

2

File No. 2-0039

CIVIL AERONAUTICS BOARD

AIRCRAFT ACCIDENT REPORT

ADOPTED: December 10, 1958

RELEASED: December 12, 1958

SIKORSKY S-58B HELICOPTER, N 861,
NEAR GRAND ISLE, LOUISIANA, FEBRUARY 1, 1958

SYNOPSIS

During a night takeoff from an offshore oil-drilling platform, a Sikorsky helicopter, owned by the Humble Oil and Refining Company, experienced control difficulties and was crash landed in the Gulf of Mexico, nine miles southeast of Grand Isle, Louisiana, February 1, 1958. One of the two pilots and three of the nine nonrevenue passengers were drowned after leaving the sinking aircraft. The survivors suffered chemical skin burns from gasoline released from the fuel tanks.

The flight, a company scheduled pickup of passengers and cargo, had been routine until start of the takeoff for return to Grand Isle. Uncontrollable and increasingly rapid right turning began on completion of the center of gravity check just after liftoff. It continued while the helicopter drifted downwind into the water.

During the hovering interval the occupants heard a loud metallic sound at the aft end of the aircraft. The immediate loss of directional control indicated a structural failure or control malfunction. This was confirmed by the disclosure, during examination of the recovered helicopter, of a mechanical failure in the tail rotor drive mechanism. The failed parts were studied by technical personnel of the Board and the manufacturer. It was determined that the failure occurred as a result of overloading the tail rotor drive system. Consequently, the manufacturer has initiated inspection procedures in an effort to detect tail rotor drive system damages when overload occurs.

Investigation

The accident occurred immediately alongside a landing platform, known as Platform 803L, 9.1 miles southeast of Grand Isle, Louisiana. The dimensions of the platform are 70 feet x 70 feet and it is about 75 to 80 feet above mean sea level. Time of the accident was two minutes after midnight and local ceiling and visibility were unlimited with wind from the west-northwest at 25-30 knots, a velocity well below the operator's maximum limits. Six- to eight-foot swells were running and air and water temperatures were approximately 61 and 66 degrees F., respectively.

The aircraft, with the two pilots and five passengers, departed Humble Heliport, Grand Isle, at 2334^{1/2} January 31, 1958, arriving on Platform 803L

^{1/} All times are central standard based on the 24-hour clock.

at 2342. This flight was normal in all respects and there were no apparent mechanical difficulties. The engine was stopped and the aircraft loaded for departure with 9 passengers and 585 pounds of cargo. The weight and balance report indicates the gross weight at takeoff to have been 11,835 pounds, which is 865 pounds less than the authorized gross weight of 12,700 pounds.

After starting and warmup of the engine, takeoff was commenced with the aircraft on a northwesterly heading. Shortly after takeoff a sound was heard, similar to metal striking metal. This occurred while the pilot hovered the aircraft at 8 to 10 feet above the platform checking the center of gravity position before continuing flight. Almost immediately the helicopter started turning slowly to the right. After a movement away from and back to the platform the turn became rapid and the helicopter drifted southeast approximately 100 yards before it struck the water in a level, upright attitude. Shortly afterwards the left float separated and the helicopter capsized to the left.

All passengers left by the main door and the pilots by the right cockpit window. There were no injuries as a result of the emergency landing. The pilot seats were equipped with safety belts and shoulder harnesses and the passenger seats had Davis-type safety belts. The pilots wore Navy-type inflatable lifejackets and the passengers wore Topatco lifejackets, style No. 207. The former is the "Mae West" with leg straps; the latter is a kapok-filled vest-type jacket without collar or leg straps.

The company shore station at the Grand Isle Heliport was advised of the accident and search and rescue action was immediately initiated. Five helicopters and a tug owned by Humble were dispatched to the scene.

All survivors clung to the undamaged right pontoon as directed by the pilot. When the pontoon started to break up under impact of heavy seas, persons who had been clinging to it swam free lest they be drawn down. The high winds and rough seas quickly dispersed the group and four subsequently drowned, possibly as a result of exhaustion. Some of the seven survivors reached and boarded life rafts which had been cast adrift from the well-lighted drilling platform.

Salvage operations to recover the sunken helicopter were hampered by continuing winds and waves. However, recovery was completed on February 4 and the wreckage was transported to the Grand Isle Heliport for examination. Study of the wreckage disclosed that the tail cone had been damaged by the tail rotor drive shaft which was badly bent and the shaft had battered the tail cone structure as it rotated. All tail rotor drive shaft bearings inside the tail cone had been broken from their fuselage frame supports and the disconnect coupling at the pylon folding station had been badly damaged when it disengaged under load prior to striking the water.

The aft fuselage received sufficient handling damage during recovery operations to prevent precise determination of the manner and direction of the tail section failure.

All shafts in the tail rotor drive system had elongated collet holes at each end. The Nos. 2 and 3 shafts had slight bends and were out of alignment. The rubber coupling connecting the Nos. 3 and 4 shafts had failed in the rubber shock pads.

The condition of the tail rotor blades gave no indication that they were rotating when the aircraft struck the water.

No evidence was found to indicate that the engine was malfunctioning or incapable of normal operation and power output at the time of the accident. Witnesses substantiated this observation by stating there was no apparent power loss or loss of engine control.

Maintenance records of the helicopter indicate that it was properly maintained. There were no logged discrepancies or conditions which would have contributed to the failure or malfunction of the tail rotor drive mechanism.

The helicopter had received a 550-hour periodic inspection on January 9, 1958. Among many other items, this inspection covered the following: Lubrication of tail rotor shaft bearings; inspection of tail rotor pitch system; inspection of tail rotor blades; inspection of tail rotor hubnut and blade stops; inspection of tail rotor drive shaft bearing brackets for cleanliness, cracks, security, bearing for overheat; rubber couplings inspected for damage, separation, and deterioration; tail rotor gear box and intermediate gear box inspected for oil level, leakage, alignment, and security; and tail rotor drive shaft disconnect coupling inspected for cracks, damage, security, condition of teeth, spring for tension and movement. The aircraft was flown approximately 26 hours between this inspection and the accident.

Rotor Aids, Inc., the operating and maintenance agency for Humble Oil, has operated helicopters for 10 years with operations including crop dusting, forest fire suppression, charter, aerial photography, mapping in Alaska, air-sea rescue, and, for the last three years, transportation of personnel and equipment for offshore oil drilling. Records of Rotor Aids, Inc., show more than 350,000 passengers transported and over 100,000 individual flights in its 10 years of helicopter operation. At the time of the accident, operations averaged more than 1,000 hours and 13,500 passengers per month. The company employed 37 qualified pilots and 30 qualified mechanics in its operation of the 21 helicopters. Investigation of this accident brought to light the commendably high quality of operating and maintenance procedures as practiced by Rotor Aids, Inc.

Analysis

It is evident that the accident resulted from a loss of power to the tail rotor, leaving the pilot without directional control of the aircraft. Nearly all of the components of the tail rotor drive system received some kind of damage before impact with the water. However, no evidence of fatigue was noted and all failures were of the type associated with the transmission of excessive power through the tail rotor drive system.

The most significant items of damage were elongated collet holes in all drive shafts, broken bearing hangers, and corkscrewed No. 3 and No. 4 drive shafts. During tests with a tied down S-58 helicopter, on which excessive loads were applied through the tail rotor drive system, similar damage was produced plus slight bends in the tail rotor blades which, though not obvious to visual inspection, were sufficient to increase markedly the "parasite drag horsepower" at normal r. p. m.

The fact that the damage found on N 861 was typical of overload damage and that similar damage resulted from overload tests on an actual installation indicates conclusively that the accident to N 861 was the result of a tail rotor drive system overload sometime during operation of the aircraft.

The highest tail rotor loads occur at maximum weight in hovering turns, climbing turns, and during sideways flight. These conditions are slightly more critical with floats, as installed on N 861, than with landing wheels. High loads can also be transmitted through the drive system by any malfunction (jerking or grabbing) in the hydromechanical clutch during starting. Large sideways gusts can likewise cause excessive loads in the tail rotor drive system.

The copilot stated that no sudden maneuvers were attempted and that just as the pilot started to lower the nose and add power at the end of the center of gravity check the uncontrollable turn started. It appears that the high loads imposed by those conditions merely set off the sequence of destruction that occurred because previous excessive loads had damaged and weakened the tail rotor drive system. As a result of this accident, the manufacturer is in the process of issuing inspection data to all operators designed to ensure detection of tail rotor drive system damage due to overload.

The evidence indicates that at the time of the accident the sea was rough and breaking. Accordingly, it would be expected that exhaustion of the passengers and crew could result from combatting the heavy seas. Furthermore, the water temperatures alone were such that exposure of dressed persons for 50 minutes could be expected to result in the collapse of some otherwise physically active and healthy individuals. Collapse from exhaustion and/or exposure may be accentuated by shock which is in turn affected by fear and apprehension. The design of the lifejackets used is such that in the event of physical collapse the head is not supported out of water.

Conclusion

Since the conditions reported for the last takeoff should not have been sufficient to overload an undamaged tail rotor drive system, it must be concluded that earlier undetected damage had occurred which either weakened the system or created additional loads in the tail rotor drive system. Either or both of these events caused the failure under conditions imposed by the final takeoff. The likelihood of a recurrence of the failure will be rendered remote by inspection procedures being developed by the manufacturer. The Civil Aeronautics Board has been advised by the manufacturer that this inspection data will be disseminated to all operators by information circulars as soon as possible.

As a result of this investigation the operator is attaching a whistle and flashlight to each life preserver. He is also experimenting with the towing of life rafts by rescue helicopters during similar emergencies. The Board has not fully established whether a lifevest design, which would offer more complete support of the head in the event of incapacitation, would materially affect the prospects of survival under the conditions encountered in this accident. However, the survival gear provisions of the Civil Air Regulations are being reviewed in the light of this accident in order to determine whether amendment of life-saving equipment requirements is in the public interest.

Probable Cause

The Board determines that the probable cause of the accident was the failure of the tail rotor drive system during takeoff, induced by previous undetected excessive loads.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

/s/ G. JOSEPH MINETTI

/s/ LOUIS J. HECTOR

S U P P L E M E N T A L D A T A

Investigation

The Civil Aeronautics Board was notified of the accident soon after occurrence. An investigation was started immediately in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

Owner and Operator

The aircraft was owned by the Humble Oil and Refining Company, a private corporation engaged in the exploration, production, refining, and sale of petroleum. This helicopter, and nine others, were used to transport company personnel between offshore oil-drilling platforms, located in the Gulf of Mexico, and the company private heliport at Grand Isle, Louisiana. The Humble Oil and Refining Company, whose main offices are located in Houston, Texas, engaged Rotor Aids, Inc., of Ventura, California, and Grand Isle, Louisiana, to furnish operating and maintenance personnel.

The Aircraft

N 861, a Sikorsky, model S-58B, serial number 58456, was manufactured in January 1957. The engine, a Curtiss-Wright, model R-1820-989C9HE2, serial number 505853, had a total of 198 hours since new. The four main rotor blades, serial numbers 58-M-6538, 58-M-6608, 58-M-6562, and 58-M-6621, had total times of 576, 576, 223, and 69 hours, respectively, with 576, 576, 136, and 4 hours, respectively, since overhaul. The four tail rotor blades, serial numbers 58-V-5221, 58-V-5182, 58-V-5218, and 58-V-5151 all had total time of 76 hours, 27 minutes, and the same since overhaul. The helicopter had a total time of 576 hours, with 76 hours since overhaul and 40 minutes since line inspection.

Pilots

Edgar E. Eskridge, age 42, was employed by Rotor Aids, Inc., January 12, 1951. He held a currently effective airman certificate with privileges of commercial pilot. His ratings were airplane single- and multi-engine land, instrument, helicopter, and Sikorsky S-58. His flying hours totaled 5,751, of which 3,751 were in helicopters and 170 in the type involved. His last physical examination was passed, no limitations, on March 24, 1957. Helicopter flying time last 30 days: 21 hours, day and 12 hours, night.

Copilot Donald R. Morgan, age 27, was employed by Rotor Aids, Inc., July 1, 1957. He held a currently effective airman certificate with privileges of commercial pilot. His ratings were airplane single-engine land and helicopter. His flying hours totaled 1,317, of which 773 were in helicopters and 19 in the type involved. His last physical examination was passed, no limitations, on May 9, 1957. Helicopter flying time last 30 days, 26 hours, day, and 13 hours, night.