



Aviation Investigation Final Report

Location:	Saucier, Mississippi	Accident Number:	ERA15FA173
Date & Time:	March 30, 2015, 14:36 Local	Registration:	N50KH
Aircraft:	BELL HELICOPTER TEXTRON 206 L-1	Aircraft Damage:	Destroyed
Defining Event:	Loss of engine power (total)	Injuries:	2 Fatal, 1 Serious
Flight Conducted Under:	Part 137: Agricultural		

Analysis

The purpose of the flight was to assist in the scheduled burn of an 800-acre wooded area. The helicopter was under contract with the US Department of Agriculture Forest Service. A Forest Service employee reported that, as the helicopter neared the conclusion of a 61-minute controlled burn mission, he observed it complete a turn to a northerly heading at the southwestern end of the burn area. About 7 seconds later, he heard a sound that resembled an air hose being unplugged from a pressurized air tank. A crewmember, who was the sole survivor, reported that the helicopter was about 20 ft above the tree canopy when the pilot announced that the helicopter had lost power. The helicopter then descended into a group of 80-ft-tall trees in a nose-high attitude and impacted terrain. Witnesses participating in the controlled burn at the time of the accident did not observe any other anomalies with the helicopter before the accident.

The fuel system, fuel pump, and fuel control unit were destroyed by fire, which precluded a complete examination. During the engine examination, light rotational scoring was found in the turbine assembly, consistent with light rotation at impact; however, neither the turbine rotation speed nor the amount of engine power at the time of the accident could be determined. The rotor blade damage and drive shaft rotation signatures indicated that the rotor blades were not under power at the time of the accident. An examination of the helicopter's air tubes revealed that they were impact-damaged; however, they appeared to be secure and properly seated at their fore and aft ends.

On the morning of the accident flight, the helicopter departed on a reconnaissance flight with 600 lbs of JP-5 fuel. The helicopter returned with sufficient fuel for about 133 minutes of flight, and the helicopter was subsequently serviced with an unknown quantity of uncontaminated fuel for the subsequent 60-minute accident flight. Based on the density altitude, temperature, and airplane total weight at the time of the accident, the helicopter was operating within the airplane flight manual's performance limitations.

Most of the cockpit control assemblies were consumed by fire except for the throttle, which was found in the "idle" position. Given the crewmember's report that, after the engine failure, the helicopter entered and maintained a nose-high attitude until it impacted trees and then the ground, it is likely that the pilot initiated an autorotation in accordance with the Pilot's Operating Handbook engine failure and autorotation procedures. A review of the pilot's records revealed that he passed the autorotation emergency procedure portion of his most recent Federal Aviation Administration Part 135 examination, which occurred 1 month before the accident, and this may have aided in his recognition of the engine failure and decision to initiate an emergency descent.

Although a weather study indicated that smoke and particulates were present in the area before, during, and after the accident, witnesses reported an absence of smoke near the area where the helicopter lost power and impacted the ground.

Probable Cause and Findings

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

A loss of engine power for reasons that could not be determined due to postaccident fire damage.

Findings

Not determined	(general) - Unknown/Not determined
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Factual Information

History of Flight

Maneuvering-low-alt flying	Loss of engine power (total) (Defining event)
Autorotation	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

On March 30, 2015, about 1436 central daylight time, a Bell 206 L-1, N50KH, registered to HLW Aviation, LLC and operated by T & M Aviation, Inc. under contract to the United States Forest Service, was destroyed by controlled burn fire after it impacted terrain near Saucier, Mississippi. The commercial pilot and the front left seat crew member were fatally injured; the rear seat crew member sustained serious injuries. Visual meteorological conditions prevailed and no flight plan was filed for the aerial application flight that was conducted under the provisions of Title 14 Code of Federal Regulations Part 137. The flight departed Dean Griffin Memorial Airport (M24), Wiggins, Mississippi, about 1334.

After a pre-mission briefing at M24, the flight departed to assist in the scheduled burn of an 800 acre wooded area through a process known as "aerial ignition." A witness that observed the helicopter prior to the accident was walking a road on the southern end of the burn area when he noticed the helicopter "make a turn and go back." About 7 seconds after the turn, the witness heard a sound that resembled an air hose being unplugged from a high pressure air tank, and heard the helicopter impact terrain about three seconds later. With the exception of the high pressure sound, the witness did not observe anything unusual with the helicopter. According to the witness, the helicopter's last transmission to ground personnel was approximately 7 minutes prior to the accident.

Several Forest Service personnel were performing controlled burn functions on the ground during the mission. About 6 employees were located near the northeastern tip of the planned burn area, 1 employee was located at the western end, and 3 employees were stationed at the southeastern end, where the helicopter came to rest. Multiple witnesses on the ground, were in contact with the accident helicopter during the operation; however, none of the witnesses observed the helicopter crash nor did they hear a distress call prior to the accident. Several witnesses observed small plumes of smoke scattered across the burn area blowing east as a result of the western wind. One witness reported that a helicopter crewmember inquired about the smoke levels during the mission and made a decision to continue after he determined the smoke levels would not pose a hazard to the flight. None of the witnesses observed the helicopter come into contact with smoke.

Satellite tracking data provided by the online government contracted application Automated Flight Following (AFF), and monitored by a Forest Service dispatch office through a unit mounted in the helicopter, indicated that the helicopter had been operating at a low altitude over the controlled burn area for approximately 56 minutes prior to the accident. According to the data, the helicopter had been flying a grid pattern from the northwest to the southeast. The last recorded position for the helicopter at 1433, indicated that it was at an altitude of 354 feet mean sea level (132 feet above ground level (AGL)), a heading of 150 degrees true and a calculated groundspeed of 43 knots. Forest Service employees reported that the flight pattern for firing is normally based on wind parameters and vegetative conditions

to control for smoke management and burn results. According to the surviving crew member, the accident helicopter and crew completed a reconnaissance flight on the morning of the accident flight to evaluate the prescribed burn area. The AFF satellite tracking data showed that the flight was completed in approximately 72 minutes.

The surviving crew member stated that he was operating a plastic sphere dispenser (PSD) from the rear right seat at the time of the accident. This device injects plastic spheres filled with potassium permanganate with glycol and dispenses them below the helicopter. Towards the end of the aerial ignition mission, the helicopter was in "slow" forward flight about 20 feet above the trees when the surviving crew member heard "buzzers and alarms" and the engine spool down. Almost simultaneously, the pilot announced "we lost power" and the firing boss remarked "we are going in." The helicopter completed a quarter turn and "slipped" through the trees in a nose high attitude; it subsequently impacted the ground hard and came to rest on its left side. The surviving crew member did not receive a response from the front seat occupants despite his attempts to get their attention. The wreckage was not on fire after it came to rest, but the crew member observed an approaching ground fire from the controlled burn and decided to vacate the area to a nearby Forest Service road. The surviving crew member reported that the helicopter was in level forward flight at an estimated airspeed of approximately 50 knots when the pilot announced a loss of power.

The audio files from the helicopter's aural warning system were played for the surviving crew member during a follow-up telephone conversation. The crew member recognized both alarms and arranged them in the following sequence: the sustained alarm immediately followed by the fast pulse alarm. According to the manufacturer, the sustained alarm corresponds with the low rpm horn and the fast pulse alarm is an engine out indication; however, the pulsed tone will sometimes follow the steady tone when a power loss occurs.

The surviving crew member recounted the events that transpired during a failed engine start attempt that occurred before the accident flight. He described hearing "whine" and "clicking" sounds with the absence of the turbine flame associated with a normal engine start. The second attempt resulted in a successful engine start, which was preceded by a "click, click, click" of the igniter followed by the flame of the turbine.

Pilot Information

Certificate:	Commercial	Age:	40,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Unknown
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	February 23, 2015
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	(Estimated) 6471 hours (Total, all aircraft), 6300 hours (Total, this make and model), 22 hours (Last 90 days, all aircraft)		

Other flight crew Information

Certificate:	Age:	
Airplane Rating(s):	Seat Occupied:	Left
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:		

Other flight crew Information

Certificate:	Age:	
Airplane Rating(s):	Seat Occupied:	Right
Other Aircraft Rating(s):	Restraint Used:	4-point
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 40, held a commercial pilot certificate with ratings for rotorcraft-helicopter, airplane single engine land, and instrument airplane. He additionally held a mechanic's certificate with ratings for airframe and powerplant, which was issued on May 19, 2005. His most recent Federal Aviation Administration (FAA) second-class medical certificate was issued on February 23, 2015 with the limitation, "must wear corrective lenses."

According the pilot's resumé, in 1998, he accepted a position as an aircraft technician with T&M Aviation and subsequently received flight instruction from a company owner. After he obtained his private pilot certificate, he performed ferry flights for the company until 2005, when he received his commercial pilot certificate and was subsequently approved to fly under the company's Federal Aviation Regulations (FAR) Part 135 certificate. The pilot's flight experience between 2006 and the date of the accident, included agricultural spraying, long line external load, low level reconnaissance flights, and prescribed burn operations. Additionally, he maintained the company's helicopters as a mechanic during this time and served as the director of maintenance from 2010 through 2013. According to the aircraft owner's records, the pilot's most recent FAR Part 135.293 and FAR Part 135.299 recurrent check was completed on February 3, 2015 in a Bell 206 L3 helicopter. The pilot satisfactorily completed the proficiency check, which involved two emergency simulations; a stuck pedal, and an autorotation.

T&M Aviation entered into a contract with the Forest Service on January 10, 2012 to conduct aerial ignition operations. Pilots of T&M Aviation were required to complete an Interagency Helicopter Pilot Qualifications and Approval Record and pass a flight evaluation by an Interagency Helicopter Inspector

Pilot. The pilot's most recent mission approval was completed on April 30, 2014, at which time he was approved to fly aerial ignition operations until April 30, 2015.

According to the pilot's personal flight logbooks, he had accumulated 6,471 total hours of flight experience, about 6,300 hours of which were in the accident helicopter make and model. The owner estimated that the pilot had accrued 22 additional flight hours in the 90 days that preceded the accident flight.

Aircraft and Owner/Operator Information

Aircraft Make:	BELL HELICOPTER TEXTRON	Registration:	N50KH
Model/Series:	206 L-1	Aircraft Category:	Helicopter
Year of Manufacture:	1980	Amateur Built:	
Airworthiness Certificate:	Normal; Restricted (Special)	Serial Number:	45560
Landing Gear Type:	N/A; High skid	Seats:	7
Date/Type of Last Inspection:	March 11, 2015 100 hour	Certified Max Gross Wt.:	4251 lbs
Time Since Last Inspection:	5 Hrs	Engines:	1 Turbo shaft
Airframe Total Time:	11602 Hrs at time of accident	Engine Manufacturer:	Allison
ELT:	C91A installed, not activated	Engine Model/Series:	M250-C30P
Registered Owner:	HLW AVIATION LLC	Rated Power:	650 Horsepower
Operator:	T and M Aviation, Inc.	Operating Certificate(s) Held:	Agricultural aircraft (137)
Operator Does Business As:		Operator Designator Code:	W70G

According to FAA records, the accident helicopter was manufactured in 1980, at which time it was equipped with an Allison 250-C28 500 hp turbo-shaft engine. In 1993, an Allison 250-C30P 650 hp turbo-shaft engine was installed in accordance with Petroleum Helicopters, Inc. supplemental type certificate (STC) SH5695SW and modified in 2001 in accordance with Air Services International STC SH296NM. At the time of the accident, the helicopter had accrued approximately 11,602 flight hours.

A maintenance history of the helicopter was established through the operator's archived records, as the most recent maintenance records were destroyed by fire. The helicopter's most recent 100-hour inspection was completed on March 11, 2015, at which time it had accumulated 11,597 hours total time in service. Life limited component inspection schedules were listed for the gearbox, compressor and turbine, which had accrued 11,487 hours, 1,974 hours, and 1,861 hours since their most recent overhauls, respectively. A review of the component maintenance tracking history revealed that each life or time limited engine component were within their respective life expectancies.

A scheduled inspection of the accident helicopter was completed on November 20, 2014, as part of the operator's contractual agreement with the Forest Service, which did not reveal any discrepancies.

The helicopter's most recent turbine engine power check was completed on February 28, 2015, at 5,742 flight hours. A trend value of +19 was recorded under the following atmospheric conditions: 2 degrees C and a pressure altitude of 10,000 feet, which did not exceed the helicopter's operating limitations when compared to the pilot's operating handbook (POH).

The pilot completed a load calculation form, provided by the Forest Service, for a reconnaissance flight that took place on the morning of the accident flight. According to a USDA Forest Service representative, a new form must be completed each day or if there are changes to the flight crew, the pressure altitude changes by at least 1,000 feet, or the ambient temperature changes by a minimum of 5 degrees C. The pilot first calculates the mission operating weight, the combined sum of the aircraft empty weight, the pilot's weight, and total weight of the fuel. This number is then subtracted from the helicopter gross weight to determine the mission payload weight. A pressure altitude of 300 feet and an outside air temperature of 23 degree C were included on the form that was completed the day of the accident. The form showed a total combined weight of 3,952 lbs, 198 lbs below the helicopter's published gross weight and 118 lbs below the USDA Forest Service's artificially reduced gross weight. The pilot used the same form to calculate an additional payload to plan for an unscheduled long line fire-fighting mission; however, a representative of the USDA Forest Service reported that the bucket and line were not used on the day of the accident flight.

At the time of the accident, the helicopter had burned approximately 196 lbs of fuel. The density altitude at the time of the accident was 1,489 feet, which was used in conjunction with a temperature of 27 degrees C and a revised total weight of 3,756 lbs. to compute the helicopter's performance at the time of the accident. A review of the helicopter flight manual indicates the helicopter was operating within "AREA A" of the out of the ground effect performance chart.

T&M Aviation uses a portable fuel truck to supply helicopters based at M24 with JP-5 aviation fuel. As part of their refueling procedure, a record of the fuel sample, quantity, and amount dispensed is maintained by the fuel technician. T&M Aviation was not able to provide a copy of the fuel record on the date of the accident flight; however, according to a load calculation, the helicopter was serviced with approximately 600 lbs of fuel in advance of the helicopter's morning flight. Fuel performance calculations indicate the helicopter landed at 1050 with approximately 133 minutes of fuel remaining and the surviving crew member reported that the helicopter was subsequently refueled before departing on the accident flight. A fuel sample taken from the fuel tank after the accident was clear and free of any water or contaminants.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	GPT, 28 ft msl	Distance from Accident Site:	14 Nautical Miles
Observation Time:	14:53 Local	Direction from Accident Site:	180°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	9 knots / 21 knots	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	200°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	30.14 inches Hg	Temperature/Dew Point:	26°C / 17°C
Precipitation and Obscuration:	Moderate - Patches - Smoke		
Departure Point:	WIGGINS, MS (M24)	Type of Flight Plan Filed:	None
Destination:	WIGGINS, MS (M24)	Type of Clearance:	None
Departure Time:	13:34 Local	Type of Airspace:	

According to a National Transportation Safety Board weather study, the observations at GPT and BXA indicated ceilings greater than 3,000 feet AGL at the surface at the time of the accident, no visibility restrictions, and variable wind. The wind reported at GPT at the time of the accident was from the south/southwest between 10 and 20 knots, and the wind at BXA reported a west/northwest wind between 5 and 15 knots. Witnesses reported the winds at the time of the accident were variable from the northwest and south at approximately 5 mph.

The environment was unstable from the surface through 8,000 feet mean sea level (msl), which would allow for air to rise and fall easily with lifting mechanisms in the area of the accident site. A sounding wind profile revealed the presence of low level wind shear between the surface and 1,000 feet msl, with several layers of clear air turbulence from the surface through 10,000 feet.

A base reflectivity measurement indicated multiple targets at the accident site at the time of the accident, likely as a result of the smoke and particulates from the fire burning before, during and after the accident. While Forest Service personnel reported the presence of smoke in the area, there was little smoke at the accident site when the helicopter impacted the ground.

Wreckage and Impact Information

Crew Injuries:	2 Fatal, 1 Serious	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal, 1 Serious	Latitude, Longitude:	30.667778,-89.094718

The accident site was located at the southern end of the controlled burn area in a wooded area about one quarter mile north of a road. An initial impact point (IIP) was identified by several 80-foot-tall broken trees, about 70 feet south of the main wreckage. The helicopter tail rotor marked the beginning of the debris path, which was located about 30 feet beyond the IIP on a northerly heading. The main wreckage was oriented northwesterly about 180 feet above msl and comprised of the cockpit, fuselage, engine, main rotor assembly, and main rotor blades. The high landing skid was in the debris path, a few feet aft of the main wreckage. The helicopter upper deck section, which included the main rotor, transmission, and collective/cyclic hydraulic servos, was attached to the fuselage and had sustained fire damage. The cockpit and cabin were destroyed by fire with the exception of the center window frame and portions of the instrument panel, which were co-located with the fuselage. Both main rotor blades sustained significant fire damage, but were attached to the main rotor hub: Blade A (the white blade) was slightly bent opposite the direction of the rotation and Blade B (the red blade) displayed two 45 degree chordwise bends. The tip to Blade B exhibited signs of overload separation that was consistent with impact forces and was located about 20 feet northeast of the main wreckage. Both the tail rotor and tailboom sustained fire damage and were co-located near a tree 20 feet south of the main wreckage.

The tail rotor assembly was located next to a tree and was separated from the tail rotor drive shaft. The tail rotor drive system was traced from the tail rotor through the gearbox to the steel tail rotor drive shaft that was mounted to the freewheeling unit on the engine gearbox. There were no indications of spline drive wear on the tail rotor spline shaft coupling at the freewheeling unit and the main drive shaft did not exhibit any resistance when moved forward and aft.

The cockpit/cabin section came to rest on its left side and was destroyed by fire. The collective control was found in the cockpit area with the throttle mechanism exposed and in the idle position. Cyclic and collective control continuity from the cockpit to the hydraulic servos could not be attained due to fire damage. The helicopter upper deck section, including the main rotor assembly and transmission, was damaged by fire, but remained attached to the fuselage. Continuity was established from the collective/cyclic hydraulic servos to the swash plate and through overload fractures of the pitch change links. Hand rotation of the main drive shaft confirmed the presence of drive continuity through the main transmission to the main rotor blades. Both main rotor pitch change links exhibited signs of overload separation; the white blade link was separated at the swaged end and the red blade link separated about mid-span.

Engine Examination

The engine was recovered from the accident site and subsequently disassembled at the manufacturer's facility, under the supervision of the NTSB. Several accessories including the accessory gearbox, power turbine governor fuel control unit, and fuel pump could not be examined as they were consumed by post-crash fire. Both the right and left air discharge tubes displayed some impact damage, but were properly seated at their fore and aft ends. The compressor remained intact in its normal position and did not display any evidence of impact damage. The impeller and impeller shroud did not exhibit any rotational scoring and the no abnormalities were observed on the compressor scroll and diffuser.

The combustion section outer case remained in its normal position and was not damaged during the impact. The left side tube was dented and the forward end was seated on the scroll partially covered in molten metal. A visual inspection of the outer combustion case revealed the weld material on the mating

flange to the left side air tube had melted and the tube shifted away from the mating flange. The combustion liner was not damaged and did not display any unusual burn patterns or streaking.

The N1 shafting turbine to compressor coupling and spur adapter gear were properly seated and exhibited heat damage. Both the power turbine inner and outer shafts were also in their proper positions.

The fuel pump was consumed by fire and the fuel lines were also damaged by fire, which precluded a complete examination of the fuel system. Although the fuel nozzle could not be separated due to thermal damage, a visual inspection of the nozzle revealed no abnormalities.

Thermal damage prevented an examination of the accessory gearbox; however, several idler gears along with three oil pump gears, the torque meter gear and pinion gear were recovered from the accident site. Each gear displayed evidence of exposure to fire, but a visual inspection of the teeth and splines did not reveal any evidence of mechanical deformation.

The turbine section contained two areas of light rotational scoring on the stage four nozzle blade track that displayed evidence of contact with the stage four wheel outer shroud knife seals.

Rotor Blade Examination

An examination of photographs by a NTSB helicopter engineer revealed that both main rotor blades remained attached to the main rotor hub. One of the main rotor blades exhibited two chordwise bends along its span and its tip end was fractured and had separated from the blade. The leading edge of both main rotor blades did not exhibit evidence of damage consistent with high rotational energy. The afterbody and trailing edge of both main rotor blades exhibited multiple wrinkles along the blade span and was primarily heat distressed due to exposure to the postcrash fire. The main rotor hub remained attached to the main rotor shaft. The main rotor shaft exhibited impact marks from both main rotor flap stops.

The engine-to-main transmission drive shaft remained connected to the engine output flange, but the engine gearbox housing was consumed by the postcrash fire. The steel tail rotor drive output shaft (normally beneath the engine) remained connected on both ends via flexible couplings; the forward flexible coupling did not exhibit abnormal rotational damage and the aft flexible coupling exhibited slight openings between its laminates.

Both tail rotor blades remained attached to the tail rotor hub and exhibited evidence of heat distress due to exposure to the postcrash fire. The leading edges of both tail rotor blades did not exhibit evidence of damage consistent with high rotational energy.

Medical and Pathological Information

An autopsy was performed on the pilot by the Mississippi State Medical Examiner's Office, Jackson, Mississippi. The cause of death was listed as "thermal injuries and smoke inhalation."

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing on the pilot. No carbon monoxide, ethanol, or drugs were detected in the samples submitted.

Additional Information

72-hour History

Follow-up interviews with both the pilot's wife and the pilot's roommate were used to construct a 72-hour history. After 7 days of crew rest, the pilot was requested to return to work Sunday, March 29, 2015 as a relief pilot. According to the pilot's wife, he slept normally Thursday and Friday night. On Saturday morning he attended a church conference and then completed a 12 hour drive to Mississippi to prepare for work. The roommate stated that the pilot normally slept "quite a bit." He observed no abnormalities with the pilot's behavior or sleep patterns during the two nights that preceded the accident.

Part 137 Operations Specifications

According to T&M Aviation's Operations Specifications, the accident helicopter was authorized to conduct Title 14 CFR Part 137. The operations specifications also required the holder to maintain the engine in accordance with the Rolls-Royce 250-C230P operations and maintenance manual and had a Time-in-Service (overhaul) interval of 2000 hours for the turbine assembly. The Time-in-Service intervals for the compressor and gearbox assemblies were noted as "On Condition."

USDA Forest Service Contract

On January 10, 2012, the USDA Forest Service entered into a contract with T&M Aviation, to provide an aircraft and pilot for the purpose of performing aerial ignition operations. The contract listed numerous requirements and specified the configuration of the aircraft, the installation of required equipment, and the qualifications and duties of the pilot.

Aerial Ignition Operation

As part of the contract, T&M Aviation provided a pilot and helicopter during plastic sphere dispensed ignition, a common practice in controlled burn operations to ignite ground fuels on large acreage without damaging the tree canopy. According to the PSD manual, the dispenser case is constructed of aluminum and houses a supply of plastic spheres that each contain 3.0 grams of potassium permanganate. The PSD injects a predetermined dosage of ethylene glycol (common automotive coolant) from an inclusive tank and are ejected from the helicopter in batches of 2 or 4. The injection creates a timed combustion to detonate the spheres outside the helicopter. In the event of a malfunction, the unit is equipped with a 1 gallon water reservoir to extinguish burning spheres that remain within the chamber.

During aerial ignition operations, the plastic sphere dispenser operator (PLDO) is accompanied by a

firing boss who directs the mission. The PLDO is a Forest Service-employed helicopter crewmember responsible for the preparation, installation, operation and maintenance of the PSD. Two sections of the device were recovered from the accident site including the PSD exit chute and a small water tank used in the event of a premature ignition. The unit was bench tested by the plastic sphere dispenser operator (PLDO) prior to the accident flight in accordance with the manufacturer's test procedure and a one-gallon container of water was placed in the helicopter.

The Forest Service allows its contract pilots to operate below 500 feet AGL as higher altitudes provide less control of sphere placement, which may result in unintended ignition outside of burn boundaries. The airspeed/altitude combination depends on how the PSD firing boss decides to deploy the spheres, which precludes the use of a prescribed flight profile.

Pilot's Operating Handbook (POH)

According to the "Engine Failure and Autorotation" section of the pilot's operating handbook,

"At low altitude, close throttle and flare to lose excessive airspeed. Apply collective pitch as flare effect decreases to further reduce forward speed and cushion landing. It is recommended that level touchdown be made prior to passing through 70% rotor RPM..."

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Steven Felts; FAA/FSDO; Jackson, MS David Riser; Rolls-Royce Corporation; Indianapolis, IN Mark Stuntzner; Bell Helicopter; Fort Worth, TX Lori Clark; United States Forest Service; Kooskia, ID
Original Publish Date:	June 22, 2016
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=90956

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](#).