



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Westminster, Maryland	Accident Number:	ERA18FA221
Date & Time:	August 18, 2018, 10:40 Local	Registration:	N105SE
Aircraft:	Quicksilver MXL II Sport	Aircraft Damage:	Substantial
Defining Event:	Aircraft structural failure	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot and a passenger departed on a local flight and returned for landing about 15 minutes later. While the airplane was on final approach at an altitude between 100 and 200 ft, several witnesses heard a loud sound, and one of the witnesses saw the right wing fold and the airplane enter a steep descent. The airplane subsequently impacted terrain in a field near the airport.

A witnesses reported observing the airframe parachute system deploy. The inspection of the components of the airframe ballistic parachute system indicated that the system had likely deployed just before or at the time of impact. Deployment of the parachute system at that low altitude would have been insufficient to adequately arrest the airplane's descent prior to impact.

A stainless steel bolt secured the upper and lower wing cables to the outer leading edge spar of the right wing. Examination of the bolt showed that it fractured during flight due to stress corrosion cracking that extended across about 95% of the cross-section area of the bolt shank. The bolt failure allowed the leading edge spar to rotate upward relative to the trailing edge spar and fracture at the inboard cable attach point, precluding controlled flight.

The stainless-steel material used for the wing cable attachment bolt was susceptible to stress corrosion cracking when exposed to a chloride-containing environment (such as the ocean). The airplane was previously equipped with floats, and was likely operated as an amphibious airplane at some point before the pilot purchased it. In addition, the installed bolt was a different material than the AN5-30A bolt specified in the Quicksilver Assembly, Maintenance, and Parts Manual for securing the outer upper and lower wing cables to the leading edge spar of the right wing. The material of the bolt recommended in the manual would be generally resistant to stress corrosion cracking as a result of a chloride-containing environment. The maintenance records did not indicate when the stainless steel bolt was installed.

Evidence of stress corrosion cracking might not be apparent during visual inspections of the bolted joint. Also, the location of the stress corrosion cracking on the bolt would likely not have been detected during a condition inspection with the bolted joint in place. Further, the assembly, maintenance, and parts

manual did not provide for a specific inspection of the bolt that secured the upper and lower wing cables to the outboard leading edge spar. However, the manual indicated that the security of all bolts should be checked every 50 hours.

Although the pilot was taking a medication that could impair his ability to perform tasks requiring judgment or motor and cognitive skills, his use of the medication did not contribute to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The in-flight fracture of a stainless steel bolt that was used to secure the upper and lower wing cables to the outer attach point at the leading edge spar of the right wing due to stress corrosion cracking, which caused the right wing to fail and precluded controlled flight. Contributing to the bolt failure was the installation of a bolt that did not conform with the company's specification.

Findings

Aircraft	(general) - Fatigue/wear/corrosion
Aircraft	(general) - Attain/maintain not possible
Aircraft	(general) - Incorrect service/maintenance

Factual Information

History of Flight

Approach-VFR pattern final	Aircraft structural failure (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On August 18, 2018, about 1040 eastern daylight time, a Quicksilver MXL II Sport light sport airplane, N105SE, was substantially damaged when it impacted a field near Baugher's Orchard Airport (07MD), Westminster, Maryland. The private pilot and passenger were fatally injured. The airplane was owned and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed, and no flight plan was filed for the local flight, which originated about 1025 from 07MD.

Witnesses at the airport reported that the flight departed normally, flew to the north, before returning and entering the final approach for landing. One witness (the 07MD manager) reported that, when the airplane was about ¼ to ½ mile from the runway, a loud "bang" was heard. One witness reported the sound as a "high pitch crack of something under stress." The 07MD manager provided the account of a witness who wanted to remain anonymous. This witness was looking directly at the accident airplane during its landing approach. The witness indicated that the loud "bang" was followed by the "upward folding" of the right wing, after which the airplane rolled to the right and descended. Another witness stated that the wing "broke" when the airplane was at an estimated altitude of 100 to 200 ft. The 07MD manager observed the airplane descending "straight down" while rotating to the right and noted that the airframe parachute "blew" just before impact.

Two witnesses who were located about 2,100 ft south-southeast of the accident site reported hearing a sound similar to a sputtering engine followed by a "bang" sound. One of the witnesses reported that the airplane then began descending, and the other witness reported seeing white/gray dust. This witness could not discern the airplane's altitude when she saw the dust.

Pilot Information

Certificate:	Private	Age:	62,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	October 18, 2017
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	1200 hours (Total, all aircraft)		

The pilot held a private pilot certificate with an airplane single-engine land rating and a third-class medical certificate issued on October 18, 2017, with the limitation "must wear corrective lenses for near and distant vision." On the medical certificate application, the pilot reported 1,200 hours of total flight experience. The pilot also held a repairman certificate for light sport aircraft, with a limitation for the inspection of the accident airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	Quicksilver	Registration:	N105SE
Model/Series:	MXL II Sport	Aircraft Category:	Airplane
Year of Manufacture:	2006	Amateur Built:	
Airworthiness Certificate:	Experimental light sport (Special)	Serial Number:	000891
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	January 6, 2010 Condition	Certified Max Gross Wt.:	1000 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	75 Hrs as of last inspection	Engine Manufacturer:	Rotax
ELT:	C91 installed, not activated	Engine Model/Series:	582 UL DCDI
Registered Owner:		Rated Power:	65 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

The high-wing, two-seat, tricycle gear airplane was built in 2006 and purchased by the pilot and his wife during August 2010. It was powered by a 65-horsepower Rotax 582 UL DCDI engine and was equipped with a Warp Drive four-bladed 62-inch composite adjustable propeller. The airplane was also equipped with a BRS-5 model UL2 ballistic airframe parachute that was mounted to the main axle tube behind the right seat.

The wing structure consisted of leading and trailing edge spars separated by a diagonal tube at the inboard end and four spanwise tubes. Eight support cables were attached to each wing at four attachment locations. On the wing, the cables were attached to the leading and trailing edge spars at the locations of the inboard and outboard middle chordwise tubes.

According to the *Quicksilver Assembly, Maintenance, and Parts Manual*, an AN5-30A bolt is one of the parts used to secure the upper and lower wing cables to the outboard attach point at the leading edge wing spar. The head of the bolt pointed downward, and the lower leading edge outboard cable was attached to the lower surface of the leading edge spar by the bolt, and the anti-drag cable, bellcrank strut cable, and upper leading edge outboard cables were attached to the upper surface of the leading edge spar. The section of the manual titled Construction Notes specifies that AN quality bolts are used throughout the airplane for structural integrity and indicates "NEVER USE SUBSTITUTES!" Although the manual did not provide a specific inspection interval for the bolt that secured the upper and lower

cables to the outboard leading edge spar, the manual indicated that the security of all bolts and nuts should be checked every 50 hours.

The available maintenance records contained entries from January 6, 2010, to May 9, 2013. Review of the records revealed that entries dated January 6 and 7, 2010, documented the condition inspection of the airplane for the issuance of a Light Sport Aircraft Airworthiness Certificate. An entry dated July 21, 2010, indicated the removal of floats and amphibious landing gear and the installation of standard Quicksilver wheels and brakes. At that time, the airplane had accumulated 81 hours. None of the remaining entries specified the removal and replacement of the bolt that secured the wing cables to the outboard attach point at the right wing leading edge spar.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	DMW,789 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	10:50 Local	Direction from Accident Site:	103°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	7 knots /	Turbulence Type Forecast/Actual:	Unknown / Unknown
Wind Direction:	240°	Turbulence Severity Forecast/Actual:	Unknown / Unknown
Altimeter Setting:	29.93 inches Hg	Temperature/Dew Point:	26°C / 22°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Westminster, MD (07MD)	Type of Flight Plan Filed:	None
Destination:	Westminster, MD (07MD)	Type of Clearance:	None
Departure Time:	10:20 Local	Type of Airspace:	

The weather observation at 1050 at Carroll County Regional Airport, located in Westminster about 2 nautical miles east-southeast of the accident site, reported wind 240°; at 7 knots, 10 miles visibility, temperature 26°C, dew point 22°C, and altimeter setting 29.93 inches of mercury.

Airport Information

Airport:	Baughers Orchard Airport 07MD	Runway Surface Type:	Grass/turf
Airport Elevation:	700 ft msl	Runway Surface Condition:	Unknown
Runway Used:	19	IFR Approach:	None
Runway Length/Width:	1035 ft / 60 ft	VFR Approach/Landing:	Full stop;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	39.614723,-77.047775

The airplane crashed into a field located about 1,500 ft and 003° from the approach end of the runway. The cockpit was inverted, and the main wreckage was located along a magnetic heading of 124°. All airplane components were located within or near the main wreckage. There was no evidence of fire on any airplane component, but black soot had discolored the sheath of a cable attached to the BRS rocket near the rocket exhaust.

The engine had separated and was found near the mount location on the airframe. The right wing was beneath the inverted empennage, and the outer section of the left wing was laying over the top of the wreckage. A section of wing cable with a fractured attach bolt was found resting on the engine between the propeller and gearbox. The head of the bolt was not located.

Flight control continuity in the roll and yaw axes was confirmed from the respective cockpit control to the respective control surface. Control continuity in the pitch axis was confirmed through breaks in the elevator control system that were consistent with overload and impact damage. The elevator trim tab was in the tab trailing-edge-down position. Multiple tailboom tubes were fractured in a manner consistent with bending overload.

On-scene examination of the left wing revealed that the leading edge spar was fractured about 61 3/8 inches from the root tube attachment and that the trailing edge spar was fractured about 62 inches outboard of the structural attach point. The lower forward inboard wing cable was fractured about 11 inches from the attach point on the tube, and the upper aft inboard wing cable was fractured about 12 inches from the king post. All other cables remained attached to their respective attach points on the wing and structure. Examination of the left wing by the National Transportation Safety Board (NTSB) Materials Laboratory found that the fracture surfaces of both the leading and trailing edge spars were on slant angles and had a matte gray color consistent with ductile overstress fracture, which was consistent with aft bending loads on the leading edge spar and forward bending loads on the trailing edge spar. The individual wires in the lower forward inboard wing cable showed distributed fracture locations with necking deformation and chisel-like features consistent with ductile overstress fracture. The cable ends (which were examined on scene) exhibited similar necking deformation and chisel-like features that were consistent with ductile overstress fracture.

The right wing was fragmented. The aft edge of the leading edge spar exhibited two creases about 6 and 7 inches outboard of the compression strut near the wing tie-down location. The leading edge spar was fractured about 62 inches outboard of the root tube attachment, which coincided with the location of the inboard wing cable attachment; bending deformation was noted at the fracture surface. The trailing edge spar was fractured into four pieces. The wing cables were intact except for the outboard forward upper and inboard aft upper cables. The fractured wire strands revealed necking deformation and chisel-like

features consistent with ductile overstress fracture.

The four sections of the trailing edge spar of the right wing were examined by the NTSB Materials Laboratory, which found that the fracture surfaces of the trailing edge spar were on slant angles and had a matte gray color consistent with ductile overstress fracture. At the inboard fracture location, the deformation pattern was consistent with forward bending loads on the spar, and, at the outboard fracture location, the deformation pattern was consistent with torsion loads in which the outboard piece rotated clockwise (as viewed looking toward the wingtip) relative to the inboard piece.

The fractured bolt found resting on the engine (between the propeller and gearbox) was associated with the hardware that attached the right wing outer upper and lower wing cables to the leading edge spar. The NTSB Materials Laboratory's examination of the fractured bolt revealed the presence of chlorine branching cracks on the fracture surface, which were consistent with stress corrosion cracking. The cracking extended across about 95% of the cross-sectioned area of the bolt shank before final fracture. The bolt material was identified to be stainless steel.

A search of the area surrounding the wreckage located two AN43B-14A eyebolts with attached anchor nuts and an attached fractured forkbolts. The hardware was associated with the right aileron. Examination of the fracture surfaces revealed evidence of overload. No evidence of pre-existing cracks in either forkbolt were noted.

Examination of the left aft tri-bar downtube revealed that it had separated from the left aft tri-bar downtube fork, which was fractured. The NTSB Materials Laboratory found that the fracture features of the fork were consistent with ductile overstress fracture.

Examination of the airframe ballistic parachute system revealed that the plastic cap of the rocket housing was located on the ground about 50 ft east of the main wreckage. One-half of a fractured black-colored plastic cap with a hole in the center (consistent with the inner canister cap) was located and recovered near the main wreckage. The outer canister cap was not located. The parachute canister was securely mounted to the main axle tube, but displacement of the structure in that location was noted. The canister, as viewed from the right side, was rotated clockwise, and its long axis was nearly parallel to the right seatback. Continuity was noted from the activation handle to the base of the canister. The cable from the handle to the canister remained attached to the airframe structure. The pilot canopy, a portion of the parachute, and the rocket remained attached by the cable and were located on the ground with the wreckage. A portion of the parachute remained inside the canister. The rocket was inspected and found to be discharged.

The parachute system components were further examined at the manufacturer's facility. The canister and rocket launch tube had visible dents and scrapes, and the inner canister cap, when lined up with the parachute canister, showed damage consistent with the canister cap being in place during impact. The mounting brackets, which were used to secure the parachute canister to the airplane, were "severely bent." The incremental bridle assembly, which consisted of a continuous strap of nylon folded over itself and sewn together was "fully intact, with no stitches broken." The suspension line attachment to the riser showed degradation consistent with the material being wet for a long period of time.

Examination of the Rotax engine revealed no evidence that the power train, fuel metering, air induction,

ignition, exhaust, cooling, and lubrication systems experienced preimpact failure or malfunction. The cylinder head was removed, and no carbon was noted on the piston crowns. The gearbox was cracked on the left side. The power takeoff (PTO) coupling was not fractured. The propeller attachment bolts damaged the gearbox exterior, which was consistent with rotation at impact. The gearbox was removed for further examination. The crankshaft gear teeth, propeller shaft, reduction gearbox crankshaft bearings, and reduction gearbox gear teeth were satisfactory.

Examination of the propeller revealed that all blades were secured in their respective clamps. One blade was full span and exhibited a deep gouge on the leading edge about 3.5 inches inboard from the tip; blue paint was noted in the center of the gouge. The other three blades were fractured at varying lengths from the propeller hub.

Medical and Pathological Information

The Office of the Chief Medical Examiner, State of Maryland, Baltimore, Maryland, performed an autopsy on the pilot. His cause of death was multiple injuries.

Toxicology testing performed at the FAA Forensic Sciences Laboratory detected acetaminophen in the pilot's urine specimens and bupropion (and its metabolite hydroxybupropion), tamsulosin, and diltazem in the pilot's urine and cavity blood specimens. No carbon monoxide or ethanol were detected in the pilot's specimens.

Bupropion is an antidepressant marketed with the name Wellbutrin and is the active drug in Zyban, often marketed to help with smoking cessation. Bupropion can cause various neuropsychiatric symptoms and seizures, and prescribers are advised to counsel patients that the use of the drug could "impair their ability to perform tasks requiring judgment or motor and cognitive skills."

Tamsulosin is prescription medication used to treat symptoms from an enlarged prostate, and diltiazem is a prescription medication used to treat blood pressure. Acetaminophen is an over-the-counter analgesic often marketed with the name Tylenol. These three drugs are not considered to be impairing.

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	David B Garey; FAA/FSDO; Baltimore, MD Steven O'Rourke; FAA/FSDO; Baltimore, MD Troy Siekas; FAA/FSDO; Minneapolis, MN Enrique Dillon; BRS Aerospace; Miami, FL
Original Publish Date:	May 19, 2020
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=98094

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).