Havarikommissionen
Accident Investigation Board Denmark

BULLETIN

Accident

24-6-2019

involving

Airbus Helicopters AS 350 B3

OY-HGT

FOREWORD

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

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

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

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

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BULLETIN

General

File number:	2019-283
UTC date:	24-6-2019
UTC time:	16:31
Occurrence class:	Accident
Location:	Near Telesite Dye One on the mountain of Qaqatoqaq in Greenland
Injury level:	None

Aircraft

Aircraft registration:	OY-HGT
Aircraft make/model:	Airbus Helicopters AS 350 B3
Current flight rules:	Visual Flight Rules (VFR)
Operation type:	Specialized operations
Flight phase:	Approach
Aircraft category:	Helicopter
Last departure point:	A barge in a fjord approximately 3.5 nautical miles to the Southeast of the accident site
Planned destination:	Telesite Dye One
Aircraft damage:	Substantial
Engine make/model:	1 x Safran Helicopter Engines Arriel 2B1

SYNOPSIS

Notification

All times in this report are UTC.

The operator notified the Aviation Unit of the Danish Accident Investigation Board (AIB) of the accident on 24-62019 at 16:54 hours (hrs).

The AIB notified the Danish Transport, Housing and Construction Agency (DTHCA), the French Accident Investigation Board (BEA), the European Aviation Safety Agency (EASA), the Directorate-General for Mobility and Transport (DG MOVE) on 25-6-2019 at 09:44 hrs.

The AIB notified the International Civil Aviation Organization (ICAO) on 9-10-2019 at 12:02 hrs.

The BEA appointed a non-travelling accredited representative to the AIB safety investigation.

Summary

During a sling operation of a fuel tank to a telesite station on a mountaintop, the helicopter, while positioning for the agreed-upon delivery point, entered orographic clouds causing loss of pilot external visual references.

While attempting to recover, loss of external visual cues led to spatial disorientation and a partial loss of control of the helicopter.

Downhill on a southerly track, the fuel tank, at the end of the 30-meter long line, started colliding with rocky terrain.

After a cargo hook release of the fuel tank, and on a position approximately 100 meters (m) downhill, the helicopter skids impacted with rocky terrain, and the long line entangled with rocks.

The helicopter ended up on its right hand side with the nose section facing towards the telesite.

The accident occurred in daylight and under instrument meteorological conditions (IMC).

FACTUAL INFORMATION

History of the flight

The accident occurred during a sling operation of a fuel tank from a barge in a fjord to a telesite station on top of the mountain of Qaqatoqaq.

The accident flight was flight number 29 (next to last on this location) out of 30 sling operations on different locations.

The barge was attached to and towed by a vessel.

Before and during the flight to the mountaintop, the pilot discussed, with a Task Specialist (TS) on board the vessel, the possibility of launching another sling operation at another location before sunset. This potential launch depended on the time of completion at Telesite Dye One.

For this specific task of slinging a fuel tank to the mountaintop, the pilot decided to make use of a 30-meter long line. The alternative was use of a 15-meter long line.

After lift-off from the ground next to the fjord, the pilot at low altitude continued to the barge to pick up the fuel tank.

This picture (taken by the operator) presents the vessel on location on the day of the accident.

After pickup of the fuel tank, the pilot started a climb towards the mountaintop.

During climb, at approximately 400-600 feet above the ground, along the mountain ridge and passing approximately 2200 feet Mean Sea Level (MSL), the pilot called a TS at the telesite station in order to obtain an opinion on the visibility and presence of clouds at the mountaintop.

The TS reported that *actually only the telesite station itself was open, but the rest was foggy*. The pilot replied that he would *try to find his way up to the mountaintop*.

After several turns during climb and at various airspeeds, the pilot at approximately 4900 feet MSL on a westerly track, approached the agreed-upon delivery point, which was a footbridge along the station buildings.

This picture (taken by the operator) presents a previous delivery on the day of the accident.

The pilot, with his head down while keeping fully external focus on the agreed-upon delivery point, started positioning the helicopter.

While positioning the helicopter, at approximately 150 feet above the ground, the pilot, due to clouds/fog, lost external visual references and started feeling spatial disorientated.

The pilot feared that the fuel tank might hit ground personnel, buildings, and/or high antenna masts, and abruptly started flying rearward.

In the rearward manoeuvre on an easterly track, the pilot, via the electrically operated release control on the cyclic stick, intended to release, however unsuccessfully, the fuel tank. In combination with various oscillating flight parameters, and an unstable external load, the pilot experienced partial loss of control of the helicopter

After further rearward and now descending downhill flying away from Telesite Dye One with oscillating flight parameters, the fuel tank started colliding with rocky terrain.

Approximately 30 m downhill, the pilot, via the electrically operated release control on the cyclic stick, successfully released the fuel tank at the cargo hook.

In a helicopter nose down attitude on a southerly track, at a high sink rate, and at a low height above the ground, the pilot regained partial visual references and noted that impact was inevitable.

On a position approximately 100 meters downhill, the helicopter skids impacted with rocky terrain, and the long line entangled with rocks, became tight and slowed down the forward energy.

The helicopter ended up on its right hand side with the nose section facing towards Telesite Dye One.

The pilot felt unharmed and evacuated the helicopter through the left hand door.

Witnesses observing the sequence of events initiated a rescue mission.

Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal			
Serious			
None	1		

Damage to helicopter

The accident led to substantial damages to the:

- undercarriage
- bottom of the fuselage
- cabin structure
- main rotor
- rotor blades
- horizontal stabilizer.

Personnel information

License and medical certificate

The pilot - male, 36 years - was the holder of a valid Commercial Pilot License (H) issued by the Norwegian Civil Aviation Authority on 9-7-2013.

The rating AS 350 / EC 130 was valid until 31-3-2020.

The medical certificate (class 1) was valid until 22-5-2020. The medical certificate held no limitations.

Flying experience

	Last 24 hours	Last 90 days	Total
All types	7:33	24:36	3037:42
This type	7:33	24:36	-
Landings this type	-	-	532:00

Employment and previous flying experience

The operator hired the pilot on a short term contract.

The pilot had extensive firefighting and mountain flying experience including flying experience with 30-meter long lines.

Operator Proficiency Check (OPC)

On 21-2-2019, the pilot performed his latest Operator Proficiency Check (OPC).

One of the required OPC tasks was a whiteout landing.

Area and task familiarization

On 17-2-2019, the pilot passed a written route area and role test.

On 16-3-2019, the pilot passed the operator Helicopter External Sling Load Operations (HESLO) check.

On 18-3-2019 and 19-3-2019, the pilot completed line flying under supervision.

Flight and duty time

Date	Duty	Duty Begin	Duty End	Rest	Block Time	Duty Time	FDP Time
17/06/2019	PMI-D83667-CPH.....	9:40	13:40	19:40		4:00	
18/06/2019	CPH-785-UAK-422-GOH.....	9:20	19:34	22:41		10:14	
19/06/2019	GOH-1E-SERM-2E-GOH.....	18:15	20:20	21:55	0:24	2:05	1:39
20/06/2019	GOH-1E-SERM-2E-GOH.....	18:15	20:20	12:55	0:24	2:05	1:45
21/06/2019	GOH-1E-POS1-2E-DYET-3E-POS1-4E-POS1-5E-DYET-6E-POS1-7E-SFJ	9:15	20:45	12:30	5:23	11:30	11:15
22/06/2019	JAV-515-SFJ-515-GOH.....	9:15	20:14	37:01		10:59	
23/06/2019	NIL.....	0:00	0:00				
24/06/2019	GOH-1J-POS1-2J-DYET-3J-DYET-4J-POS1-5J-POS1-6J-POS1..... -7J-DYET.....	9:15	16:48		4:28	7:33	7:18
	Totals in 7 duty period(s)			126:42	10:39	48:26	21:57
	Grand Totals in 7 duty period(s)			126:42	10:39	48:26	21:57

The AIB removed the name of the pilot.

Helicopter information

General information

Manufacturer:	Airbus Helicopters.
Type:	AS 350 B3.
Serial number:	4279.
Airworthiness Review Certificate:	Valid until 12-6-2020.
Engine manufacturer:	Safran Helicopter Engines.
Engine type:	Arriel 2B1.
Maximum take-off mass (MTOM):	2800 kilos (kg) with external load.
Hover Out of Ground Effect (HOGE):	2703 kg (elevation 4757 feet / temperature +3° Celsius.
Fuel on board at first sling operation:	300 litres.
Helicopter total flight hours:	5565:41.
Next maintenance inspection:	5710:00 helicopter total flight hours.
Technical status of the helicopter:	There were no log remarks, and the pilot experienced no technical deficiencies during the sequence of events.

Mass and balance

Before the sling operation, the commander made a mass and balance calculation using an electronic mass and balance program developed by the operator.

See appendix 1.

Using factual mass and balance data and the operator electronic mass and balance program, the AIB made a mass and balance calculation.

See appendix 2.

HOGE flight performance

See appendix 3.

Aircraft Flight Manual (AFM) SUP. 13.2 (extract)

CARGO SWING 1400 kg (3086 lb) with "ON-BOARD" release unit (P/N 528-023-51).

1 GENERAL

For detailed description of the load indicator and the "ON-BOARD" release unit, refer to their vendor manuals.

The "CARGO SWING" external load installation (Figure 1) is composed of:

- *A suspended pyramid frame (3) held by two elastic straps (2) equipped with a bumper ring (P/N: 232-155-00) (4) and an "ON-BOARD" release unit (P/N 528-023-51) (5) allowing:*
  - *electrical cargo hook opening,*
  - *mechanical cargo hook opening.*
- *A load indicator (1), on the RH door pillar.*

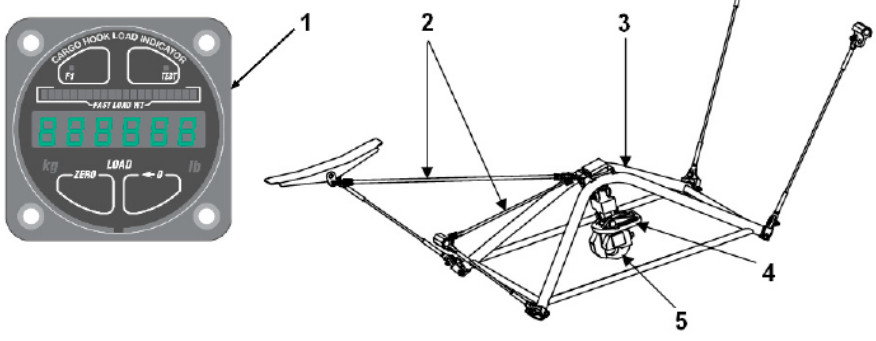


Figure 1: Cargo swing component

- *A control system for the pilot (Figure 2), including:*

  - *a [SLING] pushbutton (4) located on the console (1), for powering-on the installation,*
  - *a release control (3) on the cyclic stick (electrical mode),*
  - *a release handle (2) located under the collective lever (mechanical mode).*

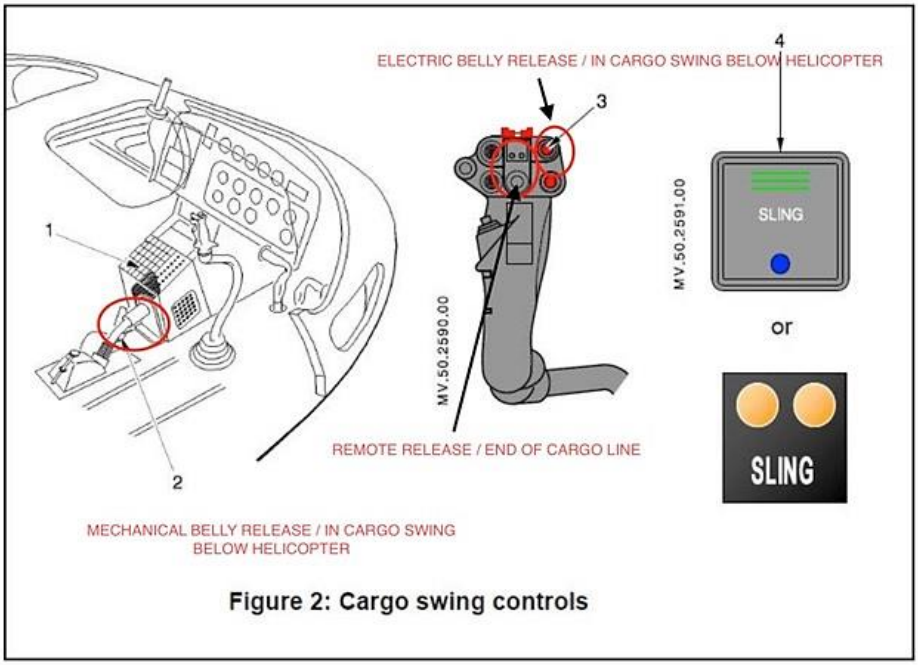


Figure 2: Cargo swing controls

AIB note to figure 2.
The AIB has inserted 3 explanatory texts in red, 3 marking circles in red, and 2 pointing arrows in black.

3 EMERGENCY PROCEDURES

The emergency procedures specified in the basic flight manual and in the flight manual supplements remain applicable and are supplemented or modified by the following:

3.1 ENGINE FAILURE WITH EXTERNAL LOAD

- IN CRUISE FLIGHT

1. Autorotation procedure	APPLY.
2. External load	RELEASE as soon as possible.

- IN HOVER

1. Collective pitch.	REDUCE according to the height.
2. External load	RELEASE as soon as possible.
3. Pedals	CONTROL yaw.
4. Cyclic	FORWARD to gain forward speed according to the height.
5. Collective pitch	INCREASE as needed to cushion touch-down.

NOTE

In case of a failure during the hooking phase, the pilot shall move the aircraft away to the right. Ground personnel are to be forewarned that in the event of an engine failure they have to move away to the left of the helicopter.

3.2 ELECTRICAL LOAD JETTISONING FAILURE

Collective pitch mechanical release ..... ACTUATE.

Meteorological information

Route forecasts

The Danish Meteorological Institute (DMI) did not issue a route forecast valid for the accident flight.

As supplementary information, two (other) route forecasts are presented in the next page.

Please note that these two route forecasts were not valid for the accident flight.

24. of June 2019 11:00 UTC

C

VALID:	1200-1615 UTC JUNE 24TH 2019
ACFT:	HGV
ROUTING:	BGGH-DYET-BGGH
SYNOPSIS:	SEE NORTHAVIMET.COM
WEATHER:	AT COAST LCA PATCHES OF FOG, AND BTN BGGH AND BGMQ LGT LCA MOD RAIN/DRIZZLE, ELSE NSW
SURFACE VIS:	IN RA/DZ 5-8KM, IF BCFG 1200-4000M, ELSE MORE THAN 10KM.
CLOUDS *:	BKN/OVC SC/AC/AS BASE 3500-9000FT GENERALLY LOWEST S-PART, BLW LCA FEW/SCT ST BASE 0200-1000FT.
FREEZING LEVEL *:	ABT 5000FT
ICING *:	LGT/MOD INC ABV FZL.
TURBULENCE *:	NIL
SURFACE WIND:	VRB 03-08KT
UPPERWIND/T 5000 ft.:	S-LY 05-10KT TEMP: PS01
SUPPL. INFORM.:	

* **if not otherwise indicated, height is in feet above MSL and winds in true.**

Terminal Aerodrome Forecast (TAF)

a. Kangerlussuaq (BGSF)

TAF bgsf 241058z 2412/2518 vrb08kt 9999 few060 bkn100 tempo 2412/2512 bkn060 tempo 2512/2518 -ra bkn035=

TAF bgsf 241708z 2418/2524 vrb08kt 9999 few060 bkn120 tempo 2418/2509 bkn060 tempo 2509/2524 -ra bkn025=

b. Sisimiut (BGSS)

TAF bgss 241205z 2412/2417 vrb05kt 9999 few002 sct060 tempo 2412/2414 2000 bcfg bkn002 tempo 2414/2417 30012kt bkn060=

TAF AMD bgss 241712z 2417/2420 30014kt 9999 few005 sct060 bkn210 tempo 2417/2420 vrb05kt bkn060=

Pilot weather observations at the accident site

Wind conditions: 210° / 5 knots - no turbulence.

Visibility limitations: Fog and clouds.

Aviation Routine Weather Report (METAR)

a. Kangerlussuaq (BGSF)

METAR bgsf 241550z auto vrb03kt 9999ndv few070/// sct230/// 14/07 q1010=
METAR bgsf 241620z auto 17004kt 130v210 9999ndv bkn070/// 15/07 q1011=
METAR bgsf 241650z auto 08007kt 050v120 9999ndv bkn070/// 15/06 q1011=
METAR bgsf 241720z auto 07007kt 040v100 9999ndv bkn070/// 15/06 q1011=

b. Sisimiut (BGSS)

METAR bgss 241550z 30014kt 9999 few006 bkn060 13/05 q1010 rmk 1sc 6sc rwy 13 mod turb=
METAR bgss 241650z 30014kt 9999 few006 sct060 bkn210 14/05 q1011 rmk 1sc 4sc 5ci rwy 13 mod turb=
METAR bgss 241750z 30015kt 9999 few006 bkn060 15/06 q1011 rmk 1sc 6sc rwy 13 mod turb=

Aftercast valid for Telesite Dye One

General:	Observations in the area were few and far apart, and the terrain was complex. The four nearest observations were BGSS, BGSF, Maniitsoq (BGMQ), and Aasiaat (BGAA). In addition, satellite images often provided useful information, but in this case not so much. For that reason, it was not possible to make an aftercast with exact and detailed information about cloud base and visibility for this specific mountain.
Visibilty:	Below the clouds presumably good visibility, i.e. more than 10 kilometers (km). But if/when a cloud with a base lower than the mountain height passes over the mountain, then the resulting visibility on the mountain would be like in fog, i.e. could easily be reduced to less than 1000 m, and maybe even as low as approximately 50 m.
Clouds:	Presumably broken (BKN) (could be scattered (SCT) or overcast (OVC) stratocumulus (SC)/altocumulus (AC)/altostratus (AS)), base most likely between 4500 feet (ft) and 7000 ft above MSL, but periodically bases down to approximately 2500 ft above MSL may have been

	present. Since the terrain height at Dye One is stated to be 4800 ft, consequently it is possible/likely that the clouds may have obscured the telesite, at least periodically.
Surface wind:	Wind direction not possible to say due to complex terrain. Probably variable 2-10 knots.
Turbulence and wind shear:	Nil/light turbulence. No wind shear.

Communication

A vessel towed the barge, and the pilot was in radio contact with an on-board TS and a TS at Telesite Dye One.

Information on Telesite Dye One

General information

Telesite Dye One (4757 feet MSL) was located on top of the mountain of Qaqatoqaq Southeast of BGSS on the Greenlandic West coast.

The helipad is marked with a red circle.

A footbridge along the station buildings is marked with a yellow square.

Flight recorders

Image recorder

The helicopter was equipped with an on-board image recorder.

The BEA assisted the AIB in downloading data from the on-board image recorder. The downloaded data was of good quality and useful to the AIB safety investigation.

Flight routing

From the on-board image recorder, the BEA downloaded the flown route from full stop on ground until the time of the accident.

See appendix 4.

Wreckage and impact information

During the recovery manoeuvre and downhill, the fuel tank at the end of the 30-meter long line started colliding with rocky terrain.

Approximately 30 m downhill from Telesite Dye One, the pilot successfully released the fuel tank at the cargo hook installed at the end of the 30-meter long line.

On a position approximately 100 m downhill, the helicopter skids impacted with rocky terrain, and the long line entangled with rocks, became tight and slowed down the forward energy.

The helicopter ended up on its right hand side with the nose section facing towards Telesite Dye One

At approximately 19:35 hours, the local Police took the below picture (taken from Telesite Dye One toward the accident site).

The fuel tank is marked with a yellow circle.

The helicopter is marked with a red circle.

On the accident site, helicopter technicians performed a test of the electrically operated main cargo hook release system.

Failure, caused during the impact sequence, to an electrical plug of the main cargo hook release system, made the test impossible.

A test of the mechanical main cargo hook release (belly release) was successful.

Presence of fire

There was no post-crash fire or fuel leaks.

Survival aspects

The pilot used lap and shoulder harness.

The impact of the helicopter skids with rocky terrain at a shallow angle, and the tightening of the long line slowed down the forward energy and reduced the final impact force.

The pilot felt unharmed and evacuated the helicopter through the left hand door.

Witnesses observing the sequence of events initiated a rescue mission.

G-forces activated the onboard Emergency Locator Transmitter (ELT).

The COSPAS-SARSAT (International Satellite System for Search and Rescue Services) received the ELT distress signal at 16:31 hours.

Organization and management information

Operations Manual Part B AS 350 (extract)

1.1.3 Standard operational flight height (AGL)

High risk SPO	For certain SPOs, including HESLO, heliskiing, power line inspection, photo flight, firefighting and others it may be necessary to operate **below 300 ft AGL** to complete the specific task, as specified in OM-E(H) SPO.

Planning and operational minima for day VFR is:

PLANNING WEATHER MINIMA:	OPERATIONAL WEATHER MINIMA:
Takeoff and enroute: 600 ft ceiling 1.5 km visibility	600 ft ceiling 800 meter visibility Surface in sight
Destination: 600 ft ceiling 3 km visibility	

The pilot shall have clear visual reference to landmarks within autorotation distance during all phases of flight.

Operations Manual Part E (H) (extract)

1. Commercial Air Transport
2. Specialized Operation (SPO)
3. High risk SPO

The operator categorized HESLO as a high risk SPO.

Additional information

Rules of the Air

The below text is an extract of the International Civil Aviation Organization (ICAO) Annex 2.

Flight visibility. The visibility forward from the cockpit of a helicopter in flight.

Danish regulations on Rules of the Air (BL 7-1) (extract)

Table 5-1 (VMC minima)

Altitude band	Airspace class	Flight visibility	Distance from cloud
At and above FL 100	A*BCDEFG	8 km	1500 m horizontally 300 m (1000 ft) vertically
Below FL 100 and above 900 m (3000 ft) MSL, or above 300 m (1000 ft) over terrain, whichever is the higher	A*BCDEFG	5 km	1500 m horizontally 300 m (1000 ft) vertically
At and below 900 m (3000 ft) MSL or 300 m (1000 ft) above terrain, whichever is the higher	A*BCDE	5 km	1500 m horizontally 300 m (1000 ft) vertically
	FG	5 km 3 km **/140 KT	Clear of cloud and with the surface in sighe

* The VMC minima in Class A airspace are included for guidance to pilots and do not imply acceptance of VFR flights in Class A airspace.

** Flights with aircraft established in the aerodrome traffic round may be permitted with a flight visibility of at least 1.5 km clear of cloud and in sight of the aerodrome.

Flights with manned free balloons at or below 450 m (1500 ft) MSL or 300 m (1000 ft) above terrain, whichever is the higher, may be permitted with a flight visibility of at least 1.5 km.

Helicopters may be permitted to operate with a flight visibility of at least 0.8 km on condition that the helicopter is operated at a speed that will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision.

ANALYSIS

General

The license and qualifications held by the pilot and his duty time had, in the AIB's opinion, no influence on the sequence of events.

To the AIB, the technical status of the helicopter had no influence on the sequence of events.

The differences between the mass and balance calculation made by the pilot and by the AIB respectively only were minor and had no influence on helicopter performance.

In general, when operating in specific remote and hostile areas, the access to proper and reliable weather information before flight might be difficult or even impossible, which might make the pre-flight planning phase and the later on operational phase unpredictable and not fact-based leading to subjective decision-making processes.

The above statement is an operational condition, when operating in such specific environments, which, in the general opinion of the AIB, requires operational creativity and innovation in order to optimize flight safety.

The standard operating procedures (Operations Manual Part B) on operational weather minima was in wording not fully comparable to the rules of the air (BL 7-1).

However, to the AIB, the limitation in the standard operating procedures of a cloud ceiling of 600 feet seems to be more restrictive than the wording *clear of cloud* of BL 7-1 for operations in airspace class G.

Taking into consideration that the accident flight was a high risk SPO, the AIB, from a flight safety point of view, finds the limitation on cloud ceiling rational.

At the time of the accident, the pilot had performed several sling operations from the fjord to the mountaintop and presumably had a reliable knowledge of the general weather conditions at the mountaintop.

S-turns, instead of a straight route, at various airspeeds during climb in combination with the radio correspondence between the pilot and a TS at Telesite Dye One supports the premise that the weather conditions at the mountaintop were marginal for this sling operation.

The helicopter, while positioning at the mountaintop, most likely entered orographic clouds causing loss of pilot external visual references.

The AIB considers that the advantages (operation above the vessel) or disadvantages (actual positioning of the fuel tank at the agreed-upon delivery point) of choosing a 30-meter long line rather than a 15-meter long line for this specific task counterbalanced each other and did not directly contribute to the sequence of events.

The impact of the helicopter skids with rocky terrain at a shallow angle, and the tightening of the long line slowing down the forward energy and reducing the final impact force, made the accident survivable.

Recovery manoeuvre

The agreed-upon delivery point of the fuel tank was the footbridge along the station buildings and not the helipad.

The footbridge compared to the helipad required, in the opinion of the AIB, more pilot precision and head down external focus, which in combination with the actual weather conditions at the mountaintop probably reduced and/or eliminated pilot perception of changes to the available external visual cues.

Upon loosing external visual references, the pilot feared the consequences of an intermediate release of the fuel tank or a fuel tank collision with obstacles and abruptly started flying rearward. This rationale of the pilot potentially prevented a more severe outcome.

Loss of external visual cues leading to spatial disorientation resulted in an emergency requiring release of the external load.

The emergency procedure, though not specific for this type of emergency, stipulated release of the external load. However, the emergency procedure did not distinguish between a cargo hook and a main cargo hook release.

In an emergency, the AIB considers a main cargo hook release (release of the external load and the long line) to be more conducive to flight safety than just a cargo hook release.

Taking into consideration the previous flying experience of the pilot (firefighting) and the sling operations of the day, the pilot most likely acted on stored routines rather than by rationale when trying to and finally successfully released the fuel tank at the cargo hook.

During the impact sequence, the continued attachment of the long line to the helicopter caused entanglement with rocks.

Human performance

A potential launch of another sling operation at another location before sunset might have provoked a pilot self-induced commercial pressure and task fixation.

Task fixation might have expanded the pilot risk tolerances leading to changes of perception of risks, and decision-making processes during the sling operation.

CONCLUSIONS

The helicopter, while positioning for the agreed-upon delivery point, entered orographic clouds causing loss of pilot external visual references.

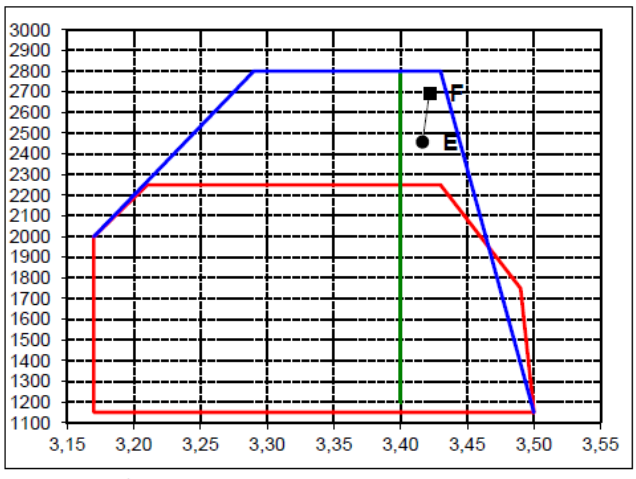
While attempting to recover, loss of external visual cues led to spatial disorientation and a partial loss of control of the helicopter.

APPENDIX 1

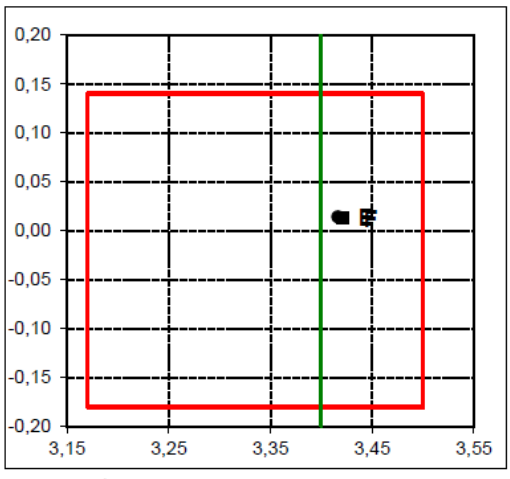
Return to mass and balance

The mass and balance calculation made by the commander.

	Mass [Kg]	Arm [m]	Moment [kgm]	Arm [m]	Moment [kgm]
BEM - Basic Empty Mass	**1.456**	**3,49**	**5.079**	**0,00**	**0**
Equipment - Added	67	4,41	296	0,07	5
Equipment - Removed	0	0,00	0	0,00	0
Pilot Front Seat	85	1,55	132	0,36	31
DOM - Dry Operating Mass	**1.608**	**3,43**	**5.507**	**0,02**	**36**
Passenger Front - Left Seat		1,55	0	-0,36	0
Passenger Aft - Right Seat		2,54	0	0,62	0
Passenger Aft - Right Centre Seat		2,54	0	0,21	0
Passenger Aft - Left Centre Seat		2,54	0	-0,21	0
Passenger Aft - Left Seat		2,54	0	-0,62	0
Baggage Front - Left Seat		1,55	0	0,00	0
Baggage Aft (Seats up)		2,25	0	0,00	0
Cargo Compartment - Right Side		3,20	0	0,54	0
Cargo Compartment - Left Side		3,20	0	-0,54	0
Cargo Compartment - Rear Hold		4,60	0	0,00	0
Ski Pod / Basket - Left Side		3,43	0	-1,25	0
- SLING LOAD -	850	3,40	2.890	0,00	0
ZFM - Zero Fuel Mass	**2.458**	**3,42**	**8.397**	**0,01**	**36**
Fuel - 540L Main Tank **[Liter!]**	300	3,48	825	0,00	0
Fuel - 378L Ferry Bladder **[Liter!]**		2,25	0	-0,21	0
TOM - Take Off Mass	**2.695**	**3,42**	**9.221**	**0,01**	**36**



Longitudinal



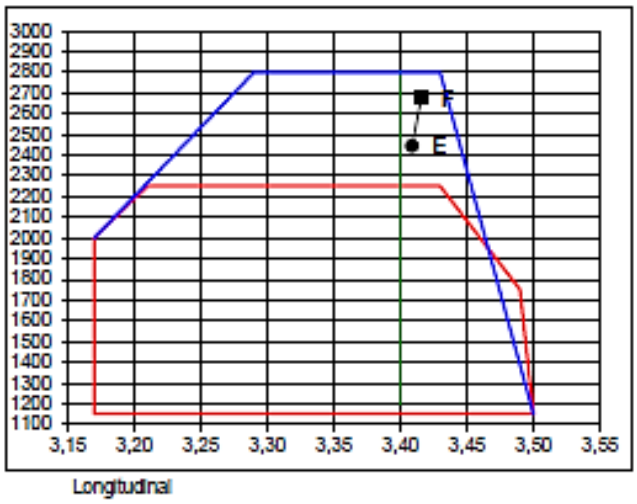
Lateral

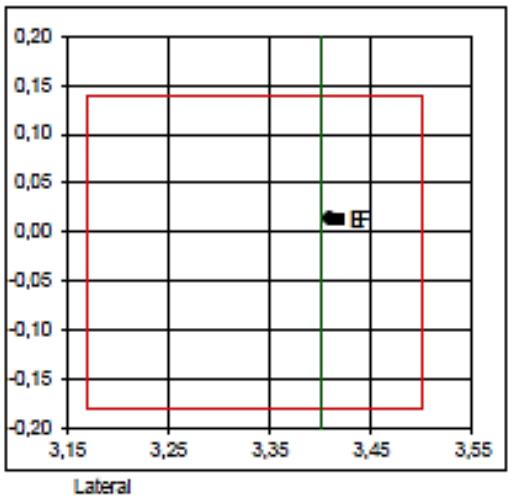
APPENDIX 2

Return to mass and balance

The mass and balance calculation made by the AIB.

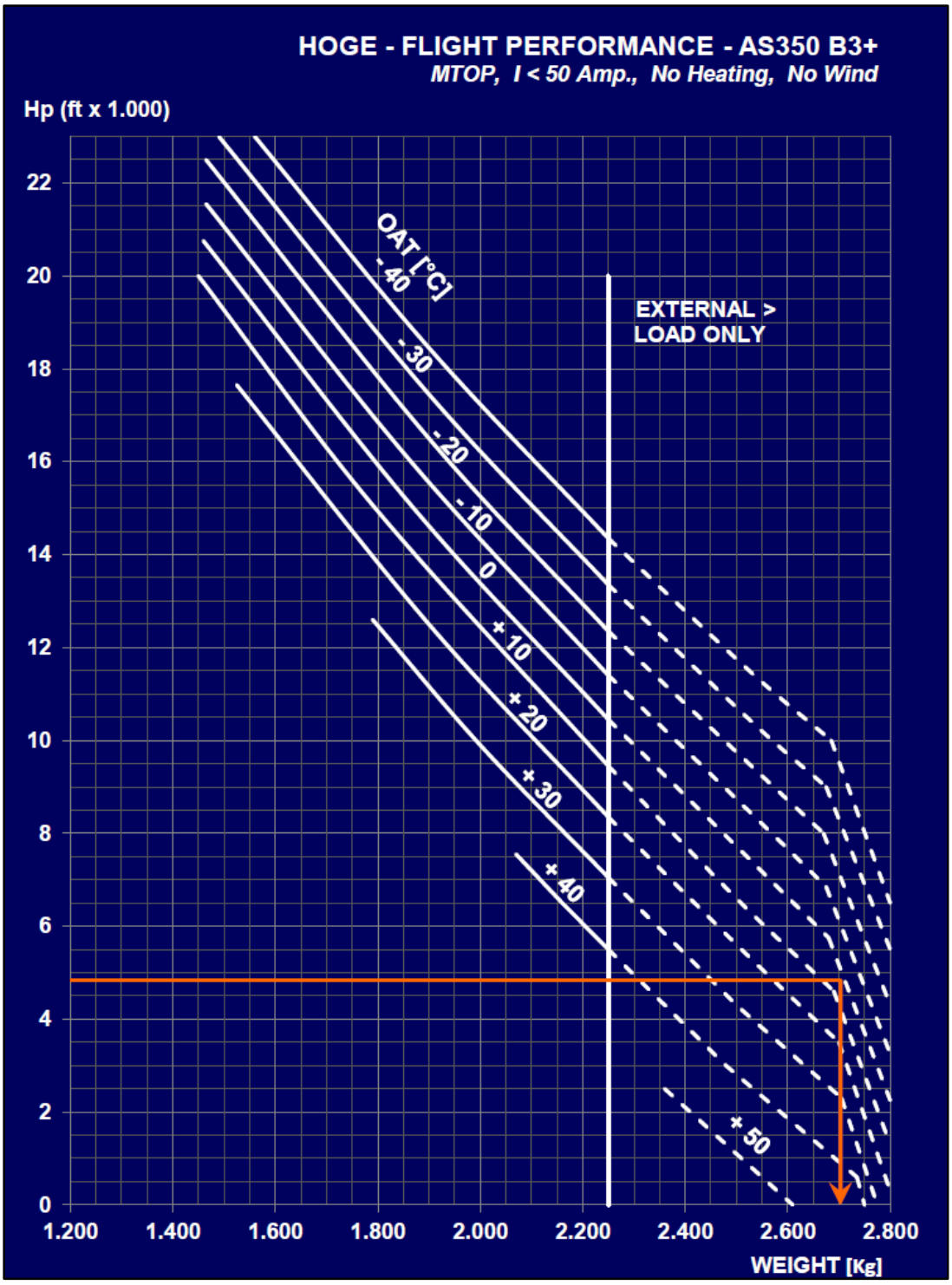
	Mass [Kg]	Arm [m]	Moment [kgm]	Arm [m]	Moment [kgm]
BEM - Basic Empty Mass	**1.441**	**3,50**	**5.048**	**0,00**	**0**
Equipment - Added	67	3,87	260	0,07	5
Equipment - Removed	0	0,00	0	0,00	0
Pilot Front Seat	85	1,55	132	0,36	31
DOM - Dry Operating Mass	**1.594**	**3,41**	**5.440**	**0,02**	**36**
Passenger Front - Left Seat		1,55	0	-0,36	0
Passenger Aft - Right Seat		2,54	0	0,62	0
Passenger Aft - Right Centre Seat		2,54	0	0,21	0
Passenger Aft - Left Centre Seat		2,54	0	-0,21	0
Passenger Aft - Left Seat		2,54	0	-0,62	0
Baggage Front - Left Seat		1,55	0	0,00	0
Baggage Aft (Seats up)		2,25	0	0,00	0
Cargo Compartment - Right Side		3,20	0	0,54	0
Cargo Compartment - Left Side		3,20	0	-0,54	0
Cargo Compartment - Rear Hold		4,60	0	0,00	0
Ski Pod / Basket - Left Side		3,43	0	-1,25	0
- SLING LOAD -	850	3,40	2.890	0,00	0
ZFM - Zero Fuel Mass	**2.444**	**3,41**	**8.330**	**0,01**	**36**
Fuel - 540L Main Tank [Liter!]	300	3,48	825	0,00	0
Fuel - 378L Ferry Bladder [Liter!]		2,25	0	-0,21	0
TOM - Take Off Mass	**2.680**	**3,42**	**9.154**	**0,01**	**36**





APPENDIX 3

Return to HOGE flight performance



APPENDIX 4

Return to flight routing