Aviation Investigation Final Report

Location:	Front Royal, Virginia	**Accident Number:**	ERA18FA006
Date & Time:	October 7, 2017, 13:45 Local	**Registration:**	N90866
Aircraft:	Piper PA 25-235	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Glider tow		

Analysis

A glider was being towed for an introductory flight with the student in the front seat and the glider flight instructor in the rear seat. The glider flight instructor recorded the flight using a digital video camera. At the end of the first video, the tow plane and glider were on the upwind leg of the airport traffic pattern, during initial climb, and the glider was about 200 ft above ground level. The glider's airspeed indicated about 60 knots, and the glider's position relative to the tow plane was consistent with a high-tow position (that is, the glider was positioned slightly above the wake of the tow plane). The video then stopped for unknown reasons. About this time the instructor diverted his attention away from the tow plane. When the instructor looked back toward the tow plane, he did not immediately see it, but then noted that it was below and right of the glider.

Analysis and extrapolation of the tow plane and glider flightpaths revealed that during this time the tow plane turned toward the crosswind leg, stopped climbing, and began to descend while the glider continued to climb. The video then showed that the glider's nose then yawed right, and the yaw string was nearly 90° right. The glider's yellow tow rope release handle moved partially aft, and then a snapping sound was heard followed by the tow rope release handle extending further. The tow plane's elevator was in the "up" position at that time, and the glider then turned left and returned to the airport. The tow plane descended nose down into the backyard of a residence and was consumed by postimpact fire.

Microscopic examination of the tow rope separation revealed features indicative of overstress separation. This evidence and the snapping sound heard on the second video are consistent with the tow rope breaking about 1 second before the glider instructor fully pulled the tow rope release handle. The up-elevator and nose-down tow plane descent was consistent with the tension on the tow rope lifting the empennage of the tow plane. Examination of the tow plane did not reveal evidence of any preimpact mechanical malfunctions that would have precluded normal operation, and there was no evidence that the pilot attempted to cut the tow rope with the tow plane's guillotine.

The tow pilot had a history of hypertension, high cholesterol, and nonocclusive coronary artery disease. The pilot was taking medications to treat these conditions, but they were not considered impairing. According to the tow pilot's autopsy report, his heart was enlarged and he had mild-to-moderate atherosclerosis. Although the pilot's significant coronary artery disease increased his risk for an acute cardiac event, no evidence was found during the autopsy indicating that such an event occurred.

On the basis of the available evidence, the investigation could not determine if the tow plane pilot experienced a medical event during the accident flight or why the airplane stopped climbing at 200 ft rather than continuing to climb to the tow-release altitude.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The tow plane pilot's loss of airplane control for reasons that could not be determined based on the available evidence. Contributing to the accident was the glider instructor's diversion of attention away from the tow airplane which resulted in his delay in releasing the tow rope once the tow plane was no longer visible from the glider cockpit.

Findings

Personnel issues	Aircraft control - Pilot
Personnel issues	Monitoring other aircraft - Pilot of other aircraft
Personnel issues	Identification/recognition - Pilot of other aircraft
Personnel issues	Delayed action - Pilot of other aircraft
Not determined	(general) - Unknown/Not determined
Personnel issues	Predisposing condition - Pilot

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On October 7, 2017, about 1345 eastern daylight time, a Piper PA-25-235 airplane, N90866, was destroyed when it impacted terrain during initial climb after takeoff from Front Royal-Warren County Airport (FRR), Front Royal, Virginia. The airline transport pilot was fatally injured. The airplane was owned and operated by the Skyline Soaring Club under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed at the airport, and no flight plan was filed for the local glider tow flight.

According to the glider flight instructor, he was providing an introductory glider flight to a passenger in the glider. The passenger was seated in the front seat, and the instructor was seated in the rear seat. He stated that the takeoff from runway 28 was normal and that he then looked away from the tow plane briefly to adjust a video camera. When he looked back toward the tow plane, he did not immediately see it but then noted that it was below and right of the glider. Additionally, the flight instructor noticed slack in the tow rope that attached the glider to the tow plane. He then released the tow rope, turned the glider 180°, and landed uneventfully. While approaching the runway, the glider flight instructor saw a fireball from where the tow plane had been descending. Several witnesses at the airport stated that the takeoff appeared to be normal but that the tow plane then pitched down, descended below the glider, and turned right before impacting terrain.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	76,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 1, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	11953 hours (Total, all aircraft), 999999 hours (Total, this make and model)		

The tow plane pilot, age 76, held airline transport and commercial pilot certificates with an airplane multiengine land rating and an airplane single-engine land rating, respectively. Additionally, the pilot held a flight instructor certificate with airplane single- and multiengine and instrument airplane ratings.

His most recent Federal Aviation Administration (FAA) second-class medical certificate was issued on October 1, 2015. At that time, the pilot reported a total flight experience of 11,953 hours. The pilot's logbook was not recovered.
The glider flight instructor held a commercial pilot certificate with ratings for airplane single-engine land, airplane single-engine sea, airplane multiengine land, instrument airplane and glider. He also held a flight instructor certificate with a rating for glider. His most recent FAA second-class medical class medical certificate with issued on March 30, 2017. The glider flight instructor reported a total flight experience of 1,580.2 hours; of which 107.7 hours were in gliders.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N90866
Model/Series:	PA 25-235 UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	1981	**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	25-8156005
Landing Gear Type:	Tailwheel	**Seats:**	1
Date/Type of Last Inspection:	February 2, 2017 Annual	**Certified Max Gross Wt.:**	2900 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	8265 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	Not installed	**Engine Model/Series:**	O-540-B2C5
Registered Owner:	SKYLINE SOARING CLUB	**Rated Power:**	235 Horsepower
Operator:	SKYLINE SOARING CLUB	**Operating Certificate(s) Held:**	None

The single-seat, low-wing, fixed-tailwheel airplane was manufactured in 1981. It was powered by a Lycoming O-540, 235-horsepower engine and was equipped with a Hoffman four-blade, fixed-pitch wooden propeller. Review of the maintenance records revealed that the tow plane's most recent annual inspection was completed on February 2, 2017. At that time, the airframe had accumulated about 8,265 total hours of operation, and the engine had accumulated 468 hours since overhaul.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FRR,703 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	13:55 Local	**Direction from Accident Site:**	110°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots / 15 knots	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	29°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Front Royal, VA (FRR)	**Type of Flight Plan Filed:**	None
Destination:	Front Royal, VA (FRR)	**Type of Clearance:**	None
Departure Time:	13:44 Local	**Type of Airspace:**	

The recorded weather at FRR, at 1355, was wind from 230° at 10 knots, gusting to 15 knots; visibility 10 statute miles; clear sky; temperature 29°C; dew point 14°C; and altimeter 30.01 inches of mercury.

Airport Information

Airport:	Front Royal FRR	**Runway Surface Type:**	Asphalt
Airport Elevation:	703 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	28	**IFR Approach:**	None
Runway Length/Width:	3007 ft / 75 ft	**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:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	38.920276,-78.263053(est)

The wreckage was consumed by a postcrash fire and located in the backyard of a residence, about 1,600 ft northwest of the departure end of runway 28. A small crater was observed in the grass, consistent with engine contact, and fragments of the propeller were also located near the crater. The main wreckage came to rest upright about 65 ft north of the crater. The tow rope was also located along the debris path. The left main landing gear (MLG) had separated and was located left of the main wreckage. The right MLG and tailwheel remained attached. All major components of the tow plane were accounted for at the scene.
The flaps and ailerons were located with their respective wing, but the wings were consumed by fire. Control cable continuity was confirmed from the left and right ailerons to the control stick in the cockpit. Continuity was also confirmed from the elevator and rudder to the control stick and rudder pedals, respectively. No readable instruments were recovered from the cockpit.

The engine had separated from the airframe and was resting in front of it. The four wooden propeller blades had separated from the hub. Two of the propeller blade roots remained attached to the hub. The engine's valve covers were removed, and oil was noted throughout the engine. The top spark plugs were removed, and the propeller was rotated by hand. Camshaft, crankshaft, and valve train continuity were confirmed to the rear accessory section. Thumb compression was attained on all cylinders. Borescope examination of the cylinders was unremarkable for the pistons and valves. The bottom spark plugs were then removed from the engine. All spark plug electrodes were intact, and no damage was noted. The engine-driven fuel pump was removed from the engine. The screws that attached the engine-driven fuel pump to the engine were noted to be finger tight, as were the screws that secured the pump; however, when the pump was disassembled, disintegration of the internal components was noted, consistent with thermal damage. The carburetor was disassembled, its plastic floats were melted, and its needle was intact. The fuel inlet screen to the carburetor was present and exhibited some debris, consistent with fire damage. The oil filter was opened, and no contamination was observed. Both magnetos sustained thermal damage and did not produce spark when rotated via an electric drill. The oil suction screen was absent of debris.

About 145 ft of tow rope was recovered at the accident site; about 5 ft of rope at the Tost reel (spool of rope on the tow plane) was presumed consumed by fire. Additionally, about 10 ft of rope aft of the tow plane was consumed by fire. The other (glider) end of the tow rope appeared separated, and a section of that rope was retained for further examination. The Tost weak link ring assembly (end of rope that attaches to glider) was not located. The tow rope adjacent to the guillotine was examined further, and no guillotine or other marks were noted on the tow rope.

The pilot's seat was equipped with a four-point inertial reel harness system, and the inertial reel had sustained impact and fire damage. The lock control was in the "full-aft" position and would not move. The cable was fully retracted to the stop in the inertial lock reel and would only move about 1/8 inch. The cable had separated at a length consistent with the 90° pulley wheel, and the pulley wheel remained intact and attached to the airframe. The examination did not reveal evidence of any preimpact malfunctions with the airframe or engine.

Medical and Pathological Information

The Office of the Chief Medical Examiner, Manassas, Virginia, performed an autopsy of the tow plane pilot. The cause of death for the pilot was "blunt force trauma to the neck, torso, and extremities, thermal injuries, and blunt force trauma." According to the autopsy report, the pilot's heart weighed 560 grams; the average heart weight for a 190-lb man, the pilot's weight, is 367 grams with a range of 278 to 484 grams. In addition, the pilot had mild-to-moderate atherosclerosis, described as 50% stenosis in the proximal and 75% stenosis in the distal right coronary artery. He also had 50% stenosis in the left anterior descending coronary artery. The autopsy report did not note any evidence of heart attack.

The FAA's Bioaeronautical Science Research Laboratory, Oklahoma City, Oklahoma, conducted toxicological testing on a specimen from the pilot. The testing detected atorvastatin, a cholesterol lowering drug that is not considered impairing, in the blood and liver.

According to FAA records, at the time of his last medical examination in October 2015, the pilot was 71 inches tall and weighed 190 lbs. The pilot reported that he had hypertension, high cholesterol, and coronary artery disease. Although the coronary artery disease was diagnosed by cardiac catheterization in 2004, he did not report this to the FAA until 2015. The catheterization revealed that the disease was nonocclusive and mild to moderate. His personal records indicated that he subsequently had annual cardiac calcium scoring and that, when his results increased significantly in early 2015, he underwent a thalium stress test that showed that he had transient ischemic dilation.

Tests and Research

Video Study
The glider flight instructor recorded two videos on a GoPro Hero 5 video camera that included most of the flight. Although the videos did not capture the tow plane's ground impact, they captured portions of the tow plane's flight just before impact. Copies of the videos were forwarded to the National Transportation Safety Board Vehicle Recorders Laboratory, Washington, DC, for further examination.

When the first video ended, the tow plane and glider were on the upwind leg of the airport traffic pattern, during initial climb, and the glider's altimeter indicated about 890 ft mean sea level (msl) (about 200 ft above ground level). The glider's airspeed indicated about 60 knots, and the glider's position relative to the tow plane was consistent with a high-tow position (that is, the glider was positioned slightly above the wake of the tow plane). The recording stopped for unknown reasons, and a new recording about 5 seconds later.

At the start of the second video, the tow plane was not visible in the camera's field of view. After about 5 seconds, the glider's blue spoiler/brake handle was nearly full aft, and the yaw string was about 45° right. The glider's instruments indicated about 940 ft msl and about 70 knots. The tow plane's right wing came into view right of the glider's nose and below the glider. At 7 seconds, the glider's nose yawed right, and the yaw string was nearly 90° right. At 8 seconds, the glider's yellow tow rope release handle moved aft momentarily. Relative to the glider's movement, the tow plane's right wingtip moved down and left, out of the camera's field of view. At 9 seconds, a snapping sound was heard, followed by the tow rope release handle being extended about 6 inches and dangling down. In the last frame in which the tow plane was visible, its elevator appeared to be in the "up" position. The glider then turned left and

returned to the airport.

About 13 seconds elapsed between the end of the first video and when the tow plane is visible in the second video. Based on the glider altimeter readings that can be seen in the videos, the glider climbed about 50 ft during this time, from 890 to 940 ft msl. Video analysis showed that the tow plane altitude relative to the glider decreased by 63 ft during these 13 seconds (based on an estimated tow rope length of 160 ft).

Materials Examination

Microscopic examination of the tow rope separation revealed features indicative of overstress separation, consistent with the tow rope breaking while the glider was still attached to the tow plane. Additionally, a dark band with a metallic sheen was visible on the rope near the separation, indicating that the separation point was near the Tost weak link.

Additional Information

According to the FAA Glider Flying Handbook (FAA-H-8083-13A), "One of the most dangerous occurrences during aerotow is allowing the glider to fly high above and losing sight of the towplane. The tension on the towline caused by the glider pulls the towplane tail up, lowering its nose. If the glider continues to rise, pulling the towplane tail higher, the tow pilot may not be able to raise the nose. Ultimately, the tow pilot may run out of up elevator authority." Further review of the handbook revealed, "Upon losing sight of the towplane, the glider pilot must release immediately."

Administrative Information

Investigator In Charge (IIC):	Gretz, Robert
Additional Participating Persons:	David G Reese; FAA/FSDO; Herndon, VA TR Proven; Skyline Soaring Club; Front Royal, VA David Harsanyi; Lycoming Engines; Williamsport, PA Shane Neitzey; Skyline Soaring Club; Front Royal, VA
Original Publish Date:	March 18, 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=96151