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Helicopter Loses Power After Exhausting Fuel Supply During External-load Operation

U.S. National Transportation Safety Board said pressure to meet a work schedule was a factor in the pilot's failure to plan and monitor the helicopter's fuel load.

FSF Editorial Staff

On March 3, 1996, a McDonnell Douglas (formerly Hughes) 500E Model 369E helicopter was damaged substantially during a forced off-airport landing after losing engine power while engaged in construction work in Manhattan, Kansas, U.S. The pilot was not injured, but a crewmember sustained serious injuries.

The U.S. National Transportation Safety Board (NTSB) determined that the probable cause of the accident was the pilot's improper planning and decisions regarding the helicopter's fuel supply. The NTSB also concluded that pressure to meet a work schedule was a contributing factor.

The NTSB accident report said that the pilot, 41, had a commercial pilot certificate and an instrument rating issued by the U.S. Federal Aviation Administration. He had 6,533 hours of flight experience in rotorcraft, including 3,597 hours in the Hughes 369E.

The helicopter had a total of 4,698 hours in service, including 78 hours since completion of its last scheduled maintenance inspection about a month before the accident. The NTSB accident report said that no evidence was found of a pre-existing failure or malfunction of the airframe, engine, fuel system or flight controls.

Weather conditions included a clear sky and 10 miles (16 kilometers) visibility. The temperature was 42 degrees Fahrenheit (six degrees Celsius). The wind was from 130 degrees at 10 knots, gusting to 18 knots.

The pilot said that the helicopter was engaged in replacing 720 miles of telephone cable throughout the state of Kansas.

"The company was running behind on their power-line installation contract due to unforeseen delays," said the report. The helicopter was operated by Haverfield Corp. of Miami, Florida, U.S.

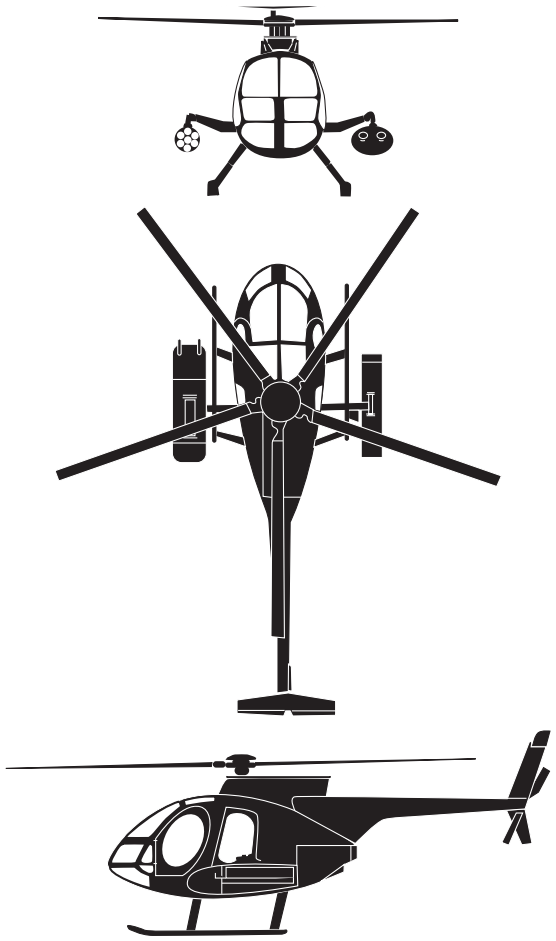
The pilot was working with one flight crewmember aboard the helicopter and members of a ground crew to replace cables suspended from telephone poles in a congested area.

The report said that the pilot's job was to hover the helicopter close to each pole while the flight crewmember disconnected the cables so that they could be removed by the ground crew. Following removal of the cables, subsequent flights were required to install fiber-optic cables on the poles. The flight crewmember worked from a platform attached to the helicopter; the helicopter also was equipped with an external cargo rack.

The pilot said that the crew was assigned two days to complete the replacement of cables on 48 poles in the congested area.

"This job was to be worked only on Saturday and Sunday," said the pilot.

Disconnection of the cables was completed by 1230 on the first day, but difficulties experienced by the ground



McDonnell Douglas 500E Model 369E

The McDonnell Douglas (formerly Hughes) 500E was introduced in 1982. The helicopter has a longer and more streamlined nose, more cabin space and a higher usable-fuel capacity than its predecessor, the Model 500D.

The MD 500E has a fully articulated, five-blade main rotor, a two-blade tail rotor and a 420 shaft horsepower (313 kilowatt) Allison 250-C20B turboshaft engine. A four-blade tail rotor and a 450 shp (336 kW) Allison 250-C20R turboshaft engine were offered as optional equipment for the helicopter beginning in 1988. The Allison 250-C20B and 250-C20R engines both have a maximum-continuous-power rating of 350 shp (261 kW).

The helicopter has a forward bench seat for the pilot and two passengers, and a rear bench seat for two or four passengers. Maximum normal takeoff weight is 3,024 pounds (1,361 kilograms). Maximum cruising speed at sea level is 134 knots (248 kilometers per hour). Service ceiling is 15,097 feet (4,575 meters). Hovering ceiling in ground effect is 8,550 feet (2,590 meters). Range at sea level is 233 miles (431 kilometers).♦

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

crewmembers delayed the installation of the fiber-optic cables until the afternoon of the next day.

The pilot stated that, because of this unexpected delay, he believed that completing the job within the allotted time was "a virtually impossible task."

The report said that standard operating procedure was for the helicopter crew to complete work on six poles during each flight and to refuel and re-equip at the loading zone (LZ) between flights. The pilot said that he normally took off with approximately 300 pounds (135 kilograms) of fuel because of weight-and-balance considerations.

The helicopter took off for its third flight of the second day at 1435. The pilot said, "We departed [from] the LZ with a normal fuel and material load, the same as I have worked since the start of this job in December 1995." He said that the helicopter had almost 350 pounds (158 kilograms) of fuel aboard.

The pilot said that one minute of flying time was sufficient to reach the first of the six poles on which they planned to work during the third flight. Local law-enforcement officers blocked nearby road traffic while the helicopter crew and ground crew began to install the fiber-optic cable on the poles. The pilot said that his flight crewmember "worked as smoothly and [as] fast as he could." He said that six to eight minutes normally were required to complete work on one pole.

The crews completed work on four of the poles, then moved to the fifth pole. The pilot said that when the helicopter arrived at the fifth pole, he noticed that the helicopter's fuel supply was just under 150 pounds (68 kilograms). He said that this was "normal and not alarming enough to catch my attention."

"At the sixth structure, a quick glance at the [fuel] gauge [showed] just under 100 pounds [45 kilograms], still normal," said the pilot. The report does not say how much time the helicopter loitered at the sixth pole. The pilot stated that his flight crewmember had almost finished his work on the pole when the helicopter's Allison 250-C20B turboshaft engine lost power. The helicopter was about 75 feet (23 meters) above the ground.

The flight crewmember said that he was on the edge of the external platform when he heard the pilot say on the intercom, "Uh, oh." He then felt the helicopter begin to descend. The report said that the flight crewmember did not know what had happened and that he was "more or less going along for the ride."

The power loss occurred at 1558 hours local time, 1.6 hours after the helicopter's engine was started in preparation for the flight, said the report.

The pilot said that he used collective control to maintain altitude and applied right cyclic control to maneuver the helicopter clear of the pole and the wires below the main rotor. He then lowered the collective in an attempt to increase rotor speed. The pilot said that the helicopter was unable to achieve any

lift and that he was able to control only the helicopter's angle of descent. He said that before touchdown, he applied full collective in an attempt to cushion the landing.

The pilot said, "[The] aircraft slowed, but I still felt it would be a hard landing." He said that he then banked to the right in an attempt to protect the flight crewmember, who was still strapped to the end of the work platform attached to the left side of the helicopter. The pilot said that he wanted to confine the damage on the right side of the helicopter, to avoid crushing the work platform and to prevent the rotor blades from flexing to the left and striking the flight crewmember. The helicopter came to rest, tilted 40 degrees to the right, on the driveway of an office building.

The pilot said, "I looked down to find [the flight crewmember] in the clear, laying back and smiling at me. I exited the machine, shut the generator down on the right side of the [helicopter] and returned to the left side to attempt to disconnect [the flight crewmember's] harness, when police arrived."

The accident was witnessed by one of the law enforcement officers engaged in traffic control at the work site.

"I was approximately 250 yards [228 meters] south of the helicopter's position," said the officer. "My attention was drawn to the helicopter when I heard what I believed to be a change in the sound of the rotors.

"I turned to see the helicopter at pole-top level [about] 75 feet [23 meters]. The helicopter was in a pronounced nose-up attitude, and a distinct cloud of black smoke [was] behind the helicopter.

"The helicopter was oriented facing east-southeast, with the tail to the west-northwest. I next saw the helicopter suddenly list violently to its right side and turn more to a true south direction.

"The helicopter fell to the ground and out of my view. I estimate the total time from when I first looked to the helicopter until it fell out of sight to be about five seconds."

The witness and another law enforcement officer then drove to the accident site. "When we arrived, the pilot was out of the helicopter and was giving aid to the line man who had been working on the platform," said the witness.

The report said that both the pilot and the flight crewmember complained of back pain and that they were transported to a hospital. The pilot was treated and released; the flight crewmember was transferred to a medical center for treatment of a broken pelvis.

"A continuity check of the flight control system (collective, cyclic and directional) was completed with no preimpact discrepancies noted," said the report. "An inspection of the collective/throttle control linkage to the governor/fuel-control system showed evidence of damage from impact to the right side of the helicopter.

"The tail-boom control rod remained attached to the tail-rotor gearbox bellcrank and, when moved, showed no damage or malfunction of the tail-rotor pitch-control system. The main-rotor system (hub assembly) showed minor damage with lead/lag excursions and excessive blade flapping (chordwise). The hub assembly had impact marks consistent with main-rotor-blade strikes." All five main-rotor blades were bent upward during the accident but remained attached to the hub.

"The drive system was examined," said the report. "The overrunning clutch functioned when inspected. From the engine to the transmission drive shaft, there was no evidence of damage. The main-rotor system and tail-rotor drive shaft rotated when the drive shaft was turned by hand. The tail-rotor gearbox rotated in both directions and showed no evidence of lockup or ratcheting.

"All engine fuel and air lines were inspected, and no evidence of damage or looseness was observed," said the report. "No mechanical failure [or] malfunction of the airframe, power plant, fuel system or flight controls was discovered."

The main fuel tank and the auxiliary fuel tank were not damaged in the accident, and there was no evidence of leakage; the auxiliary tank was empty, said the report.

"A member of the ground crew stated they did not use the auxiliary tank due to the payload," said the report. "The main fuel tank showed no evidence of damage or leakage, and contained only 20 ounces [600 milliliters] of fuel. … Two teaspoons [10 milliliters] of fuel were found in the fuel control line [attached] to the spray nozzle. The fuel-vent system was inspected to verify that the vent was open. No restriction was noted."

Tests of the fuel-quantity sending unit disclosed no abnormalities.

"At about 50 pounds [23 kilograms], the low-fuel warning light illuminated on the annunciator panel," said the report.

In the section of the report soliciting recommendations on how the accident could have been prevented, the pilot said, "Pilot and crew pushing to get job completed. Pilot failed to notice fuel level and starved engine."

The NTSB concluded that the probable cause of the accident was "improper planning/decision [making] by the pilot, which resulted in fuel exhaustion due to an inadequate supply of fuel." The safety board said a factor contributing to the accident was "pressure to meet a work schedule."♦

Editorial note: This article is based on information included in the U.S. National Transportation Safety Board's factual report on the accident, NTSB identification CHI96FA099. The 52-page report contains diagrams, black-and-white photographs and appendixes.

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