Misreading the Weather

Accident investigators say flight into adverse weather conditions factored in the crashes of two helicopters during sightseeing flights in the Hawaiian Islands — an area known for challenging weather patterns.

BY LINDA WERFELMAN

The fatal crashes of two helicopters during Hawaiian sightseeing flights have led to safety recommendations calling for improved pilot training on hazardous weather phenomena, rest breaks for air tour pilots and accelerated development of automatic dependent surveillance-broadcast (ADS-B) technology.

The recommendations are among a dozen that were generated by the U.S. National Transportation Safety Board (NTSB) investigation of the two accidents, which killed a total of eight people. Issuance of the recommendations coincided with the publication by the U.S. Federal Aviation Administration (FAA) of new safety standards for the air tour industry — standards prompted by a series of crashes in the early and mid-1990s.

The accidents that prompted the new recommendations involved two helicopters that departed from airports on the Hawaiian island of Kauai (Figure 1):

- On Sept. 24, 2004, a Bell 206B operated by Bali Hai Helicopter Tours crashed in a mountainous area in Kalaheo. The pilot and all four passengers were killed, and the helicopter was destroyed; and,
- On Sept. 23, 2005, a Eurocopter AS 350BA operated by Heli-USA plunged into the Pacific Ocean near Haena. Three of the five passengers died of drowning or related factors, and the two other passengers and the pilot received minor injuries; the helicopter was destroyed.

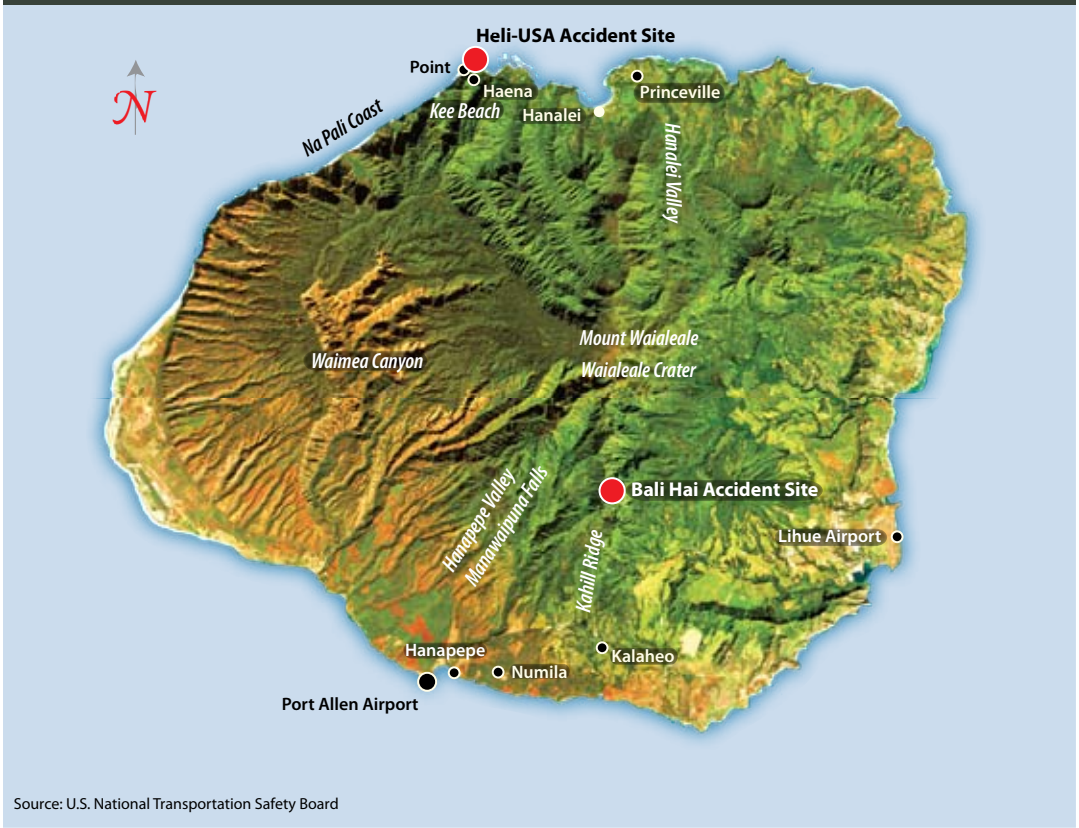
The NTSB report on the 2004 accident said that the flight was operating without a flight plan as a visual flight rules (VFR) flight under provisions of U.S. Federal Aviation Regulations (FARs) Part 91, *General Operating and Flight Rules*, and under Special Federal Aviation Regulation (SFAR) 71, *Special Operating Rules for Air Tour Operators in the State of Hawaii*.

Instrument meteorological conditions prevailed near the accident site at the time of the crash, 1642 local time.

The flight — planned as the pilot's eighth and final flight of the day — departed from Port Allen Airport (PAK) in the Kauai community of Hanapepe about 1600. The air tour was to have lasted about 45 minutes before the helicopter's return to PAK.

"Digital, time-stamped still images recovered from a passenger's camera showed that, when the helicopter departed, the weather near PAK appeared sunny, with good visibility," the report said. "Subsequent images taken during the tour showed low clouds and precipitation near some site-specific locations."

Kauai Accident Sites



Source: U.S. National Transportation Safety Board

Figure 1

After the helicopter failed to return on schedule to PAK, Bali Hai notified authorities. Helicopters and crew from Bali Hai, other air tour operators and the U.S. Coast Guard conducted aerial searches, but, because of obscuring clouds, they were unable to locate the accident site until the following day. Recovery of the victims and wreckage from the crash site, about 200 ft (61 m) below the ridge on a steeply sloping mountainside, was conducted over 10 days because of terrain and weather conditions, including downdrafts and low clouds.

Spatial Disorientation

The NTSB, in its final report on the accident, said that the probable cause was "the pilot's decision to continue flight under visual flight rules into an area of turbulent, reduced-visibility weather conditions, which resulted in the pilot's spatial disorientation and loss of control of the helicopter." Contributing factors were "the pilot's inexperience in assessing local weather conditions, inadequate [FAA] surveillance of SFAR 71 operating restrictions and the operator's pilot-scheduling practices that likely had an adverse impact on pilot decision making and performance," the report said.

Investigators found no indication of any pre-existing problems involving the helicopter's engine, airframe or systems that contributed to the accident. Helicopter weight and balance were within acceptable limits.

There was no indication that the pilot had any medical condition that might have interfered with his conduct of the flight, the report said.

The pilot — a former Indian air force helicopter pilot who said he had experience in mountain and coastal flying — had flown

commercial air tours for less than two months. He had "limited knowledge of Kauai's weather patterns … and he began conducting tour flights after accruing just 6.7 hours of flight training from company personnel, none of which included specific training on Kauai weather," the NTSB said in the safety recommendation letter.

The helicopter's flight path — an "increasingly erratic" descending spiral — was "consistent with pilot spatial disorientation," the accident report said. "The pilot's inexperience with Hawaii weather conditions affected his ability to make appropriate in-flight decisions when faced with deteriorating weather."

The NTSB said that Bali Hai helicopter pilots typically had no scheduled breaks and remained at the flight controls "nearly continuously for up to eight hours per day." Their schedules and the lack of restroom facilities at the staging area "probably discouraged consumption of food and liquids during the workday" — factors that increased the risk of dehydration and were conducive to fatigue, the NTSB said.

The safety recommendation letter noted that the accident pilot had been seen leaving the cockpit once the day of the accident, about 1500, and that passengers on the 1500 flight said that he appeared fatigued.

The accident report also said that the FARs "do not adequately address the pilot fatigue issues associated with the continuous, repetitive, high-frequency flight operations that are unique to commercial air tour helicopter operations." Bali Hai's scheduling practices were in compliance with FAA regulations.

In addition, investigators found "evidence that Bali Hai managers had inappropriately pressured some pilots to fly in poor weather conditions and to avoid late returns"; nevertheless, the report said, "The extent to which management pressure might have influenced the pilot's decision making during the accident flight could not be determined."

The report said that the FAA had not allocated adequate resources for its flight standards district office (FSDO) in Honolulu to conduct surveillance of air tour operations. As a result, pilots violated SFAR 71 and related requirements "either intentionally or unintentionally, thus placing themselves and their passengers at unnecessary risk for accidents, particularly in marginal weather conditions," the report said.

The safety recommendation letter said that the FSDO manager had estimated that, at the time of the accident, the FSDO was "about 10 inspectors short"; he was not authorized to hire new inspectors.

Interviews with air tour pilots found that they sometimes did not understand the altitude restrictions discussed in SFAR 71 or the waivers that allowed some operations below those altitudes, the letter said. "Thus, these pilots likely crossed ridgelines in some locations during tour flights at altitudes lower than what is permitted under SFAR 71 or their respective authorizations, and without FAA surveillance and

Bell 206B JetRanger

U.S. National Transportation Safety Board

The Bell Helicopter (now Bell Helicopter Textron) 206B JetRanger is a general-purpose light helicopter powered by a 400-shaft-horsepower (298-kilowatt) Allison 250-C20 engine. The 206B was developed as a more powerful version of the 206A, which had a 317-shaft-horsepower (236-kilowatt) engine. The first deliveries of the 206B were in early 1971.

The 206B is configured with two seats in front and a rear bench seat for three people.

Empty weight is 1,455 lb (660 kg); maximum takeoff weight is 3,200 lb (1,451 kg).

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

intervention, they probably believed that such practices were permissible and safe."

FSDO surveillance before the accident might have "detected and corrected the accident pilot's risky flying practices, such as low-altitude, off-route ridge crossings and flight into clouds and reduced visibility," the report said.

As a result of the investigation, the NTSB recommended that the FAA, "in cooperation with Hawaii commercial air tour operators, aviation psychologists and meteorologists," develop a training program for Hawaiian commercial air tour pilots that addresses hazardous local weather phenomena and related in-flight decision making. Hawaiian air tour operators should be required to provide this training to all newly hired pilots, the report said.

The safety recommendation letter said that experienced air tour pilots on Kauai told investigators that VFR operations in the area are "unusually challenging because of the rugged terrain, mountain winds and rapidly changing visibility and cloud conditions." As a result, the usual sources of pilot weather information — including automated reporting stations and flight service station briefings — are "not very useful," according to the pilots; instead, pilot skills in evaluating changes in weather during tour flights are crucial.

However, the accident pilot and others with limited experience flying in the island's weather conditions may be "hindered in their ability to make appropriate in-flight decisions when faced with deteriorating weather," the letter said, recommending development of specialized training on "recognition of local weather cues that are critical for in-flight decision making in the Hawaiian Islands."

The weather conditions and terrain, along with large numbers of air tour flights and limited radar coverage by air traffic control (ATC), make Hawaii "a prime candidate for the national ADS-B program," the letter said.

"ADS-B will support avionics features that enable pilots to see the location, extent and movement of weather systems, thus improving pilot awareness and helping pilots make safer decisions in flight," the NTSB said. "For example, if the accident helicopter had been equipped with avionics capable of displaying ground-based, weather-radar information transmitted via ADS-B infrastructure, the pilot would have been able to see the full extent of the weather converging on the … ridge, and his decision to continue into the weather may have been different."

The NTSB recommended that the FAA accelerate the implementation of ADS-B in Hawaii to aid pilots of low-flying aircraft along commercial air tour routes and require Hawaiian air tour operators to equip their aircraft with ADS-B technology within one year of the installation of ADS-B infrastructure in Hawaii.

The recommendation letter also said that, because existing FARs "do not adequately address the pilot fatigue issues associated with the

Eurocopter AS 350 Ecureuil

© Ivan Nishimura/airliners.net

The Eurocopter AS 350 is a light utility helicopter first produced in October 1977 by Aerospatiale as the AS 350B. The AS 350BA is an upgraded version of the 350B, with larger main-rotor blades and a maximum takeoff weight of 4,630 lb (2,100 kg), or 331 lb (150 kg) more than the AS 350B.

The AS 350BA has two standard buckets seats at the front of the cabin, and two two-place bench seats aft.

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

continuous, repetitive, high-frequency flight operations that are unique to commercial air tour helicopter operations, … the FAA should establish operational practices for commercial air tour helicopter pilots that include rest breaks and that will ensure acceptable pilot performance and safety, and require commercial air tour helicopter operators to adhere to these practices."

Recommendations also called on the FAA to develop a permanent means of providing direct surveillance of commercial air tour operations in Hawaii; to direct the Honolulu FSDO to ensure that annual safety meetings include discussions of air tour accidents, Hawaii weather phenomena and SFAR 71 procedures; to re-evaluate altitude restrictions in Hawaii "to determine if they may have resulted in any unintended degradation of safety with regard to weather-related accidents"; and to develop safety standards for all commercial air tour operators, including pilot training in "local geography and meteorological hazards and special airspace restrictions, maintenance policies and procedures, [and] flight scheduling that fosters adequate breaks and flight periods."

Change in the Weather

The report on the 2005 accident also discussed deteriorating weather conditions and visibility.

The accident helicopter, registered to Jan Leasing and operated by Heli-USA Airways under Part 135, *Commuter and On-Demand Operations*, departed at 1354 from Lihue on a company flight plan in visual meteorological conditions. The pilot described weather as good during the first portion of the sightseeing flight, which was to have lasted 45 minutes.

"However," the report said, "the helicopter entered heavy rain and reduced visibility while flying along the island's northern coast. The pilot decided to turn back, but the helicopter rapidly descended, did not respond to control inputs, entered a hard spin to the left and collided [with] the water."

The helicopter, which was not equipped with flotation equipment, rapidly filled with water, rolled over and quickly sank several hundred feet from the coast — so quickly, the NTSB said, that "some occupants were submerged before they could even undo their seatbelts." The six occupants all wore "waist pouches" that contained life jackets, and all had been instructed in their use; nevertheless, not all were able to don the life jackets and properly inflate them after exiting the helicopter, the report said.

The NTSB report on the accident said that the probable cause was "the pilot's decision to continue flight into adverse weather conditions, which resulted in a loss of control due to an encounter with a microburst." A contributing factor to the accident was the FAA's "inadequate … surveillance of [SFAR] 71 operating restrictions"; a contributing factor to the loss of life was "the lack of helicopter flotation equipment," the report said.

Investigators found no indication of any mechanical problem that could have contributed to the accident.

The NTSB said in a statement accompanying release of the report that typical weather patterns on Kauai bring brief, localized rain showers every day, and air tour pilots often encounter these showers during their flights, relying on their own judgment to determine whether to proceed or to turn back. There is no weather-reporting facility in the area of the island where the accident occurred.

An analysis of meteorological data found that weather conditions at the time of the accident were favorable for the rapid development of cumulus clouds capable of producing heavy rain and microbursts, the report said.

As a result of its investigation, the NTSB recommended that the FAA require that all helicopters used in commercial air tours over water, "regardless of the amount of time over water," be equipped with floats or amphibious landing gear. The NTSB also recommended that the FAA "evaluate the design, maintenance and in-service handling of personal flotation devices" manufactured specifically for use in the event of an aircraft ditching to determine the cause of inflation problems and to ensure that they are manufactured in compliance with standards designed to ensure their effectiveness throughout the manufacturer's inspection interval.

New Regulations

Days before the NTSB issued its recommendations in February 2007, the FAA published new regulations, effective in March, for airplane and helicopter air tour operators nationwide. The regulations include requirements for enhanced pre-takeoff passenger safety briefings and life jackets and helicopter floats for some overwater flights.

The FAA said that the regulations contain reporting requirements that will aid in development of a database to help identify operational trends that could present safety risks and to provide "better oversight of the commercial air tour industry, especially flights previously conducted under the general operating and flight rules section of the regulations." ●

This article is based on U.S. National Transportation Safety Board (NTSB) reports NTSB/AAR-07/03 and NTSB/AAB-07/01, and NTSB Safety Recommendation letters A-07-18 through -26 and A-07-27 through -29.