pkt. 9, Eftersøgnings- og redningsområde. Kort.

MRCC Grønnedal: Søndrestrøm SRR. Grønnedal virker som søredningscentral, og særlige rapporterings- og overvågningsområder for skibsfarten til og fra Grønland er oprettet.

Politimesterembedet: Politiet i Grønland er ansvarlig for eftersøgning og redning af nødstedte på land og i det kystnære farvand.

3. Tjenestetyper

3.1 Luftfartøjer, som er stationerede i Grønland og anvendelige til SAR-operationer, vil være til rådighed gennem SAR-koordinator i RCC Søndrestrøm.

3.2 Danske militære luftfartøjer og søredningshjælpemidler, som er stationerede i Grønland og anvendelige til SAR-operationer, vil være til rådighed gennem SAR-koordinator i MRCC Grønnedal.

3.3 Landredningshjælpemidler og kystfartøjer, som er anvendelige til SAR-operationer, vil være til rådighed gennem Politimesteren i Grønland.

3.4 Nedenstående skema viser placeringen af mulige SAR-enheder/hjælpemidler.

Location/Sted	Facilities/Hjælpemidler	Remarks/Bemærkninger
Aasiaat, Ilulissat, Kangerlussuaq, Kulusuk, Maniitsoq, Narsarsuaq, Nerlerit Inaat, Nuuk, Qaanaaq, Sisimiut, Thule, Upernavik, Uummannaq/Qaarsut	Miscellaneous aircraft/ Forskellige luftfartøjer	No dedicated SAR aircraft are located permanently i Greenland. The SAR Coordinator may charter civilian aircraft suitable for SAR operations and can request deployment of dedicated SAR aircraft from outside Greenland/ Der er ikke i Grønland til stadighed udstationeret luftfartøjer, der alene er beregnet til SAR-operationer. SAR-koordinator kan chartre civile luftfartøjer egnet til SAR operationer og kan fra steder uden for Grønland anmode luftfartøjer, som er beregnet til SAR operationer, om at deltage
Kangilinnguit	Rescue cutters suitable for operations in the fjords and at sea, and vessels of various types/ Redningskuttere anvendelige såvel i fjordene som på havet, samt skibe af forskellig art	Available through CinC Greenland Command, Grønnedal Naval Base/ Til rådighed gennem chefen for Grønlands Kommando, Flådestation Grønnedal
Ilulissat, Maniitsoq, Nuuk, Paamiut, Qaqortoq, Sisimiut	Rescue- and policecutters suitable for operations in the fjords and near-shore waters/ Rednings- og politikuttere anvendelige i fjordene og det kystnære farvand	Available through the chief Constable at Nuuk/ Til rådighed gennem Politimesterembedet i Nuuk

4. SAR Agreements

4.1 Agreements on cooperation within Search and Rescue have been signed with Iceland and Norway.

5. Conditions of Availability

5.1 The agreements includes provisions for pooling of SAR facilities.

6. Procedures and Signals

6.1 General

6.1.1 In order to enable RCC Søndrestrøm to activate the most suitable facilities as quickly as possible, operators are requested to forward to RCC Søndrestrøm information on the emergency and survival equipment carried on board any of their aircraft operating regularly within Søndrestrøm SRR.

6.2 Other procedures

6.2.1 Aircraft not engaged in an actual search and rescue operation should as far as practical avoid any area in which actual search and rescue operations are in progress unless authorized by the appropriate controlling agency.

4. SAR aftaler

4.1 Aftaler om samarbejde inden for flyveredningstjeneste er indgået med Island og Norge.

5. Rådighedsbetingelser

5.1 Aftalerne inkluderer bestemmelser for gensidig bistand med SAR-hjælpemidler.

6. Forskrifter og signaler

6.1 Generelt

6.1.1 For at RCC Søndrestrøm kan være i stand til at indsætte de mest hensigtsmæssige hjælpemidler så hurtigt som muligt, anmodes luftfartsforetagender om at fremsende oplysninger til RCC Søndrestrøm vedrørende nød- og redningsudstyret, som medføres i de af deres luftfartøjer, som regelmæssigt udfører flyvninger i Søndrestrøm SRR.

6.2 Andre forskrifter

6.2.1 Luftfartøjer, som ikke deltager i en igangværende eftersøgnings- og redningsaktion, bør så vidt muligt undgå ethvert område, i hvilket sådanne operationer foregår, medmindre tilladelse er givet af vedkommende kontrollerende myndighed.

6.2.2 Procedures for a pilot-in-command observing an accident or intercepting a distress call and/or message are outlined in ICAO Annex 12.

6.2.3 On request to RCC Søndrestrøm escort service on a limited scale may be provided to an aircraft in an emergency phase.

6.2.4 A ditching report, requested by an aircraft about to ditch will as far as possible be given in accordance with the provisions in ICAO Annex 3, Meteorological Service for International Air Navigation.

6.3 Communications

6.3.1 Exhange of distress messages within Søndrestrøm search and rescue region are handled in accordance with the provisions of ICAO Annex 10.

6.3.2 For communication during search and rescue operations, the codes and abbreviations published in ICAO DOC 8400, ICAO Abbreviations and Codes are used.

6.3.3 RCC Søndrestrøm communication frequencies are identical with the frequencies published in AIP Greenland ENR 2.1 for FIC Søndrestrøm. Additionally the frequencies 3023 KHZ and 5680 KHZ will be available upon request to FIC Søndrestrøm or RCC Søndrestrøm.

6.3.4 The international emergency frequencies are guarded continuously as indicated below.

6.2.2 Bestemmelser for en fartøjschef, der observerer et ulykkestilfælde eller opfanger et nødopkald/nødmelding, er fastsat i BL 7-4 (ICAO Annex 12).

6.2.3 Efter anmodning til RCC Søndrestrøm kan der udføres begrænset eskorteringstjeneste for et luftfartøj i en kritisk situation.

6.2.4 Når et luftfartøj anmoder om nødlandingsrapport for nødlanding på vandet, vil en sådan rapport så vidt muligt blive givet i overensstemmelse med det i ICAO Annex 3, Meteorological Service for International Air Navigation angivne.

6.3 Kommunikation

6.3.1 Udveksling af nødmeldinger inden for Søndrestrøm eftersøgnings- og redningsregion sker i overensstemmelse med det i ICAO Annex 10 angivne.

6.3.2 Ved kommunikation under eftersøgnings- og redningsaktioner anvendes koder og forkortelser publiceret i ICAO DOC 8400, ICAO Abbreviations and Codes.

6.3.3 RCC Søndrestrøms kommunikationsfrekvenser er identiske med det i AIP Grønland ENR 2.1 publicerede for FIC Søndrestrøm. Derudover vil frekvenserne 3023 KHZ og 5680 KHZ være til rådighed på anmodning til FIC Søndrestrøm eller RCC Søndrestrøm.

6.3.4 Der holdes døgnvagt på de internationale nødfrekvenser som angivet herunder.

Station/CS	Emergency FREQ/Nødfrekvenser	Remarks/Bemærkninger
Aasiaat/Aasiaat Radio	500/2182 KHZ 156.800 MHZ (CH16)	Direction finding not available/ Radiopejling ikke til rådighed
Ammassalik/Ammassalik Radio	500/2182 KHZ 156.800 MHZ (CH16)	Direction finding not available/ Radiopejling ikke til rådighed
Kangilinnguit/Grønnedal Radio	500/2182 KHZ 156.800 MHZ (CH16)	Direction finding not available/ Radiopejling ikke til rådighed
Nuuk/Nuuk Radio	500/2182 KHZ 156.800 MHZ (CH16)	Direction finding not available/ Radiopejling ikke til rådighed
Qaqortoq/Qaqortoq Radio	500/2182 KHZ 156.800 MHZ (CH16)	Direction finding not available/ Radiopejling ikke til rådighed

6.4 On–scene–frequencies

6.4.1 The frequencies 3023 KHZ, 5680 KHZ, 123.100 MHZ, 156.300 MHZ (CH6), 156.600 MHZ (CH12) and 156.800 MHZ (CH16) are used by military vessels and aircraft as on-scene-frequencies. The frequency 3023 KHZ will also be utilized by rescue vessels and police cutters when communicating with SAR aircraft and RCC Søndrestrøm.

6.4.2 Military SAR aircraft are equipped with UHF, VHF (AM/FM) and HF (SSB).

6.5 Military and civil SAR aircraft will use the call sign RESCUE followed by aircraft tail number or identification, e.g. "RESCUE 276". Civil helicopters will use the call sign "RESCUE HELICOPTER" followed by identification.

6.6 Homing capabilities of SAR aircraft

6.6.1 Military SAR aircraft are able to home on all frequencies in VHF and UHF band and on the frequency band 190 to 2182 KHZ.

6.6.2 Civilian HEL (SK61N) are able to home on 121.5 MHZ.

6.7 The Search and Rescue Signals to be used are those prescribed in ICAO Annex 12.

7. Emergency Locator Transmitters (ELT)

7.1 Søndrestrøm Search and Rescue Region is an integrated part of the Norwegian Service Area in the polar orbiting COSPAS-SARSAT System (Space System for the Search of Vessels in Distress (Russia) - Search and Rescue Satellite-Aided Tracking (Canada, France and USA)).

7.2 The Norwegian COSPAS-SARSAT Mission Control Centre at Bodø will through JRCC in Denmark inform RCC Søndrestrøm whenever Emergency Locator Transmitter (ELT) signals on 121.5, 243 or 406 MHZ are received and positioned within Søndrestrøm SRR.

6.4 Frekvenser der anvendes på nødstedet

6.4.1 Frekvenserne 3023 KHZ, 5680 KHZ, 123.100 MHZ, 156.300 MHZ (CH6), 156.600 MHZ (CH12) og 156.800 MHZ (CH16) anvendes af militære skibe og luftfartøjer på stedet, hvor redningsaktionen foregår. Frekvensen 3023 KHZ anvendes også af redningsskibe og politikuttere til kommunikation med SAR-luftfartøjer og RCC Søndrestrøm.

6.4.2 Militære SAR luftfartøjer er udstyret med UHF, VHF (AM/FM) og HF (SSB).

6.5 Militære og civile SAR luftfartøjer anvender kaldesignalet RESCUE efterfulgt af luftfartøjsnummer eller identifikation, f.eks.: "RESCUE 276". Civile helikoptere benytter kaldesignalet "RESCUE HELICOPTER" efterfulgt af identifikation.

6.6 SAR-enheders pejlemuligheder

6.6.1 Militære SAR-luftfartøjer kan pejle på alle frekvenser i VHF og UHF båndet og på frekvensbåndet 190 til 2182 KHZ.

6.8.2 Civile HEL (SK61) kan pejle på 121.5 MHZ.

6.7 Ved eftersøgning og redning anvendes de i BL 7-4 (ICAO Annex 12) anførte signaler.

7. Nødradiosendere (ELT)

7.1 Søndrestrøm eftersøgnings- og redningsregion er en integreret del af det norske service område i forbindelse med det polarkredsende COSPAS-SARSAT System (Space System for the Search of Vessels in Distress (Rusland) - Search and Rescue Satellite-Aided Tracking (Canada, Frankrig og USA)).

7.2 Det norske COSPAS-SARSAT Mission Control Centre i Bodø vil via JRCC i Danmark informere RCC Søndrestrøm når som helst signaler fra en nødradiosender (ELT) på 121.5, 243 eller 406 MHZ er modtaget og positionsbestemt inden for Søndrestrøm SRR.

7.3 Location accuracy on 121.5 and 243 MHZ is normally better than 20 KM when an ELT is positioned for the first time and the accuracy improves with additional positioning to within a few KM. The accuracy on 406 MHZ is better than 5 KM at the first positioning and improves with additional positioning to within 1 KM.

7.4 The maximum waiting time for the polar orbiting satellites within Søndrestrøm SRR is approximately 30 minutes, therefore survivors should activate their ELT without delay.

7.5 Valuable SAR resources are at times being spent searching for the source of inadvertent ELT transmissions and can thus delay the response to an actual emergency situation. Great care should be taken to avoid inadvertent ELT transmissions, but if it occurs, a report should be made to the nearest ATS unit as soon as possible.

7.6 It is recommended that the emergency frequencies are briefly monitored as part of the aircraft shutdown procedure to detect inadvertent ELT transmissions.

7.7 Denmark has nominated JRCC as the SAR Point of Contact (SPOC) for Denmark, Greenland and the Faeroe Islands in connection with the use of the COSPAS-SARSAT System, and they maintain the national register of all registered 406 MHZ ELTs. SPOC Denmark can be contacted either through RCC Søndrestrøm or directly.

7.8 SPOC Denmark postal address:

Joint Rescue Coondination Center (JRCC)
P.O. Box 483
DK-8100 Aarhus C
Denmark

TEL: +45 89 43 32 06 or +45 89 43 32 07
FAX: +45 89 43 32 20
E-mail: jrcc@sok.dk

7.9 In connection with check-up and maintenance of ELTs, installed in aircraft, an occasional need for a functions check is necessary. The Civil Aviation Administration therefore allows that such checks are carried out on the following conditions:

Tests of automatic ELTs, installed in aircraft, may only take place on the ground and only during the first 5 minutes of every full hour in accordance with the following guidelines:

a. The VHF-receiver of the aircraft is tuned to the civilian emergency frequency 121.5 MHZ.

b The ELT is activated - the activation switch is shifted from OFF to ON for 1 second or 3 sweep (tonecycles), while the function is monitored on the in para. a. mentioned VHF-receiver.

Bear in mind, that civilian ELTs are transmitting simultaneously on both the civilian and military emergency frequencies (121.5 and 243 MHZ), in which case false, as well as intentional, transmissions of a longer duration than specified above, may activate a search operation or seriously disrupt an ongoing operation.

8. Special Signals and Procedures for Use in Search Operations

8.1 When observing or hearing an aircraft, survivors should fire a red pyrotechnical signal.

8.2 When observing this signal SAR aircraft and if feasible also other aircraft engaged in the operation will fire a single green pyrotechnical signal or change course towards the survivors.

8.3 Survivors should hereupon fire another red pyrotechnical signal to enable the aircraft to obtain the correct heading.

8.4 Survivors should economize on signals and only fire further signals when:

a. the aircraft so request by firing a green signal

b. it is observed that the aircraft appears to be getting off track and

c. the aircraft is almost overhead

7.3 Positionsnøjagtigheden på 121.5 og 243 MHZ er normalt bedre end 20 KM ved første positionsbestemmelse og nøjagtigheden forbedres ved efterfølgende positionsbestemmelser til et par KM. Nøjagtigheden på 406 MHZ er bedre end 5 KM ved første positionsbestemmelse og forbedres ved efterfølgende positionsbestemmelser til omkring 1 KM.

7.4 Maksimum ventetid for positionsbestemmelse ved de polarkredsende satellitter inden for Søndrestrøm SRR er omkring 30 minutter, hvorfor overlevende uden forsinkelse skal aktivere deres ELT.

7.5 Værdifulde SAR-ressourcer bliver til tider anvendt i eftersøgning af utilsigtet aktiverede ELT'er og kan på den måde forsinke reaktionen på en aktuel nødsituation. Stor agtpågivenhed skal derfor udvises for at undgå en utilsigtet ELT aktivering. Skulle dette alligevel ske, skal nærmeste ATS-enhed straks underrettes.

7.6 Det anbefales at nødfrekvenserne kortvarigt aflyttes som en del af proceduren i forbindelse med en flyvnings afslutning for at opdage utilsigtet ELT-udsendelse.

7.7 Danmark har udpeget JRCC som SAR kontaktpunkt (SPOC) for Danmark, Grønland og Færøerne i forbindelse med brugen af COSPAS-SARSAT systemet, og de vedligeholder det nationale register for alle registrerede 406 MHZ ELT'er. SPOC Danmark kan kontaktes enten gennem RCC Søndrestrøm eller direkte.

7.8 SPOC Danmark postadresse:

Joint Rescue Coondination Center (JRCC)
Postboks 483
8100 Aarhus C

TEL: 89 43 32 06 eller 89 43 32 07
FAX: 89 43 32 20
E-mail: jrcc@sok.dk

7.9 I forbindelse med eftersyn og vedligeholdelse af ELT'er, installeret i luftfartøjer, er der lejlighedvis behov for at kunne udføre en funktionsprøve. Statens Luftfartsvæsen skal derfor tillade, at sådanne prøver udføres på følgende vilkår:

Afprøvning af automatiske ELT'er, installeret i luftfartøjer, må kun udføre på jorden og kun i de første 5 minutter af hver fulde time efter følgende retningslinier:

a. Flyets VHF-modtager indstilles på den civile nødfrekvens 121.5 MHZ.

b. ELT'en startes - betjeningskontakten skiftes fra OFF til ON i 1 sekund eller 3 sweep (tonegennemløb), medens funktionen kontrolleres på den under a. nævnte VHF-modtager.

Der erindres om, at civile ELT'er sender samtidig på både den civile og den militære nødfrekvens (121.5 og 243 MHZ), hvorfor såvel falske som tilsigtede udsendelser af længere varighed end ovenfor angivet, kan igangsætte en eftersøgning eller alvorligt forstyrre en igangværende.

8. Særlige signaler og fremgangsmåder ved eftersøgninger

8.1 De nødstedte skal, efter at have observeret eller hørt et luftfartøj, affyre et rødt pyroteknisk signal.

8.2 Når SAR luftfartøjer og om muligt også andre luftfartøjer, der deltager i en eftersøgning, observerer dette signal, vil de affyre et grønt pyroteknisk signal eller ændre kurs mod de nødstedte.

8.3 De nødstedte skal herefter affyre endnu et rødt pyroteknisk signal for at sætte luftfartøjet i stand til at korrigere kursen.

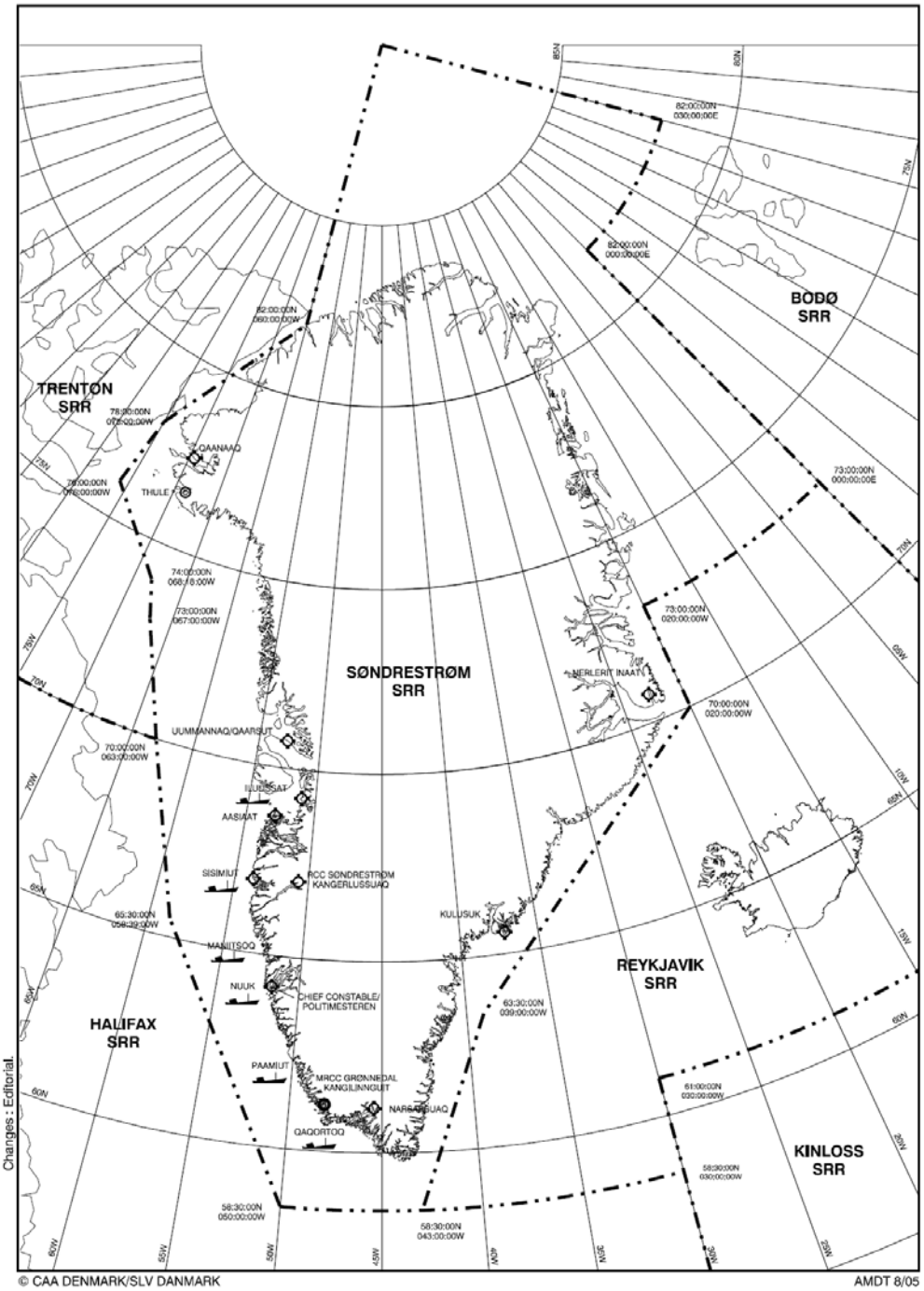
8.4 De nødstedte skal spare på signalerne og kun affyre yderligere signaler, såfremt:

a. luftfartøjet anmoder herom ved at affyre et grønt pyroteknisk signal

b. de nødstedte observerer, at luftfartøjet er kommet ud af kurs samt

c. luftfartøjet befinder sig omtrent over de nødstedte.

9. Search and Rescue Region. Chart/Eftersøgnings- og redningsregion. Kort



Changes : Editorial.

AMDT 8/05

5.10.3 AIP Greenland Narsarsuaq (BGBW)

22. Flight Procedures/Flyveprocedurer

1. IFR/VFR State Minima/IFR/VFR "State Minima"

"State minima" applies as follows/"State minima" er etableret som følger:

	RWY	Ceiling (FT)	GND VIS (M)
DAY:			
IFR approach NDB-DME 1	07	1500	6000
IFR approach NDB-DME 2	07	1500	6000
IFR approach NDB	07	2400	6000
Take-off VMC/SID	07 and 25	1200	6000
VFR	07 and 25	1500	8000
NIGHT:			
IFR approach NDB-DME 1	07	3000	6000
IFR approach NDB-DME 2	07	3000	6000
IFR approach NDB	07	not available	
Circling	25	not available	
Take-off VMC/SID	07 and 25	not available	
VFR	07 and 25	not available	

2. IFR arrival

2.1 Standard Arrival Routes (STAR) have not been established

2.2 VISUAL ARRIVAL TRACKS have been established as shown on the chart BGBW VMC ARR 07. Mentioned tracks may be used in connection with the IAL procedures.

For aircraft not able to follow the steep approach path to the RWY it is recommended to descend towards the RWY, and when overhead the THR 07 carry out a 360° left turn, and intercept the final, as the weather in this area can be observed from the airport. Turn radius should not exceed 1 NM. This procedure may only be used during daylight and within the civil twilight periods.

3. IFR departure

3.1 Standard Instrument Departure (SID) RWY 25:

Climb visual to 1200 FT MSL, intercept and follow QDR 278° climbing to MSA. Pass QDR 278°/DME 2.5 at 1200 FT MSL or above.

Minimum requirement IMC: Climb gradient 200 FT/NM

See chart BGBW SID 25

2. IFR-anflyvning

2.1 Standard anflyvningsruter (STAR) er ikke etableret.

2.2 "VISUAL ARRIVAL TRACKS" er etableret som vist på kortet BGBW VMC ARR 07. Nævnte "tracks" kan anvendes i forbindelse med IAL-procedurerne.

Det anbefales luftfartøjer, der ikke kan udføre den stejle nedstigning til banen, at påbegynde nedstigning mod banen og ved passage af THR 07 foretage et 360° venstre drej med efterfølgende tilslutning til endelig indflyvning, da vejret i dette område kan observeres fra flyvepladsen. Drejeradius bør ikke overskride 1 NM. Denne procedure må kun anvendes ved dagslys og inden for de borgerlige tusmørkeperioder.

3. IFR-udflyvning

3.1 Standard indstrumentudflyvning (SID) RWY 25:

Climb visual to 1200 FT MSL, intercept and follow QDR 278° climbing to MSA. Pass QDR 278°/DME 2.5 at 1200 FT MSL or above.

Minimum requirement IMC: Climb gradient 200 FT/NM

Se kortet BGBW SID 25

23. Additional Information

1. Request for clearance for aircraft which depart from Narsarsuaq AD in order to operate within Gander OCA/CTA should be forwarded not later than 45 minutes before expected time of departure to the Air Traffic Service Unit at Narsarsuaq AD.

   It is recommended not to start engines until clearance is received.
2. Two-way radio communication with AFIS is required prior to engine start-up, and AFIS frequency is to be monitored at all times when engines are running
3. Pilots are urged to flightplan via OSTED and EVABU when heading westbound into BGBW at or above FL 180.

   Pilots are urged to flightplan via KUNUL and 61N 040W heading eastbound after BGBW departure at or above FL 180.

   The purpose of this flightplanning is to secure oceanic separation in controlled airspace, and enable ATC to maximize the use of flight levels available in the non radar oceanic airspace.

23. Yderligere information

1. Anmodning om klarering for luftfartøjer, som efter start fra Narsarsuaq AD skal operere inden for Gander OCA/CTA, bør fremsættes senest 45 minutter før forventet starttidspunkt til lufttrafiktjenesteenheden på Narsarsuaq AD.

   Det anbefales at afvente modtagelse af klarering før opstart af motorer.
2. To-vejs radiokommunikation med AFIS skal være etableret før motorerne startes, og AFIS frekvensen skal altid aflyttes når motorerne kører.
3. Piloter opfordres til at planlægge flyvning via OSTED og EVABU på vestgående flyvninger ind til BGBW på eller over FL 180.

   Piloter opfordres til at planlægge flyvning via KUNUL og 61N 040W på østgående flyvninger efter start fra BGBW på eller over FL 180.

   Formålet med denne flyveplanlægning er at sikre adskillelse i kontrolleret luftrum, og tillade ATC at maksimere brugen af flyvehøjder i det ikke-radardækkede oceaniske område.

24. Charts Related to the Aerodrome/Kort tilknyttet lufthavnen

Chart type/Korttype	Chart title/Korttitel	Chart type/Korttype	Chart title/Korttitel
Aerodrome Chart-ICAO	ADC	Standard Arrival Chart-Visual	VMC ARR 07
Aerodrome Obstacle Chart-ICAO Type A	AOC-A 07 (Chart 1) AOC-A 07 (Chart 2) AOC-A 25 (Chart 1) AOC-A 25 (Chart 2)	Instrument Approach Chart-ICAO	NDB+DME 07-1 NDB+DME 07-2 NDB 07-1 NDB 07-2
Standard Departure Chart-Instrument-ICAO	SID 25	Visual Approach Chart-ICAO	VAC
		Other Charts	LDC

AERODROME CHART - ICAO
AD 2 - BGBW
ADC
Narsarsuaq
Changes : VAR.
ARP : 61 09 38.59N 045 25 32.43W
923 M from THR 07
AD ELEV : 112
Apron ELEV : -
ELEV in FT
Dimensions / Distances in M
Narsarsuaq AFIS : 119.100
RWY SLOPE
1.68%
1830
THR 25
112 FT
THR 07
11 FT
SCALE 1 : 12 500
0 100 200 400 600 800 M
VAR 25° W
(JAN 2009)
WARNING :
Minor Icebergs may
occur in the fiord close
to the runway
Datum : WGS-84
61 09 50N
92°
61 09 40N
115°
Not useable
61 09 30N
61 09 20N
61 09 10N
PAPI
Strip 1950 X 300
1830 X 45
07
25
Cellametre
Anemometer
Cellametre
Anemometer
Cellegraph
120°
PLG W EV 2 SEC
ADM
Hangar
Hangar
MKR
155°
NDB
61 10 20N
61 10 10N
045 24 40W
045 24 50W
045 24 30W
045 25 00W
045 25 10W
045 25 20W
045 25 30W
045 25 40W
045 25 50W
045 26 00W
045 26 10W
045 26 20W
APRON
Pavement : Concrete / Asphalt
Strength : PCN 43 / R / B / X / U
TAXIWAYS
Width : 23
Pavement : Asphalt
Strength : PCN 43 / R/ B / X / U
Day marking : Centre line, Side stripes, Holding PSN
Lighting : Blue edge, LIL RGL
Taxiing guidance system : Marshalling service AVBL
RUNWAYS
NR | Direction | THR PSN | Pavement Strength | Day marking | Declared distances: TORA | TODA | ASDA | LDA | APCH and RWY LGT (Unless otherwise stated lighting is LIH adjustable): APCH | PAPI | THR ID LGT | THR | Edge | End
07 | 040.3° GEO 065.3° MAG | 61 09 15.84N 045 26 12.43W | Concrete PCN 43 R / B / X / U | THR, TDZ, Aiming point, RWY NR, Centre line, Side stripes | 1830 | 1830 | 1830 | 1830 | | * 3.5° MEHT 46 FT | FLG W | Green | 1830 M White | Red
25 | 220.3° GEO 245.3° MAG | 61 10 00.91N 045 24 53.15W | | | 1830 | 1830 | 1830 | 1830 | | | | Green | 1830 M White | Red
OTHER : Secondary power supply : Yes, switch-over time MAX 15 SEC
OBSTACLES : All obstacles are marked by day and night
* PAPI to be used only within 2 NM from THR 07 (within DME NQ 3 NM)
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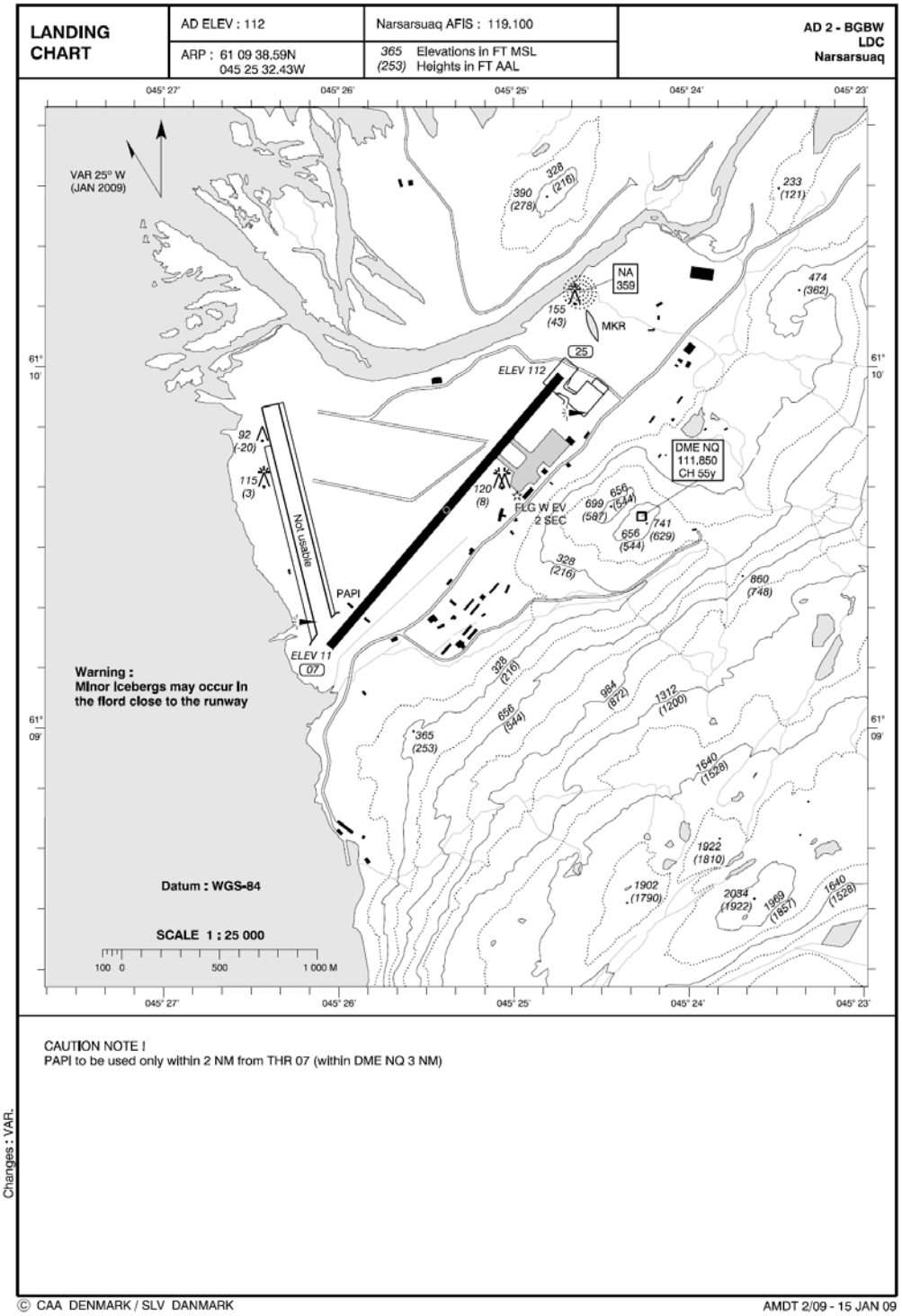
AMDT 2/09 - 15 JAN 09


LANDING CHART
AD ELEV : 112
ARP : 61 09 38.59N
045 25 32.43W
Narsarsuaq AFIS : 119.100
365 Elevations in FT MSL
(253) Heights in FT AAL
AD 2 - BGBW
LDC
Narsarsuaq
045° 27'
045° 26'
045° 25'
045° 24'
045° 23'
61° 10'
61° 09'
VAR 25° W
(JAN 2009)
NA
359
MKR
25
ELEV 112
DME NQ
111,850
CH 55y
FLG W EV
2 SEC
NOT usable
PAPI
ELEV 11
07
Warning :
Minor Icebergs may occur in
the flord close to the runway
Datum : WGS-84
SCALE 1 : 25 000
100 0
500
1 000 M
CAUTION NOTE !
PAPI to be used only within 2 NM from THR 07 (within DME NQ 3 NM)
Changes : VAR.
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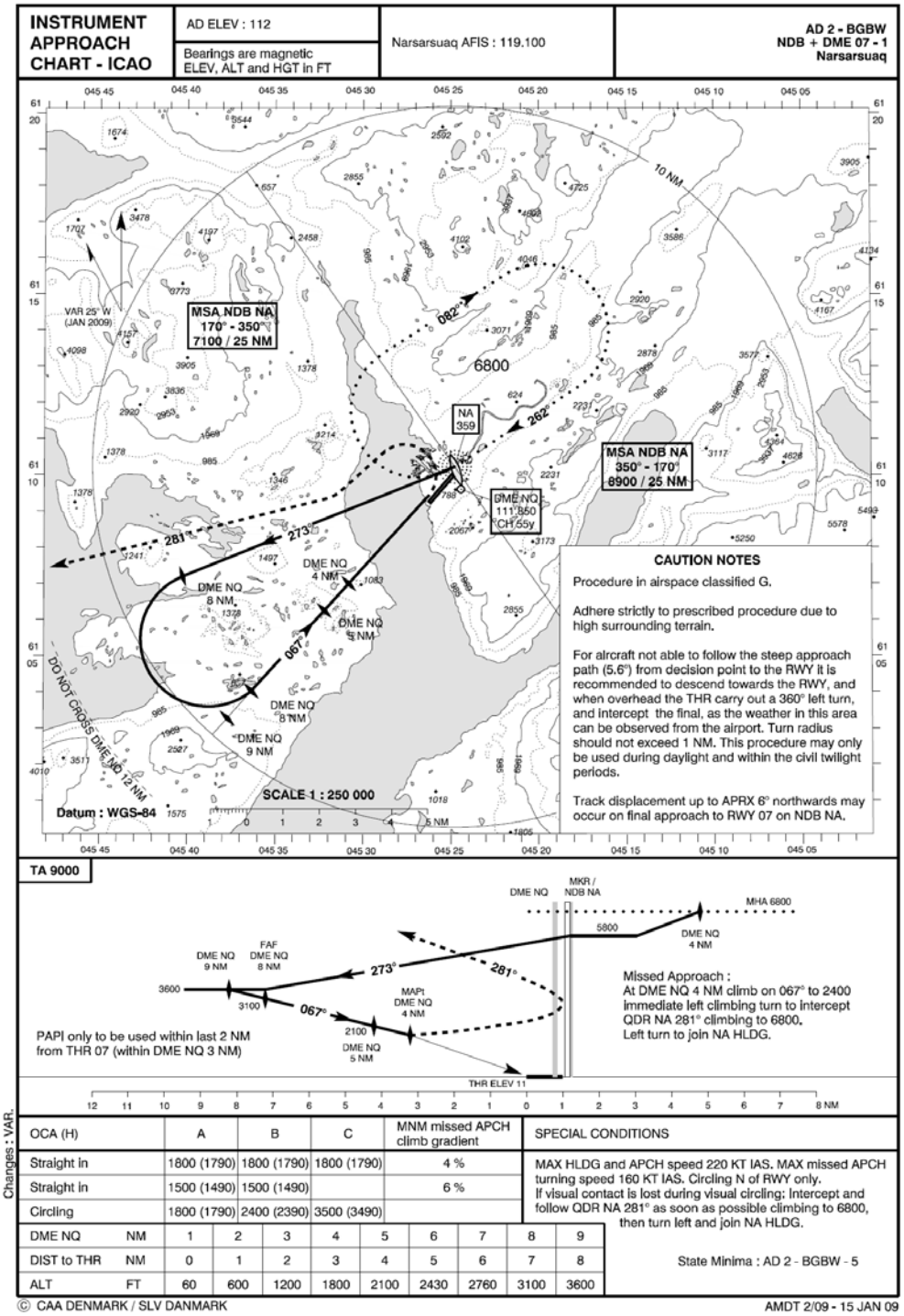
AMDT 2/09 - 15 JAN 09


INSTRUMENT APPROACH CHART - ICAO
AD ELEV : 112
Bearings are magnetic
ELEV, ALT and HGT in FT
Narsarsuaq AFIS : 119.100
AD 2 - BGBW
NDB + DME 07 - 1
Narsarsuaq
VAR 25° W (JAN 2009)
MSA NDB NA
170° - 350°
7100 / 25 NM
MSA NDB NA
350° - 170°
6900 / 25 NM
NA
359
DME NQ
111.850
CH 55y
10 NM
6800
082°
262°
281°
273°
067°
DME NQ
4 NM
DME NQ
8 NM
DME NQ
5 NM
DME NQ
8 NM
DME NQ
9 NM
DO NOT CROSS DME NQ 12 NM
SCALE 1 : 250 000
Datum : WGS-84
CAUTION NOTES
Procedure in airspace classified G.
Adhere strictly to prescribed procedure due to high surrounding terrain.
For aircraft not able to follow the steep approach path (5.6°) from decision point to the RWY it is recommended to descend towards the RWY, and when overhead the THR carry out a 360° left turn, and intercept the final, as the weather in this area can be observed from the airport. Turn radius should not exceed 1 NM. This procedure may only be used during daylight and within the civil twilight periods.
Track displacement up to APRX 6° northwards may occur on final approach to RWY 07 on NDB NA.
TA 9000
DME NQ
MKR / NDB NA
MHA 6800
5800
DME NQ
4 NM
FAF
DME NQ
8 NM
DME NQ
9 NM
3600
3100
273°
281°
067°
MAPt
DME NQ
4 NM
2100
DME NQ
5 NM
THR ELEV 11
PAPI only to be used within last 2 NM from THR 07 (within DME NQ 3 NM)
Missed Approach :
At DME NQ 4 NM climb on 067° to 2400 immediate left climbing turn to intercept QDR NA 281° climbing to 6800.
Left turn to join NA HLDG.
Changes : VAR.
OCA (H) | A | B | C | MNM missed APCH climb gradient | SPECIAL CONDITIONS
Straight in | 1800 (1790) | 1800 (1790) | 1800 (1790) | 4 %
Straight in | 1500 (1490) | 1500 (1490) | | 6 %
Circling | 1800 (1790) | 2400 (2390) | 3500 (3490) |
MAX HLDG and APCH speed 220 KT IAS. MAX missed APCH turning speed 160 KT IAS. Circling N of RWY only.
If visual contact is lost during visual circling: Intercept and follow QDR NA 281° as soon as possible climbing to 6800, then turn left and join NA HLDG.
DME NQ NM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
DIST to THR NM | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
ALT FT | 60 | 600 | 1200 | 1800 | 2100 | 2430 | 2760 | 3100 | 3600
State Minima : AD 2 - BGBW - 5
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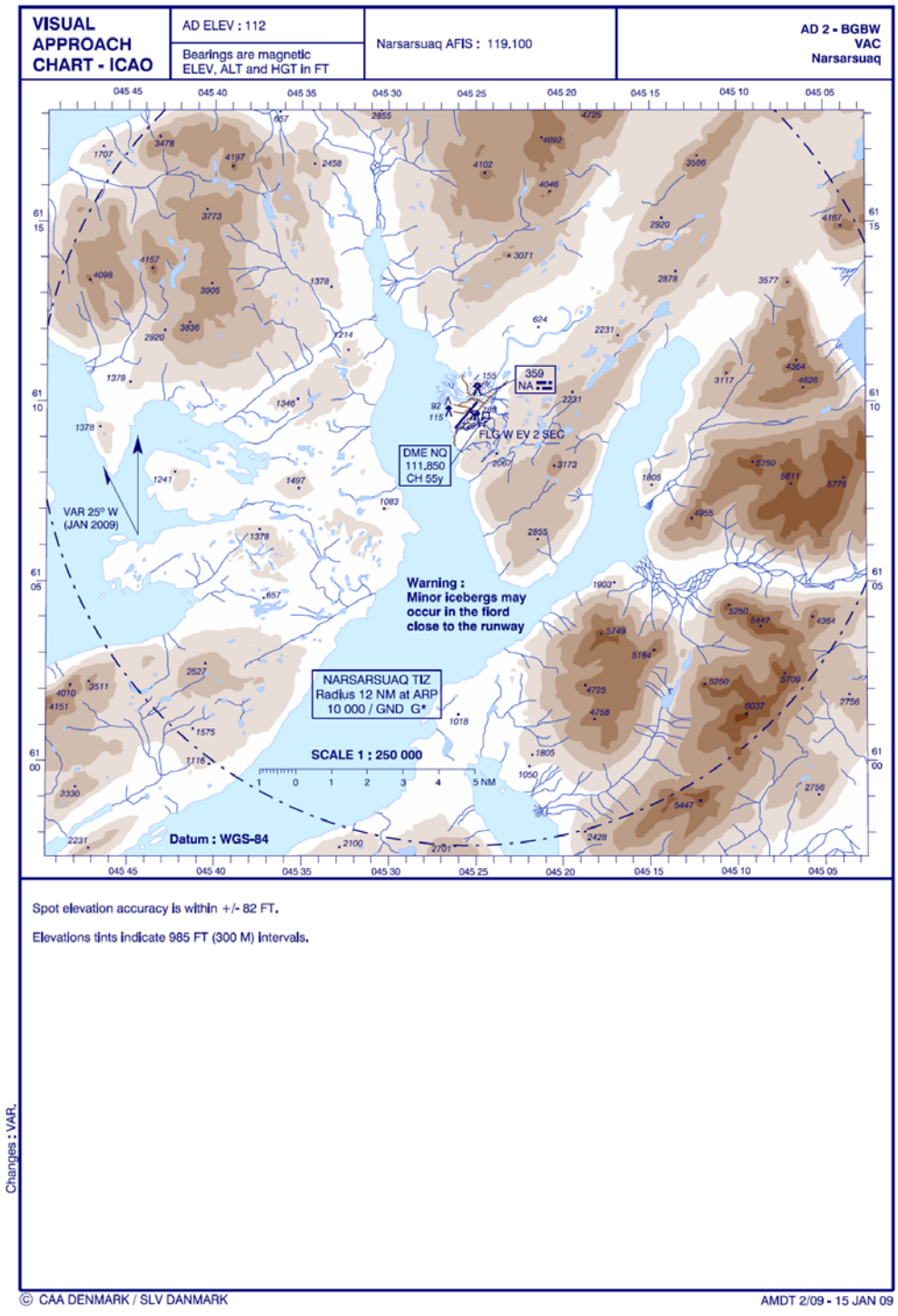
VISUAL APPROACH CHART - ICAO
AD ELEV : 112
Bearings are magnetic
ELEV, ALT and HGT in FT
Narsarsuaq AFIS : 119.100
AD 2 - BGBW
VAC
Narsarsuaq
359
NA
FLG W EV 2 SEC
DME NQ
111.850
CH 55y
VAR 25° W
(JAN 2009)
Warning :
Minor icebergs may
occur in the fiord
close to the runway
NARSARSUAQ TIZ
Radius 12 NM at ARP
10 000 / GND G*
SCALE 1 : 250 000
1 0 1 2 3 4 5 NM
Datum : WGS-84
045 45
045 40
045 35
045 30
045 25
045 20
045 15
045 10
045 05
61 15
61 10
61 05
61 00
Spot elevation accuracy is within +/- 82 FT.
Elevations tints indicate 985 FT (300 M) intervals.
Changes : VAR.
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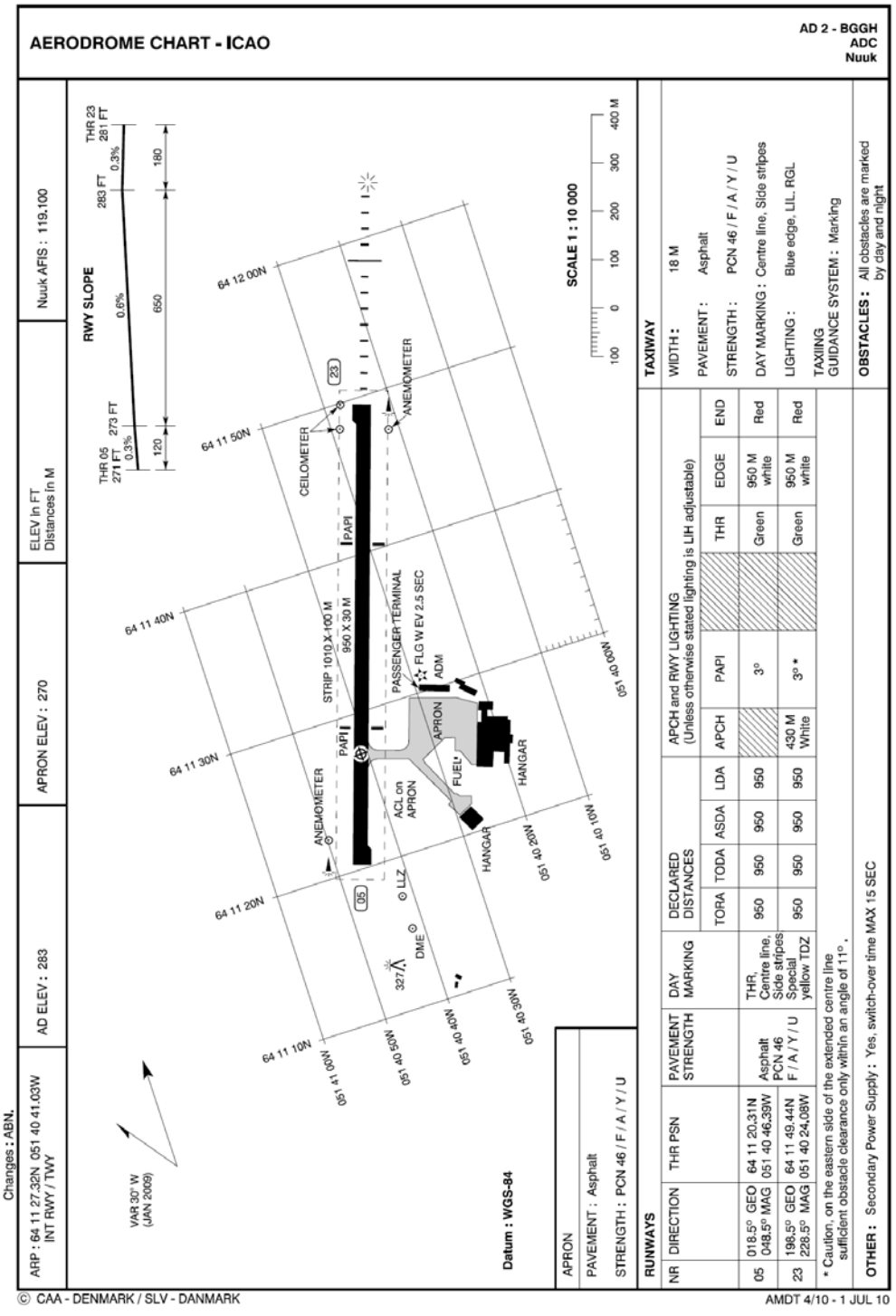
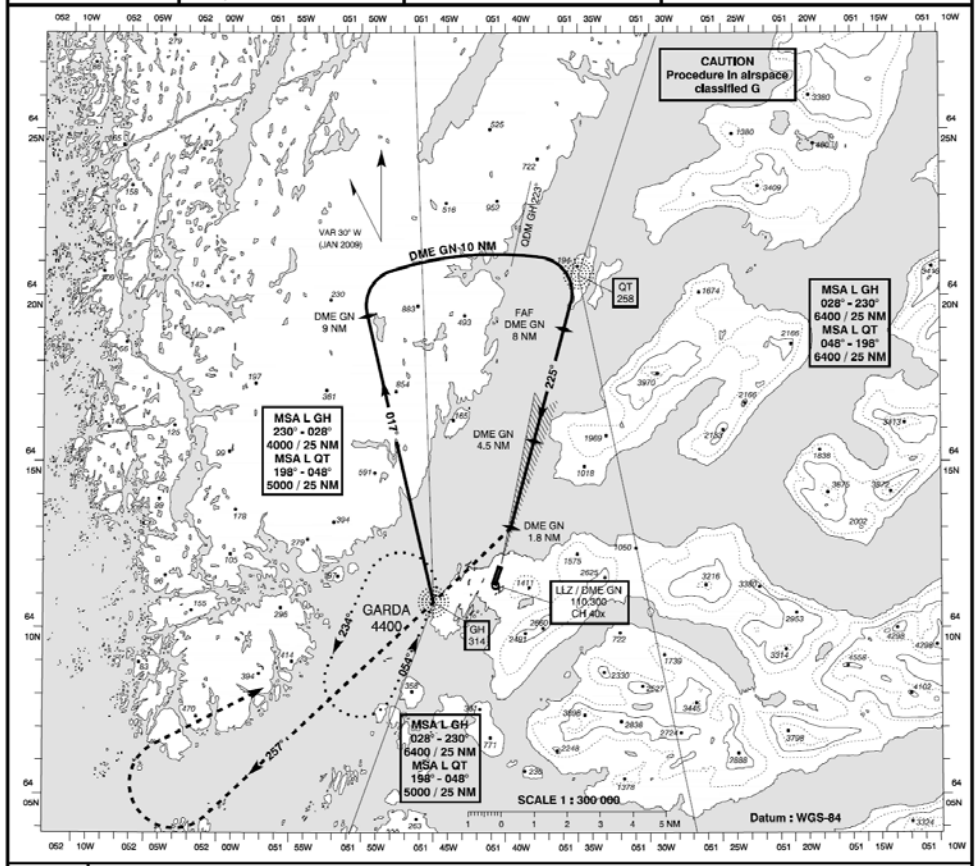
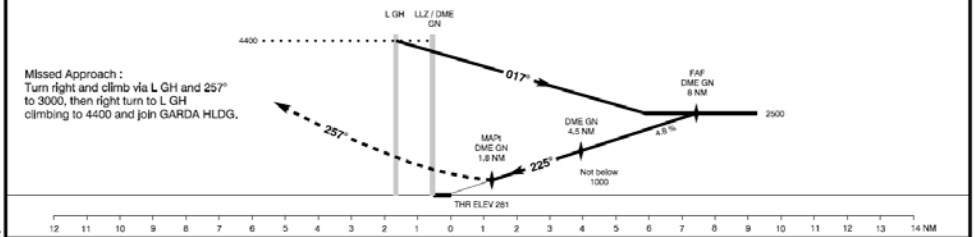
5.10.4 AIP Greenland Nuuk (BGGH)



INSTRUMENT APPROACH CHART - ICAO	AD ELEV : 283 Bearings are magnetic ELEV, ALT and HGT in FT	Nuuk AFIS : 119.100	AD 2 - BGGH LLZ / DME 23-1 Nuuk



TA 7000



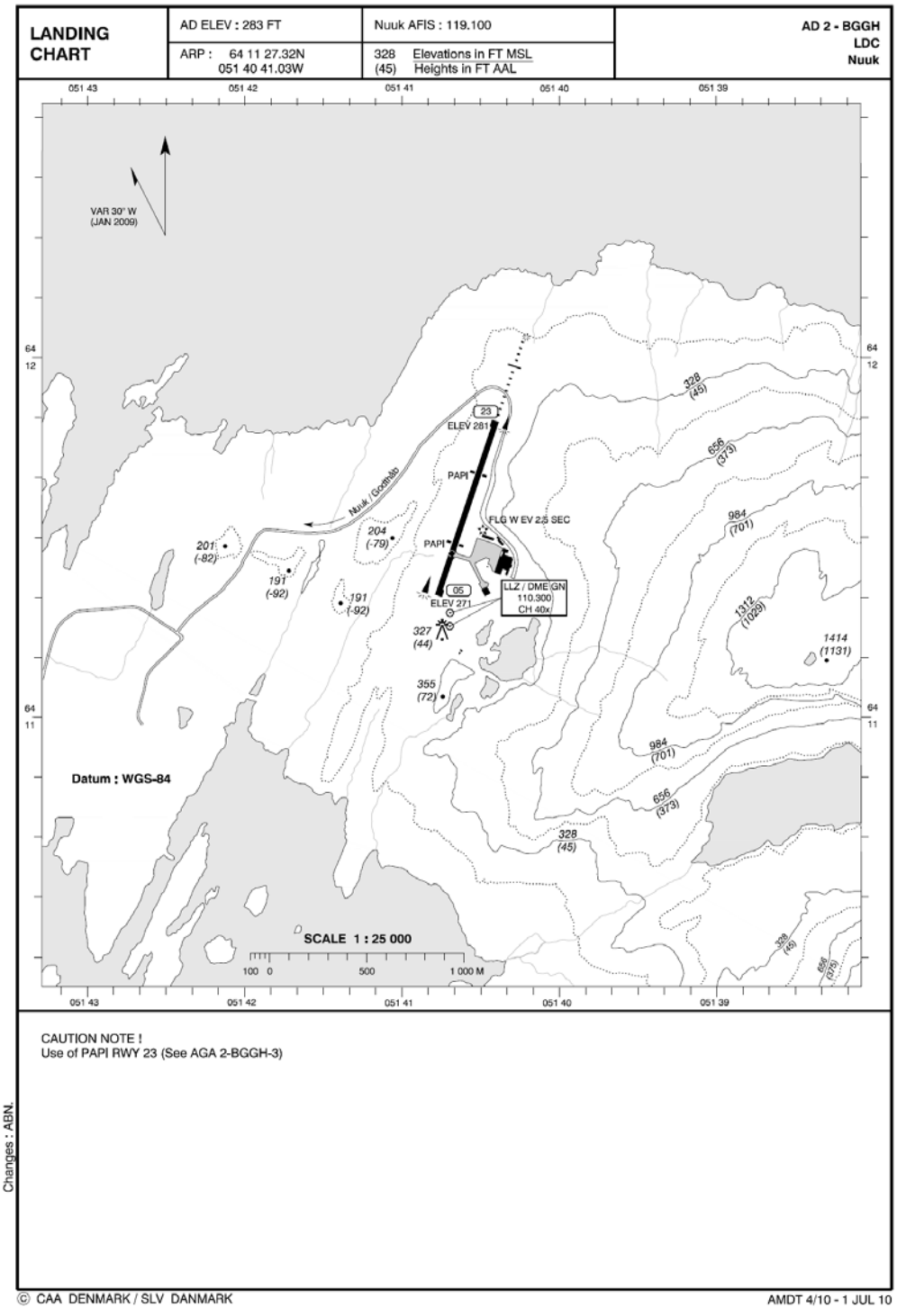
Missed Approach :
Turn right and climb via L GH and 257° to 3000, then right turn to L GH climbing to 4400 and join GARDA HLDG.

Changes : VAR

OCA (H)		A		B	SPECIAL CONDITIONS					
LLZ / DME *		630 (350)		630 (350)	* LLZ offset 3.5°					
Circling **		730 (450)		730 (450)	** W of RWY only					
DME GN	NM	2	3	4	5	6	7	8		
DIST to THR	NM	1.4	2.4	3.4	4.4	5.4	6.4	7.4		
ALT	FT	745	1035	1330	1620	1915	2205	2500		
GS	KT	50	60	70	80	90	100	110	120	130
Time FAF to MAPt		7 : 26	6 : 12	5 : 19	4 : 39	4 : 08	3 : 43	3 : 23	3 : 06	2 : 52
Rate of desc.	FT / MIN	240	288	336	384	432	480	528	576	624

Timing not authorized for defining the MAPt

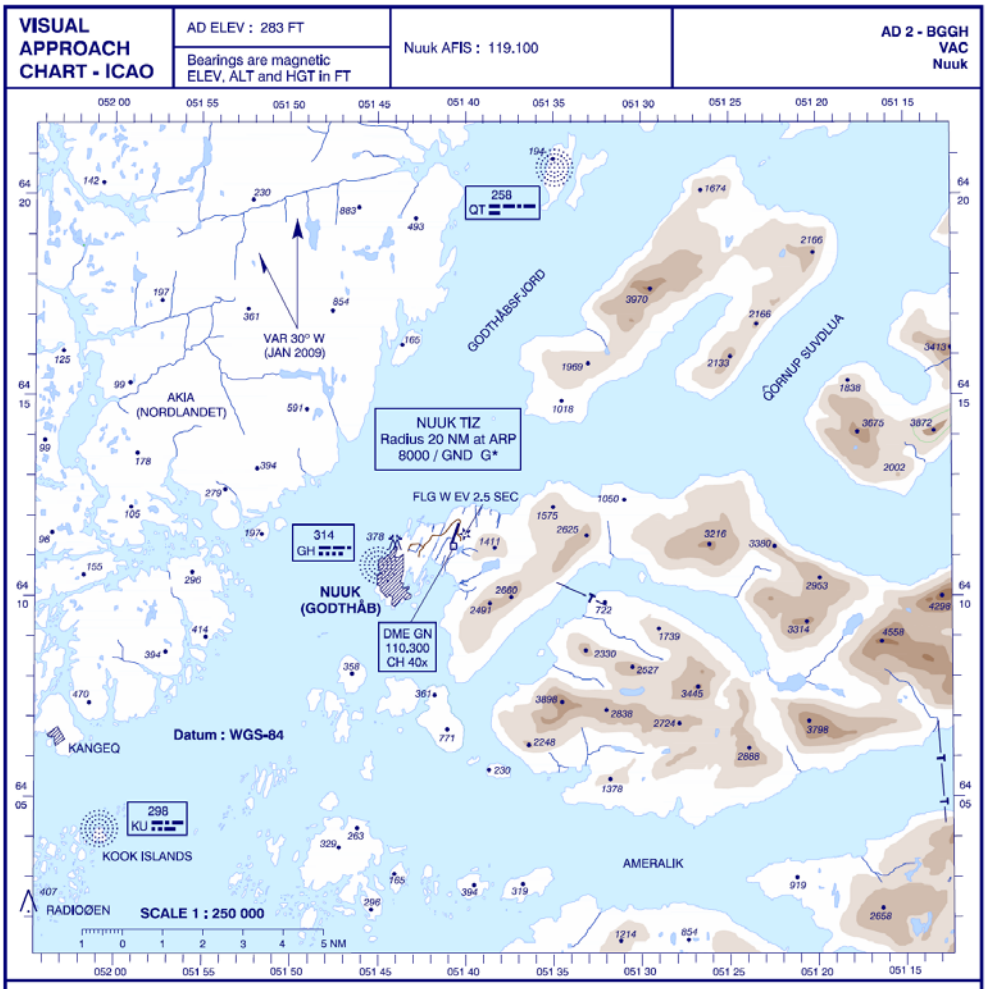
AIRAC AMDT 1/09 - 9 APR 09



CAUTION NOTE !
Use of PAPI RWY 23 (See AGA 2-BGGH-3)

Changes : ABN.

AMDT 4/10 - 1 JUL 10



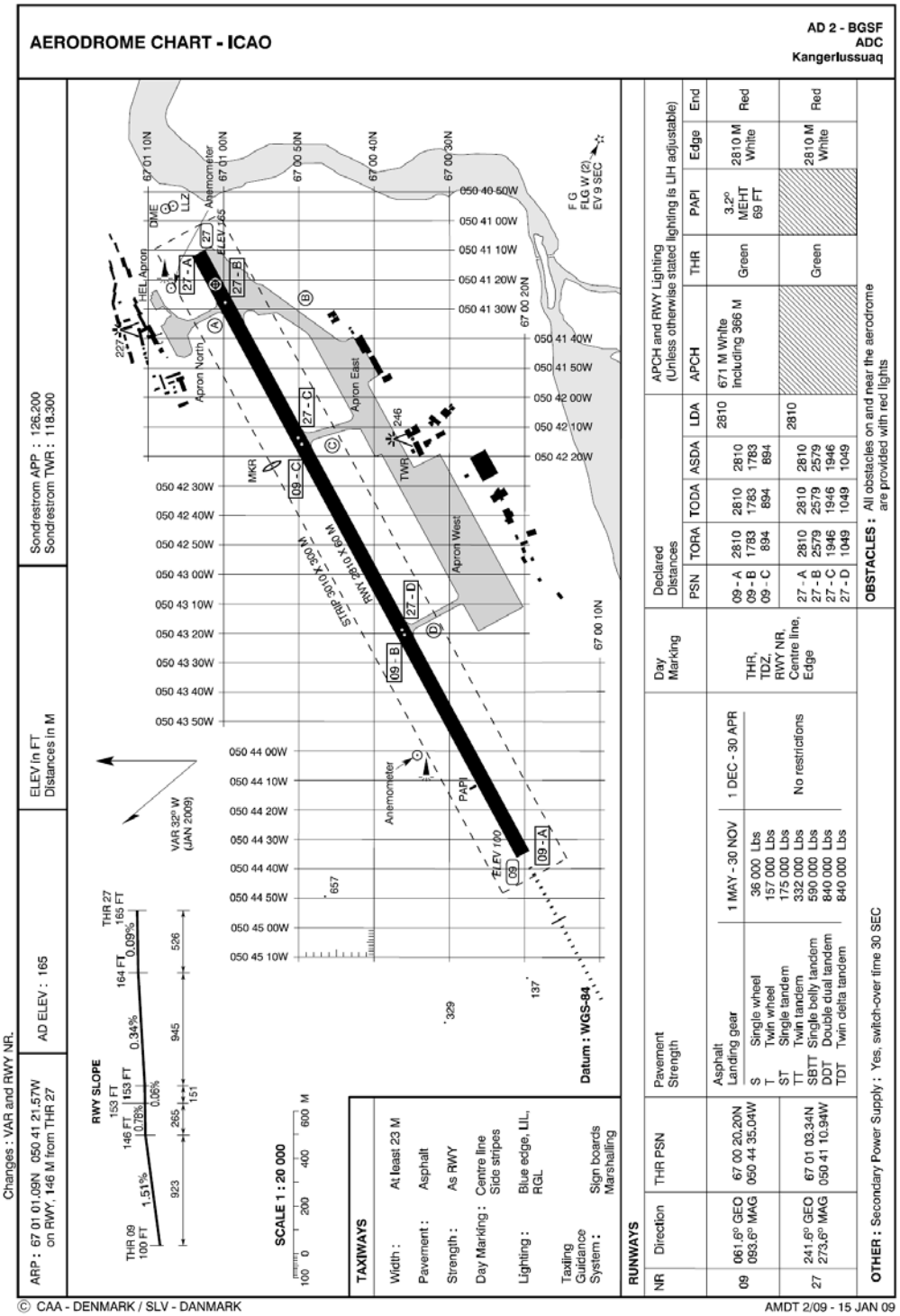
Spot elevation accuracy is within + / - 82 FT.

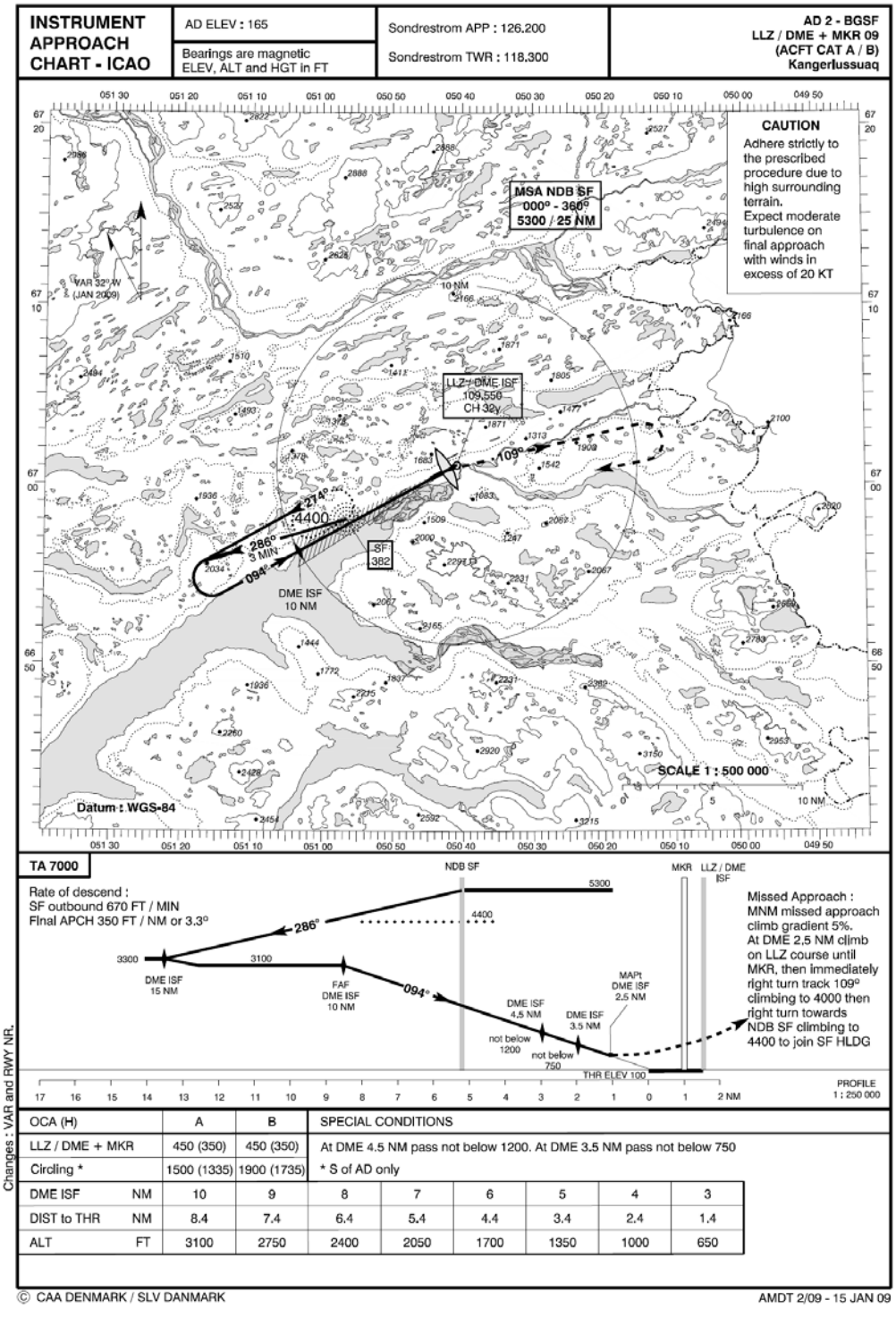
Elevation tints indicate 985 FT (300 M) intervals.

CAUTION NOTE !
Extreme caution should be exercised when flying in fjords, valleys or near islands along the coast due to transmission lines.
See also ENR 5.4.

Changes : ABN.

5.10.5 AIP Greenland Kangerlussuaq (BGSF)





OCA (H)		A	B	SPECIAL CONDITIONS					
LLZ / DME + MKR		450 (350)	450 (350)	At DME 4.5 NM pass not below 1200. At DME 3.5 NM pass not below 750					
Circling *		1500 (1335)	1900 (1735)	* S of AD only					
DME ISF	NM	10	9	8	7	6	5	4	3
DIST to THR	NM	8.4	7.4	6.4	5.4	4.4	3.4	2.4	1.4
ALT	FT	3100	2750	2400	2050	1700	1350	1000	650

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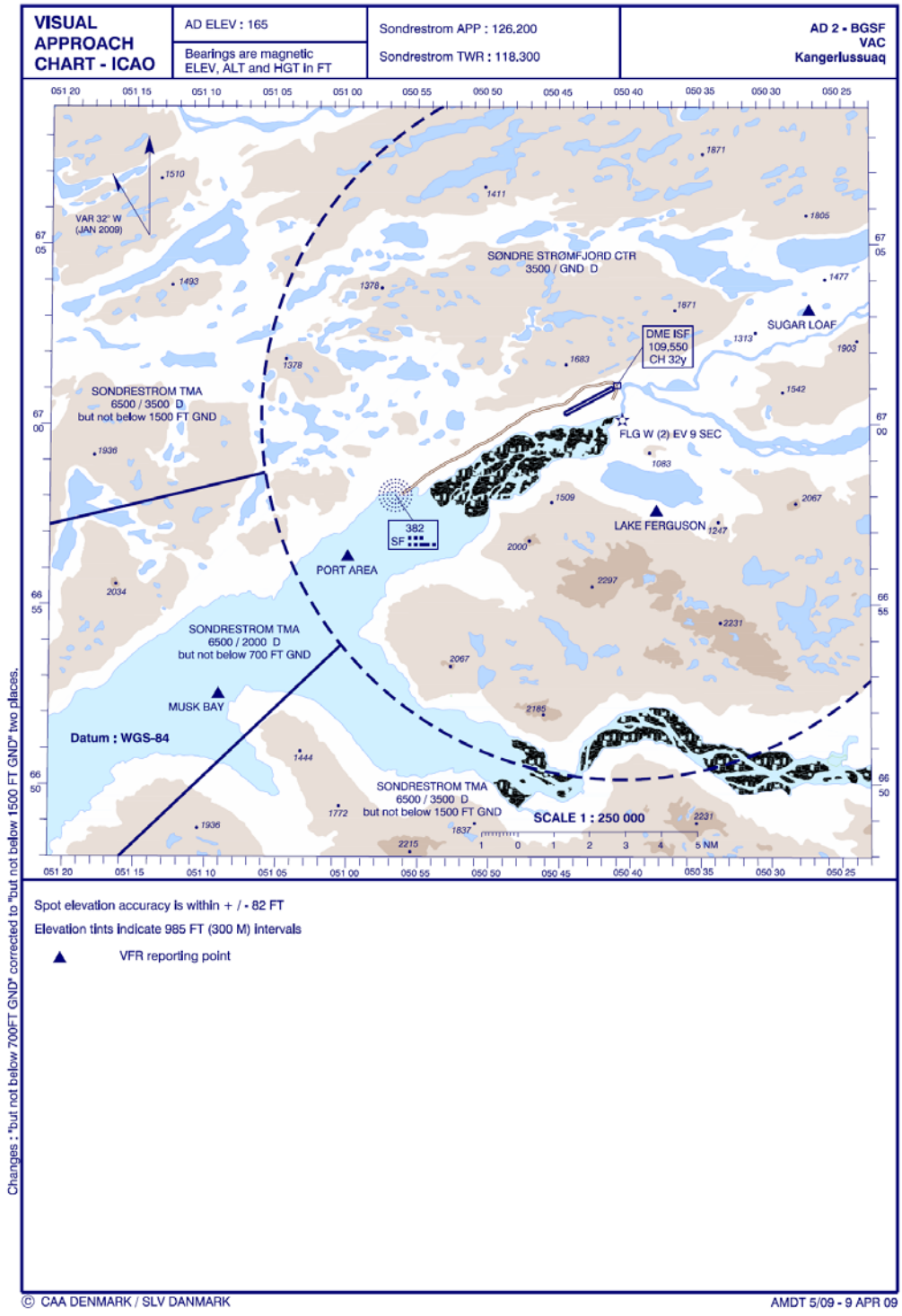
VISUAL APPROACH CHART - ICAO
AD ELEV : 165
Bearings are magnetic
ELEV, ALT and HGT in FT
Sondrestrom APP : 126.200
Sondrestrom TWR : 118.300
AD 2 - BGSF
VAC
Kangerlussuaq
VAR 32° W (JAN 2009)
SØNDRE STRØMFJORD CTR
3500 / GND D
SONDRESTROM TMA
6500 / 3500 D
but not below 1500 FT GND
SONDRESTROM TMA
6500 / 2000 D
but not below 700 FT GND
SONDRESTROM TMA
6500 / 3500 D
but not below 1500 FT GND
DME ISF
109.550
CH 32y
SUGAR LOAF
FLG W (2) EV 9 SEC
LAKE FERGUSON
PORT AREA
MUSK BAY
382
SF
Datum : WGS-84
SCALE 1 : 250 000
5 NM
Spot elevation accuracy is within + / - 82 FT
Elevation tints indicate 985 FT (300 M) intervals
VFR reporting point
Changes : *but not below 700FT GND* corrected to *but not below 1500 FT GND* two places.
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AMDT 5/09 - 9 APR 09

5.12 Wreckage and impact information

5.12.1 The accident site

5.12.2 The wreckage

The tail section, the wing/engine section and the cockpit/cabin section

The right engine and the right propeller

The left engine and the left propeller

There were numerous of pieces from the aircraft. After being recovered the pieces were placed in the snow

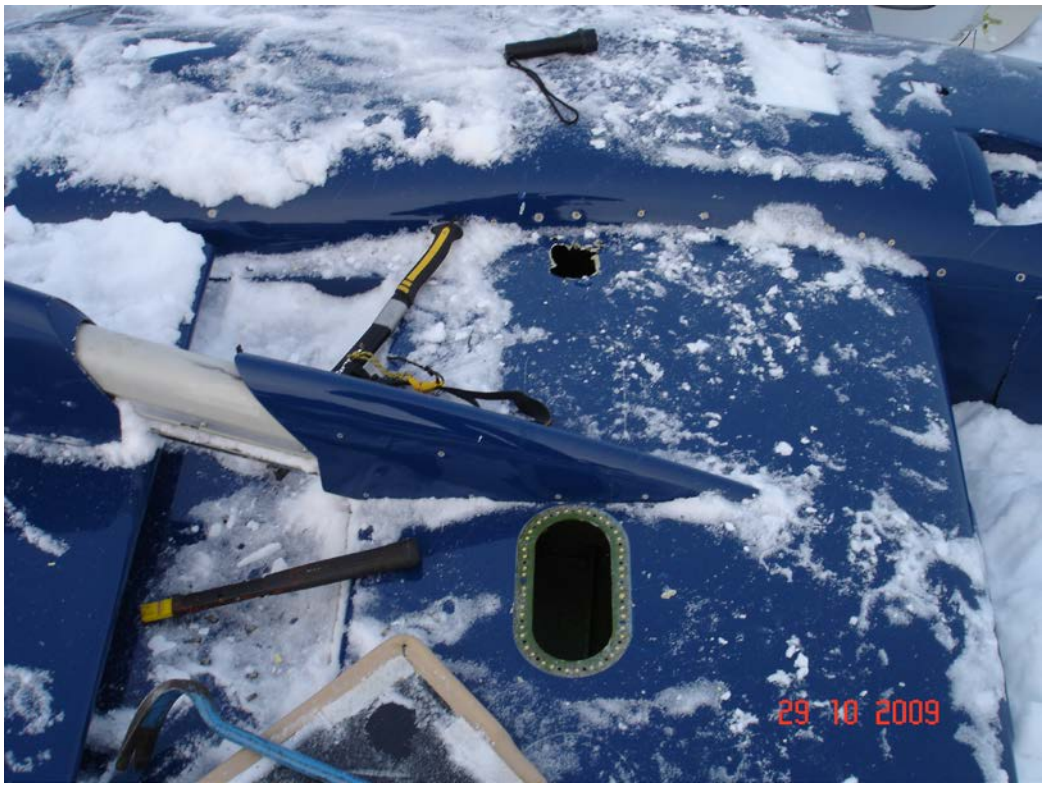
The cockpit/cabin section impacted a one meter high ice formation and turned over the nose

The cabin door could be operated but the access to the cabin was difficult

The wing/engine section was found upside down and pointing in the opposite direction of the track

The tail section was found upside down

The wing fuel tanks were opened and no fuel were found



The Landing Gear was found retracted

The wing flaps were found in the mid position

The cockpit was almost intact

Broken carbon structure

5.17 Organizational and management information.

5.17.1 Fuel requirements.

USA fuel requirements

FAR Part 91 § 91.167, § 91.169 § 91.153 are referred to in this report (see below).

§ 91.167 Fuel requirements for flight in IFR conditions.

(a) No person may operate a civil aircraft in IFR conditions unless it carries enough fuel (considering weather reports and forecasts and weather conditions) to—

(1) Complete the flight to the first airport of intended landing;

(2) Except as provided in paragraph (b) of this section, fly from that airport to the alternate airport; and

(3) Fly after that for 45 minutes at normal cruising speed or, for helicopters, fly after that for 30 minutes at normal cruising speed.

(b) Paragraph (a)(2) of this section does not apply if:

(1) Part 97 of this chapter prescribes a standard instrument approach procedure to, or a special instrument approach procedure has been issued by the Administrator to the operator for, the first airport of intended landing; and

(2) Appropriate weather reports or weather forecasts, or a combination of them, indicate the following:

(i) For aircraft other than helicopters. For at least 1 hour before and for 1 hour after the estimated time of arrival, the ceiling will be at least 2,000 feet above the airport elevation and the visibility will be at least 3 statute miles.

(ii) For helicopters. At the estimated time of arrival and for 1 hour after the estimated time of arrival, the ceiling will be at least 1,000 feet above the airport elevation, or at least 400 feet above the lowest applicable approach minima, whichever is higher, and the visibility will be at least 2 statute miles.

[Doc. No. 98-4390, 65 FR 3546, Jan. 21, 2000]

§ 91.169 IFR flight plan: Information required.

(a) Information required. Unless otherwise authorized by ATC, each person filing an IFR flight plan must include in it the following information:

(1) Information required under §91.153 (a) of this part;

(2) Except as provided in paragraph (b) of this section, an alternate airport.

(b) Paragraph (a)(2) of this section does not apply if :

(1) Part 97 of this chapter prescribes a standard instrument approach procedure to, or a special instrument approach procedure has been issued by the Administrator to the operator for, the first airport of intended landing; and

(2) Appropriate weather reports or weather forecasts, or a combination of them, indicate the following:

(i) For aircraft other than helicopters. For at least 1 hour before and for 1 hour after the estimated time of arrival, the ceiling will be at least 2,000 feet above the airport elevation and the visibility will be at least 3 statute miles.

(ii) For helicopters. At the estimated time of arrival and for 1 hour after the estimated time of arrival, the ceiling will be at least 1,000 feet above the airport elevation, or at least 400 feet above the lowest applicable approach minima, whichever is higher, and the visibility will be at least 2 statute miles.

(c) IFR alternate airport weather minima. Unless otherwise authorized by the Administrator, no person may include an alternate airport in an IFR flight plan unless appropriate weather reports or weather forecasts, or a combination of them, indicate that, at the estimated time of arrival at the alternate airport, the ceiling and visibility at that airport will be at or above the following weather minima:

(1) If an instrument approach procedure has been published in part 97 of this chapter, or a special instrument approach procedure has been issued by the Administrator to the operator, for that airport, the following minima:

(i) For aircraft other than helicopters: The alternate airport minima specified in that procedure, or if none are specified the following standard approach minima:

(A) For a precision approach procedure. Ceiling 600 feet and visibility 2 statute miles.

(B) For a nonprecision approach procedure. Ceiling 800 feet and visibility 2 statute miles.

(ii) For helicopters: Ceiling 200 feet above the minimum for the approach to be flown, and visibility at least 1 statute mile but never less than the minimum visibility for the approach to be flown, and

(2) If no instrument approach procedure has been published in part 97 of this chapter and no special instrument approach procedure has been issued by the Administrator to the operator, for the alternate airport, the ceiling and visibility minima are those allowing descent from the MEA, approach, and landing under basic VFR.

(d) Cancellation. When a flight plan has been activated, the pilot in command, upon canceling or completing the flight under the flight plan, shall notify an FAA Flight Service Station or ATC facility.

[Doc. No. 18334, 54 FR 34294, Aug. 18, 1989, as amended by Amdt. 91–259, 65 FR 3546, Jan. 21, 2000]

§ 91.153 VFR flight plan: Information required.

(a) Information required. Unless otherwise authorized by ATC, each person filing a VFR flight plan shall include in it the following information:

(1) The aircraft identification number and, if necessary, its radio call sign.

(2) The type of the aircraft or, in the case of a formation flight, the type of each aircraft and the number of aircraft in the formation.

(3) The full name and address of the pilot in command or, in the case of a formation flight, the formation commander.

(4) The point and proposed time of departure.

(5) The proposed route, cruising altitude (or flight level), and true airspeed at that altitude.

(6) The point of first intended landing and the estimated elapsed time until over that point.

(7) The amount of fuel on board (in hours).

(8) The number of persons in the aircraft, except where that information is otherwise readily available to the FAA.

(9) Any other information the pilot in command or ATC believes is necessary for ATC purposes.

(b) Cancellation. When a flight plan has been activated, the pilot in command, upon canceling or completing the flight under the flight plan, shall notify an FAA Flight Service Station or ATC facility.