Aviation Investigation Final Report

Location:	Sebring, Florida	**Accident Number:**	ERA14FA066
Date & Time:	December 6, 2013, 16:30 Local	**Registration:**	N1001N
Aircraft:	TEXAS HELICOPTER CORP M74L	**Aircraft Damage:**	Destroyed
Defining Event:	Fuel contamination	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

After a day of aerial application flights, the pilot landed in a farm field and had the helicopter serviced with fuel from a truck before departing on the accident flight. A witness observed the helicopter descending toward an open field from an altitude about 150 feet above ground level. The helicopter then descended to about 50 feet, leveled briefly, then "fell" straight to the ground, and erupted in flames. The wreckage was partially consumed by a postimpact fire.

Examination of the wreckage following the accident revealed that the engine's carburetor float bowl was absent of fuel and contaminated with a rust-colored powder, which contained both ferrous and non-ferrous metal. Detailed examination of particulate matter collected from the filter housing of the fuel truck used to service the helicopter showed those components to be similarly contaminated. Additionally, during a postaccident demonstration of the procedure used to fuel the helicopter, the initial fuel dispensed was brown and gold in color. The operator of the fuel truck noted that it was typical to continue dispensing fuel into a separate container until it "turned blue," before beginning to fill the helicopter.

The extent to which the fuel onboard the helicopter at the time of the accident was contaminated could not be determined due to the extent of the post-impact fire and lack of available fuel samples from the helicopter. However; based on the powdered contamination recovered from the carburetor float bowl, it is likely that the fuel contamination was significant enough to result in a partial or total loss of engine power, which would have required that the pilot conduct an off-airport precautionary landing, or autorotation and forced landing.

The pilot's toxicology testing revealed a carbon monoxide level that was consistent with the autopsy findings of abundant soot in the upper and lower airways and indicated exposure to combustion products in the postimpact fire. It was unlikely that an elevated level of carbon monoxide was present in the pilot's blood before that crash. Toxicology testing also indicated that the pilot had used diphenhydramine before the accident. Diphenhydramine, a sedating antihistamine used to treat allergy symptoms and as a

sleep aid. Diphenhydramine can cause marked sedation, altered mood, and impaired cognitive and psychomotor performance may. The pilot's diphenhydramine levels were above the therapeutic range, but may have been redistributed following death. Thus, it is likely the pilot had therapeutic levels of diphenhydramine in his system at the time of the crash. The pilot's time-critical decision-making and ability to perform an effective autorotation and/or landing were likely impaired by the use of diphenhydramine.

Probable Cause and Findings

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

A partial loss of engine power as a result of contamination of the engine's fuel supply, and the pilot's impaired performance due to his use of diphenhydramine, which resulted in his inability to complete a forced or precautionary autorotative landing successfully.

Findings

Aircraft	Fuel - Fluid condition
Personnel issues	Decision making/judgment - Pilot
Personnel issues	Aircraft control - Pilot
Personnel issues	OTC medication - Pilot

Factual Information

History of Flight

Enroute-cruise	Fuel contamination (Defining event)
Emergency descent	Off-field or emergency landing
Emergency descent	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On December 6, 2013, about 1630 eastern standard time, a Texas Helicopter Corporation M74L, N1001N, operated by Spray Copter LLC., was destroyed after impacting the ground during a positioning flight near Sebring, Florida. The commercial pilot was fatally injured. Visual meteorological conditions prevailed and no flight plan was filed for the flight that departed a local farm field about 1615, and was destined for Sebring Regional Airport (SEF), Sebring, Florida. The positioning flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

During the course of the day, the helicopter was conducting aerial application flights in the local area. According to the operator's ground crew manager, about 400 acres had been treated with insecticide, and the purpose of the accident flight was to reposition the helicopter from a farm field to SEF, where the pilot planned to wash the helicopter and change the engine oil. Before departing the farm field, the helicopter was serviced with fuel from a truck, which was also used to transport chemicals used during aerial application flights.

A witness observed the helicopter as it approached where he was working, traveling to the southwest. He estimated that the helicopter was flying at an altitude of about 150 feet above the ground.. The helicopter then, "dipped down" to between 50 and 75 feet above the ground, and again leveled. The helicopter then "fell" straight to the ground. The helicopter subsequently impacted the ground, and burst into flames. As he was standing near an operating farm tractor, the witness was not able to hear the helicopter as it approached.

Pilot Information

Certificate:	Commercial; Private	**Age:**	52
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	January 29, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	October 20, 2012
Flight Time:	(Estimated) 10800 hours (Total, all aircraft), 999999 hours (Total, this make and model)		

According to Federal Aviation Administration (FAA) records, the pilot held a commercial pilot certificate with a rating for helicopter and airplane single engine land. The pilot also held a mechanic certificate with ratings for airframe and power plant. The pilot was issued an FAA second class medical certificate on January 29, 2013 with the medical restriction "must have available lenses for near vision." In January 2013, the pilot reported he had accumulated 10,800 total hours of flight experience, 500 hours of which had been accumulated in the preceding six months. According to the pilot's personal flight log, as of October 2013 he had accumulated 11,052 total hours of flight experience.

Aircraft and Owner/Operator Information

Aircraft Make:	TEXAS HELICOPTER CORP	**Registration:**	N1001N
Model/Series:	M74L	**Aircraft Category:**	Helicopter
Year of Manufacture:	1981	**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	81-037
Landing Gear Type:	Skid	**Seats:**	1
Date/Type of Last Inspection:	Condition	**Certified Max Gross Wt.:**	2850 lbs
Time Since Last Inspection:	43 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	7949 Hrs at time of accident	**Engine Manufacturer:**	LYCOMING
ELT:	Not installed	**Engine Model/Series:**	VO-435 SERIES
Registered Owner:	Rotor Tech, Inc	**Rated Power:**	260 Horsepower
Operator:	Spray Copter, LLC	**Operating Certificate(s) Held:**	Agricultural aircraft (137)

According to FAA airworthiness records, the accident helicopter was manufactured in 1981, and was powered by a Lycoming VO435 reciprocating engine. A review of the helicopter's maintenance records revealed that the engine's most recent overhaul was completed in July 2013, and a serviceable carburetor was installed in October 2013. The helicopter's most recent annual inspection was also completed in October 2013, and at that time the helicopter had accumulated 7,915 total hours of operation. Since that time the helicopter had accumulated 33 additional flight hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	OBE,33 ft msl	**Distance from Accident Site:**	29 Nautical Miles
Observation Time:	16:35 Local	**Direction from Accident Site:**	120°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	160°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.12 inches Hg	**Temperature/Dew Point:**	26°C / 18°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Sebring, FL (NONE)	**Type of Flight Plan Filed:**	None
Destination:	Sebring, FL (SEF)	**Type of Clearance:**	None
Departure Time:	16:15 Local	**Type of Airspace:**	Class G

The weather conditions reported at SEF, at 1559, included wind from 140 degrees at 09 knots, 10 statute miles visibility, clear skies below 12,000 feet, a temperature of 31 C, a dew point of 19 C, and an altimeter setting of 30.10 inches of mercury.

Airport Information

Airport:	Sebring Regional Airport SEF	**Runway Surface Type:**	
Airport Elevation:	62 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 Fatal	**Latitude, Longitude:**	27.463333,-81.366668

The accident site was located in an open sod field located 1.3 nautical miles west of SEF. The debris path was about 120 feet in circumference, and located in close proximity to an irrigation canal. The helicopter came to rest on its right side and was oriented 210 degrees magnetic. The debris field was oriented roughly 110 degrees magnetic. The cockpit, rotor system, tail boom, empennage section, and spray boom were all located 20 feet from the initial impact point.

Examination of the cockpit revealed that the windscreen was shattered and destroyed. The left door was removed for the flight and the right door was attached and destroyed due to thermal damage. The instrument panel was still attached, thermal damaged and laying on its right side. The altimeter was set at 29.84 inches of mercury and indicated 770 feet. The left and right anti-torque pedals were attached and unremarkable. The cyclic control was thermally damaged and severed at its base. The collective pitch control was thermally damaged and fractured at the base consistent with overload failure. The engine firewall and pilot seat were thermally damaged and crushed forward.

Main rotor flight control continuity was confirmed from the cyclic and collective pitch controls to the main rotor blades. Several separations were noted, though all were consistent with overload or fire damage. The equalizer beam was thermal damaged and the respective pitch links were separated consistent with bending overload.

One of the rotor blades exhibited thermal damage from the blade root to 8 feet outboard. From the blade tip to 11 feet inboard were chord wise scratches consistent with a ground scar of the same length, located adjacent to the wreckage. The trailing edge was buckled for the entire length of the blade. The pitch link was connected and thermal damaged. The drag link was sheared and the remaining bolt was inside the connecting hole of the blade.

The remaining rotor blade was thermally damaged on the entire length of the blade underside. The blade also exhibited separation of the trailing edge for the entire length of the blade. About 5 feet outboard the blade root, the trailing edge was torn chord wise to the blade spar. The pitch link was separated consistent with overload failure. The drag link was sheared and a portion of the bolt remained inside the connecting hole of the blade.

The tail boom was bent upward about 30 degrees with the lower attach points fractured. About 6 feet aft of the attach points, the tail boom was twisted 180 degrees and resting on the ground. The lower support tubes exhibited fractures that were consistent with bending overload.

Tail rotor flight control continuity was confirmed from the anti-torque pedals to the tail rotor. Tail rotor drive continuity was traced from the transmission to the tail rotor gearbox. The tail rotor driveshaft was disconnected at the base of the transmission consistent with tension force. The shaft was fractured about 7 feet aft of the transmission consistent with torsional overload. The tail rotor remained attached and was free to rotate. One blade was bent 4 inches from the root and the other blade was bent 4 inches, 7 inches, and 14 inches from the blade root. The tail rotor gearbox was intact, undamaged, and unremarkable.

The left landing skid was fractured 5 feet aft of the toe and remained connected to the left spray boom apparatus. The right landing skid was fractured 6 feet aft of the toe and remained connected to the right spray boom apparatus. The rear landing skid crossbow remained attached to the airframe and bent aft 20

degrees. The front crossbow remained attached to the airframe and was crushed upwards into the flight control torque tube area behind the cockpit. The helicopter was equipped with two chemical tanks and one fuel tank that ruptured during the crash sequence. The fuel tank departed the mounting pedestal and was located underneath the main rotor mast in the soil. It was ruptured, thermally damaged, and absent of fuel.

Visual examination of the engine revealed that the cooling fan exhibited reverse bending signatures on nine of the blades, while the remaining nine blades had separated completely. The engine oil sump was breached and absent of oil. The oil suction screen was absent of metallic debris and unobstructed.

The engine crankshaft was rotated via the engine-driven fuel pump port. Continuity of the main drive and valve train was confirmed from the power output of the engine to the rear accessory gears. Rotation of the crankshaft produced suction and compression on all cylinders. Visual inspection cylinder bores with a lighted bore scope revealed no anomalies. The left magneto remained attached to the engine, but did not produce spark when the input shaft was rotated, and was subsequently disassembled. A small amount of oil was observed in the magneto housing but no damage to the ignition points or other internal components observed. The right magneto was separated from the engine and produced spark from all 6 ignition towers when rotated by hand. The top and bottom spark plugs were removed, and their electrodes appeared medium brown in color with normal wear. The engine hydraulic pump, engine tachometer, and rotor tachometer were free to rotate. Battery power was applied to the engine starter resulting in free rotation of the crankshaft and valvetrain.

The carburetor was removed and inspected for contamination and debris. The carburetor bowl was absent of fuel and contained rust-colored powder. The carburetor inlet screen was absent of debris. The carburetor float was dry and coated with the same substance that was located in the carburetor bowl along with small metallic fragments. The airframe fuel filter screen was absent of debris or obstruction.

The fuel filter, hose, and fuel pump from the fuel truck last used to service the helicopter were retained and cut open for internal examination. The components contained the same rust-colored substance that was observed in the carburetor bowl and on the floats.

The powder recovered from the carburetor bowl and fuel truck components were forwarded to the NTSB Materials Laboratory for detailed examination utilizing a 20-200X zoom stereomicroscope and an x-ray fluorescence analyzer. With the exception of the fuel hose, material consisting of a reddish brown particulate of relatively uniform size and morphology were present throughout. Several metallic colored flakes were also present in the material recovered from the carburetor bowl and the fuel filter element. The elemental composition of the material consisted mainly of aluminum (Al), iron (Fe), chromium (Cr), lead (Pb), vanadium (V), and zinc (Zn).

Medical and Pathological Information

An autopsy was performed on the pilot on December 7, 2013 by the Highlands County Medical Examiner's office. The medical examiner determined that the cause of death was thermal burns and smoke inhalation and the manner of death was accident. The pathologist did not identify any natural

disease of the heart or brain.

Toxicology testing performed by the FAA's Civil Aerospace Medical Institute found 18% carbon monoxide in the heart blood. In addition, diphenhydramine was detected in the heart blood (0.147 ug/ml) and urine.

Diphenhydramine was a sedating antihistamine used to treat allergy symptoms and as a sleep aid. It was available over the counter under various trade names including Benadryl and Unisom. Diphenhydramine carried the following warning: may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery). The therapeutic range for the drug was from 0.0250 to 0.1120 ug/ml.

Tests and Research

An agricultural GPS system was retained and forwarded to the NTSB Vehicle Recorder Laboratory for download. No data relevant to the accident flight were recovered.

Additional Information

The fuel truck that supplied the helicopter with the fuel and chemical for the spray operation was inspected shortly after the accident. The ground handler responsible for running the truck was asked to demonstrate his procedures for daily operations. He explained that when he turned on the pump and expended fuel, he would flow about 2 gallons of fuel into a bucket until the fuel turned blue, fill up a water bottle, and conduct a visual "clear and bright" check of the fuel. The ground handler subsequently demonstrated this procedure, activated the pump and expended fuel into a bucket. The fluid observed was initially gold and brown in color and then eventually changed to a blue color.

Administrative Information

Investigator In Charge (IIC):	Murray, Patrick
Additional Participating Persons:	David Schmidt; FAA/FSDO; Orlando, FL Don Maguire; Scott's Bell 47 Inc.; Le Sueur, MN James Childers; Lycoming Engines; Williamsport, PA
Original Publish Date:	July 23, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=88523