Aviation Investigation Final Report

Location:	Jordan Valley, Oregon	**Accident Number:**	WPR20FA016
Date & Time:	October 25, 2019, 15:41 Local	**Registration:**	N280F
Aircraft:	Enstrom 280F	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was performing low-level flight over high desert terrain. The passenger reported that, during the flight, the pilot became concerned over a low “rpm” indication. The pilot began to manipulate the flight controls, and the helicopter rapidly descended, yawed to the right, and impacted terrain.

Examination revealed that significant sections of the outer liner of the engine’s air induction hose were abraded, consistent with long-term wear, and had worn away from the supporting structure, allowing the hose liner to collapse and restrict airflow into the engine. Given this condition, the engine would have experienced a partial power loss due to the restricted airflow; damage signatures indicated that the engine was producing some power at the time of impact. The helicopter’s most recent annual inspection was completed about three months before the accident, and the worn hose should have been apparent at the time of the inspection.

Automatic Dependent Surveillance-Broadcast (ADS-B) data indicated that, before the accident, the helicopter was traveling at a speed and altitude such that, in the event of an engine failure, the pilot would have had limited time to enter and establish a controlled autorotative descent. The helicopter’s operating handbook stated that, at low altitude and low speed, sufficient altitude may not be available to increase rotor rpm following a loss of engine power. Impact damage to the helicopter was consistent with an uncontrolled collision with terrain.

The helicopter was equipped with a current emergency locator transmitter (ELT), but it had been incorrectly installed inside the metal baggage compartment in a portable configuration and was not equipped with the required external antenna. Therefore, although the ELT activated, it’s signal was likely shielded by the metal compartment, and not received by search and rescue personnel. As a result, the helicopter was not discovered until the following morning. Even if the ELT signal had been received, the unit was not registered with the current

owner; this could potentially have resulted in a delay as search and rescue personnel attempted to track down the owner and ascertain the validity of the alert.

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 due to a worn engine air induction hose, and a subsequent uncontrolled descent into terrain. Contributing to the accident was the failure of maintenance personnel to adequately inspect the hose, and the pilot's decision to fly the helicopter at a speed and altitude that provided limited time to enter and establish an autorotation following the loss of power.

Findings

Aircraft	Air intake - Fatigue/wear/corrosion
Personnel issues	Scheduled/routine inspection - Maintenance personnel
Personnel issues	Replacement - Maintenance personnel
Aircraft	Emergency locator beacon - Incorrect use/operation

Factual Information

History of Flight

Maneuvering-low-alt flying	Loss of engine power (partial) (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On October 25, 2019, about 1541 mountain daylight time, an Enstrom 280F helicopter, N280F, was substantially damaged when it was involved in an accident near Jordan Valley, Oregon. The pilot was fatally injured, and the pilot-rated passenger sustained serious injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the passenger, the intent of the flight was to fly from their home base of Caldwell Industrial Airport (EUL), Caldwell, Idaho, toward the Owyhee Mountain Range and Reservoir, a trip they had taken multiple times before. Upon her arrival at the airport that afternoon, the pilot had already moved the helicopter out of the hangar. A short time later, they boarded and taxied to the local fueling facility, where the pilot serviced the helicopter with the addition of 22.5 gallons of fuel.

The passenger stated that the departure was to the southwest and was uneventful, and after arriving over the Owyhee Mountain Range, they observed some wild horses. The pilot performed an orbit over the horses while the passenger took photos (See figure 1, inset). Once complete, they proceeded toward the southwest.

A few minutes later, the pilot calmly stated that the "rpm" was low. Due to the tone of his voice, the passenger was not initially concerned, and continued to look out of the window; however, a short time later, the pilot appeared to have become nervous and began manipulating (“working”) the collective control.

There was no change in the sound or feel of the helicopter, but when the passenger looked at the instrument panel, one of the needles that she was used to seeing in the green zone was just to the left of that normal position. The helicopter then rapidly descended, yawed right, and struck the ground right side down.

Family members became concerned when neither occupant returned home that evening and contacted local law enforcement. The wreckage was located the following morning.

Automatic Dependent Surveillance-Broadcast (ADS-B) flight track data of the entire flight indicated that the helicopter maintained a terrain clearance of between 350 and 900 ft above ground level (agl) after departure as it approached the mountain range, while maintaining a groundspeed of about 100 mph. As it entered the range, the helicopter continued to climb as the ground speed slowed to 85 mph. It started to follow the undulating terrain with clearances varying between 0 and 100 ft agl, until 18 minutes after takeoff and 25 miles southwest of EUL.

It then began an orbit at a GPS altitude of about 4,900 ft, which was between 50 and 200 ft agl over terrain.

After completing the orbit, the helicopter departed to the southwest at an altitude of about 5,000 ft mean sea level (msl), and continued for the remaining 2 miles at the same altitude, which corresponded to terrain clearance of between 0 and 50 ft agl, at a ground speed of about 70 mph.

Figure 1 – ADS-B derived route of flight

Pilot Information

Certificate:	Commercial	**Age:**	57,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	BasicMed With waivers/limitations	**Last FAA Medical Exam:**	August 10, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	March 1, 2018
Flight Time:	(Estimated) 950 hours (Total, all aircraft), 100 hours (Total, this make and model)		

The pilot's logbook was not located; however, he reported 900 total hours of flight experience at the time of his last Federal Aviation Administration (FAA) medical examination on May 20, 2016. The pilot completed the requirements for operation under BasicMed on August 10, 2018.

Aircraft and Owner/Operator Information

Aircraft Make:	Enstrom	**Registration:**	N280F
Model/Series:	280F	**Aircraft Category:**	Helicopter
Year of Manufacture:	1981	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1501
Landing Gear Type:	N/A; Skid	**Seats:**	4
Date/Type of Last Inspection:	July 1, 2019 Annual	**Certified Max Gross Wt.:**	2350 lbs
Time Since Last Inspection:	21.8 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1504 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	HIO-360-F1AD
Registered Owner:	On file	**Rated Power:**	190 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMAN,2537 ft msl	**Distance from Accident Site:**	25 Nautical Miles
Observation Time:	22:55 Local	**Direction from Accident Site:**	64°
Lowest Cloud Condition:	Clear	**Visibility**	9 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	18°C / -3°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Caldwell, ID (EUL)	**Type of Flight Plan Filed:**	None
Destination:	Caldwell, ID (EUL)	**Type of Clearance:**	None
Departure Time:	15:20 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	43.394721,-117.04694

The helicopter was located about 500 ft south of the last ADS-B target at an elevation of 4,917 ft msl. The helicopter came to rest on its right side on a heading of about 330° magnetic. The first identified point of impact was characterized by an area of disrupted earth about 25 ft north of the main wreckage, which contained fragments of canopy plexiglass and cabin contents. A series of imprints just forward of the disruption matched the general outline of the forward section of the landing gear skids, beyond which a series of perpendicular slash marks indicated ground contact of the main rotor blade tips.

All three main rotor blades remained attached to the hub, and all exhibited 30° upward bending damage, along with leading edge and chordwise abrasion. Examination of the airframe and flight controls revealed no evidence of mechanical malfunctions or anomalies that would have precluded normal operation.

The engine sustained minimal damage and there was no evidence of catastrophic internal failure. The engine controls were continuous from their respective control arms to the cabin controls. The inlet air filter was free of obstruction. The dual magneto was intact and undamaged, and the engine-to-magneto timing met the manufacturer's recommended specifications. The spark plug electrodes were mechanically undamaged, coated in light grey deposits, and displayed normal wear signatures. Five of the engine cooling fan blades had bent about 90° opposite the direction of rotation, and rotational scoring and gouging was observed on the right side of the fan shroud adjacent to the blade tips. Examination of the fuel system revealed no anomalies, and fuel was recovered from both tanks.

The main transmission belt engagement clutch was in the fully engaged position, and there was no apparent damage or significant degradation of the drive belt. The freewheeling unit (overrunning clutch) allowed for transmission rotation in the correct direction. The engine and main rotor tachometer drives were intact and operational. The tachometer was subsequently removed, tested, and disassembled. No mechanical anomalies were noted, and the unit met the original manufacturers performance specifications. The helicopter was not equipped with an audio or visual low rotor-rpm warning system.

The engine's air induction system was composed of an air filter assembly connected to the fuel injection servo via a flexible intake hose. The servo was connected directly to the compressor section of the turbocharger, the outlet of which forced the air and fuel mixture directly into the engine induction manifold.

The flexible hose was a 3-inch diameter, "Silfab-2" type, constructed of a spring steel helix, bonded between a liner and cover which were both composed of fiberglass fabric impregnated silicone rubber. The outer surface of the hose was double wound with a fiberglass cord.

Detailed examination of the hose revealed that the outer cover and fiberglass cord had abraded, such that the steel helix was visible and protruding over about half of the hose's length. (see Photos 1 and 2.) In some areas, the helix was visible for more than half of the hose circumference, such that the liner and cover were unsupported and could be flexed inward, partially obstructing the flow.

The air induction system section of the helicopter's 100hr/annual inspection guide stated: "Inspect the flex duct and fuel servo adapter for condition and security of installation."

Photo 1 – Engine air induction hose with steel helix visible at multiple locations

Photo 2 - Engine air induction hose with protruding steel helix

Medical and Pathological Information

The Department of Pathology, Saint Alphonsus Medical Center – Ontario (Oregon), performed the pilot's autopsy at the request of the Malheur County Medical Examiner. According to the Medical Examiner, the cause of death was multiple traumatic injuries due to helicopter crash, and the manner of death was accident.

No impairing drugs were found in toxicological testing.

Survival Aspects

The helicopter was equipped with a 406 AF-COMPACT emergency locator transmitter (ELT), manufactured by Kannad in accordance with FAA technical standard order (TSO) C126. However, no activation signal was received by the Air Force Rescue Coordination Center (AFRCC) following the accident.

The manufacturers installation instructions state that in helicopter applications, the unit must be installed 45° relative to the yaw axis and mounted to a structural member. The installation instructions further stated that an external antenna must be used and installed on the top of the helicopter. On-site examination revealed that the ELT, rather being mounted to a structural member, had been mounted within the enclosed aluminum baggage compartment, on the left side of the floor panel. The unit was not utilizing an external antenna, but instead was connected directly to a portable auxiliary "whip" antenna which had been mounted inside the baggage compartment on the left wall. The ELT power switch was found in the "armed" position at the accident site, and the unit could be heard emitting an audio tone consistent with activation and transmission of its emergency signal.

Testing of the ELT revealed that the unit passed all tests, and the battery still contained sufficient charge for operation. Review of NOAA registration data indicated that the ELT had not been registered to the current owner, as required by Federal Aviation Regulations, but instead was still registered to the helicopter's previous owner.

The pilot and passenger were both using the helicopters factory-installed 3-point harness. The helicopter was not equipped with any emergency survival equipment, and the passenger stated that she was wearing pants and a shirt and had left here jacket in the hangar prior to flight.

Additional Information

The Helicopter Performance section of the FAA Helicopter Flying Handbook (FAA-H-8083-21B) discusses the height/velocity diagram, in part:

The diagram shows the combinations of airspeed and height above the ground, which will allow an average pilot to successfully complete a landing after an engine failure.

The shaded area on the lower right is dangerous due to the airspeed and proximity to the ground resulting in dramatically reduced reaction time for the pilot in the case of mechanical failure, or other in-flight emergencies.

Based on the helicopter's basic empty weight, fuel load, and occupant weight, the gross weight at takeoff was about 2,350 lbs. The height/velocity diagram for 2,350 lbs gross weight, as documented in the helicopter's operator's manual, is represented in Figure 2.

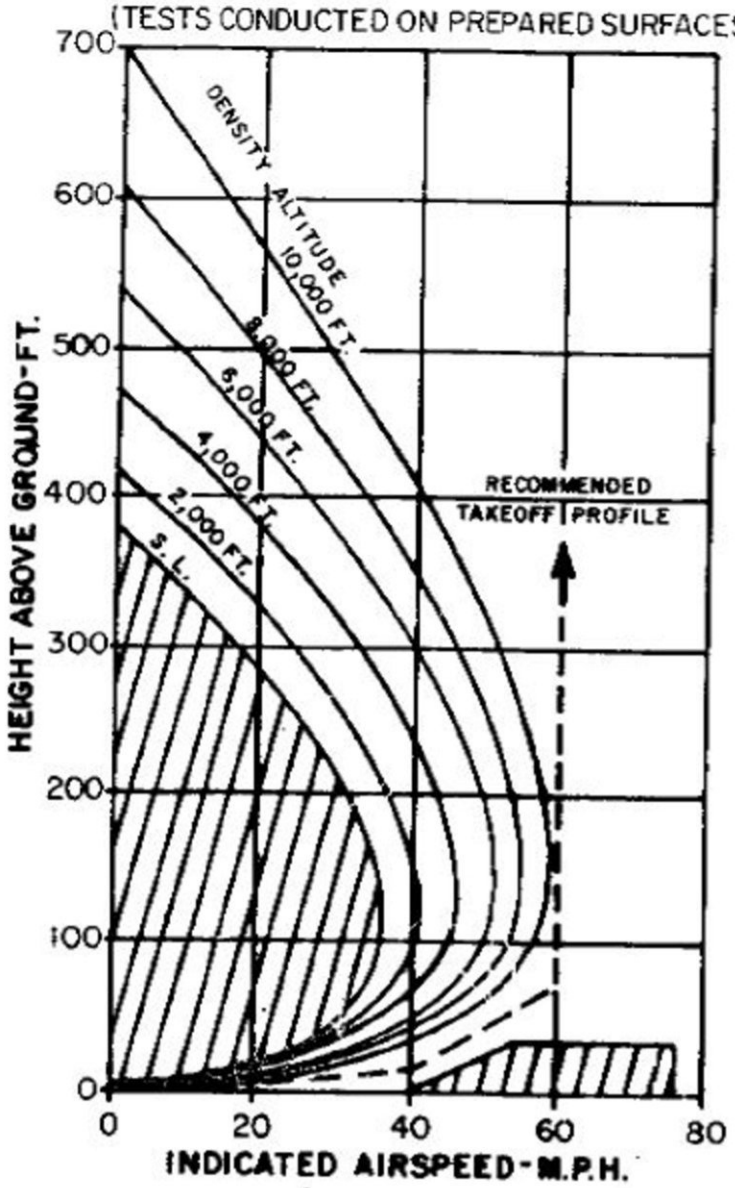

Figure 2 – 2,350-lb gross weight height/velocity diagram

The operator's manual also stated:

When an engine failure occurs at low altitude and low airspeed, sufficient altitude may not be available to increase rotor rpm…

The passenger stated that the flight was performed at a relatively low altitude, but she assumed, at least for the time that they flew around the horses, that the helicopter was about 500 ft agl. She based this assumption on the fact that the pilot utilized an iPad with software that included a terrain feature that would annunciate if the helicopter was below 500 ft agl; she did not hear any such annunciations.

Examination of the iPad revealed that the pilot utilized the ForeFlight application for navigation. According to ForeFlight documentation:

500' AGL Alerts - The 500' AGL alert is a simple callout that triggers when you descend through 500' AGL after having been above 1,000' AGL. The alert will only sound once every 60 seconds and is automatically disabled if your groundspeed is less than 40 knots.

ADS-B data indicated that the helicopter did not fly above 900 ft agl during the flight, therefore the 500' agl alert would not have been active.

Administrative Information

Investigator In Charge (IIC):	Simpson, Eliott
Additional Participating Persons:	Rudy Rossi; Federal Aviation Administration FSDO; Boise, ID Mark Platt; Lycoming Engines; Williamsport, PA William E Taylor; Enstrom Helicopers; Menominee, MI
Original Publish Date:	March 9, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100492