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Aerial Ambulance Loses Engine Power During Approach in Dense Fog

After diverting a flight because of low fuel, the pilot was told that visibility was approximately five meters (16 feet) at the highway intersection where he attempted to land a Bell LongRanger III. The engine stopped producing power during the approach, and the helicopter struck terrain.

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FSF Editorial Staff

On the night of July 24, 2000, a Bell 206L-3 LongRanger III — with a pilot, a crewman-paramedic and an intensive-care paramedic aboard — was flown from Rockhampton [on the coast of Queensland, Australia] to Yarandoo Station, approximately 167 kilometers (90 nautical miles) northwest of Rockhampton. The crewmembers loaded an injured child and the child's mother aboard the helicopter, and it departed from Yarandoo Station to fly to Rockhampton Hospital.

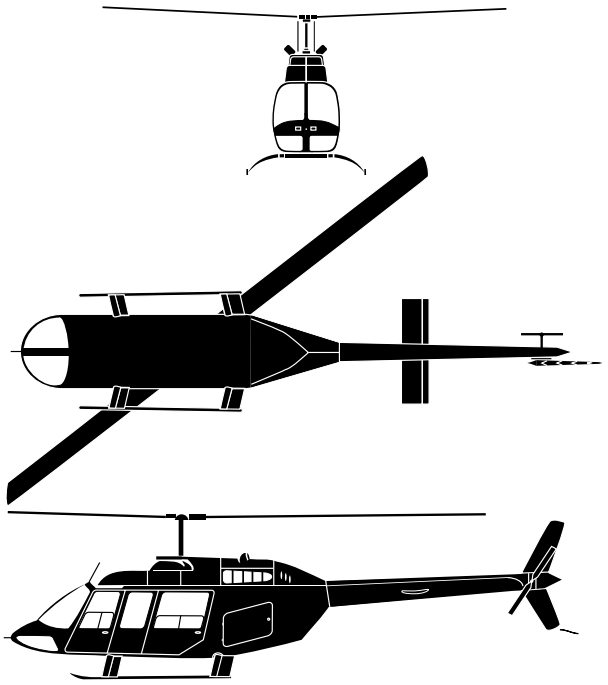
During the flight, the pilot reported "a fairly high fuel-burn rate" and said that he was diverting to Marlborough [approximately 100 kilometers (54 nautical miles) north of Rockhampton]. The helicopter struck terrain at 0203 local time during an attempted landing in dense fog on a highway intersection. The three crewmembers and two passengers were killed. The helicopter was destroyed.

The Australian Transport Safety Bureau (ATSB) said, in its final report, that the following were significant factors in the accident:

- "The helicopter departed [from] Rockhampton with insufficient fuel to carry out the intended flight, and the pilot was apparently unaware of this until some point during the return flight;
- "By the time the helicopter arrived at Marlborough, thick fog had formed in the area, preventing a landing at the normal landing site;
- "The pilot did not attempt to divert from Marlborough to look for a fog-free landing site;
- "While maneuvering in preparation for an approach to an alternative landing site, the engine lost power, possibly due to interruption of its fuel supply;
- "Darkness and thick fog, possibly aggravated by the [helicopter's] illuminated 'Nightsun' [searchlight] denied the pilot visual reference with the ground; [and,]
- "The investigation was unable to determine why the pilot was unable to carry out a safe landing following the loss of engine power."

The pilot held commercial pilot licenses for both helicopters and airplanes, and a night visual flight rules (NVFR) rating. He had 3,928 flight hours, including 3,185 flight hours in helicopters and 50 hours in type.

"He was a former military pilot whose military flying experience included 968 hours on Bell 206 (Kiowa) [helicopters] and 2,059 hours on Bell 47 (Sioux) helicopters,"



Bell 206L-3 LongRanger III

The Bell 206L LongRanger was designed to fill a size-and-performance gap between the company's five-seat 206B-2 JetRanger II and 15-seat Model 205A-1. The helicopter, which first flew in 1974, has the Bell "Noda-Matic" cabin-suspension system, which reduces rotor-induced vibration.

The LongRanger III accommodates a pilot and five passengers. Double doors on the left side of the cabin facilitate the loading of litter patients or cargo.

The helicopter has an Allison 250-C30P turboshaft engine with a maximum-continuous-power rating of 415 kilowatts (556 shaft horsepower). The standard transmission has a maximum-continuous-power rating of 276 kilowatts (370 shaft horsepower).

Fuel capacity is 416 liters (110 gallons).

Main-rotor diameter is 11.3 meters (37 feet). Tail-rotor diameter is 1.7 meters (5.6 feet).

Maximum takeoff weight is 1,882 kilograms (4,150 pounds) or 1,928 kilograms (4,250 pounds) with an external load. Maximum external load is 907 kilograms (2,000 pounds).

Maximum rate of climb at sea level is 1,340 feet per minute. Hovering ceiling in ground effect is 16,500 feet. Hovering ceiling out of ground effect is 5,400 feet.

Maximum cruising speed at 5,000 feet is 110 knots. Service ceiling at maximum cruise power is 20,000 feet. Range with no fuel reserve at 5,000 feet is 666 kilometers (360 nautical miles).♦

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

the report said. "As a military pilot, he had held a command instrument rating, but his rating was no longer valid.

"The pilot was employed as a relief pilot, working tours of full-time duty with the operator as the need arose. [The report did not identify the operator.] He had completed previous tours of duty in September and October 1997, February 1998, April 1998, October 1998, February 1999 and September 1999, totaling 43 flights. Between tours of duty, he did not fly.

"Nine days before the accident, while preparing for his current tour of duty, he underwent a flight review with the operator's chief pilot. The flight review included day and night emergency procedures. On the day following the flight review, he flew a short NVFR flight; and on the following day, he flew a short day flight."

The pilot then was off duty for five days before taking over as standby pilot from the operator's senior pilot at 0700 on July 23, 2000. The senior pilot told the accident pilot that the helicopter was fully serviceable and had 500 pounds (227 kilograms) of fuel aboard.

"The operator's procedure was to leave the helicopter on standby with 500 pounds of fuel, approximately two-thirds of a full fuel load," the report said. "When the operator received a task, the pilot would calculate the required fuel load and the maximum fuel load the aircraft could carry given the configuration and payload for the task."

The senior pilot told investigators that he offered to brief the pilot on any aspect of the aircraft systems.

"The pilot replied that he had covered the operation of the global positioning system [receiver] and the Shadin electronic fuel-management system in discussions with the chief pilot and that he was satisfied with his understanding," the report said.

"The senior pilot also showed the pilot the weather forecast covering the previous night and warned the pilot to expect fog during his shift."

The area forecast called for isolated areas of smoke and scattered patches of fog along the coast.

The report said that the pilot "spent the day quietly" and "retired to bed early in the evening."

At 2326, Rockhampton Ambulance Service Communications (CAPCOM) telephoned the pilot and requested that he transport Queensland Ambulance Service (QAS) personnel to a patient at Yarandoo Station.

The pilot and the QAS personnel departed from Rockhampton at 2340. The pilot maintained radio communication with CAPCOM throughout the one-hour NVFR flight to Yarandoo Station.

"After arrival at [Yarandoo Station], a decision was made to transport the patient (a child) and his mother to the Rockhampton Hospital," the report said.

At 0114, the pilot told CAPCOM that the flight had departed from Yarandoo Station. At 0126, he told CAPCOM that the estimated time of arrival at Rockhampton was "10 minutes past the hour."

At 0132, the pilot told CAPCOM that he was diverting the flight to Marlborough "because of a fairly high fuel-burn rate." He said that the flight would arrive in Marlborough in about 10 minutes, and he asked CAPCOM to arrange for surface transport for the patient, the patient's mother and the intensive-care paramedic from Marlborough to Rockhampton Hospital.

"In response, CAPCOM directed a Marlborough-based ambulance vehicle to deploy to the Marlborough state school sports field to meet the helicopter," the report said.

Dense fog had developed in the Marlborough area before the helicopter arrived at the school sports field.

"At 0141, the pilot called the officer in charge of the Marlborough-based ambulance vehicle, now deployed to the school sports field, and asked him to switch on all of the vehicle's external flashing lights," the report said. "The ambulance officer replied that the vehicle's lights were on and that visibility on the ground was 'about the length of a football field.'"

The helicopter arrived at the school sports field at 0144. Fog extended to approximately 300 feet above ground level, and there was "little or no cloud" above the fog.

"The pilot could see the vehicle when the helicopter was directly overhead, but the fog was sufficiently thick to deny the pilot any slant visibility of ground objects," the report said.

The pilot used the helicopter's searchlight during two approaches and go-arounds at the school sports field. The searchlight was illuminated for the remainder of the flight.

"At 0154, the pilot asked the ambulance officer to reposition the ambulance vehicle to the northern intersection of Bruce Highway and Perkins Road, which was illuminated by overhead orange lights," the report said. "The pilot said that he could see the cross-pattern of lights and that he would use the cross as an approach reference … and that he would aim his approach to the center of the cross-pattern."

The pilot asked the ambulance officer to check the road west of the intersection for cables that might be a hazard during final approach.

"At 0201, the ambulance officer informed the pilot that visibility was about five meters [16 feet]," the report said. "The pilot replied, but the reply could not be understood. At 0203 and again one minute later, the ambulance officer called the pilot but received no reply. Around that time, he heard a sound consistent with a ground impact."

At 0206, a local resident arrived at the highway intersection and told the ambulance officer that he believed the helicopter had struck terrain. A search was begun immediately by State Emergency Service personnel, a police officer, the ambulance officer and several residents.

"About one hour later, two residents searching in fog with 20 meters [66 feet] visibility located the accident site," the report said. "The helicopter had been destroyed, and all occupants had received fatal injuries."

The helicopter had struck the ground in a steep nose-down attitude and in a left bank. The helicopter then rolled forward and came to a stop inverted.

The helicopter had struck the ground in a steep nose-down attitude and in a left bank. The helicopter then rolled forward and came to a stop inverted.

"Damage to the engine, the main[-rotor] and the tail-rotor assemblies and drive systems was consistent with the engine delivering little [power] or no power at impact," the report said.

Laboratory examination of the helicopter's caution/warning panel showed that four warning lights — "LOW RPM," "TRANS CHIP," "BATTERY RLY" and "TRANS OIL TEMP" — were missing from the panel; the lights were not found in the helicopter wreckage.

"Inspection of the filaments of the recovered warning lights indicated that the 'FUEL LOW' and 'LITTER DOOR OPEN' lights were illuminated at impact," the report said.

Results of examination of the "GEN FAIL," "L/FUEL PUMP" and "R/FUEL PUMP" warning lights were "inconclusive." Examination of all other warning lights, including the "ENG OUT" warning light, indicated that the lights were not illuminated at impact.

The report said that the "FUEL LOW" warning light normally illuminates when 50 pounds to 75 pounds (23 kilograms to 34 kilograms) of usable fuel remain in the helicopter's fuel system. The "ENG OUT" warning light normally illuminates when engine speed decreases to about 55 percent of maximum rpm (revolutions per minute).

"The apparent non-illumination of the 'ENG OUT' warning light following the power loss might have been due to a very short time between loss of engine power and impact," the report said.

During postaccident tests, the engine started immediately and accelerated normally to idle speed. After reaching normal operating temperature, the engine accelerated normally to 35 percent torque.

"The test run [in an engine test cell] was carried out using all the accessories that were fitted to the engine in service before the accident," the report said. "The test indicated that there was no technical fault in the engine that would have prevented it from producing power before impact.

"Damage to all other helicopter systems was consistent with impact damage. The wreckage examination did not reveal any pre-impact technical fault that could have contributed to the accident. The maintenance records for the helicopter showed compliance with all applicable airworthiness directives, and all required maintenance had been carried out."

The helicopter's fuel system remained intact during the accident, except for one fuel line that fractured between the engine and a bulkhead.

"There was no evidence of fuel spillage [at the accident site] or any fuel smell in the wreckage," the report said.

Analysis of a fuel sample from the accident helicopter showed that it conformed to density specifications and was free of water and contaminants.

Investigators found a total of 40 pounds (18 kilograms) of fuel remaining in the main tank and the two auxiliary tanks. Of the total, 31 pounds (14 kilograms) were usable. The report said that this quantity of usable fuel was sufficient for eight minutes of flying — if all the remaining usable fuel was in the rear tank.

"However, the fuel was removed from all three tanks and the interconnecting fuel lines," the report said. "If fuel in the forward tanks had not transferred to the rear tank, the remaining flight time would have been less than eight minutes."

The report said that the rear tank might have become unported [i.e., the fuel might have moved away from the fuel outlets leading to the engine] during an uncoordinated flight maneuver.

"Advice from experienced helicopter pilots was that in order to obtain an unobstructed view of a landing area ahead and below, a pilot seated in the right-side pilot seat could place a helicopter in an uncoordinated nose-left, right-banked attitude," the report said. "Alternatively, while maneuvering the helicopter, he might have inadvertently placed it into an uncoordinated turn.

"With the low fuel level remaining in the rear tank, an uncoordinated flight condition might have unported the fuel outlets at the bottom of the rear tank. That could have led to air being drawn into the fuel line that supplied the engine, causing the engine to lose power. The pilot then would have been faced with conducting an approach in autorotation in adverse conditions."

The report said that reflection of searchlight illumination by fog droplets likely would have aggravated the pilot's visibility problems, causing "virtual whiteout conditions" during the autorotation.

The company's operations manual said that a minimum fuel consumption of 250 pounds (113 kilograms) per hour must be used in planning for flights in the LongRanger "regardless of weight, altitude and temperature."

The flight from Rockhampton to Yarandoo Station and return to Rockhampton would have required about two hours and 500 pounds of fuel, not including reserves. The report said, however, that 500 pounds of fuel was "insufficient" for the flight. The company's operating procedures required a minimum fuel reserve for 30 minutes of flight (i.e., at least 125 pounds of reserve fuel) during night operations. Therefore, the flight required a minimum fuel load of 625 pounds (284 kilograms). The helicopter could have been loaded with 675 pounds (306 kilograms) of fuel to depart at gross weight from Rockhampton.

"Whether the pilot miscalculated his fuel requirements or did not consider them at all could not be determined," the report said.

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The report said that if the pilot was awakened by the telephone call from CAPCOM, he might have been affected by sleep inertia during the pre-departure period and the early stage of the flight.

"Sleep inertia refers to a feeling of disorientation, mental dullness or sluggishness that occurs after awakening from a period of sleep," the report said. "In broad terms, sleep inertia may affect mood, memory, attention, concentration, cognitive processing, performance accuracy and reaction time. It is a recognized state of transition from sleep to wakefulness.

"A variety of factors can influence the effect of sleep inertia on performance. When awakening from sleep normally, the effect of sleep inertia is believed to last for less than five minutes. When abruptly [awakened], the effects have been identified as typically lasting up to 30 minutes, with some research indicating that performance can be impaired for over one hour."

The report said that even if the pilot had been affected by sleep inertia during the pre-departure period and the early stage of the flight, he would have recovered from sleep inertia after

departing from Yarandoo Station for the return flight to Rockhampton.

When the pilot reported his intention to divert the flight to Marlborough, the helicopter had been flown about 78 minutes and had used about 325 pounds (147 kilograms) of fuel.

"At that time, approximately 175 pounds [79 kilograms] of fuel would have remained, representing 42 minutes of flight time available," the report said. "It is likely that the flashing light in the Shadin fuel-management system, which was set to illuminate when 45 minutes of fuel remained, had illuminated some minutes earlier and that the pilot had used the intervening period to decide to divert, to determine his new destination and, in consultation with the paramedics, to determine the further ambulance services required for the patient."

When the helicopter arrived over the school sports field in Marlborough, about 125 pounds of fuel remained. The accident occurred 19 minutes later.

"During that time [i.e., the 19 minutes], the pilot made three attempts to position the helicopter for an approach to the sports field and one attempt to position for an approach to the road intersection," the report said. "There is no evidence to indicate whether the pilot had considered leaving Marlborough to seek a fog-free landing site."

A postmortem medical examination of the pilot indicated that he had severe calcific arteriosclerosis (i.e., coronary artery disease).

"The postmortem also found a localized area of scarring and myofiber hypertrophy consistent with ischemia [inadequate blood flow]," the report said. "The histology indicated coronary vessel disease (narrowing of the arteries causing a degree of blockage) of long standing. The changes were indicative of long-term effects (progressing over many years) of nutrient starvation to focal areas of the heart muscle, caused by significant narrowing of the critical coronary vessels responsible for supplying oxygenated blood to those areas."

The report said that the effects of the pilot's medical condition during the flight could not be assessed.

"Aviation medical opinion was that, given the presence of advanced ischemic heart disease coupled with high levels of stress, the possibility that the pilot suffered an incapacitating medical event before impact could not be ruled out," the report said. "If the pilot had suffered severe chest pain during the attempt to land at Marlborough, he might have attempted an immediate landing and lost control of the aircraft."

The report said that the accident flight was conducted as a noncommercial, "aerial work" operation.

"At the time of the accident, CASA [Australian Civil Aviation Safety Authority] classified aircraft operations in accordance with the type of flight being conducted," the report said. "Operators that carry fare-paying passengers (regular public transport and charter) are required to meet higher regulatory standards and receive a higher level of surveillance from CASA than other types of operators."

[In June 1996, CASA began a project to review and to revise the Australian Civil Aviation Regulations (CARs) and Civil Aviation Orders (CAOs). The revised legislation will be called Civil Aviation Safety Regulations (CASRs).]

The report said that in developing CASR Part 133 ["Commercial Air Transport Operations — Rotorcraft"], CASA will consider the following:

- "Aircraft certification requirements and crew (including supernumerary crew) training requirements for aerial work operations;
- "Introducing performance requirements for helicopters in line with similar requirements for [airplanes];
- "Introducing rules specific to certain types of aerial work operations;
- "Reintroducing minimum fuel requirements; and,
- "The issue of 'persons directly involved' (including patients whose travel has been requested by a medical officer and an escort, usually a member of the patient's immediate family) traveling on aerial work flights."

Based on the findings of the investigation of the LongRanger accident, ATSB recommended that CASA "consider proposing an increase in the operator's classification and/or the minimum safety standards required for organizations that transport their own employees or similar personnel (for example, contractors, personnel from related organizations or prisoners, but not fare-paying passengers) on a regular basis. This recommendation [Air Safety Recommendation R20010195] applies to all such operations, regardless of the takeoff weight of the aircraft involved."

In a response issued Feb. 1, 2002, CASA said that it "is presently reviewing the standards contained within the existing [CARs] and [CAOs] with regard to the classification of operations. The input and recommendations contained within Air Safety Recommendation R20010195 will be taken into consideration and addressed as part of this project. The outcome of the review will determine which category employees (and similar personnel such as contractors) are placed and the standards that will apply to their transportation in aircraft."♦

[FSF editorial note: This article, except where specifically noted, is based on the Australian Transport Safety Bureau final report on Occurrence No. 200003130. The report comprises 12 pages.]

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