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Hughes 369FF Strikes Power Lines During Approach to Landing Site

The accident report said that the pilot probably was concentrating on flying the approach and was looking away from the power lines. Because the power lines were not equipped with high-visibility devices, determining the distance between the helicopter and the power lines would have been difficult, the report said.

FSF Editorial Staff

Shortly after 1013 local time March 28, 2000, a Hughes 369FF struck high-tension power lines over a settlement near Lake Manapouri, New Zealand. The helicopter descended out of control, struck the ground and rolled down a bank toward the lake. The pilot and all four passengers were killed; the helicopter was destroyed.

The New Zealand Transport Accident Investigation Commission (TAIC), in its final report on the accident, said, "The pilot was probably concentrating on flying her approach and looking towards the intended landing area and away from the power lines when the helicopter flew around the base turn and struck the conductors [the power-line wires that transmit electricity]. … After striking the wires, the helicopter was uncontrollable."

There were 24 26-millimeter (one-inch) diameter conductors, each of which carried 220,000 volts of electricity. The conductors were held in pairs about six meters (19.7 feet) apart. The span of wires over the settlement of West Arm was about 1,179.5 meters (3,870 feet) long, supported by four towers. Eight nine-millimeter (0.4-inch) diameter ground wires (also called earth wires) were strung about six meters above the conductors.

The power lines were marked on maps and aeronautical charts of the area. A warning printed on the aeronautical chart said that the power lines were 885 feet to 1,285 feet (290 meters to 422 meters) above sea level — about 285 feet to 685 feet (94 meters to 225 meters) above the lake.

"The size and number of conductors in the power lines made [them] relatively easy to detect, but the long span between towers made it difficult to correctly judge distance from them," the report said. "Had high-visibility devices been fitted to the power lines, the pilot may have been able to more accurately judge her distance from the wires."

The helicopter, operated by Fiordland Helicopters, departed from the operator's base at 0952 on a charter flight to Te Anau

Aerodrome to pick up four members of a tour group who had missed their bus and wanted to meet the remainder of the group at West Arm at the western end of Lake Manapouri. The pilot was to fly the four tourists to one of three helicopter landing pads at West Arm, refuel the helicopter and return to the operator's base.

The accident report said that the owner of Fiordland Helicopters told investigators that he had briefed the pilot about the flight and that, after she started the engine, he had "leaned into the helicopter and reminded the pilot 'to watch those wires,'" referring to the power lines that crossed the eastern approaches to West Arm.

"The pilot acknowledged the owner's comment," the report said.

The pilot landed the helicopter at Te Anau Aerodrome at 0955 and refueled, then boarded the passengers. The helicopter departed from Te Anau at 1003 and overflew West Arm at 1013. The pilot then flew the helicopter through part of a valley, descended and turned left to fly downwind along the Spey River. As the helicopter approached the mouth of the river, the pilot turned left again toward the landing area.

"As [the helicopter] turned through a northerly heading, the main rotors struck one pair of conductors of the high-tension power lines spanning West Arm," the report said. "The helicopter then fell, out of control, impacted the ground and rolled down a small bank, coming to rest on its side near the edge of the lake."

The pilot had accumulated 1,498 flight hours, including 904 flight hours in airplanes and 594 flight hours in helicopters. Her helicopter flight time included 455 flight hours in Hughes 369 helicopters, of which 429 flight hours were in Hughes 369FF helicopters. She received her commercial helicopter rating in mid-1995 and began working for Fiordland Helicopters in May 1997 as a pilot, helicopter crew member and vehicle driver.

"The owner was training her to become a fully operational utility pilot," the report said. "The owner said the pilot was competent in most aspects of operating a utility helicopter, including the carriage of passengers and confined-area operations. … The pilot was held in high regard by the owner, other local pilots and previous work associates. She was considered to be motivated to becoming an operational helicopter pilot in the Fiordland region. She was known to be conscientious in her work."

The pilot was described as healthy, alert and in good spirits the morning of the accident. She had not worked the day before the accident and had flown 1.45 hours in the previous seven days and 7.05 hours in the previous 28 days. Logbook entries did not record the last time she had landed a helicopter at West Arm but indicated that she had flown in the area as recently as Jan. 15, 2000.

The owner said that he believed the pilot was familiar with operations near wires and that she had been trained that, "when crossing wires, to always fly over a pole or pylon, thereby ensuring positive separation from the conductors and earth wires." He said that she had accompanied him during aerial surveys of area power lines after a snowstorm in 1998.

The pilot, a former bicycle racer, had bicycled in the West Arm area the day before the accident and had taken several photographs of the scenery along her route, with the power lines "featured prominently" in many of the photos, the report said.

The accident helicopter was manufactured in 1983, one year before Hughes Helicopters became a subsidiary of McDonnell Douglas and Hughes 369FF models were marketed as MD530Fs. The helicopters, which had higher engine ratings and longer rotor blades than previous models, were designed for operations at high altitudes and high ambient temperatures.

The accident helicopter had accumulated 6,585 flight hours since its manufacture and 33 hours since its most recent inspection, a 300-hour inspection competed Feb. 29, 2000. The engine was an Allison 250-C30 with 4,715 operating hours. The starter motor and voltage regulator had been replaced since the last scheduled engine maintenance. The owner said that the helicopter was "fully serviceable" the morning of the accident, and the helicopter was calculated to have been below its allowable weight and within center of gravity limits.

Visual meteorological conditions prevailed at the time of the accident, with a high overcast, clouds at the tops of nearby mountains, no surface wind and a slight westerly wind aloft. A fisherman who witnessed the accident said that, although the day was bright, there were no shadows or glare.

A video camera operated by the right-front-seat passenger was found at the accident site. A 5 1/2-minute recording of the flight included footage of the final approach and the flight into the power lines.

"The recording showed that the flight to West Arm proceeded without incident," the report said. "[T]he recording showed [the helicopter] flying down Spey River in a moderate left turn at about the same level as the center of the power line span … . As the helicopter moved away from the river in the turn, the angle of bank was increased slightly. The recording showed [the helicopter] flying between the conductors and earth wires to fly tangential to the second pair of conductors. After entering [between] the power lines, the helicopter descended slightly and then rolled rapidly to the right, at which point the recording stopped."

Data from the helicopter's global positioning system (GPS) showed that the helicopter was flown over the power station switchyard at a groundspeed of about 85 knots and continued on a westerly heading for about 500 meters (1,641 feet) before

entering a left turn. The turn rate and the groundspeed decreased as the helicopter approached the river and was flown on a short downwind leg. The helicopter entered another left turn about 200 meters (656 feet) west of the mouth of the river at a groundspeed of about 70 knots.

The accident occurred on a small peninsula about halfway between the mouth of the river and two ferry-boat jetties. The helicopter struck a pair of conductors, then traveled about 40 meters (131 feet) before striking the ground nose down with a force strong enough to "break the tail-rotor pedals off and lodge them in the ground," the report said. The aluminum wrapping around the conductors was stripped away, and graze marks were observed on the high-tensile steel cores.

The pilot and the two rear-seat passengers were ejected from the helicopter; their bodies were found near the main wreckage. The two front-seat passengers remained in the fuselage. Seat belts for the pilot and right-rear-seat passenger apparently failed "as a result of the disruption to the fuselage structure or massive overload," the report said. The seat belt for the left-rear-seat passenger was intact and fastened, but the report said that "there was significant deformation of the surrounding cabin area to permit the passenger to slide from the harness."

Three main-rotor blades, the left-front door and support pillar, a headset and sheets of paper from aviation documents were scattered between the damaged section of the power lines and the initial ground-impact point. The tail-rotor assembly had separated in front of the vertical stabilizer and lay near the impact point, and the fourth main-rotor blade lay about five meters (16 feet) north of the impact point. The fifth main-rotor blade was not found. The four main-rotor blades that were found had separated from the mast at their blade roots; the missing blade had separated at the blade-strap pack.

The report said that three blades displayed marks "consistent with having struck wires. The marks commenced between 1.5 [meters] and two meters [4.9 feet and 6.6 feet] in from the tips and ran outboard."

The forward section of the fuselage was "severely disrupted" by the initial impact, the report said. The engine had come loose from the engine mountings, but electrical attachments and mechanical attachments held the engine in the engine bay.

An examination of the wreckage revealed no evidence of pre-impact abnormalities, and positions of switches on the instrument panel were consistent with normal flight. The report said that the integrity of the flight controls "was established through to the swash plate, where the pitch-change links showed indications of overload." Further examination of the engine revealed partially incinerated debris on the compressor and stator blades — an indication that the engine was functioning when the helicopter struck the ground. Markings on the outer race of the over-running clutch indicated that the engine was providing power when the main rotors struck the conductors. The fuel filter and a fuel sample showed no evidence of fuel contamination.

A review of fatal aviation accidents in New Zealand showed that most power-line strikes involved local, 11,000-volt conductors. Two fatal accidents, however, involved aircraft that struck high-tension power lines; in each instance, the pilots knew about the presence of the power lines before the accident occurred. Data compiled by the New Zealand Civil Aviation Authority (CAA) showed that, between 1978 and April 2000, 96 occurrences were reported involving "wires, poles, fences or the like." Of that number, 68 occurrences (about 70 percent) involved power lines or telephone lines; those occurrences resulted in 35 fatalities.

CAA had proposed in May 1992 that wires be marked in an effort to reduce the number of aviation wire strikes.

"The [proposal] drew some criticism, in particular for the cost of marking all the wires identified as posing a significant hazard for air navigation," the report said. "Further, a contention was put forward that there may have been a possible legal impediment affecting access to already established power lines."

A panel reviewed the proposal, and at the time of the accident investigation, a second proposal was being drafted.

"The new [proposal] concerned the assessment of new or altered overhead wires or cables and their effect on aircraft navigation," the report said. "The assessment of existing structures was to be dealt with under a later amendment to Civil Aviation Rules. The criteria for the marking of wires would, however, possibly be the same for new or existing power lines. CAA advised that before the accident, the power line struck by [the accident helicopter] would not have met the criteria for marking. Despite the length and height of the span, and the close proximity of the three landing pads, CAA contended that there was insufficient traffic flying past the power lines to warrant line-marking."

An aerial inspection of the accident site was conducted the day after the accident at a similar time of day.

"The conductors were easily seen from several hundred meters away," the report said. "Although the sun was almost directly ahead of the pilot as she flew down the river, it was about 30 degrees above the horizon. With the helicopter flying essentially level, and with the sun partially obscured by the high overcast conditions, the pilot's view of the power lines should not have been inhibited."

Nevertheless, the report said, "assessment of distance was difficult. The observers generally believed that the conductors were closer than they actually were. Only by locating the towers and monitoring the conductors during the approach was a

reasonably accurate assessment of distance possible. During post-accident inspection of the power lines from a helicopter flying along the conductors, a power company observer who was on board reported that the pilot of that helicopter had difficulty maintaining a constant distance from the wires and had to break away several times."

The accident investigation resulted in two recommendations by TAIC that CAA should:

- "Review the planned criteria for the marking of overhead wires and structures to give increased priority to large spans, like West Arm"; and,

- "Include 'established structures' in the [proposed rule] on assessment of new or altered structures that comprise overhead wires or cables, and … expedite the production of a draft final civil aviation rule."

CAA said that both safety recommendations would be adopted.

Martyn Gosling, CAA communications coordinator, said in February 2001 that, while the rule-making process was continuing, CAA, the power transmission companies and the aviation industry were working to identify 20 spans that constituted the greatest risk to aviation safety.[1] As many of those spans as possible were to be marked before the rules were finalized, Gosling said.

"About 2 percent of all main wires would need to be marked through this process, and … only 10 percent of fatal wire strikes involve main lines," he said. "It would be impractical to mark every feeder line, or long-forgotten telephone lines in the bush. We are looking at other methodologies for reducing wire strikes in that area … [such as] training for wire alertness among pilots who have valid reasons for very low[-altitude] operation and through some possible technological advances where aircraft could be fitted with equipment that detected the radiation from lines, or where lines are included in an aircraft's GPS database. In other words, we see marking wires as only a very small part of the issue, and there is much to do."♦

[Editorial note: This article, except where specifically noted, is based on New Zealand Transport Accident Investigation Commission report 00-005 *Hughes 369FF, ZK-HJN, wire strike, West Arm, Lake Manapouri, 28 March 2000.*]

Note

1. Gosling, Martyn. Personal correspondence with Werfelman, Linda. Alexandria, Virginia, U.S., February 23, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

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