Norwegian Safety Investigation Authority

PRELIMINARY REPORT AUGUST 2024

ACCIDENT IN THE SEA VEST OF SOTRA, VESTLAND COUNTY, NORWAY 28 FEBRUARY 2024 WITH SIKORSKY S-92A, LN-OIJ, OPERATED BY BRISTOW NORWAY AS

This report is a preliminary and incomplete representation of NSIA's investigations in connection with the relevant aircraft accident. The report may contain faults and inaccuracies. The final report will be the Safety Investigation Authority's official document concerning the accident and investigation.

Aircraft type and reg.:	Sikorsky Aircraft Corporation S-92A, LN-OIJ
Serial No.:	920169
Call sign:	NORSAR6
No. and Type of Engines:	2 x General Electric CT7-8A turboshaft engines
Date and time (local):	Wednesday 28 February 2024 at 19:39:46 hours
Year of Manufacture:	2012
Accident site:	N60.310002 E004.823990, about 2 NM southwest of Løno island, west of Sotra, Øygarden municipality, Vestland county, Norway
Weather conditions:	METAR ENBR 281820Z 16021KT 9999 BKN019 06/04 Q1006 NOSIG RMK WIND 1200FT 16026KT= METAR ENBR 281850Z 16020KT 9999 SCT014 BKN018 06/04 Q1005 TEMPO BKN012 RMK WIND 1200FT 15026KT=
Light conditions:	Night
Operator:	Bristow Norway AS
Type of Operation:	National regulated/Special Operations (SPO), SAR training flight
Persons on board:	Six onboard, one fatally injured
Nature of damage:	Helicopter destroyed
Information Source:	NSIA Investigations

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

Introduction

This preliminary report is published to disseminate new and significant findings from the on-going investigation. The report also contains a safety recommendation to Sikorsky Aircraft.

The Flight

On contractual basis, Bristow Norway AS carried out transport and Search and Rescue (SAR) services for Equinor ASA, including a SAR-base at Bergen Airport Flesland (ENBR). The SAR helicopter, LN-OIJ, was hangered at Bristow Norway's base at Bergen Airport Flesland.

The intended flight was SAR training west, north-west in Øygarden, Visual Flight Regulations (VFR) below 1 000 ft. The plan for the training flight was to do winch training with a ship and to search for an emergency position-indicating radio beacon (EPIRB). LN-OIJ, with call sign NORSAR6, departed Bergen Airport Flesland at 1824 hours and set a westerly course (See Figure 1).

The crew dropped the EPIRB in the sea about 3.5 NM west of Sotra, abeam Telavåg. By that time, it had already gotten dark. The crew then headed north towards the cargo ship Wilson Twisteden which was sailing southwards in Hjeltefjorden. Above the ship the crew trained on winching the rescue man, the medical crew member, and a stretcher down and up from the ship deck. After about half an hour training with the ship, they climbed to 1,000 ft and set a south-westly course to search for the beacon.

It was a dark overcast night with a few distant lights, but otherwise no external visual references. The flight crew did not use Night Vision Goggles (NVG). The significant wave height was in the range of 3–4 meters with white crests. The wind 10 meters above the sea was southerly about 25 kt.

According to Flight Data Recorder (FDR) information, the crew started the search for the beacon, initially descending to 500 ft (Radar altitude), and shortly after to 200 ft. The commander was Pilot Flying (PF) during the search. The beacon was found about 2.5 NM north of the position where it was dropped. After locating the beacon, the co-pilot (Pilot Monitoring – PM) engaged the Automatic Flight Control System (AFCS) SAR mode "Mark on Top" (MOT). Once activated, the Flight Director commands the helicopter through a descending turn, aligns it against the wind and brings it to a 150 ft hover 50 meters aft and 50 meters left of the point where the MOT is engaged. The AFCS brought the helicopter into a righthand turn. As the helicopter neared the hover point it decelerated as intended. During this period, the PM completed the "Trans Down" checklist and "SAR Circuit" checklist. This included arming the emergency flotation system.

To slow down, the helicopter will pitch nose up, usually to about 10°. FDR information shows that after reaching 10° the helicopter pitch-up manoeuvre continued at an average rate of about 2° per second over several seconds. The crew realised that something was wrong, and the commander initiated a go-around by pulling the collective. At this point the helicopter had reached a nose up attitude of 30° and had already entered rearward flight. The action by the commander could not prevent the helicopter from descending into the sea. The helicopter was 15 ft above the sea when the last reliable information was recorded by the FDR/Health and Usage Monitoring System (HUMS). At this point the helicopter was traveling backwards at a groundspeed of 40 kt, had a pitch up attitude of 11,7° and a 17,6° left bank.

At the impact with the water, all the windows on the left-hand side were forced loose due to water pressure. The ramp door was also detached. The cabin quickly filled with water. The helicopter sank to a depth of about 220 metres.

Two different rescue helicopters retrieved the six people from the accident helicopter from the sea and transported them to Haukeland University Hospital in Bergen. Life jackets used in helicopters must be deployed manually. One person was found floating without a deployed life jacket and did not show sign of life when the first rescue helicopter arrived at the accident site approximately 45 minutes after the accident. It was therefore prioritized to pick up the five survivors. The situation for

one of the survivors became critical and the helicopter crew had to change priorities and was consequently unable to pick up the person without signs of life and had to leave the area. The person without any life signs was picked up by the second rescue helicopter which arrived approximately 15 minutes later.

The helicopter was equipped with floats that have both an automatic and manual method of deployment. These were armed but were not automatically deployed during the uncontrolled impact with the sea. There was no evidence of manual deployment of the floats. The flotation system of the helicopter type is designed to function in a controlled emergency ditching on water. When the main rotor blades hit the sea, the power supply required for automatic deployment stopped and thus prevented the possibility of an automatic deployment of the flotation elements. The investigation includes the functionality and system design of the floats, life rafts and corresponding regulations. New international regulations which, among other things, include emergency flotation elements and life rafts for helicopters have been published. The date for full implementation is set to August 2026.

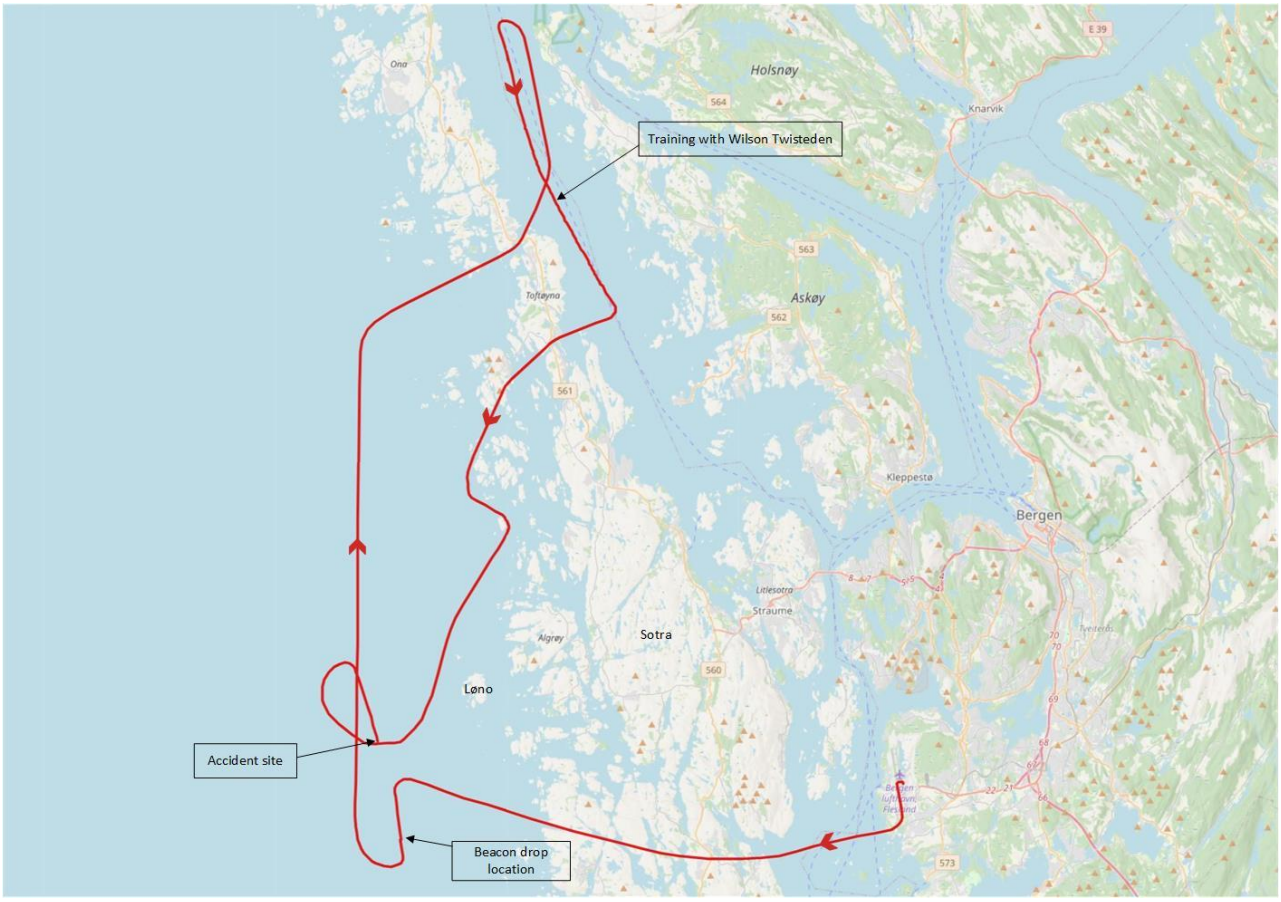

Figure 1: The route flown by LN-OIJ. Source: GPS Visualizer/NSIA

The Autopilot and training of the pilots

Available information led the NSIA, already in the early stages of the investigation, to focus on some areas of special interest. One such area was the Automatic flight Control System (AFCS). The NSIA brought the two Flight Control Computers (FCC) to the manufacturer in the USA to download its data. There are parameters regarding the autopilot system that are only stored in the FCCs. The recorded data from the HUMS, FDR and FCCs did not clearly indicate why the pitch up manoeuvre continued. Additionally, the FCC data recorded a force against trim and a degrade that did not correspond to the flight crew statements. Therefore, the NSIA brought relevant parts of the autopilot system to the manufacturers in the USA, including the pitch Stability Augmentation System (SAS)/boost actuator and the four trim servos. Examination of the pitch SAS/boost actuator found no evidence of functional anomalous that would be a factor in this accident.

After thorough investigation in cooperation with the manufacturer of the trim servo system and together with both NTSB and Sikorsky a fault was found on one of the three circuit boards in the pitch trim servo, see fig. 2 and 3. This fault appears to have a potential of explaining the helicopter movement seen in the recorded data. A total of 12 circuit boards were tested, three from each of the four trim servos. Two circuit boards had physical damage and failed during tests. No other faults were found on the remaining 9 circuit boards. The fault in the pitch trim servo is still under investigation.

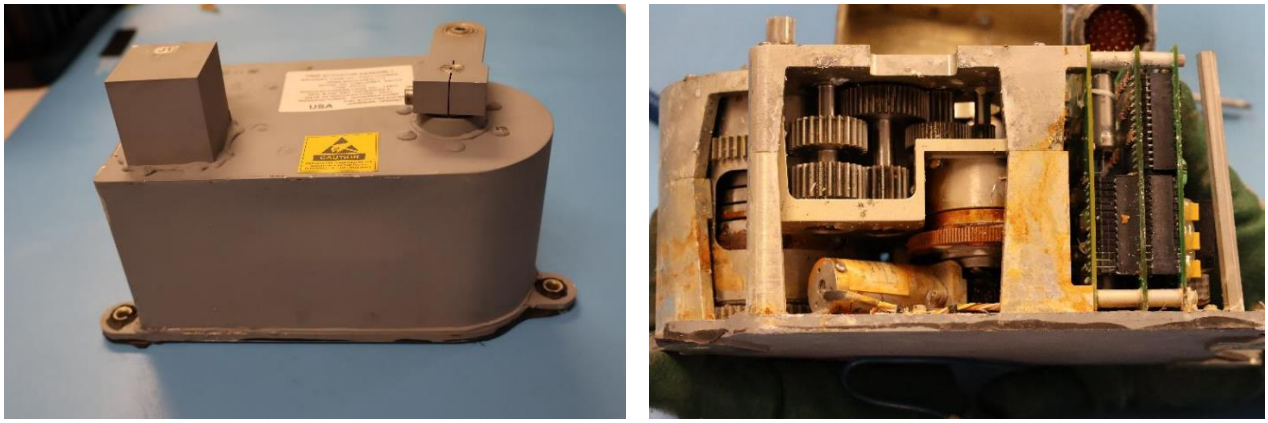

Figure 2: The pitch trim servo as found and opened showing circuit boards. Photo: Collins Aerospace/NSIA

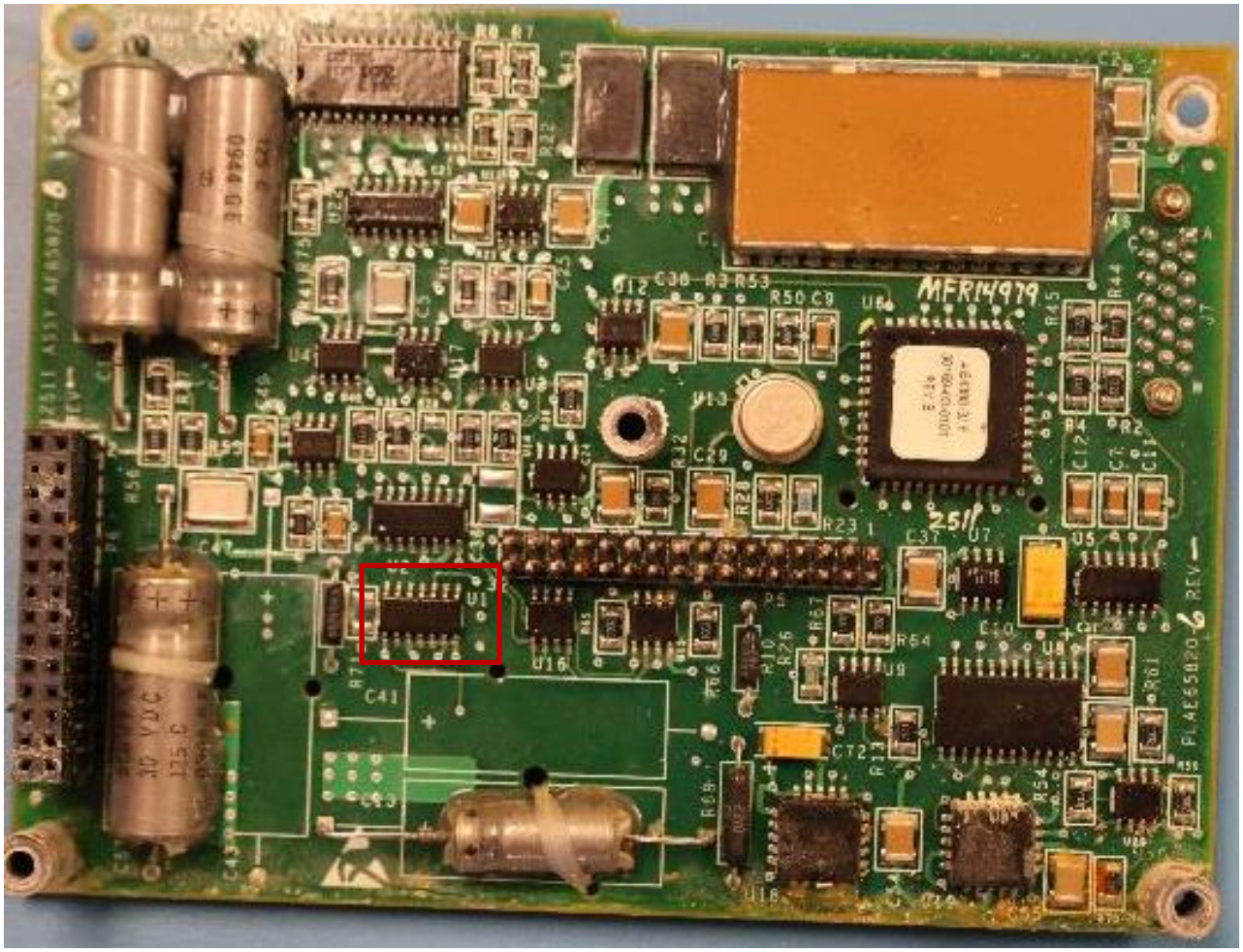

Figure 3: The circuit board with a component found to have failed highlighted in red. Photo: Collins Aerospace/NSIA

During the investigation Sikorsky has stated that when MOT is engaged the helicopter should normally not exceed 12–13° nose up attitude. This information is not stated in the Rotorcraft Flight Manual Supplement detailing the SAR modes of the AFCS. Until recently, Bristow Norway had not established call outs for unusual pitch attitudes. The pilots in LN-OIJ had few external visual

references due to the dark night conditions and were caught by surprise when the helicopter pitch continued to increase. When they realized the unusual attitude, it was too late to recover.

The NSIA would like to highlight that all operators of Sikorsky S-92 helicopters take immediate action to ensure that training of helicopter crew on the Sikorsky S-92 include the early awareness, relevant call outs and correct actions of a possible excessive pitch up attitude when using the SAR Automatic Flight Control System (AFCS) in particular, but not limited to this.

The investigation is ongoing, and updates will follow. The investigation will include survival aspects. This includes, among other things, the helicopter's emergency equipment such as the emergency flotation system and life rafts, the crew's personal equipment, the possibility of evacuation and the rescue operation itself. The personal equipment includes emergency breathing apparatus, life jackets with lights, personal locator beacon and survival suits.

Safety Recommendation Aviation no 2024/10T

On the evening of Wednesday 28 February 2024, a Sikorsky S-92A helicopter, LN-OIJ, operated by Bristow Norway AS crashed during SAR-training. There were few external visual references due to dark night conditions. The helicopter was in the Automatic Flight Control System (AFCS) SAR mode “Mark on Top”. When approaching the hover position the helicopter will pitch nose up as it slows down and descends. In this accident the helicopter continued to pitch up. The helicopter had reached a nose up attitude of 30° and had entered rearward flight when the pilots realised and acted. During the investigation Sikorsky has stated that when MOT is engaged the helicopter should normally not exceed 12–13° nose up attitude. This information is not stated in the Rotorcraft Flight Manual Supplement describing SAR modes but could help S-92 helicopter crews recognize AFCS anomalous behavior.

The Norwegian Safety Investigation Authority therefore recommends that Sikorsky Aircraft Corporation immediately ensure that expected attitude values when flying on autopilot is made known to all operators and included in any relevant Sikorsky manuals.

The Norwegian Safety Investigation Authority

Lillestrøm, 6 August 2024