Accident
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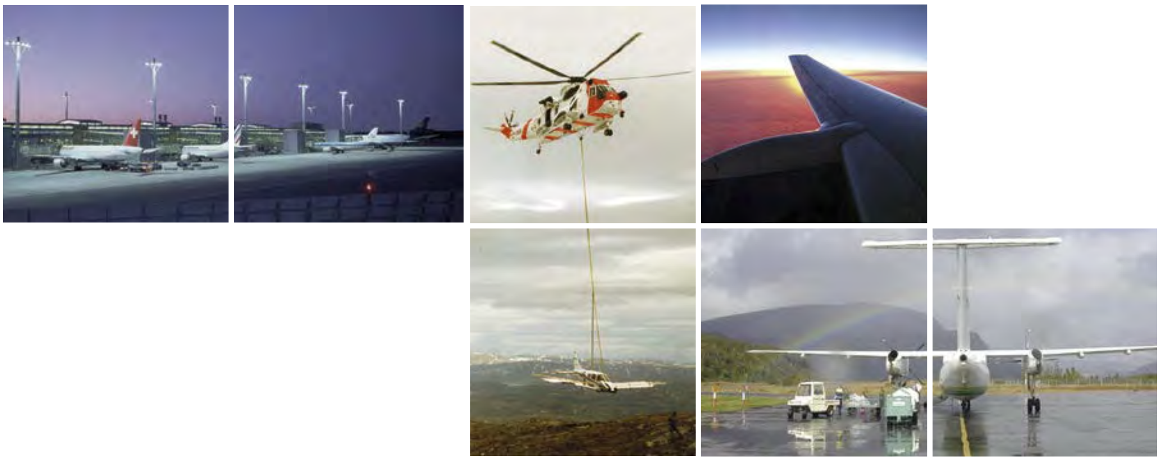

REPORT CONCERNING SERIOUS AVIATION INCIDENT ON THE ÅSGÅRD B PLATFORM ON 12 JANUARY 2012 WITH EUROCOPTER EC 225 LP, LN-OJE

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Photos: AIBN and Trond Isaksen/OSL

REPORT

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This investigation has had a limited scope, and the AIBN has therefore chosen to use a simplified report format. This report format, in accordance with the guidelines given in ICAO Annex 13, is only used when necessitated by the scope of the investigation.

All hours stated in this report are local time (UTC + 1 hour) unless otherwise indicated.

Aircraft:	
- Type and reg.:	Eurocopter EC 225 LP, LN-OJE
- Year of manufacture:	2008
- Engines:	2 Turbomeca Makila 2A1
Operator:	CHC Helikopter Service AS
Radio call sign:	HKS 403
Date and time:	Thursday, 12 January at 1700 hours
Incident site:	Åsgard B (ENUB) on Haltenbanken
ATS airspace:	Åsgard HTZ uncontrolled airspace Class G
Type of incident:	Uncontrolled movement due to brake failure after landing on floating rig, with subsequent emergency evacuation.
Flight type:	Commercial aviation/continental shelf
METAR/TAF Heidrun:	METAR 121250Z 33038KT 9999 VCSH SCT020CB SCT030 03/M04 Q0987 W04/S6 TAF 121100Z 1212/1221 33050G60KT 9999 –SHRA FEW015TCU BKN030 TEMPO 1212/1221 3000 SHRASNGS BKN012CB PROB30 TEMPO 1212/1221 TS BECMG 1212/1214 33040KT
Light conditions:	Darkness
Flight conditions:	VMC
Flight plan:	IFR
Persons on board:	2 pilots + 19 passengers
Injuries:	None
Damage to aircraft:	Minor damage to cabin doors.
Other damage:	None

Crew:	Commander:	First officer:
-Gender and age:	Man, age 46	Woman, age 32
-Licence:	ATPL-H	CPL-H
-Pilot experience:	Total flying hours 5 418, of which 712 hours with the relevant type.	Total flying hours 749, of which 551 hours with the relevant type.

FACTUAL INFORMATION

HKS403 was in ordinary shuttle service for transport of personnel for Statoil between Kristiansund Airport Kvernberget (ENKB) and the oil installations on Haltenbanken. During the flight, the helicopter was flying 19 passengers from the floating Deep Sea Bergen oil rig (XDSB) back to Kristiansund. Deep Sea Bergen was approximately 130 NM north of Kristiansund, with other installations between itself and land. (see Figure 1)

It was dark, and the weather forecast for the area indicated storm from the north-west and snow showers with possibility of thunder.

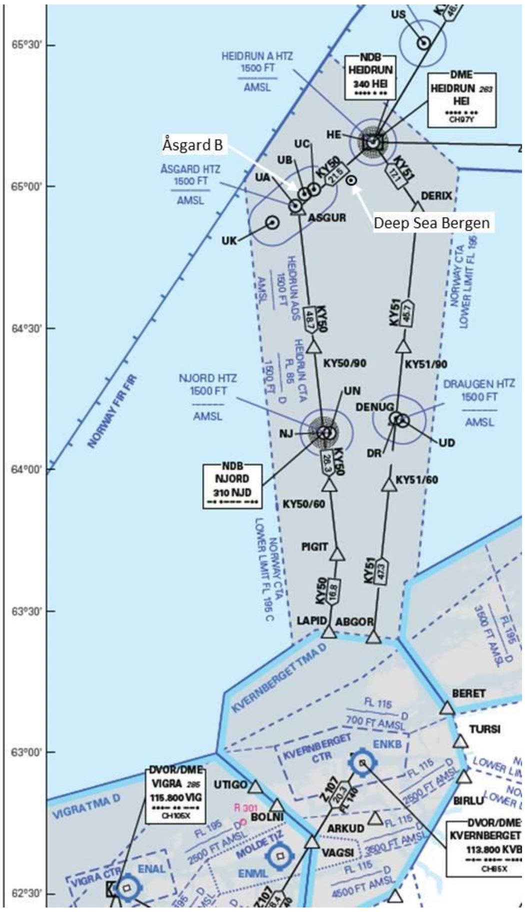

Figure 1: Maps OFFSHORE HELICOPTER AREA-SOUTHERN PART OF CENTRAL NORWAY with helicopter routes and installations marked. Source: AIP Norway

While the helicopter was unloaded and loaded on the helideck on Deep Sea Bergen, the first officer conducted an external inspection (walk-around) in accordance with the procedures. The helideck was wet due to rain.

During the take-off from the helideck, about 25 seconds after passing the decision point at 25 feet, the commander, who was flying the helicopter, felt abnormal forces in the cyclic stick. At the same time, the Caution light lit up. On the warning panels, the warning lights for hydraulic system error (HYD), level in left hydraulic system (LH.LVL) and hydraulics to autopilot (AP.P.) lit up. Data from the flight data recorder showed that the helicopter then had an altitude of 450 feet and an indicated speed of 83 knots. The crew had preselected heading, altitude and speed on the autopilot for climbing to an altitude of 3 000 feet. Flying conditions were demanding both during lift-off from the deck, with crosswind, turbulence and precipitation in darkness, and when ascending they entered a shower with associated instrument conditions.

After reporting the warning lights in the usual manner, the first officer consulted the emergency checklist. They started first with the emergency checklist for loss of hydraulic pressure to autopilot. The crew decided to wait until they were established at a safe speed and altitude before proceeding with the checklist items requiring to turn off the switch for AP hydraulics.

During the climb, the controls felt as if the hydraulic pressure was intermittent. They tried to engage the autopilot in different ways, without any noticeable success. When established at an altitude of 3000 feet, the crew reviewed the error indications and understood that they had a leak in the left hydraulic system. They then executed the emergency checklist procedure for a leak from the left hydraulic system. The course was set for Kristiansund under instrument conditions along the established KY50 route.

The chosen emergency checklist matched the error indications in the cockpit, and they executed the checklist items by turning off the switch for hydraulic pressure to the autopilot system (AP Hyd switch) and the auxiliary electric pump in the hydraulic system. Due to the indications, the After Take Off checklist was not executed after departure from Deep Sea Bergen. The crew considered that the best option was to leave the landing gear in down and locked position. Eventual failures in the hydraulic system could have led to difficulties when trying to extend the landing gear at a later stage of the flight.

There were several installations with helicopter decks between them and Kristiansund. Åsgard C (UC on Figure 1), Åsgard B (UB), Åsgard A (UA) and Kristin (UK) were all in a row. Åsgard B and Kristin are floating installations, the rest are ships. The crew considered whether continuing back to Kristiansund or landing on one of the offshore installations was the best course of action. Due to the weather conditions along the way and the conditions onshore, which could necessitate landing at a different airport, the crew decided that landing on one of the offshore installations was the best course of action.

The helicopter crew prepared to land in the usual manner. They received information about weather, wind and movement of the helideck. Significant wave height on Åsgard B was 5-7 metres at the time of the landing, and deck movement was registered as heaves of maximum 3-4 metres, heave rate 0.5 m/s, pitch approx. 3 degrees and roll approx. 2.8 degrees. The wind was from the north-west at 30-35 kt with gusts exceeding 50 kt in the last half hour.

Figure 2 LN-OJE on the helicopter deck on Åsgard B after landing. The helicopter is secured to the deck in the position where it came to rest. Photo: CHC Helicopter Service

The landing was normal, and the helicopter touched down in the correct position on the helideck.

The crew felt a certain relief at how trouble-free the landing was and prepared to shut down as normal after what they perceived to be normal landing. They had just started on the after landing checks when the helicopter suddenly started moving forward. They did not immediately understand what was happening, whether the helicopter was sliding on a slippery surface or whether the brakes had failed.

The commander re-checked that the parking brake was engaged, and the crew also tried braking with the pedals, but to no avail. The helicopter seemed to be moving forward in time with the movement of the helicopter deck. In an attempt to gain control of the movement, the commander pulled back on the cyclic stick to such an extent that main rotor blade sleeves were hitting either the droop restrainer ring or the coning stops.[1]

Figure 3: LN-OJE where it stopped on the helicopter deck on Åsgard B after the landing. The picture also shows the edge of the helicopter deck, the gutter and the walkway. Photo: STATOIL

The crew observed that the helicopter came closer and closer to the edge of the deck. When the movement seemed to stop, the commander ordered both engines shut down. The rotor brake had no effect, and the speed of the main rotor wound down by itself. The helicopter was, however, still moving and the commander ordered evacuation of the passengers. The first officer ordered the passengers to evacuate via the PA system.

The commander wanted chocks on the wheels. In accordance with procedure, the helicopter had set up the radios so that communication with the air traffic services was on VHF 2, while communication with the helideck was on VHF 1. When the engines and therefore the generators stopped, the power to VHF 1 was cut. This made radio communication impossible and the commander had to use hand signs. He also opened the cockpit door and shouted to the helideck crew. The anti-collision light was still on, but the HLO standing ready on the staircase still managed

[1] Coning stops are centrifugally operated mechanical stops that prevent the rotor blades from moving above a certain plane once the rotor's rotational speed falls below 140 RPM. The droop restrainer ring is a device which ensures that the blades do not move below a certain plane when the coning stops are active.

to quickly get the chocks in place on the right main wheel, and the helicopter came to a stop[2]. (See Figure 3)

The helicopter was secured to the deck and the blades strapped. The commander informed the passengers on what had happened.

Technical investigation

After the helicopter had been parked and secured on Åsgard B, it quickly became clear that there was a leak from an elbow union on the left main landing gear brake unit. The union hung loose on the inside of the brake unit, and there was a pool of oil on the deck. (See Figure 4)

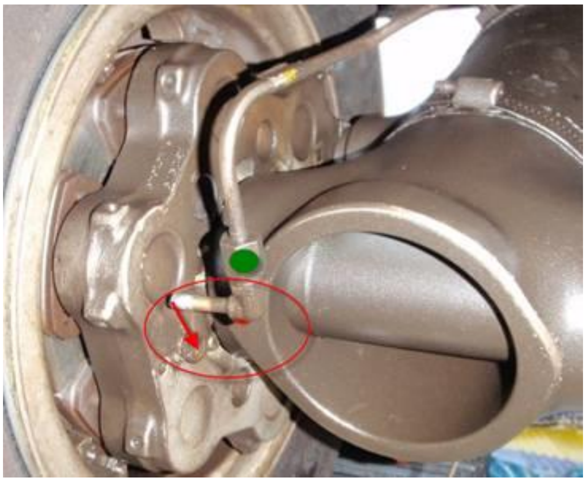

Figure 4: Left landing gear on LN-OJE after the incident. The elbow union has separated from the brake unit. Illustration: CHC Helicopter Service

An elbow union connects the supply pipe and the brake unit. The unit is equipped with external threads on the side where the pipe is connected. The supply pipe is connected to the elbow union with a nut. The other end of the union is fitted on the brake unit itself with a nut that is attached to the union with a compression ring. This compression ring is compressed around the pipe end of the elbow union. (See Figure 5).

The elbow union was new from the factory in January 2010, and was installed in a brake unit on 11 August 2011 by MRO Heli-One. This brake unit was installed in LN-OJE on 30 September 2011.

After the incident on Åsgård B, the elbow union was sent to the manufacturer for examination.

[2] The procedure is that HLO shall normally not approach the helicopter before the anti-collision light has been switched off.

Figure 5: The elbow union from LN-OJE to the left. An elbow union with a correctly installed compression ring to the right. The compression ring (dark) that came loose to the left. Photo: AIBN

In February 2012, the AIBN received a preliminary report from the manufacturer of the braking unit, Safran Messier-Bugatti-Dowty (MBD), concerning their examination. The report mainly covers the examination of a similar incident with another operator in April 2011. In that case, it turned out that the compression ring had not been sufficiently compressed around the pipe end in the elbow connection.

During production, this ring was crimped with a special tool, but the torque applied to the special tool was not specified. It turned out that this did not always give a satisfactory result, and in November 2011, MBD changed the crimping procedure by specifying a higher torque. The elbow unions produced in accordance with the new procedures were marked with the production date by hand to ensure traceability. The elbow union from LN-OJE was produced before this and was thereby not marked.

Helikopterservice carried out a fleet inspection of all helicopters in the Super Puma family based on an internal "Maintenance Alert Notice" dated 17 January 2012. This notice contained the following:

> *Check that there are no signs of leak (sweat) where the union is screwed into the brake unit body.*
>
> *If signs of leak are found, the cause of the leak must be investigated and corrected before further flight.*
>
> *Check with a torque meter that the torque applied to the union is 10Nm.*

No other elbow connections with similar faults were discovered.

On 14 November 2012, Eurocopter issued Service Bulletin (SB) EC225-32-002 with a procedure for checking the brake units on the entire affected fleet. The procedure entailed physically checking whether the compression ring could be rotated. If it could not, the unit was serviceable and could be refitted to the brake unit after being marked in accordance with the procedure in the mentioned SB. If it could be rotated, the part failed to meet the acceptance criteria and had to be replaced.

Emergency Check List

42 LEFT HAND HYD SYSTEM LEAK

Indications: HYD +

LH.LVL + AP.P

Increased control loads

1. AP Hyd Switch .... OFF
2. Limit bank angle .... MAX 45°
3. A.PUMP .... OFF
4. Landing Gear .... EMERGENCY EXTENSION (Drill step **2** on)
5. **LAND AS SOON AS POSSIBLE**

NOTES:

3. LH.LVL and AP.P may fluctuate with associated erratic LH system pressure as solenoid opens and closes on command of float switch in reservoir.
4. If leak continues, MH.P will eventually illuminate with LH pressure <110 bar and finally AUX.P
5. Wheel and rotor braking limited to the capacity of to ancillaries accumulator.

Figure 6 Excerpt from CHC Helikopterservice Emergency Checklist

After the incident, the emergency procedures for various faults in the left hydraulic system have been amended to state that the crew must check the accumulator pressure to verify the status of the hydraulic system. This change was made mandatory by an EASA Emergency Airworthiness Directive issued on 5 April 2012. (EAD 2012-0059-E).

The emergency procedure for low oil level in the left hydraulic system describes symptoms, consequences and measures. One of the consequences listed in the checklist in force at the time of the accident was:

"Wheel and rotor braking limited to the capacity of the ancillaries accumulator."

The crew has explained that their understanding of this meant that they expected to have sufficient brake effect to stand still on deck and sufficient rotor brake effect to stop the rotor after landing.

The wording has, through EASA's Emergency Airworthiness Directive, been amended to:

> *"If the pressure of the ancillary accumulator drops below 120 bars, consider that wheel and rotor braking is lost."*

Furthermore, the checklist states the following concerning low oil level in the left hydraulic system: *"Land as soon as possible"*. This is a phrase used to indicate medium priority for how quickly it is necessary to land after occurrence of a problem. The lowest priority is *"Land as soon as practical"*, and the highest is *"Land immediately"*. In the emergency checklist, "Land as soon as Possible" is defined as:

> *"Land at the nearest safe location. Offshore, fly to the nearest suitable landfall or offshore helideck at an altitude and airspeed such that a safe ditching can be made if the abnormal condition deteriorates and an immediate landing becomes necessary."*

This wording indicates a degree of seriousness which necessitates landing regardless of whether the landing site is on a floating or fixed installation.

After landing

Immediately after landing, the collective was set to flat pitch and locked. When the helicopter started moving forward towards the edge of the helideck, the parking brake was checked and ordinary wheel brakes were tried, but without effect. The cyclic was then pulled back to prevent this movement, but as the collective was locked in flat pitch, this had little or no effect. See figure 7.

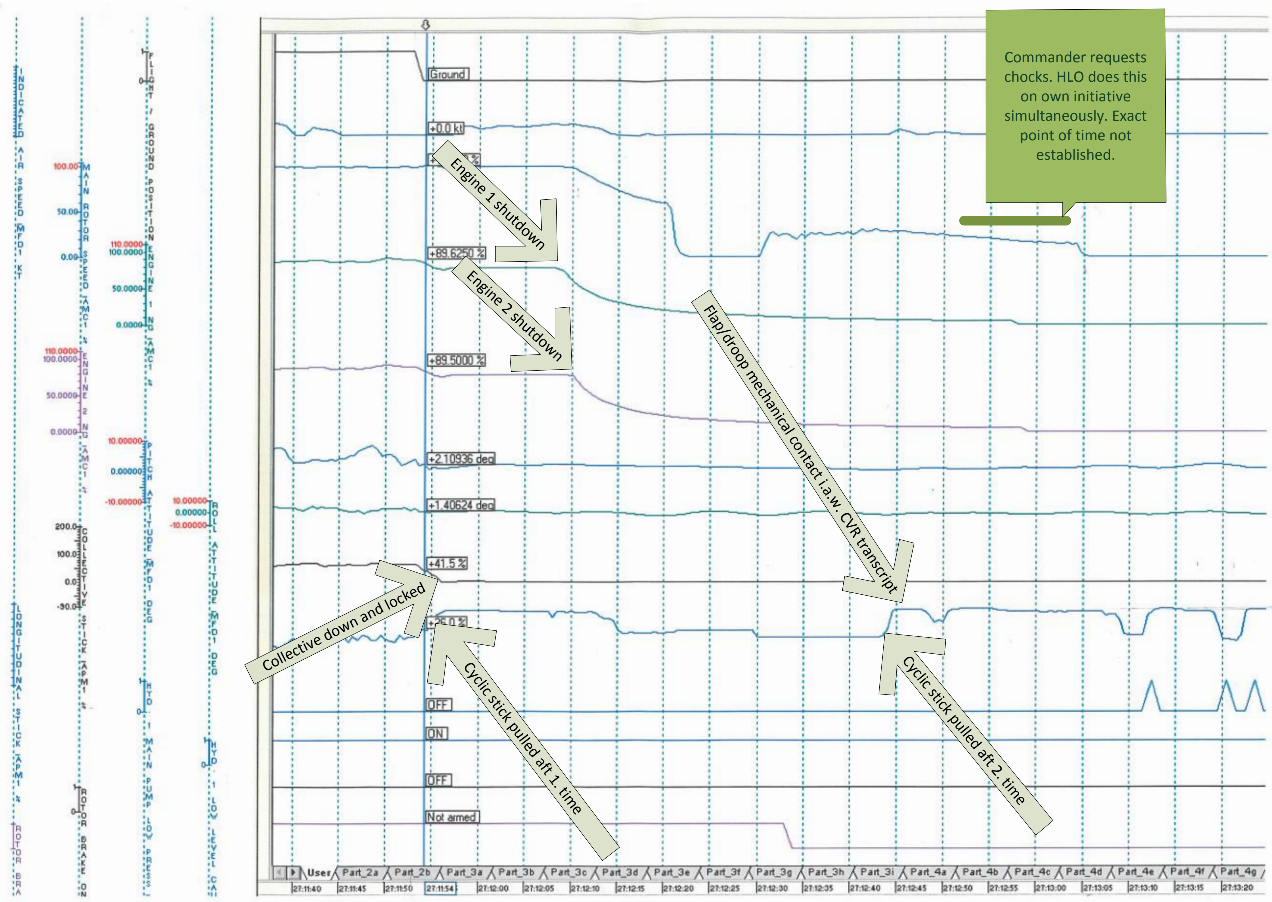

Figure 7: Relevant FDR parameters illustrating the course of events upon landing on Åsgård B.Source: CHC Helikopterservice, comments by AIBN

The type-certifying authority and manufacturer's responses following the incident

The incident happened on 12 January 2012, and EASA’s Emergency Airworthiness Directive relating to changes to operational procedures was issued on 5 April 2012.

On 14 November 2012, Eurocopter issued a Service Bulletin for the problems with the hydraulic elbow union.

Certification Specifications

EASA’s (CS 29.735) and FAA’s (Part 29.735) certification specifications relating to the design of wheel brakes for helicopters contain identical text:

> *“For rotorcraft with wheeltype landing gear, a braking device must be installed that is:*
>
> *(a) Controllable by the pilot;*
>
> *(b) Usable during poweroff landings; and*
>
> *(c) Adequate to:*
>
> *(1) Counteract any normal unbalanced torque when starting or stopping the rotor; and*
>
> *(2) Hold the rotorcraft parked on a 10° slope on a dry, smooth pavement.”*

Redundancy requirements have not been defined, unlike for airplane certification specifications. Therefore, there may be other helicopter types that are vulnerable to wheel brake system faults.

THE ASSESSMENTS OF THE ACCIDENT INVESTIGATION BOARD

The AIBN considers that the problem with insufficient fastening of compression rings on elbow unions was resolved by Helikopterservice's ” Maintenance Alert Notice” and EC Service Bulletin EC225-32-002.

Application of the collective combined with the cyclic stick would probably have resulted in improved control of the helicopter's movements after landing.

Due to the fact that the certification specifications for helicopters do not contain requirements related to redundancy in wheel brake systems, it can be assumed that there is a risk of faults on brakes on other helicopter types with wheel landing gear as well. The helicopter operators should therefore consider training on landing on movable helidecks (floating installations/ships) with wheel brake fault for all helicopter types with wheel landing gear.

The Accident Investigation Board Norway

Lillestrøm, 6 May 2014