



EMS Helicopter Strikes Terrain During Maintenance Ferry Flight

Minutes before the accident, a maintenance technician had disconnected the wiring from the main-gearbox oil-pressure switch to the main-gearbox oil-pressure warning light on the Eurocopter AS 355F2 because he believed that the warning light had failed.

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FSF Editorial Staff

About 2355 local time Oct. 16, 2000, a Eurocopter (formerly Aerospatiale) AS 355F2 struck terrain about one minute after takeoff on a maintenance ferry flight from Alamance Regional Medical Center in Burlington, North Carolina, U.S. The helicopter was destroyed, and the pilot — the only person in the helicopter — was killed.

Minutes before the accident, a maintenance technician, who believed that a warning-light switch had failed, had disconnected the wiring to the main-gearbox (MGB) oil-pressure switch.

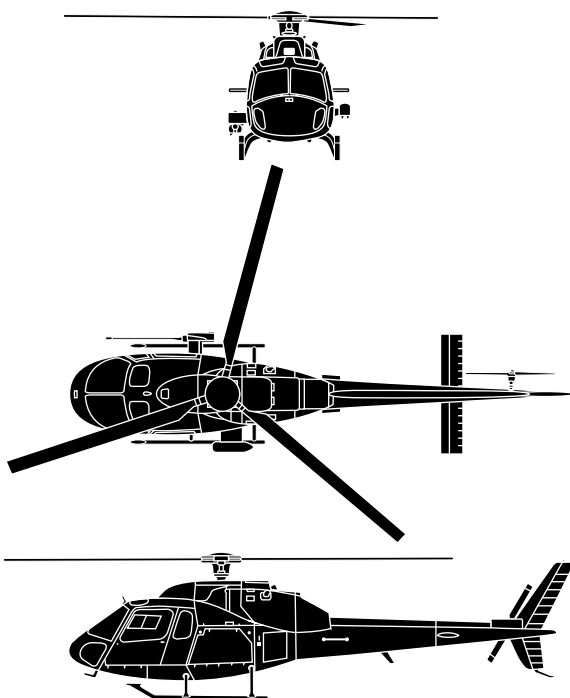
The U.S. National Transportation Safety Board (NTSB) said, in the final report on the accident, that the probable causes were “the mechanic’s failure to comply with manufacturer’s instructions for correction of [an] illuminated main-rotor-gearbox oil-pressure warning light, resulting in the helicopter being dispatched on a ferry flight with a failed main-rotor-gearbox oil pump, failure of the main-rotor-gearbox combining-gearbox gears due to oil starvation, loss of main-rotor RPM [revolutions per minute] and the helicopter colliding with trees and the ground during an uncontrolled descent.”



The pilot had observed the illuminated MGB oil-pressure warning light (an indication of minimum MGB oil pressure) near the end of the previous flight, in which the helicopter — registered to Duke University and operated by Corporate Jets of West Mifflin, Pennsylvania, U.S. — had been dispatched from Duke University Medical Center in Durham, North Carolina, at 2209 to pick up a patient from Alamance Regional Medical Center, about 25 statute miles (40 kilometers) away. In addition to the pilot, two flight nurses were in the helicopter.

About five minutes before landing, the main-transmission oil-pressure warning light illuminated. The flight nurses said that the pilot had told them that, because they were about an equal distance from Alamance Regional Medical Center and the Burlington-Alamance Regional Airport, he would fly the helicopter to the medical center, land and immediately shut down the engines.

One of the nurses said that during the engine shutdown, he told the pilot that he smelled a burning odor. The pilot



Eurocopter AS 355 Ecureuil 2/Twinstar

The Eurocopter (formerly Aerospatiale) AS 355 is a twin-engine version of the AS 350 Ecureuil/Astar. (The AS 355 is marketed in the United States as the Twinstar and elsewhere as the Ecureuil 2). Many of the components are identical to those of the AS 350, including the main-rotor mast, main-rotor head, tail-rotor hub, cabin and landing gear. The major differences involve the main-rotor blades, power plant, transmission, fuel system and fuselage structure.

Development of the basic AS 355E began in 1978, and the first production AS 355 was flown in 1980. The AS 355F2 was certified by the French Direction Générale de l'Aviation Civile (DGAC) in 1985.

The AS 355 can accommodate up to six people; the air ambulance version accommodates two stretchers, one above the other, across the rear of the cabin, along with seating for a pilot and a medical attendant.

The accident helicopter had two Rolls-Royce (formerly Allison) 250-C20F engines, each with a maximum-continuous-power rating of 313 kilowatts (420 shaft horsepower).

Fuel capacity of the AS 355 is 730 liters (193 gallons).

Main-rotor diameter is 10.7 meters (35 feet).

Maximum takeoff weight is 2,540 kilograms (5,600 pounds), or 2,600 kilograms (5,732 pounds) with an external load. Maximum external load is 1,134 kilograms (2,500 pounds).

Maximum rate of climb at sea level is 1,340 feet per minute. Hovering ceiling in ground effect is 6,560 feet; hovering ceiling out of ground effect is 4,920 feet.

Maximum cruising speed at sea level is 119 knots. Range with no fuel reserve at sea level is 695 kilometers (375 nautical miles).

Source: *Jane's All the World's Aircraft*

responded that the odor probably resulted from shutting down the engines without a cool-down period. He later told one of the nurses that the warning light probably had illuminated because of a short circuit in a light switch.

A maintenance technician was summoned, and the flight to Duke University Medical Center was canceled. (The patient was transported by ambulance.)

The maintenance technician said that when he arrived at the helicopter about 2330, the pilot told him that "all was normal except for the transmission oil-pressure light being illuminated."

The maintenance technician said that he inspected the helicopter and found no excessive oil leaks. When he disconnected the wire from the transmission oil-pressure switch, the warning light went off. He told investigators that he did not reconnect the transmission oil-pressure-switch wire before the helicopter's takeoff on the maintenance ferry flight.

"Due to past years of problems with this switch as known by himself and the pilot, they made a decision to ground run and hover the helicopter, and if there were no other indications such as vibration, noise, chip light or temperature indication and if the pilot felt comfortable with the helicopter, the pilot would fly it back to Duke [University Medical Center]," the report said. "The mechanic observed from the ground, and after a period of run-up and then hovering time, the pilot turned on his [helicopter's] landing light and took off."

Transcripts of communications between the pilot and the Duke University Medical Center Life Flight Operation Center showed that at 2347, the pilot said that the helicopter was back in service. At 2348, the helicopter was dispatched from the Alamance Regional Medical Center. There were no further transmissions from the pilot.

Witnesses near the accident site 1.3 statute miles (2.1 kilometers) south-southeast of the takeoff point at the Alamance Regional Medical Center said that the helicopter was being flown at a low altitude. They said that the helicopter "did not sound normal ... and was making a steady drone and a low-velocity thumping noise." They then heard the sound of tree limbs breaking and the helicopter striking the ground.

Visual meteorological conditions prevailed at the time of the accident. The 2354 automated surface weather observation at Burlington-Alamance Regional Airport, two nautical miles (3.7 kilometers) from the accident site, included clear skies and visibility of four statute miles (6.4 kilometers) in fog. Winds were calm. Sunset was at 1841, and moonrise was at 2117; the moon had an 87 percent illumination.

The wreckage was found east of a home in Burlington. Examination of the site showed that the helicopter struck the

trees while descending on an easterly heading. The tail boom separated from the remainder of the helicopter, which continued easterly for about 50 feet (15 meters) before striking the ground in a right-side-low attitude. A post-impact fire damaged most of the wreckage.

The pilot of the accident helicopter held a U.S. Federal Aviation Administration (FAA) commercial pilot certificate and had accumulated about 3,700 flight hours, including about 3,400 flight hours in helicopters and about 400 flight hours in AS 355s. He held an FAA class 2 medical certificate with no limitations, issued June 14, 2000. He was hired by Corporate Jets on Sept. 6, 1994, and was assigned as a pilot of the AS 355 on April 25, 1996. He had completed a 12-month knowledge, competency and line check required by U.S. Federal Aviation Regulations (FARs) Part 135 on Dec. 16, 1999, and a six-month instrument flight rules proficiency check on June 13, 2000.

The maintenance technician held an FAA mechanic certificate with a powerplant rating and an airframe rating. He also held a private pilot certificate with an airplane single-engine land rating. He was hired as a maintenance technician by Corporate Jets on Sept. 1, 1992, and received AS 355 airframe field maintenance training May 27, 1994.

The accident helicopter was manufactured in 1991 and had accumulated about 4,267 flight hours. A 100-hour inspection and a 200-hour airframe inspection were conducted in accordance with the operator's approved aircraft inspection program July 12, 2000, 75 flight hours before the accident.

Four flight hours before the accident, on Oct. 12, 2000, a 30-hour inspection was conducted. At that time, the MGB assembly was replaced with a gearbox assembly that had accumulated 6,870 flight hours since new and zero flight hours since an overhaul Oct. 9, 2000, by Eurocopter. During the overhaul, an oil pump was installed in the gearbox assembly; the oil pump had accumulated 4,339 flight hours since new and zero hours since an overhaul June 14, 1999, by Eurocopter. During the overhaul of the oil pump, a new driven gear (idler gear) and a used drive gear were installed. The report said that the time-in-service for the used drive gear could not be determined.

Maintenance records for the MGB installation showed that the preservative oil that had been placed in the gearbox after the overhaul was drained and new oil was added. The pilots who conducted the test flight after installation of the transmission and who flew the helicopter before the accident pilot said that the MGB contained the proper amount of oil during their preflight inspections. The accident flight was the seventh flight since installation of the MGB.

The AS 355 flight manual says that a pilot who observes illumination of the MGB oil-pressure light should reduce

engine power and should test the indicator lights to verify that the MGB temperature light also illuminates and then should land the helicopter as soon as possible. The explanation of the procedure is accompanied by a note that says that the MGB "has successfully passed a bench test consisting [of] running the gearbox for 45 minutes with zero oil pressure, at the power corresponding to minimum power in level flight (at 55 knots)." Eurocopter said that minimum power in level flight at 55 knots is about 190 kilowatts (255 horsepower) and that power for hovering is about 450 kilowatts to 500 kilowatts (603 horsepower to 671 horsepower).

(The accident helicopter was not equipped with an MGB oil-pressure gauge. Eurocopter had issued a service bulletin AS-355 No. 01.04 on Dec. 11, 1990, providing instructions for installation of an MGB oil-pressure gauge.)

The maintenance technician who was summoned after the pilot observed the illumination of the MGB oil-pressure warning light said that he did not have with him the helicopter maintenance manual or the Eurocopter *Fault Isolation Manual* for the AS 355.

The *Fault Isolation Manual* says, "The recommended method for trouble-shooting a main-rotor-gearbox oil-pressure warning-light illumination is, first, check the warning-light electrical circuit. Next, replace the oil-pressure microswitch. Finally, if there is no electrical anomaly, remove the main-rotor gearbox and rotor-mass assembly for major overhaul."

The maintenance technician said that he disconnected the wires from the oil-pressure microswitch to the warning light, and the warning light extinguished. The technician said that he believed that the oil-pressure microswitch had failed and that he planned to replace the microswitch after the pilot flew the helicopter back to the Duke University Medical Center.

Post-accident examination of the no. 1 engine and the no. 2 engine revealed that all damage was consistent with the impact and post-impact fire damage.

Metallurgical examination of the MGB revealed that "the oil-pump idler gear had seized in the oil pump due to undetermined reasons, and the oil-pump drive shaft had failed due to overstress," the report said. "The teeth on the engine-input gears, intermediate gears and MGB drive gear in the MGB combining gearbox had failed due to high-temperature overstress, which was the result of oil starvation."♦

[FSF editorial note: This article, except where specifically noted, is based on the U.S. National Transportation Safety Board final report on accident no. MIA01FA006. The report comprises 248 pages and includes photographs, maps and diagrams.]

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