Weather Encounter and Subsequent Collision into Terrain
Bali Hai Helicopter Tours, Inc.
Bell 206B, N16849
Kalaheo, Hawaii
September 24, 2004

ACCIDENT REPORT

NTSB/AAR-07/03
PB2007-910404

National Transportation Safety Board

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Aircraft Accident Report

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Notation 7862A
Adopted February 13, 2007

National Transportation Safety Board
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Washington, D.C. 20594

National Transportation Safety Board. 2007. ***Weather Encounter and Subsequent Collision into Terrain, Bali Hai Helicopter Tours, Inc., Bell 206B, N16849, Kalaheo, Hawaii, September 24, 2004.*** **Aircraft Accident Report NTSB/AAR-07/03. Washington, DC.**

Abstract: This report explains the accident involving a Bell 206B helicopter, N16849, registered to and operated by Bali Hai Helicopter Tours, Inc., of Hanapepe, Hawaii, which impacted mountainous terrain in Kalaheo, Hawaii, on the island of Kauai, 8.4 miles northeast of Port Allen Airport, in Hanapepe. The safety issues discussed in this report include the influence of pilot experience and operator scheduling on in-flight decision-making; the lack of Federal Aviation Administration (FAA) oversight of 14 *Code of Federal Regulations* Part 91 air tour operators; the need for national air tour safety standards; and the lack of direct FAA surveillance of commercial air tour operators in Hawaii.

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Abbreviations

ADS-B	automatic dependent surveillance-broadcast
agl	above ground level
AIRMET	airmen's meteorological information
ASI	aviation safety inspector
ATC	air traffic control
ATIS	automated terminal information service
CERAP	air route traffic control center and radar approach control
CFR	*Code of Federal Regulations*
dBZ	decibels
DOT	Department of Transportation
DUATS	direct user access terminal system
FAA	Federal Aviation Administration
FSDO	Flight Standards District Office
FSS	flight service station
GAATA	General Aviation and Air Taxi Activity
GSU	geographical surveillance unit
IFR	instrument flight rules
IMC	instrument meteorological conditions
IOE	initial operating experience
LIH	Lihue Airport, Lihue, Hawaii
LOA	letter of authorization
McIDAS	Man computer Interactive Data Access System
msl	mean sea level
NOE	nap of the Earth or nape of the Earth
NPG	National Flight Standards Work Program Guidelines
NPRM	notice of proposed rulemaking

NWS	National Weather Service
PAK	Port Allen Airport, Hanapepe, Hawaii
PIC	pilot-in-command
POI	principal operations inspector
S/N	serial number
SIC	second-in-command
SFAR	Special Federal Aviation Regulation
UTC	coordinated universal time
VFR	visual flight rules
VMC	visual meteorological conditions
WSR-88D	Weather Surveillance Radar-1988 Doppler

Executive Summary

On September 24, 2004, about 1642 Hawaiian standard time, a Bell 206B helicopter, N16849, registered to and operated by Bali Hai Helicopter Tours, Inc., of Hanapepe, Hawaii, impacted mountainous terrain in Kalaheo, Hawaii, on the island of Kauai, 8.4 miles northeast of Port Allen Airport, in Hanapepe. The commercial pilot and the four passengers were killed, and the helicopter was destroyed by impact forces and postimpact fire. The nonstop sightseeing air tour flight was operated under the provisions of 14 *Code of Federal Regulations* Part 91 and visual flight rules with no flight plan filed. Instrument meteorological conditions prevailed near the accident site.

The National Transportation Safety Board determines that the probable cause of this accident 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 to this accident was the pilot's inexperience in assessing local weather conditions, inadequate Federal Aviation Administration (FAA) surveillance of Special Federal Aviation Regulation 71 operating restrictions, and the operator's pilot-scheduling practices that likely had an adverse impact on pilot decision-making and performance.

The safety issues discussed in this report include the influence of pilot experience and operator scheduling on in-flight decision-making; the lack of FAA oversight of Part 91 air tour operators; the need for national air tour safety standards; and the lack of direct FAA surveillance of commercial air tour operators in Hawaii.

Nine safety recommendations are addressed to the FAA regarding local weather-training programs for newly hired Hawaii air tour pilots; evaluation of operational practices for commercial air tour helicopter pilots; Honolulu Flight Standards District Office control of the annual safety meetings, as required under approved certificates of waiver or authorization; evaluation of the safety impact of the altitude restrictions in the State of Hawaii; national air tour safety standards; and the potential benefits of automatic dependent surveillance-broadcast technology for Hawaii air tour operators.

1. Factual Information

1.1 History of Flight

On September 24, 2004, about 1642 Hawaiian standard time,[1] a Bell 206B helicopter, N16849, registered to and operated by Bali Hai Helicopter Tours, Inc., of Hanapepe, Hawaii, impacted mountainous terrain in Kalaheo, Hawaii, on the island of Kauai, 8.4 miles northeast of Port Allen Airport (PAK) in Hanapepe. The commercial pilot and the four passengers were killed, and the helicopter was destroyed by impact forces and postimpact fire. The nonstop sightseeing air tour flight was operated under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91[2] and visual flight rules (VFR) with no flight plan filed.[3] Instrument meteorological conditions (IMC) prevailed near the accident site.

The air tour flight was conducted under Special Federal Aviation Regulation (SFAR) 71, "Special Operating Rules for Air Tour Operators in the State of Hawaii," and in accordance with a certificate of waiver or authorization approved for Bali Hai by the Federal Aviation Administration's (FAA) flight standards district office (FSDO) in Honolulu, Hawaii. The minimum altitude for tour flights specified in SFAR 71 is 1,500 feet above ground level (agl) and no closer than 1,500 feet to any person or property, unless otherwise authorized. Bali Hai's certificate of waiver or authorization allowed its pilots to deviate from the minimum altitude requirement and to fly transition segments[4] at 1,000 feet agl, cross ridgelines at 500 feet agl, and cross razorback ridgelines[5] at 200 feet agl.

The flight, which was the pilot's eighth and final tour flight for the day, was scheduled to depart PAK about 1600 and fly clockwise around the island of Kauai for a 45-minute sightseeing tour over a number of site-specific locations,[6] including Waimea Canyon, the Na Pali Coast, Waialeale Crater, and Manawaipuna Falls (see figure 1).

[1] Hawaiian standard time is coordinated universal time minus 10 hours. Unless otherwise indicated, all times are Hawaiian standard time based on a 24-hour clock.

[2] According to Federal Aviation Regulations, 14 CFR Part 91 commercial air tour flights are authorized as long as they are conducted as "nonstop sightseeing operations in non-common carriage" in accordance with 14 CFR 119.1(e)(2) and 135.1(a)(5), which specify that the flights must begin and end at the same airport and must be conducted within a 25-statute-mile radius of that airport.

[3] Personnel at the company office logged tour departure times and knew the usual tour routes, but they did not track the flights or perform flight-following services.

[4] Bali Hai's FAA-approved transition segments were established with the Honolulu FSDO and were outlined in the certificate of waiver or authorization.

[5] The certificate of waiver or authorization does not define razorback ridgeline. Generally, the description refers to a sharp, narrow ridge.

[6] Bali Hai's site-specific locations were approved by the Honolulu FSDO, which maintained a master map that identified the locations for the operators. Bali Hai's certificate of waiver or authorization allowed its pilots to descend to 500 feet agl over site-specific locations.

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. Subsequent images taken during the tour showed low clouds and precipitation near some site-specific locations.

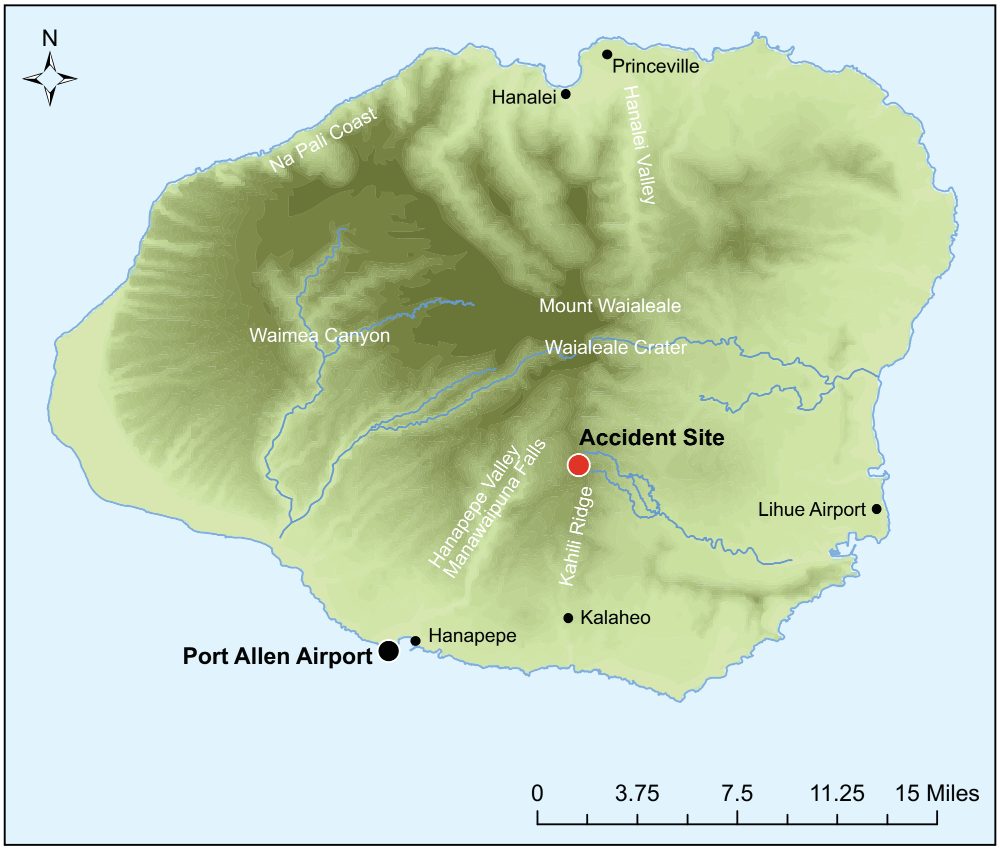

Figure 1. Map of Kauai, showing accident site and some of Bali Hai's site-specific locations.

A review of air traffic control (ATC) radar data from the FAA's air route traffic control center and radar approach control (CERAP) facility in Honolulu showed the helicopter's ground track entered the area north of Mount Waialeale about 1635;[7] however, the helicopter's flight altitudes could not be determined.[8] The radar data showed that, about 1641, the helicopter crossed a 2,000-foot ridge that extended east from Kahili Ridge (see figure 2), the main ridgeline 3,000 feet south of Waialeale Crater. Shortly

[7] Radar coverage on the island of Kauai was limited due to the location of the radar station and the high terrain in the center of the island; the CERAP facility had no radar data for the helicopter before 1635.

[8] The helicopter was equipped with a mode C transponder, which is designed to transmit the helicopter's identification code and altitude information in response to interrogation signals received from ground-based radar equipment. During the accident flight, however, the helicopter's transponder transmitted only a constant altitude of 1,000 feet mean sea level; thus, the helicopter's actual flight altitudes before the accident could not be determined.

thereafter, the helicopter tracked west toward a pass at the top of Kahili Ridge, then crossed Kahili Ridge. About 1642, the radar track depicted the helicopter on the west side of Kahili Ridge as it turned toward the north. The helicopter's ground track then made a 180º clockwise turn toward the south and crossed back to the east side of the Kahili Ridge in a zigzag pattern before it was lost from radar at 1642:46. The wreckage was located on the east side of Kahili Ridge about 200 feet below the top of the ridgeline and southeast of the last radar return.[9]

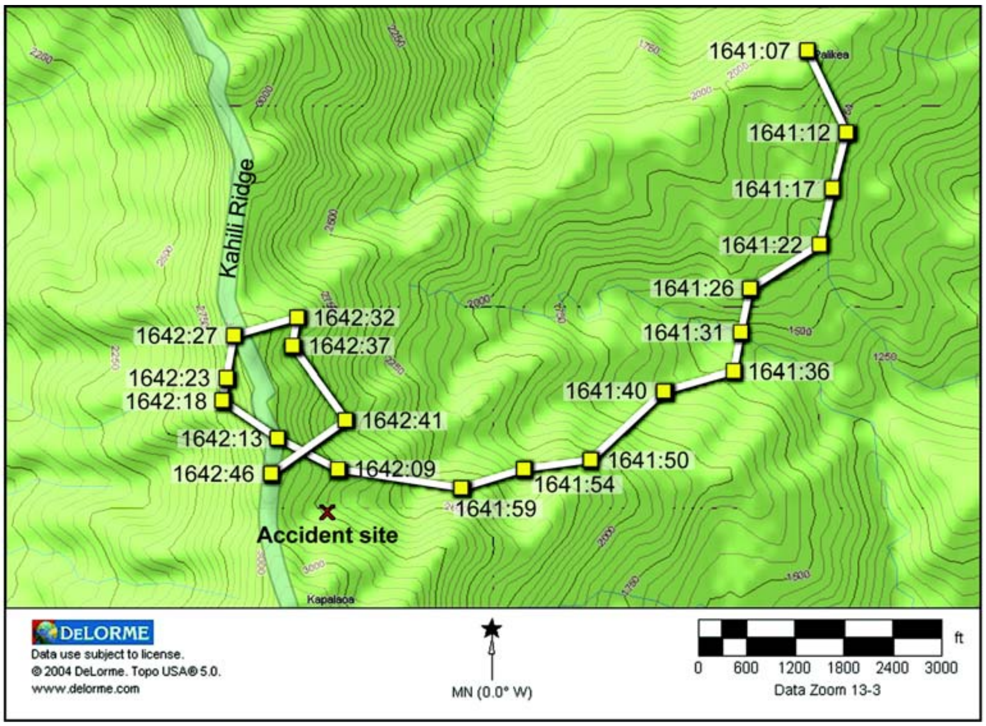

Figure 2. Radar data for the last 2 minutes of the accident flight plotted over a topographical map.

When the helicopter failed to return to PAK as scheduled, Bali Hai personnel notified the tower controllers at Lihue Airport (LIH) in Lihue, on the island of Kauai, and the U.S. Coast Guard that the flight was overdue. Bali Hai, other air tour companies, and the Coast Guard conducted visual aerial searches, but clouds obscured the location of the crash site. The Coast Guard located the wreckage about 1420 on September 25, 2004. Recovery of the victims and the wreckage took 10 days because of the terrain and weather conditions. According to recovery personnel, heavy downdraft wind conditions and low cloud cover affected the area.

[9] The wreckage debris was scattered in a west-southwest direction. The duration and directions of the helicopter's ground track between the location of the last radar return and the accident site are not known. For more information about the wreckage debris path, see section 1.12.

1.2 Injuries to Persons

Table 1. Injury chart.

Injuries	Flight Crew	Cabin Crew	Passengers	Other	Total
Fatal	1	0	4	0	5
Serious	0	0	0	0	0
Minor	0	0	0	0	0
None	0	0	0	0	0
Total	1	0	4	0	5

1.3 Damage to Helicopter

The helicopter was destroyed by impact forces and a postcrash fire.

1.4 Other Damage

Trees and other vegetation at the accident site were damaged as a result of the accident.

1.5 Personnel Information

1.5.1 The Pilot

The pilot, age 39, held a commercial pilot certificate with a rating for rotorcraft helicopter issued on May 6, 2004. His most recent FAA first-class airman medical certificate was issued on October 20, 2003, with no restrictions.

The pilot was a citizen of India and was retired from the Indian Air Force, in which he served from 1986 to 2003. He received his initial helicopter training at an Indian Air Force training school in Hyderabad, India. During his military career, he acquired a military helicopter pilot certificate with an instrument rating; was qualified as a rotorcraft instructor, instrument instructor, and pilot examiner in single- and twin-turbine helicopters; and was trained in military flying profiles, including nap-of-the-Earth (NOE) flight.[10] In a résumé dated June 3, 2004, the pilot reported he had accumulated 4,005 total

[10] NOE flight (sometimes also referred to as “nape” of the Earth) is low-level, military tactical flying that is intended to increase stealth and mission security. NOE flight requires the pilot to make continuous changes in the helicopter’s speed, altitude, and heading to fly close to the ground and among obstacles.

flight hours, which included 3,900 hours in turbine-powered helicopters, 2,820 hours pilot-in-command (PIC), 1,350 hours second-in-command (SIC), and 800 hours as an instructor pilot.

The pilot moved to Michigan in November 2003. The FAA issued him a U.S. private pilot certificate with a rating for rotorcraft helicopter in February 2004 on the basis of his foreign pilot license.[11] The pilot logged no flight time from February 2003 to March 2004. Between March and April 2004, the pilot accumulated 20 hours of civilian flight experience in Enstrom F28C2 helicopters while preparing for the FAA practical test for his commercial pilot certificate.

The pilot was hired by Bali Hai in July 2004, and he moved to Hawaii to begin work. It was his first civilian pilot job, and he had no previous Bell 206 helicopter experience. According to Bali Hai personnel, they provided the pilot 22 hours of ground instruction, 5 hours of flight instruction, and 1.7 hours of supervised PIC flight time between July 8 and July 31, 2004. Bali Hai's owner stated that the pilot demonstrated very good skills and controlled the helicopter well during training. The pilot passed an FAA SFAR 71 checkride[12] on July 22, 2004. Company records indicated that the pilot accumulated 120 hours of flight experience in the company's helicopters between August 1, 2004, and the accident date.

A search of driver history records in Hawaii found no history of driver's license revocations or suspensions.

1.5.1.1 Flight Time and Duty Period

Bali Hai did not maintain, and was not required to maintain, records of pilot flight time or duty periods.[13] Bali Hai personnel stated that they kept records of only scheduled revenue flight hours. On the day of the accident, the pilot arrived at the company office about 0800, performed a preflight inspection of the helicopter, washed the turbine engine compressor, and helped the line service technician transport the helicopter to the airport. He was scheduled to fly eight tours consisting of five 45-minute tours and three 55-minute tours departing every hour, on the hour. During tours, the pilot's duties, in addition to flying, included narrating the tour for the passengers.

During the 5 to 15 minutes of ground time between the tours, the pilot sat in the cockpit and monitored the fuel gauge while the line service technician added fuel to the

[11] According to 14 CFR 61.75, a person who holds a current foreign pilot license may apply for and be issued a U.S. private pilot certificate with the appropriate ratings on the basis of the foreign pilot license if the requirements of the regulation are met. Under this provision, a pilot who meets the requirements would not have to demonstrate proficiency to be issued the U.S. private pilot certificate.

[12] The SFAR 71 checkride is administered by the FAA and is required for Hawaii air tour pilots who fly for an operator that holds a certificate of waiver or authorization to deviate from SFAR 71. The checkride was designed to evaluate the pilot's knowledge of SFAR 71 regulations and the company's approved deviations, among other criteria.

[13] Part 91 air tour operators, unlike Part 135 and Part 121 operators, are not subject to any pilot flight time and duty period limitations or any pilot rest requirements.

helicopter, and he did not leave the helicopter to take a lunch break.[14] Interviews with company personnel and an examination of company scheduling records indicated that, on the day of the accident, the pilot had been on duty about 8.7 hours, had been at the controls of the helicopter with the rotors turning for at least 7.7 consecutive hours, and had flown about 6.5 revenue flight hours[15] by the time the accident occurred (see table 2).

Table 2. Revenue hours flown by the pilot on the day of the accident.[a]

Tour	Number of Passengers	Start Time	Stop Time	Duration (minutes)	Turnaround (minutes)
1	3	0900	0955	0:55	0:05
2	4	1000	1045	0:45	0:15
3	4	1100	1155	0:55	0:05
4	4	1200	1245	0:45	0:15
5	4	1300	1345	0:45	0:15
6	4	1400	1455	0:55	0:05
7	3	1500	1545	0:45	0:15
8	4	1600	1642	0:42	----
Totals	30	----	----	6:27	1:15

[a] All flight times are based on scheduled tour times, not actual tour times. The duration of the last flight is based on the estimated time of the accident.

With the exception of a continuous 9-day leave of absence from September 5 to September 13, 2004,[16] company scheduling records indicated that the pilot was on duty each week for the 6 weeks from August 1, 2004, to the day of the accident.[17] The pilot's average daily revenue flight time, recorded in a company spreadsheet, was 3.5 hours. According to the spreadsheet, the day before and the day of the accident were the pilot's longest days of flying, and the pilot was credited with 6.7 and 6.45 revenue flight hours, respectively.

[14] For more information about Bali Hai's pilot-scheduling practices, see section 1.17.3.

[15] Revenue flight hours include only the time that the helicopter was in use during tour flights. Additional flight time would have been required for the pilot to start the helicopter, maneuver it off the trailer, and land it nearby at the company's loading/unloading area.

[16] During his leave, the pilot traveled to Michigan to visit his family and obtained a permanent resident card.

[17] During that time, the pilot had three 6-day workweeks, two 5-day workweeks, and one 4-day workweek. In late August, the pilot worked 7 days in a row.

1.5.1.2 72-hour History

The pilot lived alone, and little information was available regarding his nonwork activities in the 72 hours before the accident. The pilot's wife still resided in Michigan with their child but planned to join the pilot in Hawaii in October 2004. She last spoke with him by telephone about 1700 on September 21, 2004, 3 days before the accident. She stated that the pilot sounded "normal" and "very happy." He told her that he had been going to bed early, getting up early, and going for morning walks. Based on the pilot's recent sleeping schedule, his wife estimated that he might have gone to bed between 2100 and 2130 that evening.

Two acquaintances of the pilot told investigators that they visited with the pilot for about an hour as he walked to his apartment after work 2 or 3 days before the crash. They reported that the pilot was very friendly during their discussion and told them he was looking forward to reuniting with his family.

The day of the accident was the pilot's fourth consecutive day of work after a 2-day weekend. According to the company's scheduling records and interviews, on September 22, 2004, the pilot flew two 45-minute tours and one 55-minute tour between 1300 and 1600.[18] On September 23, 2004, the pilot flew four 45-minute tours, three 55-minute tours, and one 60-minute tour between 0900 and 1700.[19]

On the day of the accident, the pilot was the only pilot on duty at Bali Hai, and the customer service representative stated that the pilot appeared "fine" when he arrived at the office. The pilot's first tour began at 0900, and the line service technician stated that the pilot appeared "fine" between his tours. A passenger on the fourth tour stated that the pilot was "very nice" and "professional" and appeared relaxed as he narrated the tour. The passenger stated that he never saw the pilot get out of the helicopter and that he could not tell if the pilot was tired. The line service technician stated that, before departing on the sixth tour, the pilot asked how many tours he had left.

Passengers on the seventh tour stated that the pilot looked "extremely tired" before their flight and that he got out of the helicopter to stretch and walk around. When the line service technician boarded the four passengers for the eighth tour, he reminded the pilot that this was his last tour for the day. He stated that the pilot looked "fine" but was wearing sunglasses and that he couldn't see the pilot's eyes or determine if he looked tired.

[18] Company records indicate that the pilot was credited with 2.37 hours of flight pay, rather than the 2.42 hours he was scheduled to fly.

[19] Company records indicate that the pilot was credited with 6.7 hours of flight pay, rather than the 6.75 hours he was scheduled to fly.

1.6 Helicopter Information

1.6.1 General

The helicopter, serial number (S/N) 2355, was manufactured in 1978 and was equipped with a 420 shaft-horsepower Rolls-Royce 250-C20B engine, S/N CAE 832474. The helicopter's flight instruments included an airspeed indicator, attitude indicator, and heading indicator; the helicopter was not certificated for instrument flight rules (IFR) operations. The pilot's seat was positioned at the front right, a passenger seat was positioned at the front left, and a bench seat in the back accommodated three passengers. The pilot's seat was equipped with a four-point restraining system, and each passenger seat was equipped with a lapbelt restraining system. The helicopter's second set of cockpit flight controls, normally located at the front left seat, was removed, except for the antitorque pedals.[20]

1.6.2 Maintenance Information

The helicopter was used only for Part 91 operations and was required to undergo annual and 100-hour inspections.[21] Also, the operator was required to maintain records, in accordance with 14 CFR 91.417, and to adhere to the replacement times for life-limited parts, as specified in the helicopter's specifications, type certificate data sheets, or other documents approved by the FAA.[22]

According to the helicopter's airframe and engine maintenance logbooks, the helicopter's most recent 100-hour inspection was completed on September 16, 2004, at an airframe total time of 15,963.1 hours and an engine total time of 13,281.5 hours. According to the logbooks, the helicopter's most recent annual inspection was completed on March 2, 2004, at an airframe total time of 15,392.6 hours and an engine total time of 12,711.0 hours.

A review of Bali Hai's records revealed numerous discrepancies between the airframe total time and engine total time recorded in the respective logbooks and the times recorded in the airframe and engine component status reports.[23] Other records, including component historical service records, also showed discrepancies. The discrepancies in various maintenance records included conflicting airframe and engine total times,

[20] Antitorque pedals are foot-pedal controls for the tail rotor system.

[21] A Part 91 operator must comply with 100-hour and annual inspections unless the operator elects to participate in a progressive inspection program, the manufacturer's approved maintenance/inspection program, or an FAA-approved continuous airworthiness inspection program.

[22] Some records that the operator was required to maintain, according to 14 CFR 91.417, included records of maintenance, preventive maintenance, alteration, 100-hour inspection, annual inspection, progressive inspection, and other required or approved inspections for each aircraft, engine, rotor, and appliance; records of total time in service of the airframe, engine, and each rotor; records of the current status of life-limited parts of each airframe, engine, rotor, and appliance; records of the time since last overhaul for each installed item that is required to be overhauled on a specified basis; and copies of the forms required for each major alteration to the airframe, engine, rotors, and appliances.

component times, types of maintenance or overhaul, installation and/or maintenance dates, and S/Ns. Further, the records indicated no evidence of compliance with a number of mandatory inspections, including special retorque inspections.

Bali Hai's mechanic stated that the company did not use daily discrepancy records and that, instead, the pilots relayed airworthiness issues to him verbally at the end of each day. He stated that, if he noted any issues, he would fix them and would make a maintenance logbook endorsement only when he believed the repair to be a "safety factor." Review of the maintenance records for the year before the accident revealed no record of any minor discrepancies having been reported or repaired.

The mechanic stated that he did not use the helicopter's Hobbs hour meter[24] to track airframe and engine time because it was unreliable. He stated that he, instead, tracked these times by calling the sales office each day to obtain the total scheduled trip times for the tours flown that day.[25] Review of various records revealed no evidence that time accumulated on the helicopter during nonrevenue operations, such as any flight before, between, and after tours, or during training and maintenance flights, were recorded at all for maintenance purposes as required.[26]

A review of historical correspondence between Bali Hai and the FAA revealed that, as far back as 1996, the accident helicopter was deemed unairworthy on at least two occasions because of improper maintenance practices and record-keeping.

1.7 Meteorological Information

1.7.1 Federal Aviation Administration Weather Radar Data

The FAA's Weather Surveillance Radar-1988 Doppler (WSR-88D) located on the island of Kauai provides a three-dimensional volume scan of the atmosphere at varying degrees of elevation. Figures 3 through 5 display the WSR-88D images generated from data downloaded from Unidata and displayed using the Man computer Interactive Data Access System (McIDAS)[27] and depict the base reflectivity images at 1634, 1639, and 1645.[28] At the accident site, the radar beam center is about 2,800 feet above mean sea level

[23] Bali Hai's airframe and engine component status report dated September 29, 2004, listed the airframe total time as 15,982.3 hours and the engine total time as 10,862.3 hours; this recorded engine time was about 2,000 hours less than what was recorded in the engine logbook for the annual and 100-hour inspection entries dated about 6 months and 2 weeks earlier, respectively.

[24] A Hobbs hour meter is a time-recording device that activates by sensing such things as aircraft electrical power "on," oil pressure, or other criteria. According to FAA Advisory Circular 43-9C, such a recording device can be helpful in determining time in service for maintenance purposes.

[25] Sales office personnel did not record the helicopter's actual time in service; they logged how many 45- and 55-minute tours were flown each day and provided those totals to the mechanic.

[26] For example, the accident pilot's training record showed he received 1.5 hours of flight instruction on July 13, 2004, and flew 1.5 hours with the owner on July 14, 2004, however, company flight schedules showed only revenue flights were logged, and there was no indication that the time accumulated on the helicopter during these training flights had been recorded at all for maintenance purposes.

(msl). The weather radar echo intensities are represented in decibels (dBZ) (see color bar on the right side of each figure). In the figures, the ground track of the accident flight from 1635:11 to 1642:46 is plotted in white, and selected radar plot times are noted in blue.

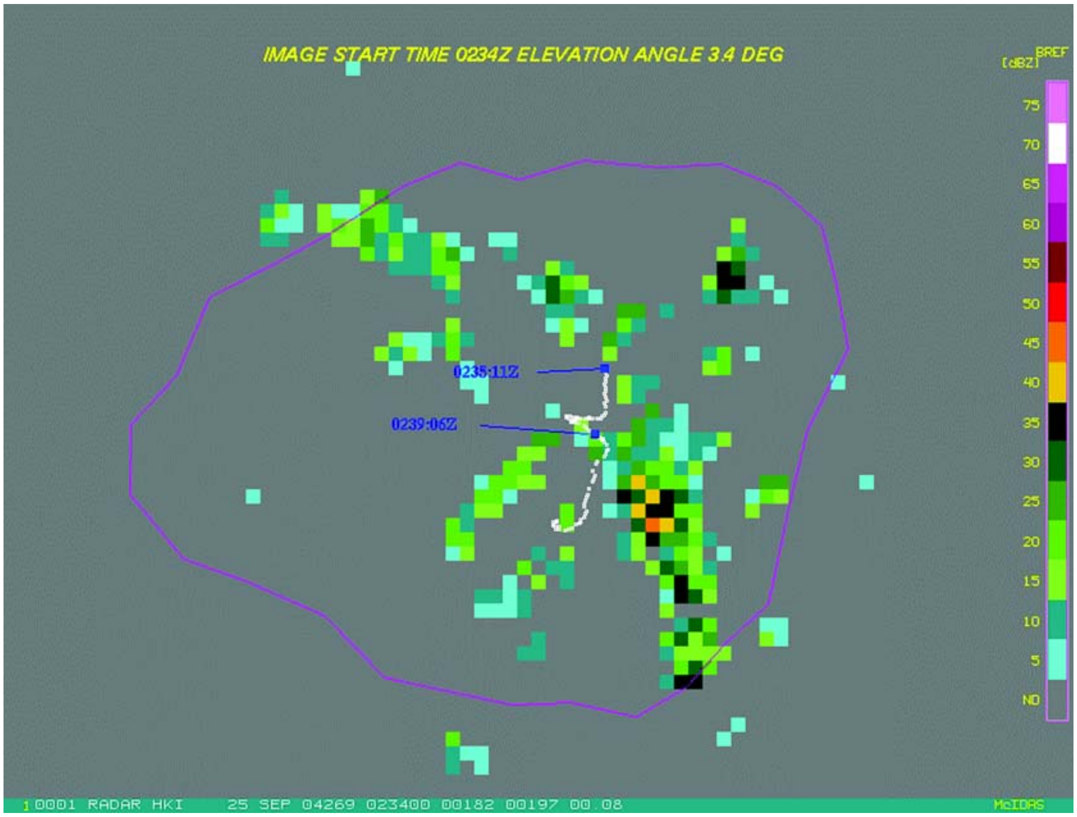

Figure 3. Weather radar at 1634.

[27] WSR-88D Doppler Weather Radar Level III products were acquired using tools made available to the research and education communities through the University Corporation for Atmospheric Research's Unidata Program, funded by the National Science Foundation. These data originated in the U.S. National Weather Service McIDAS. McIDAS is an interactive meteorological analysis and data management computer system and is administered by personnel at the Space Science and Engineering Center at the University of Wisconsin at Madison. Data are accessed and reviewed on a Hewlett-Packard 9000/C360 workstation running McIDAS-X software.

[28] The weather radar product images display time in coordinated universal time, or Zulu, as denoted by the designator "Z." The times in the figure captions have been converted to Hawaiian standard time.

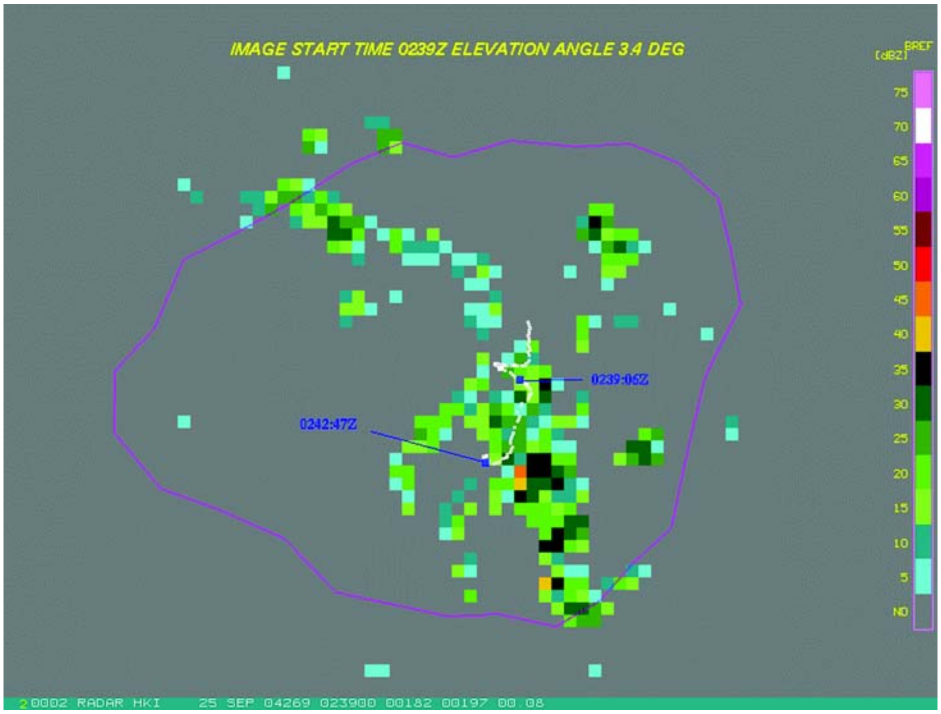

Figure 4. Weather radar at 1639.

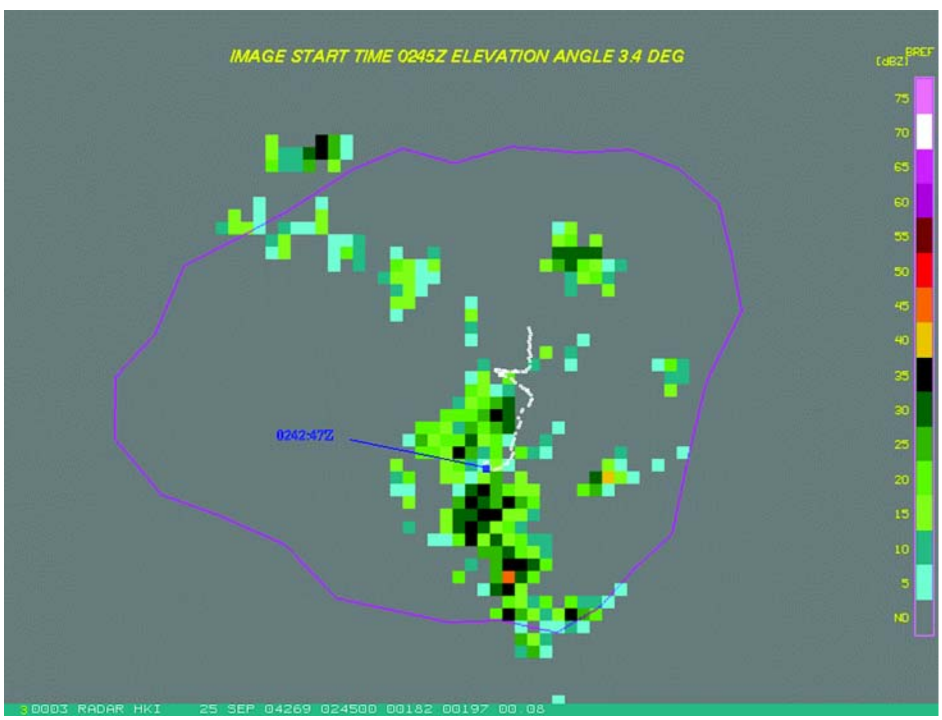

Figure 5. Weather radar at 1645.

1.7.2 Airmen's Advisories and Area Forecast

At 1200[29] on the day of the accident, the National Weather Service (NWS) Forecast Office in Honolulu issued an airmen's meteorological information (AIRMET) advisory for turbulence. AIRMET Tango Update 3 was valid until 1800, and it reported, "over and immediately south through west of mountains, all islands temporary moderate turbulence below 5,000 feet."

The area forecast, issued September 24, 2004, at 1140 and valid until midnight, contained the following information:

> North through east coastal and mountain sections and adjacent waters of the remaining islands, including central Oahu (includes Kauai), scattered clouds at 2,500 feet, broken to overcast at 4,500 feet, tops to 8,000 feet, temporary 2,500 feet broken, isolated 1,500 feet broken, tops 12,000 to 15,000 feet, visibility 3 to 5 miles, and moderate rain showers.

1.7.3 Witness Weather Observations

According to a tour pilot for another company conducting operations from PAK on the day of the accident, the weather was "really nice" in the morning but deteriorated later in the day. He also reported that he flew by Kahili Ridge about 1 hour after the accident and that the ridgeline was obscured by clouds.

A passenger on the accident pilot's fourth tour on the day of the accident stated that skies were clear when the tour departed the airport but that the flight encountered turbulence and rain along the Na Pali Coast and in Hanapepe Valley. Passengers from the accident pilot's tour before the accident tour stated that, when the helicopter crossed Kahili Ridge (near the accident site), it encountered strong winds and rain in that area. They also stated that the helicopter encountered rain, mist, and clouds inside Waialeale Crater and that clouds sometimes completely obscured ground references.

Time-stamped digital images recovered from a passenger's camera showed clouds and precipitation were at some locations along the accident tour, including areas along the Na Pali Coast, in the mountains south of Hanalei, and over the foothills east of Mount Waialeale. The last photograph recorded by the camera, which was taken about 5 minutes before the accident, showed a location about 4 miles from the accident site. The photograph showed that a broken layer of clouds appeared to be in front of the helicopter with some cloud bases below the horizon. The visibility below some clouds appeared to be degraded by mist and/or rain, and areas of coastline behind the line of clouds appeared to be brighter than the land in the foreground.

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[29] Airmen's weather information products are transmitted in coordinated universal time. However, the times in this section have been converted to Hawaiian standard time.

1.7.4 Local Weather Information Sources

According to Bali Hai personnel, weather information was available from local television broadcasts, the Internet, and the FAA's flight service station (FSS) in Honolulu, but they did not know what resources, if any, the pilot used the day of the accident. There was no record that the pilot obtained a weather briefing from the local FSS. Bali Hai did not have a direct user access terminal system (DUATS) at its office.

There were no weather information update capabilities at Bali Hai's ramp area at PAK. After a pilot left the company office, he or she could visually assess the weather from the airport or during tour flights, or the pilot could request reports from other tour pilots using the helicopter's communications radios or by cellular telephone. A pilot would also have the option of contacting other Kauai airports at Princeville, Barking Sands military airfield, or LIH by cellular telephone.

1.7.5 Hawaii-Specific Weather Challenges

Many local air tour pilots,[30] some with several years' flying experience on the island of Kauai, stated that helicopter operations there could be particularly challenging because of the terrain, mountain winds, and rapidly changing cloud conditions. They also stated that conditions were more challenging in winter. Many reported that, because weather conditions on Kauai changed so rapidly, traditional sources of pilot weather information, such as automated reporting stations, automated terminal information service (ATIS), and FSS briefings, were not very useful for flight planning.

Of the eight weather-related[31] air tour accidents that occurred in Hawaii since SFAR 71 was implemented, four involved pilots, including the accident pilot, who were relatively new to air tour operations in Hawaii, three of whom had been flying in the islands for less than 2 months.[32] For example, on September 23, 2005, an Aerospatiale AS350BA air tour helicopter crashed off the northern coast of Kauai after encountering heavy rain and other adverse weather conditions, killing three of the five passengers.[33] The pilot had been conducting tour flights in Kauai since August 8, 2005. The pilot survived and reported to investigators that he obtained a weather printout from a DUATS before his first flight that morning. He also stated that he listened to the LIH ATIS before he departed from LIH on the accident flight and that he observed good weather and visibility at the airport. One surviving passenger reported that, when the tour began, the visibility was

[30] Air tour pilots contacted during the investigation included former Bali Hai pilots and pilots who had flown or were flying for other air tour operators in Hawaii.

[31] When these data were compiled, some accidents remained under investigation, and the classification "weather-related" was derived from collected factual information. For completed investigations, the classification was derived from published probable causes and factors.

[32] The four accidents are this accident, LAX98FA211, LAX04FA190, and SEA05MA199.

[33] The description of this accident, SEA05MA199, can be found on the Safety Board's Web site at <http://www.ntsb.gov>.

good, but, as the tour progressed, the helicopter entered thick clouds and encountered heavy rain and reduced visibility.

Another pilot, who was involved in the April 18, 2004, accident on the island of Hawaii, had been employed by the tour company for 11 days and was conducting her first 14 CFR Part 135 revenue tour flight.[34] Interviews with Honolulu FSDO inspectors revealed that, after that accident, they discussed whether initial operating experience (IOE)[35] should be required for all local new-hire tour pilots to familiarize them with not only the tour routes, but also the changing weather patterns in the islands. The FSDO inspectors stated that they believed IOE would be the best way to provide guided experience to new air tour pilots, but a requirement for IOE was not implemented.

The experienced Kauai air tour pilots interviewed stated that they believed that a pilot's ability to assess local weather-related changes and to anticipate the effect of such changes on flying conditions improved as the pilot's local flying experience increased. During its investigation of the previously mentioned September 23, 2005, air tour accident, the National Transportation Safety Board identified three relatively experienced Kauai air tour pilots who encountered the same storm as the accident pilot. Of the three, one pilot chose to cancel his tour and return to base rather than attempt to enter the storm. The other two pilots chose to enter the storm and, although neither flight resulted in an accident, both pilots encountered visibility conditions below what is allowed under SFAR 71.

1.8 Aids to Navigation

Not applicable.

1.9 Communications

There were no known radio communications between the accident flight and any ATC facilities or other aircraft.

1.10 Airport Information

Bali Hai operated its tour flights from PAK, a general aviation airport 1 mile southwest of Hanapepe on the southwest side of Kauai. Located on a flat peninsula, PAK

[34] The accident involved a Piper PA-28-161 airplane. The description for this accident, LAX04FA190, can be found at the Safety Board's Web site at <http://www.ntsb.gov>.

[35] IOE is described as the initial actual aircraft flying experience a pilot performs after completing simulator training and ground school. IOE is usually performed under the oversight of an instructor or check airman, and a minimum number of IOE hours are typically required before a pilot is allowed to fly as part of a crew during a revenue flight. This type of oversight of flights is most commonly encountered in 14 CFR Part 121 operations, though some Part 135 operators choose to use this training method.

has one paved 2,400-foot runway and an adjacent, unpaved helicopter-parking apron that has no buildings or shelters.

1.11 Flight Recorders

Not applicable.

1.12 Wreckage and Impact Information

The helicopter's wreckage was located on the east side of Kahili Ridge about 200 feet below the crest of the ridge at an elevation of 2,850 feet. According to Kauai Fire Department personnel, who were the first to reach the accident site, the wreckage was located on a 75º slope covered by thick vegetation. The wreckage was oriented west-southwest, and the debris field remained within a 50-foot radius of the main impact area with the main concentration of debris scattered to the southwest up the steep slope. Nearly all the wreckage was recovered and transported to a hangar at LIH for examination.

Most of the fuselage structure was destroyed by impact and fire damage. The landing skids and crossover tubes were fragmented into numerous pieces. The top of the cockpit and cabin structure was crushed and was deformed upward. The left side cabin and cockpit doors were deformed; the right side cabin and cockpit doors were significantly more fragmented and deformed than the left side doors. Cockpit flight controls were found in the wreckage debris, but damage prevented investigators from determining control continuity.

The tail boom was separated from the fuselage at the fuselage junction area, was not fire-damaged, and was deformed downward. The transmission and the main rotor mast remained intact and were attached to the roof structure. Examination of the airframe, flight control system components, main rotor system, transmission components, and the tail rotor system components revealed no evidence of a precrash mechanical malfunction. Examination of the main rotor mast revealed no evidence of a mast-bumping event.[36]

The engine was separated from the airframe attach mounts, and the oil, air, and fuel lines showed impact and/or fire damage. From November 2 to 3, 2004, the engine was examined at the Rolls-Royce Corporation facility in Indianapolis, Indiana, under Safety Board supervision. Examination revealed that the compressor impeller shroud displayed rotational scoring and gouging throughout the entire circumference of the shroud, heavy rub damage was evident within the turbine section, and the engine fuel control unit's

[36] According to the FAA's *Rotorcraft Flying Handbook,* Chapter 11, "Helicopter Emergencies," a mast-bumping event occurs when the main rotor hub comes in contact with the rotor mast, which could result in severe damage to the rotor mast or the separation of the main rotor system from the helicopter. Mast-bumping events typically result from improper pilot control inputs or from turbulence that can subject the helicopter to low-gravity conditions.

pointer indicated the throttle was full open. No evidence of precrash engine malfunction was observed.

On May 13, 2005, the attitude indicator from the cockpit instrument panel was disassembled and was examined at the Safety Board's materials laboratory. Visual and microscopic examination of the internal rotor and its housing revealed that each showed circumferential scoring consistent with rotor rotation at impact.

Damage precluded testing of the helicopter's mode C transponder.

1.13 Medical and Pathological Information

Tissue and fluid specimens from the pilot were sent to the FAA's Civil Aerospace Medical Institute in Oklahoma City, Oklahoma, for toxicological testing. According to the toxicology report, the specimens tested negative for carbon monoxide, cyanide, and a wide range of legal and illegal drugs.[37] Traces of pseudoephedrine, a drug found in common, over-the-counter decongestants, were found in the pilot's liver. Quantities of ethanol were detected in the brain, muscle, and blood; however, the report noted, "the ethanol found in this case may be the result of postmortem ethanol production."

1.14 Fire

A fuel-fed fire erupted after the helicopter impacted the ground.

1.15 Survival Aspects

An autopsy was performed on the pilot on September 29, 2004, by the Wilcox Memorial Hospital Department of Pathology, Lihue. According to the autopsy report, the cause of death for the pilot was "multiple traumatic injuries."

According to the autopsy reports for the passengers, the cause of death for each was "multiple traumatic injuries sustained in a helicopter crash and fire."

1.16 Tests and Research

None.

[37] The drugs tested for included the following: amphetamine, opiates, marijuana, cocaine, phencyclidine, benzodiazepine, barbiturates, antidepressants, antihistamines, meprobamate, methaqualone, and nicotine.

1.17 Organizational and Management Information

1.17.1 General

Bali Hai began conducting its Part 91 sightseeing operations in 1986. Its office included an enclosed garage, which served as the company's maintenance facility. The company had two Bell 206B helicopters that operated from PAK, which was about 1 mile from the office. The helicopters were transported each day from the office to the airport on a flatbed trailer pulled by the company's fuel truck and were returned each evening in the same manner.

The company operated tours 7 days per week. Company personnel stated that the summer season and the Christmas and New Year's holidays were the company's busiest tour periods. Bali Hai did not record operating statistics, but the owner estimated that the company flew 1,000 to 1,200 flight hours and carried about 4,500 passengers per year. Review of company scheduling records for the 60 days preceding the accident indicated that the company flew 410 tours, 335 revenue flight hours, and 1,479 passengers during that time period.

At the time of the accident, Bali Hai was the only Part 91 helicopter air tour company on Kauai; the other helicopter air tour companies on the island were certificated and operated under Part 135. Bali Hai was a family-operated business in which the owner himself was pilot-certificated, his son was the company's sole mechanic,[38] his daughter was the office manager, and his son-in-law served as a customer service representative.[39]

Nonfamily employees included the senior pilot, the accident pilot, and the line service technician. The pilots received a flat monthly salary plus flight-hour pay, which was an hourly rate applied to the number of revenue flight hours flown.

1.17.2 Pilot Training

Bali Hai's owner, mechanic, and other company pilots[40] provided the accident pilot some initial company training, as their tour schedule permitted. Bali Hai was not required to have company-specific initial training;[41] the owner stated that each pilot received as much training as the owner felt was needed for the pilot to fly safely and to

[38] The mechanic held an aviation mechanic's certificate with airframe and powerplant ratings. He stated that he gained his helicopter knowledge through on-the-job training at Bali Hai.

[39] The customer service representative's duties included providing the passenger safety briefing and providing a calculated weight and balance sheet in the form of a "boarding pass" to the passengers while they were at the company's office. After the passengers arrived at the helicopter staging area at PAK, they would give the weight and balance sheet to the line service technician, who would give it to the pilot before the flight.

[40] Besides the senior pilot, Bali Hai had one other pilot when the accident pilot was hired. That pilot was no longer with the company on the date of the accident.

[41] Part 91 air tour operators, unlike Part 135 and Part 121 operators, are not subject to any initial pilot-training requirements.

pass the initial SFAR 71 checkride. Because Bali Hai held a certificate of waiver or authorization to deviate from SFAR 71, its pilots were required by the FAA to pass an SFAR 71 checkride every 12 calendar months. The owner stated that, whenever a pilot required a biennial flight review,[42] the company would pay a certificated flight instructor and supply a helicopter so that the pilot could complete the required ground and flight training.

Bali Hai did not provide, and was not required to provide, recurrent flight training.[43] According to the owner, he believed the required SFAR 71 checkrides and annual air tour safety meetings[44] provided an opportunity for the pilots to refresh their knowledge of SFAR 71 and Bali Hai's deviation authorization. The accident pilot had not been employed with Bali Hai long enough to have attended one of the air tour safety meetings.

1.17.3 Pilot-Scheduling Practices

1.17.3.1 Daily Tour Schedules

According to company personnel, unless there was a gap in the tour schedule, the helicopter would be kept running with its rotors turning continuously all day, to reduce engine wear associated with engine start cycles. On the day of the accident, the pilot did not shut down the helicopter.

The customer service representative stated that the pilots typically flew no more than seven or eight tours per day. A review of scheduling records for the 3-month period before the accident showed that the senior pilot and the accident pilot averaged six tours per day when serving as primary pilot.[45] During that timeframe, the accident pilot flew as many as 8 tours per day, and the senior pilot flew as many as 10 tours per day.

Former Bali Hai pilots stated that the company sometimes added tours to the end of the day's schedule, which would depart at 1700 or later, and that they sometimes felt too tired to fly these tours. Some former pilots reported flying as many as 13 tours per day. One former pilot stated, "There are only so many flights you can do where you feel strong enough."

[42] According to 14 CFR 61.56, a flight review requires ground and flight training from a certificated flight instructor.

[43] Part 91 air tour operators, unlike Part 135 and Part 121 operators, are not subject to any recurrent pilot-training requirements.

[44] For air tour pilots who are approved to deviate from SFAR 71, the FAA requires, in addition to the SFAR 71 checkride, that pilots participate in at least one formal air tour safety meeting each year. For more information about the meetings, see section 1.18.5.2.

[45] Company personnel stated that Bali Hai typically scheduled pilots each week to fly 2 full days and 2 half-days, plus 1 additional full or half-day, depending on the demand for tours. The pilot scheduled to work a full day was considered the primary pilot.

1.17.3.2 Pilot Lunch and Rest Breaks

According to Bali Hai's Policies and Procedures Manual, employees could take a 30-minute lunch break "provided all flight line ... needs are met." However, former Bali Hai pilots stated that they either ate lunch while sitting in the helicopter between tours or did not eat lunch at all. One former pilot stated, "I would have appreciated a half-hour [break], but that's just the way it was. I wasn't overly fatigued by that, as long as I got something to eat."

Another former pilot stated, "[Bali Hai's management] simply pushed the flights out. Pilots were just a cog in the wheel to make sure it happened. There was disregard for any fatigue or lunches or long hours, they just wanted pilots to keep flying." Former pilots reported that management strongly encouraged them to return from tours on time.

According to the line service technician, on the day of the accident, the pilot told him about 1200 that he was getting hungry and that the pilot asked him to buy a sandwich for him at a nearby store. According to the technician, the pilot ate the sandwich, while sitting in the helicopter, after returning from his fifth tour about 1345.

Bali Hai did not provide shelter or restroom facilities at the airport for its employees or customers. Former company pilots stated that, when they needed to go to the bathroom, they would ask the line service technician to hold the helicopter's flight controls so they could exit the helicopter to go relieve themselves on the ground behind the fuel truck or in nearby bushes.

1.17.4 Weather-Related Tour Cancellations

Bali Hai's owner stated that the minimum visibility requirement for tours was 3 miles. He said that he told each pilot to assess the weather conditions and his own personal safety limits and make a go/no-go decision about flying in marginal weather. The company's senior pilot said that the company tried to abide by the Part 91 minimum VFR weather requirements and the more restrictive minimums outlined in the company's SFAR 71 operations specifications document.[46]

Bali Hai's senior pilot said that, because the accident pilot was new to Kauai, he and the owner "kept [an] eye on him" and briefed him numerous times about avoiding areas of poor weather. He stated that he had taken the pilot off the tour schedule for weather-related reasons on more than one occasion, even when conditions exceeded the company's minimums. A review of Bali Hai's flight-scheduling records indicated that, during the 8 weeks before the accident, one or more tours were canceled because of weather on 7 days that the accident pilot was working. On September 21, 2004, for example, the accident pilot's 1200 and 1400 tours were rescheduled "due to [weather]."

[46] As a Part 91 operator, Bali Hai was not required to have an operations specifications document. The Honolulu FSDO issued this document to Bali Hai after the owner applied for the authorization to deviate from SFAR 71.

The senior pilot stated that the accident pilot had informed him that he had avoided the Hanalei Valley and Waialeale Crater on more than one occasion when he had become uncomfortable about the weather conditions there. The senior pilot described the accident pilot's flying as, "conservative," "very controlled," and "he tended to avoid weather at all costs." The FAA inspector who administered the pilot's SFAR 71 checkride stated that the pilot demonstrated good decision-making during the checkride by choosing not to enter Waialeale Crater during marginal weather conditions.

A passenger on the accident pilot's fourth tour on the day of the accident stated that the helicopter did not enter clouds. Passengers from another tour that day stated that the pilot maneuvered the helicopter carefully around clouds to show them Manawaipuna Falls.

A professional helicopter pilot who rode as a tour passenger with the accident pilot on August 17, 2004, stated that the pilot crossed some ridges approximately 50 feet above terrain. The passenger stated that, while crossing a ridge during the latter portion of the tour, the pilot flew the helicopter into thin, light clouds. The passenger stated that he told the pilot that he did not want to fly in clouds and that the pilot replied that it was "OK" because he could "see through them."

The senior pilot stated that he had not experienced pressure to fly in marginal weather conditions. However, six of seven former Bali Hai pilots reported feeling at least some pressure from the company to fly in marginal weather conditions. One former pilot told investigators that the company's go/no-go criteria for winds, clouds, and visibility were, "None. Put together whatever tour you can, fly in a little corner of the island if you have to." He stated, "There was always implied pressure to fly." Some former pilots reported that Bali Hai's owner came out to the airport and yelled at them when they refused to fly because of poor weather. However, Bali Hai's owner and office manager were out of town the week of the accident, and they were not on Kauai when the accident occurred.

The accident pilot's wife said that she had asked him how the flying was in Hawaii and that he told her that he enjoyed it but that he had expressed concern about challenging weather conditions. She said that he told her that it was more difficult to cancel his flights at Bali Hai than it had been in the military because Bali Hai was a commercial operation. She stated that he told her, "If it's too bad, we won't go, but if it's just OK, we'll go," and that, "[the senior pilot] goes and comes back." The pilot's wife also stated, however, that he had not told her of any instances of being pressured by management to fly in poor weather.

1.17.5 Ridge-Crossing Practices

Bali Hai's certificate of waiver or authorization to deviate from SFAR 71 included a transition segment that crossed the south end of Kahili Ridge at a landmark called the billboard. According to the transition segment approval, ridge crossings at this location could be executed as low as 500 feet agl. The ridge pass near the accident site was more than 1 mile from the centerline of the company's approved transition segment; therefore, any crossing at that location would have to be performed in compliance with the SFAR 71 minimum altitude of 1,500 feet agl.

The FAA inspector who administered the pilot's SFAR 71 checkride stated that, during the checkride, he and the pilot discussed the rules for crossing Kahili Ridge near the accident site. He stated that he told the pilot that he was not permitted to cross there at low altitudes, and the pilot stated that he understood. Bali Hai's owner stated that his pilots were allowed to cross the ridge at that location, but he incorrectly thought that a crossing could be performed there at 500 feet agl. Bali Hai's senior pilot correctly stated the crossing altitude for that location. Interviews with five former Bali Hai pilots indicated that they varied in their understanding of the regulations and company practices for ridge-crossing locations and altitudes.

The senior pilot estimated that 10 percent or less of the company's tours crossed the ridge at the location near the accident site. He stated that a pilot might choose to cross there if the weather near the billboard was bad or for "scenic reasons." A former Bali Hai pilot stated that he had often crossed the ridge where the accident occurred because passengers liked taking photographs there and because it reduced flight time by 2 to 3 minutes, which he considered helpful if the tour was running long.

The chief pilot for another helicopter tour company stated that he had observed the accident pilot cross Kahili Ridge near the accident site on previous days and twice on the day of the accident. He considered this crossing location unsafe because it brought helicopters closer to clouds and challenging winds. Passengers from the pilot's seventh tour stated that the pilot crossed Kahili Ridge near the accident site and that the helicopter encountered strong wind and rain in that area. One passenger stated that he was worried at times that the helicopter might not clear a ridge because the pilot would descend before crossing a ridge, then pull up to clear it.

1.17.6 Federal Aviation Administration Surveillance – Honolulu Flight Standards District Office

Bali Hai's operations and its certificate of waiver or authorization were under the jurisdiction of the Honolulu FSDO. The FSDO manager stated that oversight of a Part 91 air tour operator[47] would only occur during random ramp inspections, during an SFAR 71 checkride conducted on the operator's pilots, or in response to a customer complaint. The FSDO manager stated that the only complaints about Bali Hai that he could recall involved homeowners' complaints about low-flying aircraft, and he said that he received similar complaints about other operators. He stated that he followed up on the complaints but that none resulted in any enforcement action against Bali Hai. One Honolulu FSDO

[47] FAA Order 1800.56D, "National Flight Standards Work Program Guidelines (NPG)," lists the required surveillance items that inspectors must perform for Part 135 and Part 121 commercial air tour operators; however, the NPG does not contain any provisions that mandate inspector surveillance of Part 91 air tour operators.

inspector recalled receiving past complaints from Bali Hai pilots about maintenance-related issues, and he stated that one such complaint resulted in enforcement action after inspectors found deficiencies with the life vests on board Bali Hai's helicopters.

The Honolulu FSDO inspectors stated that, when they were at PAK conducting their mandatory inspections of a Part 135 air tour operator based at that airport, they would occasionally also conduct ramp inspections of Bali Hai's helicopters and/or pilots. Review of the Program Tracking and Reporting Subsystem database revealed that the last maintenance-related ramp inspection of Bali Hai took place in 2002 and revealed a few mechanical discrepancies.[48] According to the inspectors, because Part 91 surveillance was not mandatory and because Bali Hai had not been involved in an accident or incident since its inception in 1986, no emphasis was placed on monitoring its operations.

1.17.6.1 Staffing Levels

As of February 22, 2005,[49] the Honolulu FSDO employed 45 inspectors (22 operations inspectors, 18 airworthiness inspectors, and 5 avionics inspectors) and 6 managers (4 for the operations unit and 2 for the airworthiness unit). As of March 2005, the Honolulu FSDO was responsible for the oversight of 6 Part 121 operators, 46 Part 135 operators, 14 Part 133 operators, 6 Part 137 operators, and 5 Part 141 flight schools. Also, as of March 2005, the FSDO had 22 current approvals for Part 135 operator certificate of waiver or authorization for SFAR 71 deviations and 2 current approvals for Part 91 operator SFAR 71 deviations.[50] The FAA estimates that there are about 400,000 air tour flights per year in Hawaii.

Since 1990, Honolulu FSDO staffing issues and their potential impact on safety have been the subject of numerous Safety Board recommendations.[51] Although the FAA has taken action in response, Honolulu FSDO staffing has remained below its authorized level.[52] According to the Honolulu FSDO manager, at the time of the Bali Hai accident, the FSDO was about 10 inspectors short.[53] The FSDO manager stated he was not authorized to hire more inspectors to fill those positions because the FAA's Western-Pacific Region as a whole was overstaffed, and a hiring freeze was in effect.

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[48] These discrepancies included screws missing in the top engine cowling, safety wire missing for cannon plug for fuel filter assembly, and rubber boot missing for oil chip plug assembly.

[49] On February 22, 2005, Safety Board and FAA investigators met with Honolulu FSDO personnel to conduct interviews about the FSDO's staffing situation, work requirements, work scheduling, and budget issues, among others. The interviewees attending the meeting included the Honolulu FSDO manager, the operations unit managers, and the airworthiness unit managers.

[50] One Part 91 approval was for Bali Hai, and the other was for an air tour company that was in the process of obtaining a Part 135 operating certificate.

[51] For more information about the safety recommendations, see section 1.18.7.

[52] According to the Honolulu FSDO manager, the FSDO has historically experienced staffing problems because it is not easy to recruit qualified personnel willing to relocate to Honolulu due to the cost-of-living expenses associated with the area. Over the years, some inspectors retired or transferred to other FSDOs or other areas in the FAA.

During interviews, Honolulu FSDO inspectors stated that they were time-constrained in trying to complete their mandatory inspections. They stated that, because of the staffing situation that existed at the time of the Bali Hai accident, the Part 135 operations inspectors focused on Part 135 surveillance and certification oversight and had little or no time for nonmandatory oversight duties, such as Part 91 oversight and/or surveillance.

1.17.6.2 Geographical Surveillance Unit

In October 1995, the Honolulu FSDO formed a geographical surveillance unit (GSU), which provided direct oversight of all air tour operators in Hawaii, regardless of whether they operated under Part 135 or Part 91, and was responsible for ensuring compliance with SFAR 71.[54] The GSU was originally established with eight inspectors, one clerical assistant, and one supervisor. All inspectors used in surveillance operations were trained to recognize standoff distances[55] and elevations above terrain.

The GSU was equipped with surveillance cameras, binoculars, video cameras, and other equipment that the inspectors used to monitor operations and to ensure that pilots and tour companies were complying with cloud and terrain clearance requirements. The GSU used a number of innovative surveillance methods, such as monitoring air tour activity from remote locations and sending inspectors posing as tourists on revenue flights.[56] These methods resulted in some pilots being cited for violating cloud and terrain clearance restrictions.

As part of its duties, the GSU primarily focused its surveillance on operators that were the subject of air tour customer complaints. A former GSU inspector recalled at least one instance in which a passenger complaint, combined with the passenger's photographic evidence, resulted in FAA enforcement action against an operator. Former GSU inspectors recalled that the unit had performed some surveillance of Bali Hai that resulted

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[53] According to the FSDO manager, he completed a 2004 staffing allocation model, and it indicated that the FSDO was 13 inspectors short. By September 2006, FSDO personnel reported that the total FSDO staffing level was similar to that at the time of the accident; however, due to retirements and transfers, fewer inspectors were dedicated to Part 121 oversight and five more inspectors, including the newly hired ones, were dedicated to Part 135 oversight. The newly hired inspectors were not expected to be fully trained and able to resume full responsibilities until the end of fiscal year 2007.

[54] The "Geographical Surveillance Unit – SFAR Manual" contains the guidelines for the Honolulu FSDO's GSU program and lists GSU inspectors' duties, which include traveling to all airports, heliports, landing sites, remote locations, and tour routes frequented by the air tour/sightseeing industry; performing ramp inspections, en route inspections, maintenance functions, and any other surveillance to ensure compliance with SFAR 71; investigating accidents, incidents, and complaints in regards to air tour/sightseeing; and reviewing and making recommendations about problem areas or improvement of the SFAR 71 deviation process/approval, among other duties.

[55] Standoff distance refers to a defined horizontal radius to be maintained between the aircraft and any person, structure, vehicle, vessel, or raw terrain.

[56] The GSU also used inspectors from mainland FSDOs to help conduct this type of en route oversight; using non-Honolulu FSDO inspectors reduced the likelihood that the tour pilots would recognize the inspectors. This provided the FAA the opportunity to observe typical flight operations.

in the correction of minor discrepancies, but they did not recall that any in-depth inspections had been performed or any violations issued.

According to Honolulu FSDO personnel, the GSU was highly successful at performing surveillance of air tour operations. However, by late 2003, the FSDO needed to fill operations and airworthiness inspector positions, and, because the National Flight Standards Work Program Guidelines stated that oversight of certificated operators was the priority, inspectors from the GSU were reallocated to fill those positions instead. In May 2004, the GSU was officially disbanded. After the GSU disbanded, there were no inspectors dedicated to providing direct surveillance of air tour flights in Hawaii.

1.18 Additional Information

1.18.1 Helicopter Operations in Reduced Visibility

Reduced visibility conditions pose a significant challenge for helicopter operations for multiple reasons. Helicopters are usually flown at lower altitudes than fixed-wing aircraft, which imposes high visual demands on helicopter pilots to maintain obstacle and terrain clearance. When visual references are obscured, such as by fog or clouds, the risk of a collision with obstacles or terrain increases.

Helicopters are more maneuverable, but less stable, than fixed-wing aircraft, and require relatively continuous pilot control inputs unless equipped with stability augmentation systems. Most helicopters that are certificated for single-pilot flight under IFR are equipped with stability augmentation systems, such as control stabilization and autopilot systems, which are designed to reduce pilot workload.[57] However, most older helicopters, including the accident helicopter (which was not certificated for IFR operations), do not have this equipment; research has shown that these helicopters can impose a high workload on pilots who attempt to fly them in reduced visibility conditions by reference to flight instruments alone.

Accidents that occur in reduced visibility conditions after a pilot has attempted VFR flight into IMC are much more likely to be fatal than accidents that occur in visual meteorological conditions (VMC). In a 2005 study,[58] the Safety Board reported that, in 2004, only 6 percent of all general aviation accidents occurred in IMC, but 70 percent of those accidents were fatal.[59] A review of Safety Board helicopter accident data indicated that, from 1995 to 2004, about 20 percent of fatal helicopter general aviation accidents and 52 percent of fatal helicopter air taxi accidents occurred in either IMC or dark night VMC. None of the pilots who experienced fatal accidents in those conditions had activated an IFR flight plan.

[57] S.G. Hart, "Helicopter Human Factors," *Human Factors in Aviation* (1988): 591-638.

[58] National Transportation Safety Board, *Risk Factors Associated with Weather-Related General Aviation Accidents*, Safety Study NTSB/SS-05/01 (Washington, DC: NTSB, 2005).

[59] In 2004, there were 103 general aviation accidents that occurred in IMC, resulting in 143 deaths.

Reduced visibility conditions, such as IMC or dark night VMC, also greatly increase the risk of spatial disorientation. One recent study of U.S. Army rotary-wing operations found that sudden loss of visual cues preceded about 25 percent of helicopter accidents attributed to spatial disorientation.[60]

1.18.2 Spatial Disorientation

Spatial disorientation occurs when a pilot develops an incorrect perception of aircraft attitude, altitude, or motion relative to the Earth's surface. It results when a pilot's normal visual cues to aircraft attitude are inaccurate, unavailable, or inadequately monitored, and the pilot, instead, relies on other cues to aircraft attitude that may be misleading.

These cues are provided by the motion-sensing vestibular organs in each inner ear. The sensory organs of the inner ear detect angular accelerations in the pitch, yaw, and roll axes, as well as gravity and linear accelerations. The vestibular system provides useful sensory information under conditions of self-locomotion on the ground but provides misleading sensations in the flight environment. Vestibular sensations are easily ignored when pilots have a clear view of the horizon, but they become compelling illusions when external visual references are not available. Instrument-rated pilots are taught to ignore misleading vestibular sensations in favor of the visual cues from flight instrumentation when operating in IMC. However, even experienced, instrument-rated pilots can experience episodes of spatial disorientation in reduced-visibility conditions. Situational risk factors for spatial disorientation include false surface planes created by sloping clouds or terrain, transitions between VMC and IMC that require the shifting of visual attention between external visual references and cockpit flight instruments, sustained turns, and high workload.[61] Spatially disoriented pilots are at risk of making inappropriate control inputs that can result in loss of aircraft control.

A survey examining disorientation phenomena among naval helicopter pilots found that the most common form of pilot disorientation involved illusions of the helicopter banking.[62] In fact, most surveys examining the incidence of in-flight spatial disorientation among pilots have produced similar findings. For example, in one survey of Indian Air Force pilots, 55 percent of helicopter pilots reported having experienced a false sensation of "one wing low," and 45 percent reported having felt as if they were banking in the opposite direction. Also, 54 percent of helicopter pilots reported having experienced spatial disorientation illusions in clouds, and 32 percent reported experiencing such illusions in poor visibility conditions. The average duration of spatial disorientation

[60] M.G. Braithwaite, S.J. Durnford, J.S. Crowley, N.R. Rosado, and J.P. Albano, "Spatial Disorientation in U.S. Army Rotary-wing Operations," *Aviation, Space, and Environmental Medicine*, Vol. 69 (1998): 1031-1037.

[61] (a) F.H. Previc, "Visual Illusions in Flight," *Spatial Disorientation in Aviation* (2004): 283-323; and (b) L.R. Young, "Spatial Orientation," *Human Factors in Aviation* (2003).

[62] F.R. Tormes and F.E. Guedry, "Disorientation Phenomena in Naval Helicopter Pilots," *Aviation, Space, and Environmental Medicine*, Vol. 46, No. 4 (1975): 387-393.

illusions experienced by Indian Air Force pilots flying fixed- and rotary-wing aircraft was 46 seconds.[63]

1.18.3 Helicopter Pilot Fatigue Issues

Little research has examined the unique effect of time-on-task as a cause of fatigue and an influence on performance among helicopter pilots. One such study[64] examined the effect of a vibrating, noisy, helicopter cockpit environment and continuous flying activity on subjective fatigue and pilot performance. Flight legs were designed to simulate repetitive circular, helicopter air taxi flights conducted under IFR in a metropolitan area, with complete circuits lasting about 1 hour and including three approaches and landings. Pilots flew either 3-, 4-, 6-, or 8-hour flight periods.[65] Rest breaks were permitted during the 4- and 8-hour flight periods but not during the 3- and 6-hour flight periods. Pilot performance was measured, and the pilots also provided ratings of subjective fatigue each hour.

Time-on-task and subjective fatigue were found to have no effect on some basic aspects of flying performance, but they were associated with increased "lapses" in performance, such as navigational errors, which were excluded from the performance analysis. The study found that subjective fatigue increased with time-on-task, peaking during the last hour of flight, but scheduled breaks delayed the onset of subjective fatigue. The 6-hour flight period without breaks was the most fatiguing condition (more fatiguing than the 8-hour flight period with scheduled breaks). During the last hour of the 6-hour period, average subjective fatigue ratings were between "looking forward to a rest period" and "just hanging on till [sic] end of period." Some pilots who participated in the study stated that they would not feel safe to fly an actual helicopter by the end of the 6-hour period with no breaks.

1.18.4 Flight Time and Duty Period Limitations

Title 14 CFR 1.1 defines "flight time" as "pilot time that commences when an aircraft moves under its own power for the purpose of flight and ends when the aircraft comes to rest after landing." This definition is the same for helicopters and airplanes. By comparison, U.S. Army flight regulations provide a unique definition of flight time for helicopters, stating that flight time begins when a helicopter lifts off the ground and ends when it lands and either the engines are stopped or the flight crew changes.

Federal regulations do not impose maximum flight time or duty period limitations on Part 91 air tour pilots, but they do impose flight time limits for Part 135 operations.

[63] P.D. Navathe and B. Singh, "Prevalence of Spatial Disorientation in Indian Air Force Aircrew," *Aviation, Space, and Environmental Medicine*, Vol. 65 (1994): 1082-5.

[64] A.M. Stave, "The Effects of Cockpit Environment on Long-Term Pilot Performance," *Human Factors*, Vol. 19 (1977).

[65] Sleep was not intentionally restricted for this study; however, flight periods were conducted between 1700 and 0100, after the pilots had already performed 8 hours of office work.

Under 14 CFR 135.267, pilots flying nonscheduled Part 135 flights are limited to 8 hours of flight time per consecutive 24-hour period for single-pilot operations and 10 hours of flight time per consecutive 24-hour period for two-pilot crews. More flight time is permitted as long as the anticipated duty period will not exceed 14 hours and is preceded and followed by rest periods of at least 10 hours. These flight time limits for nonscheduled Part 135 flights are the same for helicopter and airplane pilots.

Army flight regulations[66] allow local commanders flexibility in developing flight time limitations for helicopter pilots, but they recommend that flight time be limited to 8 hours per 24-hour period, 15 hours per 48-hour period, and 37 hours per week. Army regulations also recommend that maximum helicopter pilot flight times be reduced by factors of 1.3 for day contour or low-level flight and 1.6 for day, NOE flight. These recommendations were developed after questionnaire data from Army pilots gathered in 1980 indicated that low-altitude flight profiles following terrain contours and lower-altitude, terrain-hugging flights were more fatiguing for pilots than higher-altitude flights.[67]

1.18.5 Special Federal Aviation Regulation 71

After two helicopter air tour accidents occurred on the same day in Hawaii on July 14, 1994, the FAA issued SFAR 71 in the form of an emergency final rule on September 26, 1994, to establish certain procedural, operational, altitude, and equipment requirements for air tour operations in Hawaii.[68] The final rule became effective on October 26, 1994. FAA headquarters personnel indicated that the 1,500-foot altitude restriction in SFAR 71 was not based on specific accident or incident data but was arbitrarily selected based on the rationale that operating at a higher altitude would provide more time for decision-making action in the event of a loss of engine power or other in-flight emergency.

In a letter to the FAA dated October 27, 1994, the Safety Board commented that it was pleased to recognize the FAA's initiative to improve the safety of air tour operations in Hawaii but that it was also concerned that the SFAR 71 altitude restriction could result in unintended degradation of the existing level of safety because of increased compression of traffic at the 1,500-foot limit. The Board urged the FAA to review the SFAR 71 altitude restriction "to [ensure] that there is no increase in the potential for in-flight collisions or inadvertent encounters with cloud layers." The Hawaii Helicopter Operators Association, Air Line Pilots Association, air tour operators, and other groups also expressed concerns

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[66] Headquarters Department of the Army, *Aviation Flight Regulations*, U.S. Army Regulation 95-1 (Washington, DC: HQDA, 1997).

[67] U.S. Army Aeromedical Research Laboratory, *Evaluation of Army Aviator Human Factors (Fatigue) in a High-Threat Environment*, USAARL Report No. 80-8 (Fort Rucker, AL: USAARL, 1980).

[68] In addition to the minimum altitude requirements, other rules specified in SFAR 71 include flotation equipment for certain helicopter tour flights (external helicopter floats were required only for single-engine helicopter flights conducted beyond the shore of any island); a helicopter performance plan; operations suited to the helicopter's operating limitations; and a passenger briefing on the use of flotation equipment, water-ditching procedures, and emergency-egress procedures.

that SFAR 71 could result in an increased likelihood of midair collisions and encounters with cloud layers.

The FAA attempted to lessen these concerns by developing a means to allow air tour operators to request FAA approval to deviate below the SFAR 71 minimum altitude at specified locations. Such approvals are granted in a certificate of waiver or authorization, which, according to the FAA, provide separation between the fixed-wing aircraft and helicopters around the scenic areas where the air tour traffic is most dense. At the time of the accident, almost every helicopter tour operator conducting business in Hawaii held an authorization to deviate below the specified SFAR 71 minimum altitude along transition routes and at site-specific locations.

A comparison of Hawaii air tour accident data[69] for the 10-year period before SFAR 71 was implemented with data for the 10-year period after SFAR 71's implementation revealed that 40 air tour accidents occurred between 1986 and 1995, resulting in 41 fatalities and that 22 air tour accidents occurred between 1996 and 2005, resulting in 43 fatalities. Because the FAA does not collect air tour passenger and flight hour data, accident rates for these two periods are not known.[70]

In the 10-year period before SFAR 71 was implemented, only 5 percent of Hawaii air tour accidents (2 of 40 accidents, resulting in 16 fatalities) involved encounters with weather. In the 10-year period after SFAR 71, 36 percent of the accidents (8 of 22 accidents) involved adverse weather and accounted for most of the fatalities (31 of 43 fatalities).[71]

1.18.5.1 Certificate of Waiver or Authorization to Deviate from Special Federal Aviation Regulation 71

To obtain a certificate of waiver or authorization to deviate from the SFAR 71 minimum altitude, operators were required to demonstrate to the FAA that they would be able to provide a level of safety equivalent to that provided by operating at the higher altitude. Operators did this by adding other safety measures to their operations. An October 30, 1997, FAA document supporting the extension of SFAR 71 stated that the FAA grants deviations case by case after scrutinizing each air tour operation to determine whether the deviation will achieve the desired safety goals.[72] According to Honolulu FSDO management, as part of obtaining the deviation approval, the operator's pilots must demonstrate knowledge of the site-specific locations during annual FAA checkrides, and helicopter pilots must demonstrate the ability to autorotate[73] the helicopter successfully to an alternate emergency landing area at each site-specific location.[74]

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[69] These data were compiled from the National Transportation Safety Board accident database and its special investigation report: National Transportation Safety Board, *Safety of the Air Tour Industry in the United States*, Special Investigation Report NTSB/SIR-95/01 (Washington, DC: NTSB, 1995).

[70] The Safety Board has issued several safety recommendations to the FAA requesting that the FAA obtain improved data. For more information about some of the recommendations, see section 1.18.7.

[71] When these data were compiled, some accidents remained under investigation, and the classification "weather-related" was derived from collected factual information. For completed investigations, the classification was derived from published probable causes and factors.

The FAA has the ability to revise an operator's certificate of waiver or authorization to require any safety enhancements that it feels are necessary, or it can revoke an authorization at any time. During interviews, Honolulu FSDO inspectors showed differences in their understanding of what they could require of operators seeking an approval to deviate from SFAR 71. Some inspectors indicated that they could require anything they deemed necessary to ensure operational safety, while others believed they were restricted as to how much they could demand on the basis of set precedent.

Interviews conducted with Kauai air tour pilots after the accident indicated that pilots showed differences in their understanding of their respective companies' FAA-approved ridgeline crossing requirements. As mentioned previously, present and former Bali Hai pilots provided various answers for permissible crossing altitudes, and a number of pilots not associated with Bali Hai believed that they were permitted to cross any ridgeline at 200 feet agl, even if it were not on a transition segment. Some pilots also did not realize that, when flying outside of a transition segment, they were required to maintain the SFAR 71 minimum altitude of 1,500 feet agl.

1.18.5.2 Formal Air Tour Safety Meetings

The SFAR 71 deviation authorizations for all operators require that air tour pilots must "participate in at least one formal air tour safety meeting each 12 calendar months to review SFAR 71 and sightseeing/air tour issues and procedures." Although the Honolulu FSDO requires air tour pilots to attend the annual safety meetings, the FSDO does not run the meetings or propose the agenda, and FSDO personnel do not always attend.[75] Instead, individual air tour industry participants host each meeting as they see fit. A FSDO inspector who attended some meetings stated that some had disintegrated rapidly into a complaint session about SFAR 71. The most recent safety meeting for the island of Kauai before the accident took place in January 2004. Bali Hai's senior pilot headed that meeting, and he stated that it concentrated mostly on concerns surrounding the FAA's proposed revisions to 14 CFR Part 136.[76]

[72] Air tour operators seeking approval for an SFAR 71 deviation were required to identify their selected site-specific locations on the FSDO's master map, document the suitable emergency landing areas for each site, and provide the FAA with ingress and egress descriptions and minimum altitudes in their selected site-specific locations. Operators seeking approval to deviate from the 1,500-foot transition segment altitude were also required to provide the FAA information on their intended transition segments and the minimum altitude along that transition segment. The FAA stated that each deviation is site-specific and allows operation only over areas of raw terrain (devoid of any persons, vessels, vehicles, or structures).

[73] Autorotation is a rotorcraft flight condition in which the lifting rotor is driven entirely by the action of the air when the rotorcraft is in motion. In the event of a loss of engine power, a helicopter pilot would have to perform an autorotation to land the helicopter. During training scenarios and checkrides, autorotations are typically performed with a simulated loss of engine power.

[74] Pilots of fixed-wing aircraft who are authorized to deviate from the SFAR 71 minimum altitudes and conduct air tour operations at 1,000 feet agl are not required to demonstrate the aircraft's ability to reach a suitable landing site.

[75] The Honolulu FSDO kept the attendance sheets for each meeting. For meetings not attended by FSDO personnel, the host operator would forward the attendance sheets to the FSDO, and FSDO personnel had no knowledge of what safety topics, if any, may have been covered.

1.18.6 Automatic Dependent Surveillance-Broadcast Program

In 1998, the FAA developed an initiative for implementing the National Automatic Dependent Surveillance-Broadcast (ADS-B) Program to support the next-generation air transportation system. The program, which includes ground-based stations, satellites, and aircraft avionics, among other technologies, is designed to provide pilots with radarlike information in the cockpit and to enable air traffic controllers to monitor low-flying aircraft in those areas with limited or no radar coverage. For Hawaii air tour pilots, who are faced with challenging local weather conditions, high-density air tour traffic, and island geography that makes large areas of low-altitude airspace invisible to FAA radar systems, an ADS-B system could provide enhanced in-flight navigation, air traffic, terrain, and weather information, and, through data-link, provide the same information to ground-equipped personnel, such as operator dispatchers, air traffic controllers, or other FAA personnel.

In 1999, the FAA began to test ADS-B program applications in some regions of Alaska, including high-volume air tour areas, such as southeast Alaska. The FAA also worked with the Cargo Airline Association and installed transceivers and tested ADS-B program applications in the Ohio River Valley. These and other tests have been highly successful. The FAA has stated that the National ADS-B Program ground infrastructure will be in place nationwide by 2013. The FAA has stepped up the implementation timeframe for the Gulf of Mexico and plans to have the infrastructure in place by 2010.[77] Louisville, Kentucky; Philadelphia, Pennsylvania; and Juneau, Alaska, are also scheduled for completion by 2010.

Hawaii is not singled out for early attention as part of this plan, however; its ADS-B ground infrastructure is scheduled to be installed by 2013, with the rest of the national airspace system. In a recent communication,[78] the FAA indicated that the surveillance services and broadcast program planned to award a contract in July 2007 for the installation of ADS-B ground infrastructure covering all the areas in which there are now surveillance services for national airspace users and air traffic controllers. The FAA also indicated that, once the new infrastructure is in place, the program office and its vendors will explore options for providing surveillance services to other areas.

[76] At the time of the meeting, Part 136 pertained to National Parks Air Tour Management. However, in an October 22, 2003, notice of proposed rulemaking, the FAA proposed a new subpart A in Part 136 that would establish general safety regulations for all commercial air tours.

[77] Safety Recommendation A-06-21, issued March 24, 2006, asked the FAA to "ensure that the infrastructure for the National Automatic Dependent Surveillance-Broadcast Program in the Gulf of Mexico is operational by fiscal year 2010." On July 17, 2006, the Board classified A-06-21, "Open—Response Received," after the FAA surveillance and broadcast services program manager provided a June 15, 2006, briefing on the ADS-B program to the Board Members and staff, which included a discussion of the progress of the program for the Gulf of Mexico.

[78] The Safety Board received an electronic communication from Vincent Capezzuto, FAA Air Traffic Organization (ATO)-E surveillance and broadcast services program manager, on October 25, 2006.

1.18.7 Previous Related Safety Recommendations

From October 1, 1988, to April 1, 1995, the Safety Board investigated 139 air tour accidents and incidents and issued numerous safety recommendations to the FAA and the Honolulu FSDO about air tours and FSDO staffing. During its investigation of the October 28, 1989, accident in Hawaii involving a de Havilland DHC-6 operated by Aloha IslandAir as a scheduled Part 135 passenger-carrying flight,[79] the Board noted specific deficiencies with Honolulu FSDO staffing and oversight of general aviation and Part 135 operators and concluded that “at least three accidents in the Hawaiian Islands might have been prevented if [Honolulu] FSDO-13 had personnel and guidance to maintain adequate surveillance of its assigned … Part 135 operators.”[80] As a result, among several recommendations, the Safety Board issued Safety Recommendation A-90-136, which asked the FAA to do the following:

> Perform a special study of the adequacy of Flight Standards District Office staffing considering the availability of work hours, the geographic area of responsibility, and the size and complexity of the assigned operations.

On February 8, 1991, the FAA responded that it had procured a contractor to develop the required analyses and revalidated staffing standard. On May 11, 1993, the FAA reported that, among other improvements, it updated the safety inspector staffing standards, that the standards were developed at the regional level and were applied using the most current data providing regional staffing estimates, and that field office staffing estimates were generated and were being analyzed against current on-board employment for accuracy.

In a June 7, 1994, response, the Safety Board noted that the FAA also reviewed aviation safety inspector (ASI) job tasks and elements, analyzed ASI job tasks by time and frequency, and planned a means to identify needed workforce distribution adjustments by option, specialty, and location. As a result, the Board classified Safety Recommendation A-90-136 “Closed—Acceptable Action.”

After the April 22, 1992, accident on the island of Maui involving a Beech Model E18S operated by Tomy International, Inc. (doing business as Scenic Air Tours),[81] the

[79] National Transportation Safety Board, *Aloha IslandAir, Inc., Flight 1712, de Havilland Twin Otter, DHC-6-300, N707PV, Halawa Point, Molokai, Hawaii, October 28, 1989*, Aviation Accident Report NTSB/AAR-90/05 (Washington, DC: NTSB, 1990).

[80] In its report, the Safety Board also concluded, “Inadequate surveillance [was] a result of the POI’s [principal operations inspector] heavy workload and insufficient qualitative guidance from FAA headquarters. … Turnover of personnel and the lack of experienced personnel resulted in only two POIs having responsibility for all the general aviation and Part 135 surveillance activities for FSDO-13 from June until August 1989.”

[81] National Transportation Safety Board, *Tomy International, Inc., d/b/a Scenic Air Tours, Flight 22, Beech Model E18S, N342E, In-flight Collision with Terrain, Mount Haleakala, Maui, Hawaii, April 22, 1992*, Aviation Accident Report NTSB/AAR-93/01 (Washington, DC: NTSB, 1993).

Safety Board issued Safety Recommendation A-93-11, among others, to request that the FAA do the following:

> Ensure that the regulatory basis and surveillance resources are in place to oversee the operations, equipment, airmen, and airspace associated with any selective attention directed toward commercial air tour operations.

Safety Recommendation A-93-11 was classified, "Closed—Acceptable Action" on February 22, 1994, after the FAA responded that it was considering rulemaking action and that it had taken action to provide better oversight of air tour operators in Hawaii and over the Grand Canyon.

The Safety Board's 1995 air tour special investigation report[82] contained 11 safety recommendations; four of which are described below.

Safety Recommendation A-95-57 asked the Department of Transportation (DOT) to do the following:

> Establish and maintain a database of all air tour operators that would provide data for use in determining the scope of air tour operations and accident rates that can be used to assess the safety of the air tour industry.

On July 14, 1999, the Safety Board classified A-95-57 "Closed—Unacceptable Action" due to the DOT's failure to take action in a timely manner.

The other three recommendations, Safety Recommendations A-95-58, -61, and -64, respectively, asked that the FAA do the following:

> Develop and implement national standards by December 31, 1995, within 14 CFR Part 135, or equivalent regulations, for all air tour operations with powered airplanes and rotorcraft to bring them under one set of standards with operations specifications and eliminate the exception currently contained in 14 CFR Part 135.1.

> Use the data for air tour operators as recommended in A-95-57 to the Department of Transportation to provide adequate staffing at all FSDOs that have air tour operations within their geographic boundary.

> As soon as possible, conduct meetings with interested parties in Hawaii to resolve the issues of optimum flight altitudes and stand-off distances for air tour flights. These discussions should consider any positive or negative effects on safety of the current provisions of SFAR 71.

The FAA responded to Safety Recommendation A-95-58 on September 15, 1995, stating that it was considering a notice of proposed rulemaking (NPRM) to address the issues in the recommendation. On June 18, 2001, the Safety Board concluded that the

[82] National Transportation Safety Board, NTSB/SIR-95/01 (1995).

delays were unacceptable, and it classified A-95-58 "Open—Unacceptable Response," pending issuance of the NPRM and the final rule. The NPRM, "National Air Tour Safety Standards,"[83] was issued on October 22, 2003; the final rule was issued February 13, 2007. The Board notes that the final rule differs substantially from the NPRM and has not yet issued a response to the FAA.[84]

In a July 25, 2001, response, the Safety Board classified A-95-61 "Closed—Acceptable Alternate Action," noting that, although the DOT failed to take the action on which the recommendation was dependent, the FAA created an alternative system to acquire data on air tour operators and use these data to provide adequate staffing at all FSDOs that have air tour operations in their geographic boundary. The FAA gathers the data through its mandatory drug-testing program for all air tour pilots.[85]

On October 29, 1996, the Safety Board classified A-95-64 "Closed—Acceptable Action" after the FAA responded on July 8, 1996, that it met with helicopter operators in Hawaii and decided to grant deviations from SFAR 71 to individual operators.

As a result of the Safety Board's analysis of the FAA's procedures for collecting and reporting general aviation activity, on May 12, 2005, the Safety Board issued Safety Recommendation A-05-13 to supersede Safety Recommendation A-03-38[86] and to ask the FAA to do the following:

> Develop, validate, and document an unbiased method for generating and revising activity estimates based on surveys or reporting of general aviation operations.

On August 2, 2005, the FAA responded that it agreed that credible data on flight hours and flight characteristics are among the most basic requirements of safety analysis. The FAA stated that it would focus on improving the General Aviation and Air Taxi Activity (GAATA) survey distribution to include a larger portion of the general aviation fleet. On January 4, 2006, the Safety Board classified A-05-13 "Open—Acceptable Response" due to the FAA's anticipated improvements to the GAATA survey process.

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[83] The NPRM was issued on October 22, 2003, in 68 *Federal Register* 60572. For more information, see section 1.18.8.1.

[84] The final rule was issued on February 13, 2007, in 72 *Federal Register* 6884. For more information, see section 1.18.8.2.

[85] Part 91, Part 135, and Part 121 operators must participate in the program. The information gathered through the testing program enables the FAA to monitor the number of air tour operators throughout the country, but it does not provide the FAA any flight-hour or passenger data for each operator for use in determining the scope of air tour operations and accident rates.

[86] Safety Recommendation A-03-38 had been issued August 20, 2003, as a result of the Safety Board's previous analysis of the FAA's accident data and activity data.

1.18.8 National Air Tour Safety Standards

1.18.8.1 Notice of Proposed Rulemaking

The FAA's original NPRM for national air tour safety standards sought to increase the safety of commercial air tours nationally by proposing requirements for the certification of air tour operators and establishing new safety requirements. The NPRM proposed to create a new Subpart A in Part 136 that would establish the general safety regulations for all air tours. The proposed Subpart A of Part 136 included a uniform definition for all commercial air tours and defined the terms "air tour operator," "raw terrain," "suitable landing area," and "shoreline."

The NPRM also proposed that, in addition to the provisions of Part 136, air tour operators would still have to comply with Part 91, Part 135, or Part 121, however, Part 91 air tour flights would be limited to charitable or community events. The 14 CFR 119.1(e)(2) and 135.1(a)(5) exception, which currently allows for air tour operators like Bali Hai to conduct business under Part 91, would be amended to allow only flights that are conducted as part of infrequent functions that enable the general aviation community to contribute in a positive way to charitable and local causes.[87] These events would be limited to a 3-day timespan and limited to four or fewer events per calendar year. According to the NPRM, the Part 91 air tour operators that were operating under the 14 CFR 119.1(e)(2) and 135.1(a)(5) exception, such as Bali Hai, would have to begin the process of obtaining a Part 135 or Part 121 operating certificate.

The Safety Board responded to the NPRM on January 22, 2004, by supporting the proposed rule and by indicating that its implementation would establish safety requirements for commercial air tours that were long overdue. The Board also noted that the NPRM attributed a decrease in air tour accidents in Hawaii to the issuance of SFAR 71. However, the Board commented that it does not believe that there is a reliable basis for this conclusion because of the current lack of an accurate, verifiable method of collecting and tracking flight-hour activity data for specific segments of nonscheduled Part 135 flight operations. The Board also commented that these data-collection deficiencies hinder the Board's and the FAA's ability to calculate safety statistics.

In addition to the Safety Board's response, however, the FAA received thousands of complaints from within the air tour industry indicating that, if the proposals under the NPRM are implemented, a number of businesses, such as single-aircraft, single-pilot, Part 91 air tour operators (for example, operators who sell rides in open-cockpit, antique biplanes), would go out of business if required to comply with Part 135 regulations. The FAA responded by substantially revising several aspects of the NPRM before releasing the final rule.

[87] According to the NPRM, to qualify for an exception under 14 CFR 119.1(e)(2), a charitable or community event must be conducted to raise funds for either of the following: a charity identified by the U.S. Department of Treasury; a nonprofit entity, with one of the entities' purposes being the promotion of aviation safety; or a local community cause not covered by the first two exceptions. The sponsor of the charitable or community flight(s) would also be required to provide the local FSDO with at least 7 days advance notice.

1.18.8.2 Final Rule

On February 8, 2007, the FAA issued the final rule for National Air Tour Safety Standards. Among the final rule's provisions, Subpart A of Part 136, as proposed under the NPRM, provides definitions for the terms "commercial air tours," "air tour operator," "raw terrain," "suitable landing area," and "shoreline." The final rule also permanently establishes the requirements outlined under SFAR 71 by including those requirements in Part 136 of Appendix A.

In contrast to what the NPRM proposed, the final rule allows most Part 91 air tour operators to still operate under the 14 CFR 119.1(e)(2) and 135.1(a)(5) exception;[88] however, these operators must also comply with the safety requirements of Part 136, Subpart A, and must also apply for, receive, and comply with a letter of authorization (LOA) from the FAA in accordance with 14 CFR 91.147. The LOA requirements include the operator's name; principal business address; principal place of business; the name of the person responsible for management; the name of the person responsible for aircraft maintenance; the make, model, and series of each aircraft; and the registration number of each aircraft. According to the FAA, the LOAs will enable the FAA to develop a database of all air tour operators, and the LOAs will be maintained in the same database as the operations specifications for certificated air tour operators. The final rule does not require operations specifications for Part 91 air tour operators, and it does not require air tour activity data reporting.

1.18.9 Requirements for Part 135 Air Tour Operators

In addition to the mandatory FAA oversight requirements for Part 135 air tour operators, in general, operators that hold Part 135 operating certificates are required to do the following: prepare operating, maintenance, and training manuals and have them accepted or approved by the Administrator; acquire and install any equipment required for their operations under Part 135, as appropriate; train and test their crewmembers to show that those crewmembers are qualified to serve under Part 135, as appropriate; maintain flight-locating or dispatch procedures; and develop record-keeping systems to show that they can comply with Part 135 crewmember and maintenance requirements on an ongoing basis. In addition, all Part 135 certificated air tour operators have specific authority in their operations specifications to conduct commercial air tours. The operations specifications also list any special authority or deviations granted to the operator.

Part 135 regulations, which were originally established for nonscheduled air taxi operations, also include restrictions and training requirements that are pertinent for air-taxi related operations, such as cargo handling, hazardous material carriage, hazardous material training programs, and international operations, among others. Air tour operators that hold Part 135 operating certificates must comply with these requirements, even though their daily operations may never involve such activities.

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[88] According to the final rule, an operator may not conduct tour flights over the Grand Canyon National Park under the exception.

2. Analysis

2.1 General

The pilot was properly certificated and qualified under Federal regulations to conduct the Part 91 nonstop sightseeing air tour flight. No evidence indicated any preexisting medical condition that might have adversely affected his performance during the flight.

Although the operator inaccurately tracked the helicopter's hours and kept inadequate maintenance records, examination of the wreckage revealed no evidence that powerplant, system, or structural failures of the helicopter contributed to the accident. The helicopter's weight and balance were within limits for the duration of the flight.

The accident was not survivable for any of the occupants because they were subjected to impact forces that exceeded the limits of human tolerance.

This analysis discusses numerous human performance issues that contributed to this accident, including the role of spatial disorientation, the pilot's inexperience with local weather patterns, his decision-making, and the effect that the operator's pilot-scheduling practices and other cognitive factors had on the pilot's ability to assess risks and make decisions. This analysis also discusses the lack of FAA oversight of Part 91 air tour operators, FAA oversight of commercial air tour operations, the inability of the Honolulu FSDO to provide direct surveillance of air tour operations in Hawaii, and the benefits of ADS-B in Hawaii.

2.2 Accident Sequence

The air tour flight was conducted under VFR and collided with mountainous terrain during IMC. The pilot had encountered deteriorating visibility and cloud conditions during his previous tour, and those conditions were also present several minutes before the accident. Moderate turbulence was forecast, and passengers from previous tours reported that the helicopter encountered some turbulence, rain, and high winds. Weather radar data indicated that a line of weather echoes containing rain showers was converging on the ridge near the accident location about the time of the accident.

This line of echoes was associated with a lowering of cloud bases below 2,400 feet msl and obscuration of the higher terrain in the area where the accident occurred. ATC radar data indicate that the helicopter passed over terrain elevations as high as 3,000 feet; thus, the pilot likely encountered areas of restricted visibility as he attempted to cross the ridge.

ATC radar data was of limited use in helping investigators understand the helicopter's movements because the helicopter's mode C transponder was not functioning properly and transmitted erroneous altitude data; damage precluded postaccident testing of the unit. As a result, the available data provided only a two-dimensional ground track for the flight. The data showed that, as the helicopter crossed the top of the ridge, it entered a clockwise, spiral pattern for the remaining 47 seconds of flight. This spiral track grew increasingly erratic before ending near the location of the aircraft wreckage, which suggests that the pilot was unable to maintain a stable heading. Without accurate altitude data, however, it is impossible to know what changes in altitude may have accompanied these changes in ground track.

The accident site was on a 75º slope, and the wreckage debris was scattered up the slope. Observed wreckage damage included fragmented skids and cross tubes, heavier crush damage on the right side of the cabin than the left, downward deformation of the tail boom, and evidence of a high engine-power setting. These damage characteristics and the wreckage debris distribution suggest that, when the helicopter struck the sloping terrain, it was in an extreme nose-high attitude with a high engine-power setting, neither of which are consistent with what would be expected for controlled cruise or maneuvering flight. Although it is possible that the pilot may have seen the terrain through the clouds moments before impact and added control inputs in an attempt to avoid it, the erratic, zigzagging ground track that preceded the impact suggests that the pilot lost control of the helicopter before the collision.

2.3 Human Performance

2.3.1 Spatial Disorientation

Spatial disorientation has contributed to many accidents involving loss of control. In these cases, loss of control follows the pilot's inappropriate control resulting from confusion about the aircraft's attitude. Major situational risk factors for spatial disorientation include sustained turns, high workload, false surface planes created by sloping clouds or terrain, and transitions between VMC and IMC that require shifting visual attention between external visual references and cockpit flight instruments. All of these risk factors were present for the pilot during the last minute of the accident flight.

Attempts to continue visual flight into IMC may be even more problematic for helicopter pilots than for pilots of fixed-wing aircraft because helicopters are inherently less stable and require near continuous control inputs from the pilot. Helicopters, like the accident helicopter, that are not equipped for IFR flight and do not have control stabilization or autopilot systems can impose high perceptual and motor demands on the pilot. These helicopters can make it very challenging for pilots to maintain stable flight by referring to flight instruments alone. When the accident pilot attempted to continue visual flight into IMC, he would have been subjected to a high workload in order to maintain control of the helicopter. Moreover, the extent of the weather echoes and the duration of the sustained turn captured by the radar track suggest that the encounter with IMC was prolonged. This would have further complicated the pilot's workload and increased the potential for spatial disorientation resulting from hazardous illusions, thereby, increasing the potential for inappropriate control input responses.

In the absence of evidence indicating a mechanical malfunction, severe turbulence,[89] or some other factor that would explain the accident pilot's apparent loss of control of the helicopter, spatial disorientation is the most likely explanation. The Safety Board concludes that the helicopter's descending spiral flightpath, which became increasingly erratic in the final seconds of the flight, was consistent with pilot spatial disorientation.

2.3.2 Pilot's Decision-making

Although the pilot likely encountered areas of deteriorating weather and IMC near the accident site, photographs recovered from a passenger's camera showed areas of clearer weather along the coastline, east of the helicopter's position, as it exited Waialeale Crater. The lower terrain between the helicopter and the coastline and the height of the clouds would have permitted a safe deviation in that direction. Furthermore, Bali Hai pilots were authorized to fly as low as 1,000 feet agl from the crater toward the coast; thus, the pilot could have flown in the direction of better weather, while remaining in compliance with SFAR 71 and the certificate of waiver or authorization requirements. Rather than deviate to the east, however, the pilot chose to fly south, along his usual tour route adjacent to Kahili Ridge, as the advancing line of clouds closed in on the high terrain. The pilot's decision to fly into an area of deteriorating weather and high terrain, despite the availability of a safer route to the east, was an error that played an important causal role in this accident, and the Safety Board considered many factors that may have influenced that decision.

2.3.2.1 Inexperience with Local Weather Patterns

The accident pilot had been flying commercial air tours for Bali Hai on Kauai for less than 2 months. Nearly all of his previous flight experience had been gained as a military pilot with the Indian Air Force. Though the pilot was experienced in helicopter operations and claimed previous mountain and coastal flying experience, he had few flight hours as a commercial air tour pilot and had limited knowledge of Kauai's weather patterns. The pilot had no previous experience flying in Hawaii before he was hired by Bali Hai, 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.

Many experienced local air tour pilots interviewed after the accident stated that VFR helicopter operations on Kauai were unusually challenging because of the rugged terrain, mountain winds, and rapidly changing visibility and cloud conditions. They stated

[89] The forecast included only moderate turbulence, and the weather study found no evidence to indicate a likelihood of severe turbulence.

that these conditions rendered traditional sources of pilot weather information, such as automated reporting stations and FSS briefings, not very useful, and that this heightened the importance of a pilot's skill in visually assessing changes in weather conditions during tour flights. The experienced pilots indicated that a pilot's skill in assessing changing weather conditions and anticipating the effect of any changes on flying conditions was critical for effective decision-making. They stated that such skills improved as local flying experience increased. This raises concern about the impact of local inexperience on the safety of pilot decision-making. A review of the eight weather-related air tour accidents that have occurred in Hawaii since SFAR 71's implementation revealed that four of the accidents involved pilots who had relatively low experience flying air tours in Hawaii. In fact, three of the accidents involved pilots who had flown there for less than 2 months.

It is highly unlikely that the accident pilot would have decided to continue into the area of deteriorating weather conditions and attempted to cross in the vicinity of the accident site if he had accurately assessed the changing weather and had appreciated how it would likely affect flight visibility in those areas. Therefore, the pilot's decision to fly in the vicinity of the accident site indicates that he was unable to accurately assess how rapidly or to what extent the weather was deteriorating in that area. As described earlier in this report, the pilot had previously told a passenger that he had flown through thin clouds during a ridge crossing because he could see through the clouds. The pilot may have expected that this would be the case during the accident flight; however, visibility was dramatically reduced along the top of the ridge as the incoming line of weather reached the high terrain.

The Safety Board concludes that the pilot's inexperience with Hawaii weather conditions affected his ability to make appropriate in-flight decisions when faced with deteriorating weather. The Board also concludes that other pilots who are inexperienced with Hawaii weather conditions may also be hindered in their ability to make appropriate in-flight decisions when faced with deteriorating weather. FAA-sponsored, human-factors research conducted by aviation psychologists suggests that cue-based training programs can improve pilots' weather-related decision-making during VFR flights.[90] The Safety Board concludes that cue-based training, tailored to the dynamic local island climate conditions of Hawaii, could provide an important safety benefit to pilots who are new to flying in the state. There are currently no FAA guidance materials providing specialized training on the recognition of local weather cues that are critical for in-flight decision-making in the Hawaiian Islands. Therefore, the Board believes that the FAA, in cooperation with Hawaii commercial air tour operators, aviation psychologists, and meteorologists, among others, should develop a cue-based training program for commercial air tour pilots in Hawaii that specifically addresses hazardous aspects of local weather phenomena and in-flight decision-making. The Board also believes that, once a cue-based training program that specifically addresses hazardous aspects of local weather phenomena and weather-related, decision-making issues is developed, as requested in

[90] M. Wiggins and D. O'Hare, "Weatherwise: Evaluation of a Cue-Based Training Approach for the Recognition of Deteriorating Weather Conditions During Flight," *Human Factors. Human Factors and Ergonomics Society*, Vol., No. 2 (2003): 337-345.

Safety Recommendation A-07-18, the FAA should require all commercial air tour operators in Hawaii to provide this training to newly hired pilots.

2.3.2.2 Overconfidence and Decision Bias

FAA-sponsored research indicates that pilots who demonstrate a willingness to fly under VFR into IMC in a simulated context tend to be more confident in their own abilities and less concerned about the associated risks.[91] The pilot had expressed concerns to his family about flying in the challenging weather conditions on Kauai. However, passengers on tour flights he conducted before the accident flight reported that the pilot was willing to fly into areas of clouds and reduced visibility. Digital photographs taken during the accident flight showed that the pilot flew through at least two such areas before reaching the Kahili Ridge. These decisions had not previously resulted in an accident. This may have increased the pilot's confidence in his own abilities and decreased his estimation of the risk associated with such decisions.

The pilot's decision to continue flying into deteriorating weather may also have been influenced by a cognitive bias. Deviating east toward the coastline would have required the pilot to disappoint his passengers by eliminating the last major scenic area on his tour and would have resulted in a late return to the airport. These outcomes represented certain inconveniences for the pilot. However, the pilot had the option of avoiding these inconveniences by continuing along his usual flightpath adjacent to the Kahili Ridge and attempting to cross the ridge at the high pass. Although the pilot may have recognized the increased safety risk associated with this option, the decision to accept a riskier choice to avoid a certain set of inconveniences would be consistent with a human decision bias that is often observed when people weigh potential decision outcomes in terms of the potential losses associated with each choice.[92] Although it is possible that the pilot's decision was influenced by overconfidence or decision-making bias, the extent to which either of these factors might have influenced his decision to continue flying into the area of deteriorating weather could not be determined.

2.3.2.3 Bali Hai's Pilot-Scheduling Practices

Bali Hai's pilots remained at the helicopters' flight controls nearly continuously for up to 8 hours per day because of the company practice of keeping the helicopters running between tour flights. The pilots did not have scheduled breaks, and they ate lunch while sitting in the helicopter between tours, if at all. There was no shelter at Bali Hai's staging area, nor were there any restroom facilities. The lack of scheduled breaks, the short turnaround times between flights, and the unavailability of private restroom facilities probably discouraged consumption of food and liquids during the workday because there

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[91] Human Factors and Ergonomics Society, "An Investigation of the Factors that Contribute to Pilots' Decisions to Continue Visual Flight Rules into Adverse Weather," (Santa Monica, CA: 2001).

[92] D. O'Hare and T. Smitheram, "Pressing On Into Deteriorating Conditions: An Application of Behavioral Decision Theory to Pilot Decision-Making," *International Journal of Aviation Psychology*, Vol. 5 (1995): 351-370.

was little opportunity to go to the bathroom. This increased the risk of dehydration and other physiological problems, which could have degraded performance.

These working conditions were also conducive to fatigue. Research on pilot fatigue in a noisy, vibrating helicopter simulator found considerable increases in subjective fatigue after 6 hours of short repetitive flights. At the end of this period, some helicopter pilots who participated in the study said they were so fatigued that they did not feel safe to fly a real helicopter. As subjective fatigue increased, study pilots demonstrated increasingly frequent “lapses” in performance. The study also found that routine, hourly rest breaks outside the cockpit reduced the buildup of pilot fatigue to manageable levels, even when flight periods were extended to 8 hours.[93]

The day of the accident was the pilot’s second-longest day of flying since he began working for Bali Hai. By the time of the accident, he had been at the controls of the helicopter with the rotors turning for about 7.7 hours and had been observed to leave the cockpit briefly only once, about 1500. Passengers waiting to board the pilot’s 1500 flight later described him as appearing fatigued at that time. This evidence suggests that the pilot was likely to have been fatigued during the accident flight.

Bali Hai operated under Part 91 and was, therefore, not subject to flight time, duty period, or rest requirements. However, the pilot’s cumulative flight time of approximately 6.5 hours did not exceed single-pilot limitations specified under Part 135. Part 135 allows a maximum of 8 hours of flight time per consecutive 24-hour period, with additional flight time permitted when the anticipated duty period will not exceed 14 hours and is preceded and followed by rest periods of at least 10 hours. By comparison, U.S. Army flight regulations[94] also recommend that helicopter pilot flight time be limited to 8 hours per 24-hour period. However, the Army has recognized the stresses associated with helicopter flying, and its regulations recommend that maximum flight times be reduced to 6.15 hours for day contour flight or low-level flight at or below 200 feet agl. Army regulations also contain a broader definition of flight time. Army regulations consider a pilot’s flight time to begin when a helicopter lifts off the ground and ends when it lands and either its engines are stopped or the flight crew changes. The accident pilot’s air tours included a combination of low-level ridge crossings and higher-altitude flying. Although not subject to Army regulations, depending on how this flying was classified, the accident pilot’s cumulative time at the controls might have exceeded Army safety limitations.

It is difficult to evaluate the relative extent to which dehydration, unmet physiological needs, or fatigue might have contributed to the accident pilot’s decision to continue flying into an area of deteriorating weather rather than deviate around the weather and risk a delayed return. However, it is likely that one or more of these factors was affecting the pilot at the time of the accident, any one of which would have negatively affected the pilot’s concentration and decision-making. The Safety Board concludes that Bali Hai’s pilot-scheduling practices, although permitted under Federal aviation

[93] Stave (1977): 503-514.

[94] U.S. Army Regulation 95-1 (1997).

regulations, likely had an adverse impact on pilot decision-making and performance. The Board also concludes that existing Federal aviation regulations 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. Therefore, the Safety Board believes that 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.

2.3.2.4 Management Pressure

Several pilots who had previously been employed by Bali Hai stated that the company owner and office manager had inappropriately pressured them to conduct tour flights in poor weather conditions on multiple occasions, and some reported being told it was unacceptable to allow tours to exceed scheduled times. In addition, the accident pilot's wife stated that the pilot had expressed concern about the commercial pressure to continue flying when weather conditions were "just OK."

Despite these statements, the influence of management pressure on the accident pilot's decision-making during the accident flight is uncertain. The pilot's wife stated that he had not told her of being directly pressured by company managers to fly in poor weather, and both the company's senior pilot and a pilot who left the company in August 2004 stated that they had not been pressured. Also, Bali Hai's owner and office manager were out of town the week of the accident and were not on Kauai when the accident occurred; thus, their physical absence likely diminished their ability to monitor and directly influence the pilot's activities on the day of the accident. The Safety Board concludes that, although there is evidence that Bali Hai managers had inappropriately pressured some pilots to fly in poor weather conditions and to avoid late returns, the extent to which management pressure might have influenced the pilot's decision-making during the accident flight could not be determined.

2.4 Federal Aviation Administration Surveillance

2.4.1 Oversight of Part 91 Air Tour Operations

Bali Hai was able to conduct its 45- and 55-minute commercial air tour flights under Part 91 because of the exception listed under 14 CFR 119.1(e)(2) and 135.1(a)(5) for nonstop flights within a 25-mile radius of the departure and arrival airport. The island of Kauai offers a unique opportunity in that its small size and large number of seasonal tourists enable an air tour operator to conduct tours of the entire island without exceeding the distance limit. Although the exception does not stipulate any operator flight-hour or passenger limitations, the intent behind the exception was likely to enable provisions for small operations, such as single-aircraft, single-pilot operators. It likely did not consider that an operator like Bali Hai could keep two helicopters running continuously daily to transport an estimated annual passenger load of about 4,500 to 8,500[95] people under the relatively lenient regulations of Part 91.

For example, in the NPRM titled "National Air Tour Safety Standards," issued on October 22, 2003, the FAA acknowledged that "commercial air tours conducted in accordance with Part 121 or Part 135 are subject to a higher level of safety than those conducted in accordance with Part 91 because of the number of passengers they carry, the type of aircraft used … and the frequency of operations." This assertion implies that the FAA expects that an air tour operator that carries a large number of passengers should be subject to a higher level of safety, yet Bali Hai was subject to no pilot training requirements, no pilot duty time limitations, relatively fewer aircraft maintenance requirements, and minimal FAA oversight and surveillance requirements.

2.4.2 Honolulu Flight Standards District Office Surveillance of Bali Hai

Bali Hai conducted its sightseeing air tours since 1986 and, before this accident, did not receive any FAA national, regional, or office inspections or focused, multiperson, team inspections because such inspections are not required for Part 91 operators. According to FAA Order 1800.56D, the National Flight Standards Work Program Guidelines for FAA inspectors, "surveillance is one of the most important functions performed by AFS [Flight Standards Service] field office personnel to ensure safety and regulatory compliance in the aviation system." The FSDO manager stated that oversight of a Part 91 operator would only be performed as needed, such as during an SFAR 71 checkride or in response to a customer complaint. With the exception of SFAR 71 pilot checkrides, the FAA performed no meaningful oversight of Bali Hai since 2002.

During the Safety Board's investigation of this accident, the FAA inspected Bali Hai and noted numerous maintenance-records discrepancies for the accident helicopter, such as the failure to record all operating hours on the helicopter and its components; the failure to maintain consistent records of component times; and the failure to record daily discrepancies, repairs, and replacements. These record-keeping discrepancies represent careless maintenance practices in which Bali Hai systematically underreported the hours on the helicopter and its components.

Although maintenance issues were not a factor in this accident, proper record-keeping and proper tracking of the time that components are in use are crucial elements in any aircraft maintenance program, and, when not performed properly, they pose a serious threat to the safety of operations. If the FAA had required and had performed any systematic oversight of Bali Hai's maintenance programs and operations, it likely would have detected the maintenance discrepancies and would have required that the operator correct these issues before any flights, revenue or otherwise, could resume.

[95] The owner estimated that the company flew 4,500 passengers annually. However, in the 60 days before the accident, the company flew 1,479 passengers, and that time period was not part of the company's busiest season.

2.4.3 Honolulu Flight Standards District Office Staffing Issues

FSDO staffing issues and their effect on safety have been subjects of Safety Board concern for years. In 1990, staffing deficiencies at the Honolulu FSDO, in particular, led the Board to conclude that "at least three accidents in the Hawaiian Islands might have been prevented if [Honolulu] FSDO-13 had personnel and guidance to maintain adequate surveillance of its assigned … Part 135 operators." The Board subsequently issued Safety Recommendation A-90-136, which asked the FAA to "perform a special study of the adequacy of Flight Standards District Office staffing considering the availability of work hours, the geographic area of responsibility, and the size and complexity of the assigned operations." Five years later, Safety Recommendation A-95-61 was issued, asking the FAA to use data collected for air tour operations to provide adequate staffing at all FSDOs that have air tour operations in their geographic boundary.

The FAA's actions in response to Safety Recommendations A-90-136 and A-95-61, which included plans for a means to identify needed adjustments to workforce distribution by option, specialty, and location, have resulted in these recommendations being classified as "Closed—Acceptable Action" and "Closed—Acceptable Alternate Action," respectively. However, the continued staffing deficiencies at the Honolulu FSDO clearly show that the FAA has not effectively implemented its plans. At the time of the accident, the FSDO manager estimated he was about 10 inspectors short but stated he was not authorized to hire any new inspectors. At the time of the Bali Hai accident, FSDO inspectors reported they were time-constrained in performing even the minimum required oversight for their Part 135 operator—a problem the Safety Board noted in its recommendation some 15 years earlier.

Without FAA enforcement, repeated noncompliance with SFAR 71 and the certificates of waiver or authorization has persisted, some of which is likely unintentional. Interviews revealed that some Kauai air tour pilots differed in their understanding of their respective companies' existing approvals and incorrectly identified their authorized ridge-crossing altitudes. Thus, these pilots likely crossed ridgelines in some locations during tour flights at altitudes lower than permitted under SFAR 71 or their respective authorizations, and, without FAA surveillance and intervention, they likely believed that such practices were permissible and safe.

Because the FAA is not enforcing SFAR 71 and the deviation authorizations for all air tour operators, some pilots may be intentionally disregarding the rules with no consequences, thus, fostering hazardous in-flight decision-making practices and placing passenger safety at risk. For example, photographic evidence from the accident flight and passengers' descriptions of flight conditions during previous tours indicate that the accident pilot had repeatedly flown the helicopter into clouds and areas of highly degraded in-flight visibility. Moreover, a Safety Board investigation of another air tour accident on Kauai found that, in addition to that accident's pilot, two other air tour pilots chose to enter areas of highly degraded in-flight visibility. Thus, the Safety Board concludes that, because the Honolulu FSDO is not providing direct surveillance and enforcement of SFAR 71, pilots continue to violate SFAR 71 and the certificate of waiver or authorization requirements, either intentionally or unintentionally, thus, placing themselves and their passengers at unnecessary risk for accidents, particularly in marginal weather conditions.

Between October 1995 and May 2004, the Honolulu FSDO's GSU had been tasked to enforce SFAR 71 by monitoring all air tour operators, including those operating under Part 91. The GSU performed periodic, direct surveillance of the flight operations of air tour operators, and this resulted in the identification of a number of in-flight violations of SFAR 71 operating requirements. Before it was disbanded, the GSU also performed some surveillance of Bali Hai that resulted in the correction of some discrepancies, but the GSU had not performed in-depth inspections of the company. Although FSDO personnel considered the GSU to be highly effective, the FSDO had to disband the GSU to reallocate the unit's personnel to fill operations and airworthiness inspector positions. The Safety Board concludes that the FAA has not provided sufficient resources for the Honolulu FSDO to implement air tour surveillance. Such surveillance, in the months before the accident, may 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. Therefore, the Board believes that the FAA should develop a permanent mechanism to provide direct surveillance of commercial air tour operations in the State of Hawaii and to enforce commercial air tour regulations.

2.4.4 Air Tour Safety Meeting Requirements

In addition to the required FAA-administered initial and annual knowledge tests and checkrides, operators approved to deviate from SFAR 71 were required to ensure that their tour pilots participate in at least one formal air tour safety meeting annually. The FAA stated that the purpose of the safety meetings was to review SFAR 71 and sightseeing/air tour issues and procedures, and Bali Hai's owner stated that he believed that the meetings provided his pilots an opportunity to refresh their knowledge of SFAR 71 and the SFAR 71 deviation requirements.

Safety Board interviews with meeting attendees, however, revealed disparity between the intent of these meetings and the actual discussion topics and followup discussions that occurred. Although the Honolulu FSDO requires meeting attendance, it does not run the meetings or dictate the agenda. A FSDO inspector stated that some past meetings disintegrated rapidly into a complaint session or strayed into other topics.

As mentioned previously, many Kauai air tour pilots demonstrated a lack of understanding of their respective companies' minimum altitudes for ridge crossings. Improved refresher training may increase their knowledge of these issues. In addition, the annual safety meeting could be used to discuss pertinent safety issues, such as lessons learned, hazardous and/or consistent weather phenomena, and hazards related to site-specific areas, among other topics. Therefore, the Safety Board concludes that the annual SFAR 71 safety meetings have not been effective because the Honolulu FSDO has not ensured that the meetings are focused on safety trends and SFAR 71 procedures. Therefore, the Board believes that the FAA should direct the Honolulu FSDO to ensure that the annual safety meetings, as required under approved certificates of waiver or authorization, focus on pertinent and timely commercial air tour safety issues, including, but not limited to, reviews of Hawaii air tour accidents, local weather phenomena, and SFAR 71 procedures.

2.5 Safety Impact of Special Federal Aviation Regulation 71

In its air tour safety NPRM, the FAA attributed a decrease in the number of air tour accidents in Hawaii to the issuance of SFAR 71. The FAA also stated that the benefits associated with minimum altitude, visibility, and cloud clearance requirements "can be attributed to: (1) Increased time available for the pilot to react in an emergency, (2) prevention of situations in which the pilot unexpectedly encounters IMC, and (3) avoidance of adverse weather conditions."

Because of the current lack of an accurate, verifiable method of collecting and tracking flight-activity data for specific segments of nonscheduled Part 135 and Part 91 flight operations, the Safety Board concluded in a January 22, 2004, letter to the FAA about the NPRM, that, without the required safety and accident rate data, there is not a reliable basis for the FAA's assertion that SFAR 71 has resulted in a decrease in air tour accidents.

Safety Board review of Hawaii air tour accident data for the 10-year periods before and after SFAR 71's implementation showed that, although the total number of air tour accidents decreased after SFAR 71's implementation, the proportion of weather-related accidents increased and was responsible for 31 of the 43 total fatalities. While the rising trend in weather-related accidents appears to support the Board's concerns that SFAR 71 altitude restrictions may increase the potential for inadvertent encounters with cloud layers, the Board acknowledges that there is not enough data to determine its significance. Therefore, the Safety Board concludes that the safety impact of SFAR 71, in terms of a potential decrease in the Hawaii air tour accident rate or a potential increase in the rate of weather-related accidents, cannot be established with the current data. Therefore, the Board believes that the FAA should reevaluate the altitude restrictions in the State of Hawaii to determine if they may have resulted in any unintended degradation of safety with regard to weather-related accidents and fatalities.

2.6 Need for National Air Tour Safety Standards

In its 1995 special investigation report, the Safety Board expressed concern that the provisions of Part 91 were inadequate to ensure sufficient FAA oversight of air tour companies to identify and correct important safety deficiencies that could expose the traveling public to unacceptable safety risks. To address this concern, the Board issued Safety Recommendation A-95-58, which asked the FAA to "develop and implement national standards by December 31, 1995, within 14 CFR Part 135, or equivalent regulations, for all air tour operators … to bring them under one set of standards with operations specifications and eliminate the exception currently contained in 14 CFR Part 135.1." This accident, involving a Part 91 air tour operator that carried a large number of passengers annually yet had numerous safety deficiencies and lacked FAA oversight, serves to illustrate the very scenario the Board's recommendation sought to prevent.

The FAA shared the Board's concern. In its 2003 NPRM, "National Air Tour Safety Standards," the FAA recognized that Part 91 air tour operators do not have the equivalent safety measures that are implemented by Part 135 operators and that action was needed. The FAA also indicated that it agreed that the same safety standard should be applied to all commercial air tours, wherever they are conducted. In the NPRM, the FAA proposed to require that all commercial air tour operators be certificated under Part 135 or Part 121 and that Part 91 air tour operations be limited to infrequent, charitable events.

In response to the NPRM, however, the FAA received an overwhelming number of complaints from air tour operators that conduct business under Part 91, indicating that a number of businesses (such as single-aircraft, single-pilot operations) would go out of business if required to comply with Part 135 regulations. As a result, the FAA made substantial revisions to the proposed rule. The final rule, which was released February 8, 2007, still allows for Part 91 air tour operations under the 14 CFR 119.1(e)(2) and 135.1(a)(5) exception. The final rule also requires these operators to obtain an LOA from the FAA and abide by the new commercial air tour safety regulations defined in Subpart A of Part 136.

Although the NPRM had proposed to place all commercial air tour operations under Part 135, the Safety Board acknowledges that Part 135 is an air taxi rule with which smaller air tour operators would have difficulties complying. Part 135 regulations were originally established for nonscheduled air taxi operations, which focused on the transport of passengers or cargo from one location to another. These regulations specify restrictions and training requirements for additional issues that would not usually be associated with air tour operations, such as cargo handling, hazardous material carriage, hazardous material training programs, and international operations.

In the final rule, the FAA effectively withdraws its proposal to place all air tours under Part 135, and the Safety Board agrees that, though a number of the regulations under Part 135 enhance safety when compared to the requirements for Part 91 operations, the additional and unrelated rules would burden the smaller air tour operators with additional training and operational requirements that do not necessarily relate to their daily operations. Additionally, there may be some requirements under Part 135 that may not be stringent enough for the air tour industry, such as flight time and duty period limitations. However, the Board concludes that the public would benefit from air tour regulations that provide increased oversight and additional safety requirements for Part 91 air tour operators that carry large numbers of passengers annually, such as Bali Hai.

The Safety Board acknowledges that, although the final rule establishes some national air tour safety standards in the form of Part 136, Subpart A, the regulation still does not contain provisions that would prevent the types of deficiencies highlighted by this accident. Specifically, for Part 91 air tour operations, the new LOA and Part 136 requirements do not provide for mandatory FAA oversight. And, for all air tour operations, the final rule does not incorporate any initial and recurrent pilot training programs that address local geography and meteorological hazards and special airspace restrictions; maintenance policies and procedures; flight scheduling that fosters adequate breaks and flight periods; and operations specifications that address management, procedures, route specifications, and altitude restrictions, as necessary.

The Safety Board concludes that a regulation specific to commercial air tour operations would be more appropriate than an air taxi regulation, and it would allow the FAA inspectors responsible for air tour operators to focus on the daily safety requirements unique to those operations. Therefore, the Board believes that the FAA should develop and enforce safety standards for all commercial air tour operations that include, at a minimum, initial and recurrent pilot training programs that address local geography and meteorological hazards and special airspace restrictions; maintenance policies and procedures; flight scheduling that fosters adequate breaks and flight periods, as established by the implementation of Safety Recommendation A-07-20; and operations specifications that address management, procedures, route specifications, and altitude restrictions, as necessary.

2.7 Implementing Automatic Dependent Surveillance-Broadcast in Hawaii

The Safety Board commends the FAA for recognizing the safety benefits of ADS-B for oil industry operators in the Gulf of Mexico and for taking action in response to Safety Recommendation A-06-21 to advance the timeline for installing ADS-B system infrastructure there by 2010. According to a 2006 proposed schedule for deploying of ADS-B services nationwide, the FAA plans to install ADS-B infrastructure in the state of Hawaii by 2013.

Hawaii's mountainous landscape, limited ATC radar coverage, challenging weather, and high-density air tour traffic make it a prime candidate for the National ADS-B Program.[96] 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. 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 Kahili Ridge, and his decision to continue into the weather may have been different.

In addition to providing in-flight weather information to pilots, ADS-B also has the potential to reduce the risk of midair collisions, a concern commonly cited by air tour helicopter operators and their pilots. As Hawaii's air tour industry continues to grow,

[96] Initial ADS-B program testing was originally slated to take place in Alaska and Hawaii, but, due to the lack of funding in the Hawaii area, the initial testing was instead conducted in Alaska and Ohio.

increasing numbers of aircraft will be flying over rugged, scenic terrain in a finite airspace, and some of these flights will occur in conditions of reduced visibility. ADS-B will support cockpit displays of traffic information that could improve pilot awareness of the position and movement of other aircraft in high-density tour areas.

ADS-B services will also allow operators to remotely monitor the progress of their own tour flights. Operators could use this information to identify pilot excursions from company tour routes or below prescribed altitudes. The detection of such events would provide an opportunity for operators to discuss such events with the pilots involved and would allow operators to evaluate the need for any changes to their pilot training, standard operating procedures, or SFAR 71 deviation authorizations. The Safety Board concludes that the National ADS-B Program technology could help Hawaii air tour operators reduce operational risks.

In October 2006, the FAA surveillance and broadcast services program manager indicated that the FAA planned to award a contract in July 2007 for the installation of ADS-B ground infrastructure covering all the areas in which there are now surveillance services for national airspace users and air traffic controllers. The FAA also indicated that, once the new infrastructure is in place, the program office and its vendors will explore options for providing surveillance services to other areas. The Safety Board notes, however, that major portions of the tour routes normally flown by Bali Hai and other air tour helicopter operators throughout Hawaii do not currently receive air traffic surveillance services. Thus, the Board concludes that, under the FAA's current plan for installing the National ADS-B Program infrastructure in Hawaii, only limited services would be provided to the Hawaii air tour operators that could achieve significant safety benefits from the technology. Therefore, the Safety Board believes that the FAA should accelerate the implementation of ADS-B infrastructure in the State of Hawaii to include high-quality ADS-B services to low-flying aircraft along heavily traveled commercial air tour routes.

In order to receive enhanced services that will be supported under the National ADS-B Program, Hawaii tour operators will first have to equip their aircraft with compatible avionics to benefit from planned ADS-B infrastructure. The FAA's proposed schedule indicates that aircraft operators will have until 2020 to ensure that aircraft utilizing air traffic services are so equipped. The ADS-B program office has stated that it has not yet been established whether low-flying aircraft throughout the State of Hawaii will be required to have ADS-B-compatible avionics installed by 2020.[97] The Safety Board concludes that commercial air tour operators operating under VFR may not be required to install ADS-B compatible avionics, even after ADS-B infrastructure is installed, which could lessen the safety-related benefit of these new services on Hawaii air tour flight operations. Therefore, the Board believes that the FAA should require that Hawaii air tour operators equip tour aircraft with compatible ADS-B technology within 1 year of the installation of a functional National ADS-B Program infrastructure in Hawaii.

[97] The FAA stated that it intends to release an NPRM in September 2007 that will define the avionics that will be required to operate in different classes of airspace.

3. Conclusions

3.1 Findings

1. The pilot was properly certificated and qualified under Federal regulations to conduct the 14 *Code of Federal Regulations* Part 91 nonstop sightseeing air tour flight. No evidence indicated any preexisting medical condition that might have adversely affected his performance during the flight.

2. There was no evidence that powerplant, system, or structural failures of the helicopter contributed to the accident. The helicopter's weight and balance were within limits for the duration of the flight.

3. The accident was not survivable for any of the occupants because they were subjected to impact forces that exceeded the limits of human tolerance.

4. The helicopter's descending spiral flightpath, which became increasingly erratic in the final seconds of the flight, was consistent with pilot spatial disorientation.

5. The pilot's inexperience with Hawaii weather conditions affected his ability to make appropriate in-flight decisions when faced with deteriorating weather.

6. Other pilots who are inexperienced with Hawaii weather conditions may also be hindered in their ability to make appropriate in-flight decisions when faced with deteriorating weather.

7. Cue-based training, tailored to the dynamic local island climate conditions of Hawaii, could provide an important safety benefit to pilots who are new to flying in the state.

8. Bali Hai's pilot-scheduling practices, although permitted under Federal aviation regulations, likely had an adverse impact on pilot decision-making and performance.

9. Existing Federal aviation regulations 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.

10. Although there is evidence that Bali Hai managers had inappropriately pressured some pilots to fly in poor weather conditions and to avoid late returns, the extent to which management pressure might have influenced the pilot's decision-making during the accident flight could not be determined.

11. Because the Honolulu Flight Standards District Office is not providing direct surveillance and enforcement of Special Federal Aviation Regulation (SFAR) 71, pilots continue to violate SFAR 71 and the certificate of waiver or authorization requirements, either intentionally or unintentionally, thus, placing themselves and their passengers at unnecessary risk for accidents, particularly in marginal weather conditions.

12. The Federal Aviation Administration has not provided sufficient resources for the Honolulu Flight Standards District Office to implement air tour surveillance. Such surveillance, in the months before the accident, may 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.

13. The annual Special Federal Aviation Regulation (SFAR) 71 safety meetings have not been effective because the Honolulu Flight Standards District Office has not ensured that the meetings are focused on safety trends and SFAR 71 procedures.

14. The safety impact of Special Federal Aviation Regulation 71, in terms of a potential decrease in the Hawaii air tour accident rate or a potential increase in the rate of weather-related accidents, cannot be established with the current data.

15. The public would benefit from air tour regulations that provide increased oversight and additional safety requirements for 14 *Code of Federal Regulations* Part 91 air tour operators that carry large numbers of passengers annually, such as Bali Hai.

16. A regulation specific to commercial air tour operations would be more appropriate than an air taxi regulation, and it would allow the Federal Aviation Administration inspectors responsible for air tour operators to focus on the daily safety requirements unique to those operations.

17. The National Automatic Dependent Surveillance-Broadcast Program technology could help Hawaii air tour operators reduce operational risks.

18. Under the Federal Aviation Administration's current plan for installing the National Automatic Dependent Surveillance-Broadcast Program infrastructure in Hawaii, only limited services would be provided to Hawaii air tour operators that could achieve significant safety benefits from the technology.

19. Commercial air tour operators operating under visual flight rules may not be required to install automatic dependent surveillance-broadcast (ADS-B) compatible avionics, even after ADS-B infrastructure is installed, which could lessen the safety-related benefit of these new services on Hawaii air tour flight operations.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident 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 to this accident was the pilot's inexperience in assessing local weather conditions, inadequate Federal Aviation Administration surveillance of Special Federal Aviation Regulation 71 operating restrictions, and the operator's pilot-scheduling practices that likely had an adverse impact on pilot decision-making and performance.

4. Safety Recommendations

As a result of the investigation of this accident, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:

> In cooperation with Hawaii commercial air tour operators, aviation psychologists, and meteorologists, among others, develop a cue-based training program for commercial air tour pilots in Hawaii that specifically addresses hazardous aspects of local weather phenomena and in-flight decision-making. (A-07-18)
>
> Once a cue-based training program that specifically addresses hazardous aspects of local weather phenomena and weather-related, decision-making issues is developed, as requested in Safety Recommendation A-07-18, require all commercial air tour operators in Hawaii to provide this training to newly hired pilots. (A-07-19)
>
> 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. (A-07-20)
>
> Develop a permanent mechanism to provide direct surveillance of commercial air tour operations in the State of Hawaii and to enforce commercial air tour regulations. (A-07-21)
>
> Direct the Honolulu Flight Standards District Office to ensure that the annual safety meetings, as required under approved certificates of waiver or authorization, focus on pertinent and timely commercial air tour safety issues, including, but not limited to, reviews of Hawaii air tour accidents, local weather phenomena, and SFAR 71 procedures. (A-07-22)
>
> Reevaluate the altitude restrictions in the State of Hawaii to determine if they may have resulted in any unintended degradation of safety with regard to weather-related accidents and fatalities. (A-07-23)
>
> Develop and enforce safety standards for all commercial air tour operations that include, at a minimum, initial and recurrent pilot training programs that address local geography and meteorological hazards and special airspace restrictions; maintenance policies and procedures; flight scheduling that fosters adequate breaks and flight periods, as established by the implementation of Safety Recommendation A-07-20; and operations specifications that address management, procedures, route specifications, and altitude restrictions, as necessary. (A-07-24)

Accelerate the implementation of automatic dependent surveillance-broadcast (ADS-B) infrastructure in the State of Hawaii to include high-quality ADS-B services to low-flying aircraft along heavily traveled commercial air tour routes. (A-07-25)

Require that Hawaii air tour operators equip tour aircraft with compatible automatic dependent surveillance-broadcast (ADS-B) technology within 1 year of the installation of a functional National ADS-B Program infrastructure in Hawaii. (A-07-26)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: February 13, 2007

5. Appendixes

Appendix A
Investigation and Public Hearing

Investigation

The National Transportation Safety Board was initially notified of this accident on September 24, 2004. An investigator-in-charge (IIC) traveled to the area on September 25, 2004, but was unable to access the accident site due to hazardous terrain and adverse weather. The IIC was flown over the accident site on October 2, 2004, and subsequently examined the wreckage as it was recovered to a hangar. The following areas were assigned to specialists during the course of this investigation: Meteorology, Operations, and Human Performance.

Parties to the investigation were the Federal Aviation Administration and Rolls-Royce Corporation. In accordance with Annex 13 to the Convention on International Civil Aviation, a nontraveling accredited representative from the Transportation Safety Board of Canada was assigned, and Bell Helicopter Textron, Inc., served as technical advisor.

Public Hearing

No public hearing was held for this accident.

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