Aviation Investigation Final Report

Location:	Pukoo, Hawaii	**Accident Number:**	WPR17FA021
Date & Time:	November 15, 2016, 18:41 Local	**Registration:**	N81GG
Aircraft:	Hughes 369	**Aircraft Damage:**	Destroyed
Defining Event:	VFR encounter with IMC	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airline transport pilot and passenger departed on an expected 30-minute visual flight rules flight that was destined for the pilot's private helipad and residence on the southeast side of a neighboring Hawaiian island. Before the flight, the pilot's mechanic asked the pilot not to fly due to the weather at the intended destination, but the pilot insisted on flying. The National Weather Service forecast products that were available before the flight indicated a trade wind pattern that would bring bands of rain, low visibility, and mountain obscurations to the eastern slopes of the islands, but it is unknown if the pilot reviewed these products or any other forecast of expected weather conditions along the flight route. One witness stated that the pilot routinely flew at night to his helipad and that she had previously seen the pilot's helicopter operating in dark adverse weather conditions. Several witnesses reported seeing the helicopter fly over their locations in dark conditions with wind and rain. Two witnesses reported that they saw the helicopter make an approach to a ridgeline near the pilot's helipad, but then the helicopter disappeared from view because of a cloud or terrain.

Meteorological data revealed that a line of rain showers moved over the accident site at the accident time. The reduced visibility and ceiling as the line of rain showers moved east to west over the rising mountain terrain likely resulted in instrument meteorological conditions and mountain obscuration conditions.

The helicopter wreckage was discovered 0.75 mile upslope of the intended destination. Tree and ground impact marks indicated a relatively level descent to the ground at an approach angle of about 18° on a 310° heading, which is indicative of impact with terrain in controlled forward flight. The helicopter was destroyed by impact forces and a postcrash fire. Examination of the wreckage revealed no evidence of any preimpact failures or malfunctions of the engine, drive train, main rotor, tail rotor, or structure of the helicopter. Damage to the mast support structure, main rotor hub, main rotor blades and upper flight controls is consistent with power-on main rotor blade impact damage.

Given the weather conditions and witness observations, the pilot encountered dark instrument meteorological conditions and rain while flying in an area of rising terrain as he likely searched for the helipad at his residence, which was outfitted with various lights that would have been difficult to see in reduced visibility. The pilot did not have the visual cues necessary to maintain clearance above the ground, resulting in geographic disorientation, which subsequently led to controlled flight into terrain.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's decision to continue visual flight into an area of instrument meteorological conditions at night in rain, which resulted in his geographic disorientation and controlled flight into terrain.

Findings

Personnel issues	Decision making/judgment - Pilot
Environmental issues	Below VFR minima - Decision related to condition
Personnel issues	Geographic disorient (lost) - Pilot
Environmental issues	Mountainous/hilly terrain - Decision related to condition
Environmental issues	Dark - Contributed to outcome
Environmental issues	Rain - Contributed to outcome

Factual Information

History of Flight

Maneuvering-low-alt flying	VFR encounter with IMC (Defining event)
Maneuvering	Loss of visual reference
Maneuvering-low-alt flying	Collision with terr/obj (non-CFIT)

On November 15, 2016, about 1841 Hawaii standard time, a turbine-powered Hughes (MDHI) 369D helicopter, N81GG, impacted mountainous tree-covered terrain about 1 mile north of Pukoo, Hawaii. The airline transport pilot and the passenger were fatally injured, and the helicopter was destroyed by impact forces and a postcrash fire. The helicopter was registered to the pilot who was operating it under the provisions of Title 14 *Code of Federal Regulations* Part 91. No flight plan was filed for the visual flight rules (VFR) personal flight. Night instrument meteorological conditions prevailed at the accident site at the time of the accident. The flight departed from Daniel K. Inouye International Airport (HNL), Honolulu, Hawaii, at 1756 and was destined for a private residence near Pukoo, located on the island of Molokai.

According to the pilot's mechanic, who helped load and fuel the helicopter, the purpose of the flight was to transport the pilot's friend from HNL to Molokai. The pilot lived and worked in Honolulu and had another residence on the east side of Molokai that included a private helipad. The residence was located on the southeast side of Kamakou Mountain. The flight distance was about 65 nautical miles (nm), and the expected flight time was 30 minutes.

The mechanic reported that he advised the pilot not to fly given the weather conditions, but that the pilot insisted on flying because he had to tend to business. About 1730, the mechanic sent a text message to the property caretaker of the pilot's home on Molokai to check the weather. According to statements provided to the Maui County Police Department, the caretaker replied, "mountain is a little wet and the clouds are low out East near the house," but the pilot had already departed.

Archived FAA voice communications from Molokai air traffic control tower, (MKK), Kualapuu, Hawaii, indicated that the pilot reported "2 miles southwest of the mudflats 1 mile off shore at 700 feet transition to the east," at 1823. The control tower approved the transition through class D airspace and provided an altimeter setting of 3003. The pilot repeated the altimeter setting. This last reported position was about 20 miles from the destination.

The mechanic reported that he called the pilot after the helicopter's expected arrival time on November 15 but was unable to reach him. Early on November 16, the mechanic asked the caretaker to check for the pilot at his residence, but the caretaker did not find the pilot or his helicopter. The US Coast Guard and Maui County Police Department were notified, and a coordinated land and sea search was conducted. At 0852, the FAA issued an alert notice for the helicopter. According to Maui County Police Department records, the crew of a Maui fire and rescue helicopter discovered the wreckage about 1331 in Pukoo, about 0.75 mile north of the pilot's helipad.

The Maui County Police Department interviewed six ground witnesses who observed the helicopter flying overhead in the Pukoo vicinity on the night of the accident. The witnesses stated that the weather conditions were dark with rain and wind and that the helicopter had its searchlight on. One of the witnesses (witness # 1 in figure 1), who lived 1.2 miles southwest of the helipad, stated that he saw the helicopter fly from the coastline to the mountain ridge and perform an approach toward the pilot's helipad, but this witness then lost sight of the helicopter when it entered a cloud.

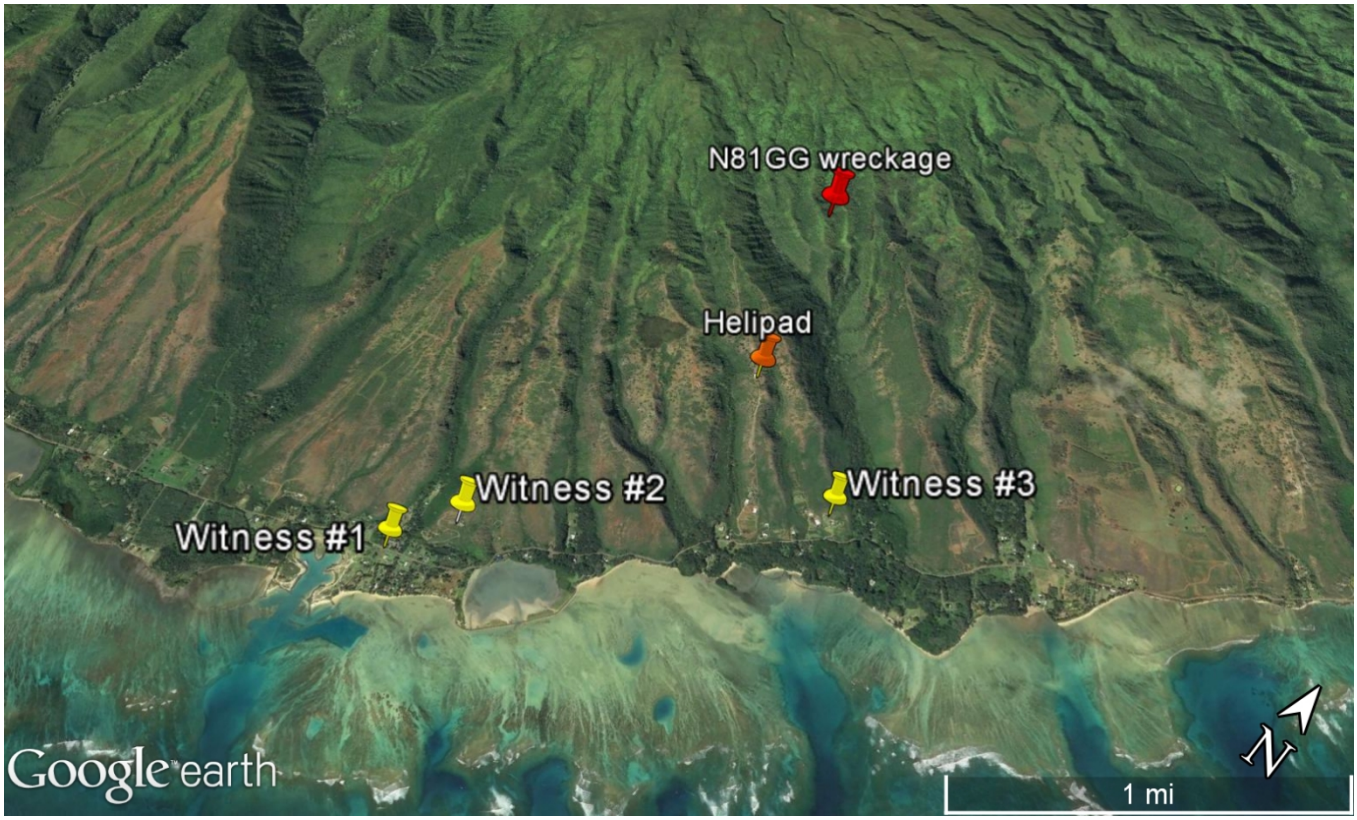

Figure 1. Location of accident site, helipad and witnesses.

The National Transportation Safety Board (NTSB) interviewed four ground witnesses. One of the witnesses, (witness #2 in figure 1) who lived with another witness about 1 mile southwest of the helipad and 2 miles from the accident site, observed the helicopter flying "surprisingly low" and slow over their property with its searchlight on. The witness recognized the accident pilot's helicopter because she was accustomed to seeing that helicopter fly over her property. She stated that the pilot had flown in "horrific conditions" before and reported that, when she observed the helicopter, it was "very dark" and "very windy" with clouds and rain higher up on the mountain. The witness photographed the helicopter with her iPhone. The time stamp on the iPhone photograph was 1836, and it revealed that the helicopter was flying in dark night conditions.

A witness who lived 0.2 mile east of the pilot's property (witness #3 in figure 1) stated that the weather on the night of the accident was "very windy and rainy" and "as bad as I've ever seen." The witness

observed the helicopter perform a controlled approach to the ridgeline above her house, and not the ridgeline to the west where the pilot's helipad was located, and then the helicopter descended behind terrain and disappeared from view. She stated that the rain appeared to fall at a 45 to 90° angle to the ground in the illumination of the helicopter's searchlight. She observed a bright orange illumination in the clouds sometime after that.

Pilot Information

Certificate:	Airline transport	**Age:**	70,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	May 17, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 4210.7 hours (Total, all aircraft), 500 hours (Total, this make and model)		

Passenger Information

Certificate:		**Age:**	66,Female
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

The pilot, age 70, held an airline transport pilot certificate with a rotorcraft-helicopter rating issued on December 29, 2009. Additionally, he held a commercial pilot certificate with airplane multiengine land and instrument airplane ratings and a private pilot certificate with an airplane single-engine land and sea rating. His most recent FAA third-class medical certificate was issued on May 17, 2016, with the limitation to have available glasses for near vision. According to a family member, the pilot was in excellent health. On his most recent medical certificate application, the pilot reported 4,210.7 hours of total flight experience, 45.2 hours of which were within the last 6 months.

The pilot's logbook was not located, so his instrument and night flight experience and the number of hours in the accident helicopter make and model could not be determined.

According to the pilot's workplace personal assistant, the pilot flew to Molokai about every other week, often after work at night. A family member recalled that, during one flight, the pilot diverted to MKK

due to deteriorating weather conditions near Pukoo. The family member also stated that the pilot used GPS to navigate at night.

Aircraft and Owner/Operator Information

Aircraft Make:	Hughes	**Registration:**	N81GG
Model/Series:	369 D	**Aircraft Category:**	Helicopter
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	100634D
Landing Gear Type:	High skid	**Seats:**	2
Date/Type of Last Inspection:	September 17, 2016 Annual	**Certified Max Gross Wt.:**	3000 lbs
Time Since Last Inspection:	17 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	9623.5 Hrs as of last inspection	**Engine Manufacturer:**	Rolls Royce Corporation
ELT:	Not installed	**Engine Model/Series:**	M250-C20B
Registered Owner:	On file	**Rated Power:**	450 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The helicopter, serial number 100634D, was manufactured in 1979 as a Hughes 369D helicopter. The type certificate at the time of the accident was held by MD Helicopters, Inc. (MDHI) The helicopter was powered by a Rolls-Royce (Allison) 250-C20B turboshaft engine. The helicopter was controlled by a single pilot from the left seat.

The helicopter's maintenance records revealed that its last annual inspection occurred on September 17, 2016. According to a maintenance tracking report dated November 17, 2016, the airframe total time was 9,640.1 hours, and the engine total time was 8,371.1 hours. An emergency locator transmitter was not installed or required to be installed.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	PHMK,454 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	17:54 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Scattered / 4400 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / 23 knots	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	30°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.02 inches Hg	**Temperature/Dew Point:**	24°C / 21°C
Precipitation and Obscuration:	Heavy - Showers - Rain		
Departure Point:	HONOLULU, HI (HNL)	**Type of Flight Plan Filed:**	None
Destination:	Pukoo, HI	**Type of Clearance:**	VFR
Departure Time:	17:56 Local	**Type of Airspace:**	Class G

The National Weather Service (NWS) area forecast for Hawaii, issued at 1734 and valid at the time of the accident, indicated the following conditions for Oahu and Molokai: scattered clouds at 2,500 ft, scattered to broken ceiling at 5,000 ft; temporary conditions of broken ceilings at 2,500 ft and visibility between 3 and 5 miles with rain showers; and isolated conditions of broken ceilings at 1,500 feet with visibility below 3 miles in rain showers. The NWS area forecast discussion (AFD) at 1604 (the closest AFD to the accident time) indicated that an area of showery low clouds was moving toward the islands in the trade wind flow (west) and was expected to continue to promote the development of marginal VFR conditions (visibilities and ceilings) over windward (east) portions of the Big Island…and appear poised to move ashore over windward portions of the smaller islands (Molokai) overnight. AIRMET Sierra was issued at 1731, before the flight departed, and was valid at the accident time and for the area near the accident site. AIRMET Sierra advised of mountain obscuration on the north- through east-facing slopes of Molokai due to clouds and rain.

The closest official weather station to the accident site was an automated surface observing system (ASOS) at MKK, which was about 17 miles west of the accident site. The ASOS recorded the following conditions at 1854 (13 minutes after the accident): wind from 030° at 15 knots with gusts to 21 knots, visibility 10 miles, a broken ceiling at 4,800 ft, a broken cloud layer at 5,500 ft, temperature 24°C, dew point 21°C, and altimeter 30.04 inches of mercury. The surface observations surrounding the accident time indicated VFR conditions on the leeward side of mountainous terrain with periods of rain and gusty wind from the east to the northeast.

A review of archived radar data from the Molokai NWS Weather Surveillance Radar-1988, Doppler (WSR-88D,) which was located 17 miles west of the accident site, showed that, between 1834 and 1845, a line of rain showers moved from east to west over the accident site, likely with reduced visibilities and ceilings.

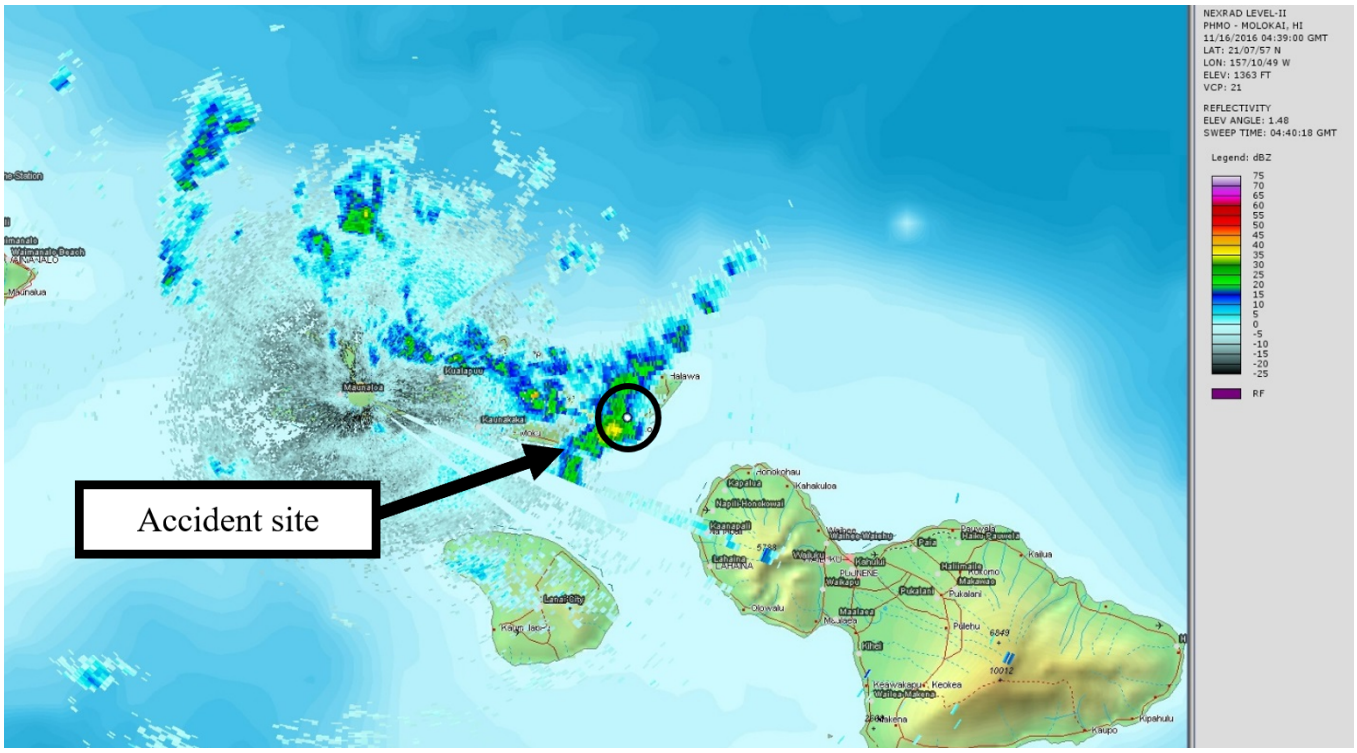

Figure 2. WSR-88D Doppler Radar at 1840.

A search of official weather briefing sources, such as Lockheed Martin Flight Service and Direct User Access Terminal Service, indicated that the accident pilot did not request an official weather briefing. The pilot's mechanic stated that the pilot normally checked the Molokai radar images on the NWS website before his flights to Pukoo.

According the US Naval Observatory astronomical data, sunset at the accident site on the day of the accident was at 1746, and the end of civil twilight was at 1809. The moon was not visible during the accident flight; moonrise occurred at 1925.

For further weather information, see the weather study in the public docket for this accident.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	Unknown
Total Injuries:	2 Fatal	**Latitude, Longitude:**	21.099721,-156.792221(est)

The accident site was located on the southeast side of Kamakou Mountain, which has a peak of 4,970 ft, in a remote area on a 25° southeast slope of a rising ridge at 1,389 ft. The wreckage came to rest about 0.75 mile north of the helipad at the pilot's residence. An aerial view of the wreckage site indicated a confined wreckage field, about 80 ft long and 25 ft wide, of burned and fragmented components on a heading of about 310° and a ground brush fire pattern that continued northwest for 50 ft upslope. Postimpact fire damage was observed throughout the wreckage field. All major components were found. Tree strike marks and broken tree limbs were observed on the south end of the wreckage field, starting at tree tops located about 100 ft from the initial ground impact. The tree strikes indicated a descent angle of about 18° from the tree tops to the landing skids, which made the first ground impact. The transmission, main rotor head, rotor blades, engine, and tail rotor drive shaft were spread upslope through the burned area and showed thermal and impact damage. The tail rotor section was found intact near the southwest portion of the site. No thermal damage was observed, but the tail rotor section was completely fractured forward of the tail rotor gear box.

The landing skid tubes had separated from the airframe and were located at the southern end of the wreckage field among broken canopy windscreen pieces. The left skid was imbedded almost 30 inches into the dirt, consistent with forward flight and the initial impact point. The fuselage and cockpit sustained extensive thermal damage with only the engine firewall intact. The cabin and cockpit were completely consumed by the postimpact fire, but a few instruments were recovered at the scene. The altimeter indicated 913 ft with a setting of 30.00 inches of mercury. The dual tachometer gauge was found on the ground with an NR (rotor speed) reading of 340 rpm and an N2 power turbine speed reading of 78 percent. The pilot's cyclic grip was fractured and separated from the control stick about 1 inch below the grip, with wires from the switches extending outward from the fracture. The GPS unit was not located. The pilot's watch was recovered at the scene; the pointers had stopped when the time was 1841.

The support structure with the mast, main transmission, upper controls, main rotor hub, and five main rotor blades separated from the main fuselage near the upper fuselage attach areas. Two of the five main rotor blades remained attached to the main rotor hub; the others had separated at the steel strap sets and were found near the rotor head. Each main rotor blade showed signs of impact damage, bending, span-wise splitting along bond joints, and thermal damage. Two of the five blade tips were located. Damage to the mast support structure, main rotor hub, main rotor blades and upper flight controls is consistent with power-on main rotor blade impact damage.

The aft section of the tailboom, which consisted of the vertical and horizontal stabilizer, tail rotor gearbox, and the tail rotor assembly, had separated from the rest of the tailboom. A long section of the tail rotor drive shaft was found near the center of the wreckage and showed evidence of torsional

twisting. The two tail rotor blades remained attached to the tail rotor hub. Both blades exhibited impact damage, with one blade fractured outboard of the root fitting. The tail rotor gearbox and tail rotor swashplate operated smoothly when rotated manually. The tail rotor blades were also manually manipulated, and control linkages and mechanisms responded appropriately. The tail rotor gearbox remained attached to the mounting frame on the aft section of the tail boom section. The upper and lower sections of the vertical stabilizer leading edge and the horizontal stabilizer were crushed and deformed.

The engine had significant damage from the postcrash fire. Most of the attached lines were consumed, as were the accessory section and support structure. The engine drive shaft had fractured at the flex couplings at both ends. The outer combustion case exhibited extensive crush damage. The engine mounts had fractured in overload.

The NTSB, Boeing, MD Helicopters, and Rolls-Royce performed a detailed wreckage examination at a secure hangar at Kahului Airport, Maui, Hawaii. The engine was partially disassembled. The gas generator rotor spun freely, and no damage was noted on the guide vanes and blades. The power turbine rotated only about 20° due to binding near the exhaust collector support. Engine control continuity could not be established due to thermal and impact damage. Drive continuity of the main transmission was verified by rotating the input shaft manually. The main rotor gearbox rotated smoothly and resulted in the corresponding rotation of the main rotor head and tail rotor output shaft. Flight control continuity of the collective and cyclic systems could not be established due to extensive postcrash fire damage. Flight control components located above the mast rails were fractured in numerous areas. The anti-torque control system was destroyed in the fire except for the aft tail rotor section, which functioned appropriately. No evidence of a mechanical anomaly or malfunction was found that would have precluded normal operation of the helicopter.

Medical and Pathological Information

Pan Pacific Pathologists, Wailuku, Hawaii, performed an autopsy of the pilot. The autopsy report stated that the pilot's cause of death was undetermined with probable multiple blunt force injuries.

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed forensic toxicology on specimens from the pilot with negative results for ethanol and drugs. Carbon monoxide and cyanide testing were not performed.

Tests and Research

The pilot's cyclic grip was one of the few flight control sections that survived the postcrash fire. The cyclic grip was examined for any signs of missing or damaged parts, contamination or any other anomalies. The NTSB documented the cyclic grip using x-ray radiograph and computed tomography (CT) scanning, which was conducted at Varex Imaging, Chicago, Illinois. The CT scans revealed

multiple cracks, displaced trigger switch interior mechanisms, splayed core electrical wire strands, a nose-down trim wire that appeared closer to the trim switch ground contact solder than the thickness of the wire insulation, where the solder composing the junction of the nose-down trim wire and its corresponding trim switch contact appeared to be distorted. The splayed core wire strands, the wire-solder proximity, and the distorted nose down trim wire contact solder joint appeared to be consistent with a tension load applied to the wires during the impact sequence.

After the CT scans were completed, the NTSB's Materials Laboratory in Washington, DC. disassembled the cyclic grip to determine the component's integrity and electrical continuity. The four-position trim switch was removed from the cyclic grip and examined using a stereo microscope. Four of the five soldered connections between the signal wires and switch contacts exhibited varying levels of disbonding, and the fifth connection (for nose-down trim) was completely disbonded and remained attached due to mechanical interference. These results were consistent with wires separating under tension during the impact sequence.

For more information about these findings, see the CT Specialist's and the Materials Laboratory factual reports in the public docket for this accident.

Additional Information

Helipad

The private helipad was located upslope of the pilot's residence at an elevation of about 750 ft on a ridgeline that runs along a 330° magnetic heading up the southeast face of Kamakou Mountain. The helipad had four red A650 automatic solar-powered perimeter lights on 14 inch mounting pads, and four red vertical exterior lights were attached to an 18 foot ladder on the south side of the hangar facility that faced to the southeast. The vertical lights were a rudimentary approach lighting design with compact fluorescent lamp (CLF) and light emitting diode (LED) bulbs. The lights were controlled by a mechanical pin timer that exhibited extended pins from time 2000 to 0600. The face of the timer had no current time dial, so set time could not be correlated to actual time. The property caretaker reported that the pilot routinely used the vertical red lights to find the helipad during dark night conditions and that the lights should have been on the night of the accident. It is unknown if the vertical lights were illuminated at the time the pilot was searching for the helipad. Red lights were also installed on the perimeter of the roof of the pilot's residence, which was located near the coastline at an elevation of about 200 ft, to assist with navigation up the ridgeline to the helipad. Witness No. 3, who resided on the adjacent ridgeline, stated that electrical power was not interrupted on the night of the accident and that the perimeter lights on the pilot's home were on.

Administrative Information

Investigator In Charge (IIC):	Price, Noreen
Additional Participating Persons:	Kyle Bartler; Honolulu FSDO; Honolulu, HI Chris Howard; Honolulu FSDO; Honolulu, HI John Hobby; Boeing; Phoenix, AZ Joan Gregoire; MD Helicopters, Inc; Phoenix, AZ Nicholas Shepler; Rolls Royce; Indianapolis, IN
Original Publish Date:	November 6, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=94386

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties … and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available here.