



# FRACTURED BLADE

Accident investigators traced the fatal crash of an AS 350D to a fatigue fracture in a power turbine blade.

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The fatigue fracture of an Aerospatiale AS 350D power turbine blade caused a loss of engine power that led to the May 24, 2008, fatal crash of an Island Express Helicopters air taxi flight on Santa Catalina Island off the coast of California, the U.S. National Transportation Safety Board (NTSB) says.

One passenger was killed in the accident, along with the pilot and another Island Express employee; the three other passengers received

serious injuries. The helicopter was destroyed.

The accident flight began at 0907 local time, when the helicopter left the Queensway Bay Heliport in Long Beach, California, to transport the four passengers to Two Harbors in Avalon on Santa Catalina Island. After departure from Long Beach, the pilot “reported via radio that they were mid-channel at 0914 and that they were on final to land at 0919,” the NTSB said in the final report on the accident.

Witnesses said that they had seen the helicopter approaching the island from the north at about 300 ft above ground level (AGL). As it neared the landing site at Two Harbors, they heard a “pop” and saw flames from the back of the engine. The helicopter then descended, struck the ground and burst into flames.

One of the surviving passengers said that just after the popping sound, the pilot told the passengers that he intended to conduct an autorotation.

"Since the pilot stated to passengers that he was going to autorotate, it is likely that the helicopter experienced a loss of power after the loud pop," the report said.

"During the descent, the pilot had to clear numerous obstacles, including buildings and power lines, to reach an open field located beyond the obstacles but short of the normal landing area. ... Because of the relatively low altitude at which the loss of power occurred, it is likely that the accident pilot had to trade rotor rpm to maintain the altitude needed to clear the obstacles and reach the open field. This would have resulted in a lack of sufficient rotor rpm to arrest the helicopter's descent rate as it approached the ground."

### First Flight of the Day

The accident flight was the pilot's first flight of the day, on his 14th consecutive duty day.

He held a commercial pilot certificate with a rotorcraft helicopter rating and an instrument rating, along with a flight instructor certificate with a rotorcraft helicopter rating. U.S. Federal Aviation Administration (FAA) records showed that the pilot had failed his first practical test for the flight instructor certificate in April 1998 because of unsatisfactory performance of a straight-in autorotation; the following month, he passed his second practical test and was granted the certificate.

## Aerospatiale AS 350

**T**he Aerospatiale (now Eurocopter) AS 350 is a light five/six-seat utility helicopter first flown in 1974.

The first versions to be marketed were AS 350Bs, powered either by an Avco Lycoming or a Turbomeca Arriel turboshaft engine. The AS 350C was first produced in 1978 and superseded later the same year by the AS 350D, marketed only in North America.

The AS 350D is equipped with an Avco Lycoming LTS 101-600A-2 engine and a rotor system of three fiberglass blades. Its maximum takeoff weight is 4,300 lb (1,950 kg). Maximum cruise speed is 124 kt, and maximum rate of climb at sea level is 1,575 fpm. Range with maximum fuel at sea level and no reserves is 410 nm (759 km).

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

When the accident occurred, he had accumulated 5,692 flight hours, including 3,942 hours in AS 350-series helicopters, 63 hours of simulated instrument flight and 340 hours at night. He was hired by Island Express in January 2003 and completed initial new hire training in March, when he passed an airman competency/proficiency check administered by the FAA principal operations inspector. The inspector said that the pilot "did rather well" on his check ride, performing maneuvers that included a straight-in autorotation, a hovering autorotation and a simulated engine failure.

The helicopter was manufactured in 1984. Its original Turbomeca Arriel 1B engine had been replaced in 2001 by a Honeywell LTS101-600A-3. The helicopter had accumulated 9,687 flight hours, and had a total airframe time of 9,681 hours and an engine total time of 13,027 hours or 30,199 power turbine cycles. The last annual inspection was completed July 17, 2007, at 8,708 hours.

Records showed that during the accident flight, the helicopter was being operated within published weight and balance limits.

The helicopter was registered to Island Express in 2000, after previously having been operated by companies in several other states. The company was authorized to conduct flights under U.S. Federal Aviation Regulations Part 135, "Commuter and On-Demand Operations," and to maintain its helicopters according to the original equipment manufacturer maintenance programs.

Island Express Helicopters, based in Long Beach, was founded in 1982 and conducts on-demand flights, sightseeing flights and flights to service offshore oil platforms near Huntington Beach and Long Beach. Company officials estimated that their helicopters fly about 3,200 hours per year from the Queensway Heliport.

At the time of the accident, the company had four helicopters and 19 employees, including four pilots and three maintenance personnel.

At 0928, eight minutes after the accident, reported weather conditions at Catalina Airport, at an elevation of 1,597 ft and about 5 nm (9

km) southeast of the accident site, included wind from 080 degrees at 3 kt; thin broken clouds at 700 ft AGL, broken clouds at 1,500 ft AGL and overcast clouds at 2,000 ft AGL; and visibility of 10 mi (16 km) in light rain.

The chief pilot for Island Express, who was flying another company helicopter in the area at the time of the crash, observed unrestricted visibility to the west with broken clouds at 3,500 to 4,000 ft. Winds at his location were light and from the west, and he told investigators that wind conditions appeared to be similar along the western shore of the island.

The helicopter was not equipped with a cockpit voice recorder or flight data recorder, and the equipment was not required.

### Damaged Blades

The crash occurred about 0.2 mi (0.4 km) from the intended landing site, “on open down-sloping terrain bordered on the north by a series of power transmission lines and on the east by small hills,” the report said.

Investigators observed localized damage of four consecutive power turbine blades, two of which were fractured transversely, “across the airfoil above the blade root platform, and two were fractured high up their respective airfoils near the blade tips,” the report said. The other power turbine blades had generalized damage. All blades were in place and securely attached to the power turbine wheel.

A metallurgical examination, conducted with a scanning electron microscope, found “striation features typical of fatigue cracking on the pressure (concave) side” of one of the blades with a transverse fracture.

“The fatigue crack features emanated from the boundary area between the base material and a casting pin,” the report said, noting that the fracture features on the three other damaged blades “exhibited a matte texture consistent with overstress separation.”

The report said that when hollow core power turbine blades are cast, 10 cylindrical platinum pins are used to position an internal mold; after the casting has been completed, the internal



mold is removed, but the 10 pins remain a part of the blade.

The metallurgical exam found “striations typical of fatigue” from the edges of two pins. The striations from pin No. 4 “progressed forward towards the leading edge and rearwards toward pin No. 5, and the fatigue from pin No. 5 progressed rearward toward the trailing edge,” the report said.

After the NTSB completed its examination of the blades, Honeywell conducted additional examinations, with the oversight of NTSB investigators, and found additional fatigue cracks emanating from pins in the pressure side of the airfoil in two other blades.

Honeywell also issued Service Bulletins LT 101-71-00-0252 and LTS 101-71-00-0253 to require removal and inspection of the turbine assemblies “to address a service-related difficulty with power turbine rotor blade part No. 4-141-084-06 cracking at the mid-span of the airfoil that can lead to a blade separation and subsequent inability to maintain powered flight, resulting in potential injuries and damage to the aircraft.”

Two FAA airworthiness directives concerning issues discussed in the accident report were pending, the NTSB said. ➤

**Passengers said they heard a popping sound just before the pilot of this AS 350D told them he planned an autorotation near the designated landing site on California's Santa Catalina Island.**