Aviation Investigation Final Report

Location:	Westminster, Maryland	**Accident Number:**	ERA12FA395
Date & Time:	June 15, 2012, 10:10 Local	**Registration:**	N206GX
Aircraft:	REMOS ACFT GMBH FLUGZEUGBAU REMOS GX	**Aircraft Damage:**	Substantial
Defining Event:	Flight control sys malf/fail	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The special-light sport airplane was designed with the ability to fold both wings back to facilitate storage and transportation. In addition, both wings and the horizontal stabilizer were removable. The pilot, who was also a mechanic, disassembled the airplane for storage during the winter. He subsequently reassembled it and completed a condition inspection. He then flew the airplane to an airport where a ballistic parachute system was installed. The pilot then flew the airplane to another airport and, the next day, departed on the accident flight with the intention of delivering the airplane to its owner.

About 20 minutes after takeoff, the airplane experienced a disconnected elevator, and the pilot attempted to fly to a nearby airport. The airplane was about 50 feet above the ground when it entered a sudden steep pitch downward and impacted the ground about 60 feet before the runway.

The airplane's flight controls were actuated by a series of push-pull rods. The respective push-pull rods for the left and right ailerons and elevator controls featured a "quick-fastener" to disconnect and reconnect the respective flight control. Postaccident examination of the airplane revealed that the elevator quick-fastener was disconnected. Additional examination of the quick-fastener revealed that it contained some corrosion; however, it did not experience any failures and was capable of functioning as designed. In addition, the ballistic parachute system parachute was not activated, and the activation handle, which was mounted on the center console, was found secured with a padlock. The key for the padlock was found on a key ring with the ignition key, which remained inserted in the ignition switch.

The preflight checklist located in the pilot operating handbook required a check of the quick-fasteners and the ballistic parachute activation handle before every flight. Associated placards were also present in the cockpit. The pilot had at least three opportunities to identify an improperly secured elevator quick-fastener since he assembled the airplane; at least two of those opportunities occurred after the installation of the ballistic recovery parachute system. While it could not be determined if the pilot would have used the airplane's ballistic recovery parachute system, his failure to remove the padlock from the activation handle precluded the option of deploying the system during the accident flight.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's inadequate preflight inspection, which failed to ensure that the elevator quick-fastener was properly secured, resulting in an inflight elevator control disconnect and subsequent loss of control during the ensuing emergency landing. Contributing to the accident was the pilot's failure to remove the padlock from the airplane's ballistic recovery system parachute activation handle.

Findings

Personnel issues	Preflight inspection - Pilot
Aircraft	Elevator control system - Inadequate inspection
Aircraft	Pitch control - Attain/maintain not possible
Personnel issues	Preflight inspection - Pilot
Personnel issues	Forgotten action/omission - Pilot

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Prior to flight	Aircraft inspection event
Enroute-cruise	Flight control sys malf/fail (Defining event)
Approach	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On June 15, 2012, about 1010 eastern daylight time, a Remos Aircraft GmbH Flugzeugbau Remos GX, special-light sport aircraft (S-LSA), N206GX, operated by a private individual, was substantially damaged when it impacted the ground during an emergency landing at the Carroll County Regional Airport (DMW), Westminster, Maryland. The commercial pilot was fatally injured. Visual meteorological conditions prevailed and no flight plan had been filed for the flight that departed the Frederick Municipal Airport (FDK), Frederick, Maryland, and was destined for the Piseco Airport (K09), Piseco, New York. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

According to witnesses, the pilot flew the airplane from K09 to Haysfield Airport (MD24), Clarksville, Maryland, during November 2011, where it was disassembled and stored for the winter. It was subsequently reassembled during April 2012. The pilot, who was also a Federal Aviation Administration (FAA) certificated airframe and powerplant mechanic, completed a condition inspection on June 1, 2012. The pilot then flew the airplane to Bay Bridge Airport (W29), Stevensville, Maryland, where a pitot-static system check was performed on June 8, and a Magnum 601 ballistic parachute system was installed on June 12, 2012. The pilot flew to FDK on June 14, 2012, and was planning to fly to K09, with an en route fuel stop, to deliver the airplane to its owner on the day of the accident.

A witness at DMW heard the pilot transmit over the airport common traffic advisory frequency "my elevator has come detached, I need to make a landing on runway 16." Another witness observed the airplane "climb and dive" as it approached the 5,100-foot-long, asphalt runway. A third witness stated the airplane appeared "very, very fast" and approached the runway in a flat or slight nose down pitch attitude. When the airplane was on short final, over the grass area just prior to the runway threshold, it pitched "sharply nose down", and impacted the ground.

PERSONNEL INFORMATION

The pilot, age 64, held a commercial pilot certificate with ratings for airplane single-engine land, airplane multiengine land, glider, and instrument airplane. In addition, he held a flight

instructor certificate with ratings for airplane single-engine, airplane multiengine, glider, and instrument airplane. He also held a mechanic certificate with airframe and powerplant ratings. His most recent FAA third-class medical certificate was issued on March 16, 2010.

Review of the pilot's logbook revealed that at the time of the accident, he had accumulated about 3,250 hours of total flight experience, which included about 100 hours during the 1 year preceding the accident. The pilot's first flight in the accident airplane was on April 24, 2011, and at the time of the accident he had accumulated approximately 16 hours of total flight experience in the same make and model as the accident airplane.

The pilot's most recent biennial flight review was conducted on December 1, 2011.

AIRCRAFT INFORMATION

According to records obtained from the FAA, the two-seat, high-wing, fixed tricycle landing gear, S-LSA, serial number 335, was issued a special airworthiness certificate on September 30, 2009, and purchased by its current owner during May 2011. The airplane was powered by a Rotax 912ULS, 100-horsepower engine equipped with a Neuform three-bladed propeller.

The airplane was of composite carbon fiber monocoque construction, and was designed with the ability to fold both wings back to facilitate storage and transportation. In addition, both wings and the horizontal stabilizer were removable. The flight controls were actuated by a series of push-pull rods. The respective control push-pull rods for the left and right ailerons, and elevator featured a "quick-fastener" to disconnect and reconnect the respective flight control push-pull rod.

Each quick-fastener consisted of two-hooks, a locking sleeve, an anti-twist pin, a locking pin, and a locking spring. To connect the respective push-pull rod, the two hooks would be interconnected, and then the locking sleeve would slide over the connection. Once the locking sleeve was in position, the spring would push the locking pin into position and secure the assembly. The anti-twist pin prevented a misalignment of the sleeve, which would prevent the locking pin from sliding into position.

The individual who assisted the pilot with the reassembly of the airplane stated that the pilot was familiar with the operation of the quick-fasteners. He stated that the wings were folded and the horizontal tail was removed for storage. He also reported that there were no issues during the reassembly of the airplane. He further stated that he did not specifically observe the quick-fastener connection associated with the elevator control system.

On March 25, 2009, after a fatal accident involving the improper connection of an aileron quick-faster, Remos Aircraft introduced the anti-twist pin feature, and issued a Safety Directive (SD) which called for an inspection of the aileron and elevator quick-fasteners, an update of the Pilot Operating Handbook (POH) and the addition of warning placards associated the quick-fasteners. Quick Fastener Safety Directive SD-05 was current at the time of the accident.

Review of SD-05 noted that the photograph depicting the elevator quick-fastener was depicted with the tail cone, which was secured by two screws removed. According to the manufacturer, it was normal procedure not to remove the tail cone during preflight inspection. A subsequent inspection of an exemplar Remos GX by the NTSB revealed that it was possible to view elevator quick-fastener locking pin with the tail cone installed.

At the time of the accident, the airplane had been operated for about 210 total hours, and about 2 hours since the condition inspection. Review of the inspection checklist utilized by the accident pilot/mechanic during the condition inspection included an inspection of all components and systems that made up the empennage assembly for insecure attachment, and improper component installation.

The mechanic who performed the parachute installation stated that he did not disconnect any of the quick-fasteners. In addition, review of the Parachute Installation Manual for the Magnum 601 ballistic parachute system revealed that it was not necessary to disconnect any of the quick-fasteners to facilitate the installation.

A placard located on the instrument panel stated: "CHECK: Flight System Control and Three Quick Fasteners." There were also placards stating to check the quick fasteners for a secure connection, with associated illustrations, consistent with compliance with the Remos Quick Fastener Safety Directive, located near the respective aileron and elevator push-pull rod quick-fasteners.

Placards located on the center console included: "Remove Lock from BRS Before Flight" and a "Start-Up Checklist" that included "Recovery System Armed."

METEOROLOGICAL INFORMATION

The reported weather at DMW, at 1007, was: winds calm; visibility 10 miles; temperature 21 degrees Celsius (C); dew point 13 degrees C; altimeter 30.31 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The wreckage was examined at the accident site on June 16, 2012. The airplane impacted the ground about 60 feet prior to runway 16, and about 12 feet to the left of the right runway edge. Debris was scattered south-southeast approximately 350 feet, with the majority of the wreckage found on the grass area that was located immediately off the right side of and parallel to the runway.

All major portions of the airplane were accounted for at the accident site. Both wings and the top portion of the cabin were inverted and found about 220 feet from the initial impact point. The main wreckage was found about 265 feet from the initial impact point. It consisted of the cockpit, which was destroyed, the engine, and the tail assembly aft of the cabin, which remained intact. The ballistic parachute system parachute was not activated and found strewn

along the debris path. The activation handle, which was mounted on the center console, was found with the main wreckage and was secured with a padlock. The key for the padlock was found on a key ring, with the ignition key, which remained inserted in the ignition switch.

Examination of the airplane's flight controls revealed that the elevator quick-fastener was disconnected. The left and right aileron quick-fasteners remained connected, and the flight control cables to the rudder remained attached. Damage was noted on the flight control push-pull rods that was consistent with impact damage. The elevator trim tab was about 1/4-inch from the full nose down trim position. Examination of the airplane's engine did not reveal any failures that would have precluded normal operation.

The elevator and aileron quick-fasteners were removed and forwarded to the NTSB Materials Laboratory, Washington, DC, for further examination. In addition, the airplane was equipped with a Dynon Avionics "FlightDEK-D180 combined EFIS and EMS" unit, and a Garmin 496 global positioning system (GPS) receiver, which were forwarded to the NTSB Vehicle Recorders Division for data download.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot by the Office of the Chief Medical Examiner, Baltimore, Maryland. The autopsy report revealed the cause of death as "multiple injuries."

Toxicological testing performed on the pilot by the FAA Bioaeronautical Science Research Laboratory, Oklahoma City, Oklahoma with negative for alcohol and positive for Doxepin, a prescription antidepressant, Nordoxepin, a metabolite of Doxepin, and Pioglitazone, a prescription anti-diabetic agent.

During the pilot's most recent FAA medical examination, he listed "occasional aspirin" as medications he was currently taking.

TESTS AND RESEARCH

Examination of the flight history page from the Garmin 496 GPS receiver revealed that the airplane was flown from K09 to MD24 on November 19, 2011. In addition, a 30 minute flight from MD24 to W29 was recorded on June 8, 2011, and a 47 minute flight from W29 to FDK was recorded on June 14, 2011. In addition, the accident flight was recorded as a 31 minute flight from FDK to DMW.

Data downloaded for accident flight from the Dynon Avionics FlightDEK-D180 revealed that the accident flight departed from FDK about 0935, climbed to a GPS altitude of about 2,500 feet and preceded on a northeasterly heading without incident. The airplane overflew DMW about 0950, and continued on a northeasterly heading for about another 5 minutes before turning right 270 degrees, and then left on a southwest heading back toward DMW, about 0958. At 1003, the airplane was about 3 miles from DMW, at a GPS altitude of about 1,700 feet, and an

airspeed of about 100 knots, when it turned onto the final approach course for runway 16. About 1 minute later, the airplane was 1.5 miles from the approach end of the runway, at a GPS altitude of about 1,400 feet (about 610 feet above ground level) and an airspeed of 87 knots. At 1004:33, the airplane was about .5 miles from the runway, at a GPS altitude of about 950 feet (160 above ground level), and an airspeed of about 125 knots.

As the airplane continued to descend toward the runway, the recorded pitch angle decreased from -0.38 to -12.38 just prior to impact with the ground. The final recorded GPS altitude was 834 feet (about 45 feet above ground level). [Additional information can be found in the Cockpit Display(s) – Recorded Flight Data Factual Report located in the public docket.]

Examination of the quick-fasteners retained from the wreckage was performed at the NTSB Material's Laboratory, Washington, DC.

Examination of the elevator quick-fastener revealed that it did not experience any pre-impact failures and all functions performed as designed. During disassembly, white salts consistent with aluminum corrosion were found in the cross-drilled hole that housed the spring and lock button, and areas of fretting wear scars and fretting corrosion were identified on the fastener clevis connector and on the inside surface of the lock sleeve. [Additional information can be found in the Materials Laboratory Factual Report located in the public docket.]

ADDITIONAL INFORMATION

Pilot Operating Handbook

The pilot operating handbook (POH) located in the cockpit was identified as "Rev. 03/May 2010" on the title page; however, the various sections of the POH contained individual revision references.

The preflight check, "Checks inside the aircraft" included: "Remove rescue system securing pin from emergency handle."

The before each flight preflight checklist included:

"12. Check all control surfaces and connection for proper operation
13. Check for free and full travel of all control surfaces
14. Check elevator quick-fastener for secure locking"

In addition, the following warning was included:

"Insecurely connection, improper operation of control surfaces or insecure locked fasteners will lead to loss of control of the aircraft."

The information pertaining to ground handling and servicing, was identified as "Rev.02-July 16,

2009." Section 8.8 regarding the connection of the folded wings to the fuselage contained a warning that stated:

"Insecurely connection, improper operation of control surfaces or insecure locked fasteners will lead to loss of control of the aircraft! When in doubt contact your local Remos dealer or service center"

The warning was not present in section 8.9, titled "Installing Horizontal Stabilizer." According to Remos, a free up-to-date version of the POH was provided on its website. Review of the Aircraft Ground Handling and Servicing section that was current at the time of the accident (Rev.04) included a numbered description of the horizontal stabilizer installation and the same warnings that were present for the installation of the wings.

On October 15, 2012, Remos released Notification NOT-008-Documentation Update, which provided the current revision number for the respective sections of the POHs of their various model airplanes, including the GX.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	64,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Sport pilot None	**Last FAA Medical Exam:**	March 16, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 1, 2011
Flight Time:	3250 hours (Total, all aircraft), 16 hours (Total, this make and model), 3080 hours (Pilot In Command, all aircraft), 11 hours (Last 90 days, all aircraft), 2 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	REMOS ACFT GMBH FLUGZEUGBAU	**Registration:**	N206GX
Model/Series:	REMOS GX	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Special light-sport (Special)	**Serial Number:**	335
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	June 1, 2012 Condition	**Certified Max Gross Wt.:**	1320 lbs
Time Since Last Inspection:	2 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	210 Hrs at time of accident	**Engine Manufacturer:**	ROTAX
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	912ULS
Registered Owner:	On file	**Rated Power:**	100 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:	DMW,789 ft msl	**Distance from Accident Site:**	
Observation Time:	10:07 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.3 inches Hg	**Temperature/Dew Point:**	21°C / 12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Frederick, MD (FDK)	**Type of Flight Plan Filed:**	None
Destination:	Piseco, NY (K09)	**Type of Clearance:**	None
Departure Time:	09:35 Local	**Type of Airspace:**	

Airport Information

Airport:	Carroll County Regional DMW	**Runway Surface Type:**	Asphalt
Airport Elevation:	789 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	16	**IFR Approach:**	None
Runway Length/Width:	5100 ft / 100 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	39.608612,-77.007499(est)

Administrative Information

Investigator In Charge (IIC):	Schiada, Luke
Additional Participating Persons:	Tony Serio; FAA/FSDO; Baltimore, MD
Original Publish Date:	September 5, 2013
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=83978