



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Sebring, Florida	Accident Number:	ERA09FA141
Date & Time:	January 25, 2009, 07:45 Local	Registration:	N9GX
Aircraft:	Remos Aircraft GmbH Remos GX	Aircraft Damage:	Substantial
Defining Event:	Loss of control in flight	Injuries:	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

During a two airplane aerial photography flight at an airshow, after takeoff the lead airplane was observed to roll to the right, with both the left and right ailerons drooping trailing edge down. The airplane descended while turning, and reached a bank angle of about 80 degrees and impacted right wing tip first on a parking apron. The airplane skidded around to the right, slid across the apron and came to rest next to a taxiway. The pilot was seriously injured, the photographer in the right seat was fatally injured, and the airplane was substantially damaged during the impact sequence. The airplane was manufactured with folding wings. Examination revealed that the roll control system had not been properly connected prior to takeoff. On the day before the accident, the pilot and the national service manager for the airplane manufacturer had been demonstrating the wing folding mechanism for prospective customers. On the morning of the accident flight, the national service manager and the pilot of the accident airplane pulled both of the airplanes that were to be used for the aerial photography flight out from under the display tent. Both airplanes had their left wings in the folded position. When they pulled the accident airplane out from under the display tent, the national service manager was at the left wing root. He inserted the left wing's main wing securing bolt, installed the securing pin, and then went over to the other airplane to preflight it. He did not however, connect the pushrod connection for the left aileron before going over to the other airplane, nor did he advise the pilot that the "coupling was not connected". The pilot, who was at the left wingtip when he and the national service manager were unfolding the left wing, thought that he saw the national service manager go inside the airplane, and assumed he was connecting the aileron. Review of the Pilot Operating Handbook revealed that after connecting the wings to the fuselage, "the pushrod connection of the ailerons MUST be established," a check for "free and full travel of all control surfaces" was required, and that a placard was located in the plane in view of the pilot which advised that as part of the "START-CHECKLIST", the flight controls were required to be "Checked".

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's inadequate preflight assembly and inspection which resulted in the pushrod connection to the left aileron not being connected, which led to a subsequent inflight loss of control and impact with terrain.

Findings

Personnel issues	Preflight inspection - Pilot
Aircraft	Lateral/bank control - Attain/maintain not possible
Aircraft	Aileron control system - Incorrect service/maintenance

Factual Information

History of Flight

Prior to flight	Preflight or dispatch event
Prior to flight	Flight control sys malf/fail
Takeoff	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On January 25, 2009, at 0745 eastern standard time, a Remos Aircraft, Remos GX, Special Light Sport Aircraft, N9GX, was substantially damaged during impact with terrain, after experiencing a loss of control during the initial climb at Sebring Regional Airport (SEF), Sebring, Florida. The certificated commercial pilot was seriously injured and the passenger was fatally injured. Visual meteorological conditions prevailed and no flight plan was filed for the local aerial photography flight conducted under Title 14 Code of Federal Regulations Part 91.

According to the national service manager for Remos Aircraft, who took off in another company airplane in-trail of the accident airplane, the purpose of the flight was to obtain aerial photographs of the manufacturer's airplanes for an article in an aviation magazine.

After takeoff from runway 18, he observed the accident airplane which had the photographer in the right seat with the right cabin door removed, roll to the right when it was 25 to 50 feet above ground level (agl). He also observed that the rudder was fully deflected to the left, the accident airplane was in a slip to the right, and both the left and right ailerons were drooping trailing edge down.

As the witness continued to observe the accident airplane, it reached an altitude of approximately 100 feet agl, then began to descend while continuing to turn right, eventually completing an approximate 270-degree turn, and reaching a bank angle of about 80 degrees right wing down. The right wing made ground contact with the airport parking apron right wing tip first, followed by the nose of the airplane. The airplane then skidded around to the right, slid across the apron and came to rest in a depression next to taxiway "A," which paralleled runway 18.

PERSONNEL INFORMATION

According to Federal Aviation Administration (FAA) records, the pilot held a commercial pilot certificate, with ratings for airplane single-engine land and instrument airplane. His most recent FAA first-class medical certificate was issued on July 23, 2008. He reported to the Safety Board that he had approximately 1,600 total hours of flight experience, and "2 to 3

hours" of flight time in the accident airplane. Review of manufacturer's records also revealed that the pilot had accrued approximately 100 total hours of flight experience in the accident airplane make and model.

AIRCRAFT INFORMATION

The accident airplane was a high wing single engine monoplane of carbon fiber composite construction. It was powered by a Rotax 912 ULS engine that produced 100 horsepower. It was certificated as a Light Sport Aircraft and was equipped with a folding wing system.

According to FAA and maintenance records, the airplane was manufactured in 2008. The airplane's most recent conditional inspection was completed on January 8, 2009. At the time of the inspection, the airplane had accrued 15 total hours of operation.

METEOROLOGICAL INFORMATION

The reported weather at OBE, approximately 29 nautical miles southeast of the accident site, at 0745, included: calm winds, visibility 5 miles in mist, sky clear, temperature 8 degrees Celsius, dew point 7 degrees Celsius, and an altimeter setting of 30.19 inches of mercury.

AIRPORT INFORMATION

According to the Airport Facility Directory, SEF was a public use airport. It had two runways, oriented in an 18/36, and 14/32 configuration. Runway 18 was asphalt, in good condition. It was 5,234 feet long by 100 feet wide. The runway had basic markings that were in good condition. It was equipped with medium intensity runway edge lights, and a precision approach path indicator.

FLIGHT RECORDERS

The airplane was not equipped with a flight recorder. It was however equipped with a Garmin GPS-496 which recorded flight and navigation data in the unit's non-volatile memory (NVM) and a Dynon EMS D-10 which collected and stored engine parameter data in the EMS-10's NVM.

Review of the data from the two units confirmed that the engine was running at the time of the accident and also confirmed that the witness's observations were accurate regarding the flight path of the airplane.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site revealed that after impacting the apron, the accident airplane traveled 262 feet in an easterly direction, before coming to rest on a 194-degree magnetic heading.

Examination of the area where the airplane first made ground contact revealed the existence of a wreckage path. Near the beginning of the wreckage path was evidence of three distinct propeller strikes. The wreckage path contained multiple fragmented portions of the airplane structure, including the right wing, which had separated into two parts; the right wing flap assembly which was separated from its mounts, and the right aileron assembly which had also separated from its mounts and had a portion of the roll control system still attached to it.

The lower and upper engine cowling were also discovered in the wreckage path, along with the propeller spinner.

Both propeller blades were found outside of and perpendicular to the main wreckage path. One blade was discovered 14 feet to the south of the wreckage path, and the other blade was discovered 138 feet north of the wreckage path. Both of the composite propeller blades were separated at the root, and displayed chordwise scratching on their leading edge erosion strips (one of which had separated from its respective propeller blade), portions of their blade surfaces, and on the blade tips which had been broken off of each propeller blade.

Examination of the engine revealed that it was still in its mounts. No evidence of any preimpact failure or malfunction of the engine was discovered. Further examination of the engine and firewall area revealed that the fuel lines were not fire sleeved, the fuel divider was made of aluminum, and a large opening was present where wiring passed through the firewall into the cabin area. Examination of the wiring also revealed a connector box that was made of plastic, and firewall carry throughs that were not sealed.

Examination of the airframe revealed no evidence of any preimpact malfunction or failure. The aft fuselage was inverted, and angled to the right of the longitudinal axis of the airplane by approximately 40 degrees. It was almost fully separated from the aft portion of the cockpit area and exhibited a vertical crack on the aft side of the vertical stabilizer. The left wing was still attached.

The left flap panel, left aileron, and the elevator had remained attached to their pivot points. The rudder was separated from its upper pivot point but had remained attached to the vertical stabilizer by its lower pivot point.

Examination of the horizontal stabilizer, left wing, and the fragmented right wing revealed that the horizontal stabilizer could be removed and the wings folded for storage or trailering. Closer examination revealed that the stabilizer-securing bolts and the wing-securing bolts were present, along with their securing pins.

Examination of the flight control system revealed that the airplane utilized cables and pulleys to connect the rudder to the rudder pedals, and push-pull rods and bell cranks to link the ailerons and elevator to the control sticks. The ailerons and elevator could be disconnected through the use of quick release rod-connectors.

Control continuity was established to the elevator, and from the right aileron bell crank assembly, to a break in the threaded portion of the rod end for the aileron push-pull rod, which displayed evidence of tensile overload, and from that break, to the right aileron's quick release rod-connector, which was found to be connected to the quick release connector fork.

Examination of both the elevator's and right aileron's quick release rod-connectors revealed that they had the lock sleeve in the locked position and the release button was fully extended.

Control continuity could not be established to the left aileron. Examination revealed that there were no mechanical failures of the bell crank or push pull rod, but it was discovered that unlike the elevator's and right aileron's quick release rod-connectors, the left aileron's quick release rod-connector was not connected to the quick release connector fork.

TESTS AND RESEARCH

At the time of the accident the US Sport Aviation Expo was being held at SEF and Remos aircraft had two airplanes on display; N9GX (the accident airplane) and N78GX. On the day before the accident, the pilot and the national service manager for Remos Aircraft had been demonstrating the wing folding mechanism in the display area for prospective customers.

According to the national service manager, on the morning of the accident flight, he and the pilot of the accident airplane pulled both of the airplanes out from under a display tent. Both had their left wings in the folded position. When they pulled N9GX out from under the display tent, he was at the left wing root. He inserted the left wing's main wing securing bolt, installed the securing pin, and then went over to N78GX. He did not however, connect the pushrod connection for the aileron's before going over to N78GX, nor did he advise the pilot that the "coupling was not connected".

According to the pilot, he remembered that he and the national service manager greeted two representatives from an aviation magazine that morning outside the display tent. He remembered being at the left wingtip of N9GX with the national service manager at the wingroot when they were unfolding the wing. He thought that he remembered seeing him go inside the airplane and assumed that he was connecting the aileron. He next remembered being ready for takeoff and then "something was amiss with my controls." Then there was a "swirling of the airplane".

Pilot Operating Handbook

According to the Pilot Operating Handbook (POH), Section 7.1, "Preflight Check", a check for "free and full travel of all control surfaces" was required.

Also according to the Pilot Operating Handbook (POH), Section 8.8, "Connecting folded Wings to Fuselage", after connecting the wings to the fuselage, "the pushrod connection of the ailerons MUST be established".

Furthermore, according to the POH, Section 9, "Required Placards and Markings", inside the cabin, a starting checklist was present on the center console of the airplane. A review of the placard also revealed that as part of the "START-CHECKLIST", the flight controls were required to be "Checked".

ADDITIONAL INFORMATION

In order to improve safety Remos Aircraft took the following actions:

1. On January 30, 2009, Safety Directive SD-004 was issued to all owners of record which discussed the importance of connecting all "quick release" connections to insure control continuity to all control surfaces before every flight. A temporary update to the Pilot Operating Handbook (POH) was also included in the SD as well as additional temporary placarding that could be cut out and attached to the airplane using spray adhesive to increase pilot awareness of the importance of assuring that the "quick release" connections were connected prior to flight.
2. On March 25, 2009, Safety Directive SD-005 was issued. In addition to the information that was contained in Safety Directive SD-004, it contained permanent placards (decals) to emphasize the importance of connecting any "quick release" connections to ensure control continuity. The permanent placards are placed near all locations where the "quick release" connections are located to increase pilot awareness, and to help assure control continuity prior to flight. For airplanes which had already left the factory prior to the accident, the permanent placards were issued to all owners of record. For new production airplanes, the placards are installed prior to the airplane leaving the factory.
3. The REMOS GX POH was revised along with the checklists for the airplane. In order to provide special emphasis to the necessary steps to assure control continuity in the POH and checklists those subject areas now contain boldfacing and are colored.
4. The "quick release" mechanism on the aileron pushrods and elevator control system were modified to provide enhanced safety compared to the old mechanism.
5. For demonstration and airshow purposes an internal procedure for two person airplane set-up was published and was made available to all REMOS personnel.
6. The existing fire sleeves for fuel lines were improved to ensure end-to-end fire integrity and were phased into the manufacturing process for the airplane.
7. The blue anodized aluminum fuel divider that had been used on all engine installations has been replaced by a stainless steel version, and the aluminum fittings that pass through the firewall have been replaced with stainless steel versions.
8. The existing breach in the firewall which allowed plastic sleeved wires to pass through into

the cabin has been replaced by United States Military Standard (MIL SPEC) Connectors.

9. All firewall carry throughs for Bowden wires, fuel lines, etc, are now made of stainless steel and are sealed with fireproof sealant.

10. Heating and ventilation inlets and their routings through the firewall are now made of stainless steel and air hoses for the cabin air system are now made of fireproof aviation grade hoses.

Pilot Information

Certificate:	Commercial	Age:	46, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane single-engine	Toxicology Performed:	No
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	July 23, 2008
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	1600 hours (Total, all aircraft), 3 hours (Total, this make and model), 1500 hours (Pilot In Command, all aircraft), 250 hours (Last 90 days, all aircraft), 150 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Remos Aircraft GmbH	Registration:	N9GX
Model/Series:	Remos GX	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Special light-sport (Special)	Serial Number:	299
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	January 8, 2009 Condition	Certified Max Gross Wt.:	1320 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	15 Hrs as of last inspection	Engine Manufacturer:	Rotax
ELT:	Installed, activated, did not aid in locating accident	Engine Model/Series:	912 UL-S
Registered Owner:	Remos Aircraft Inc.	Rated Power:	100 Horsepower
Operator:	Remos Aircraft Inc.	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	OBE,34 ft msl	Distance from Accident Site:	29 Nautical Miles
Observation Time:	07:45 Local	Direction from Accident Site:	135°
Lowest Cloud Condition:	Clear	Visibility	5 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.19 inches Hg	Temperature/Dew Point:	8°C / 7°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Sebring, FL (SEF)	Type of Flight Plan Filed:	None
Destination:	Sebring, FL (SEF)	Type of Clearance:	None
Departure Time:	07:45 Local	Type of Airspace:	

Airport Information

Airport:	Sebring Regional Airport SEF	Runway Surface Type:	Asphalt
Airport Elevation:	62 ft msl	Runway Surface Condition:	Dry
Runway Used:	18	IFR Approach:	None
Runway Length/Width:	5234 ft / 100 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 1 Serious	Latitude, Longitude:	27.453887,-81.344444

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	William D Meenan; FAA/FSDO; Orlando, FL Michael Meirer; Remos Aircraft Inc.; Santa Cruz, CA Eric Tucker; Rotax Aircraft Engines; Nassau, Bahamas Roger Knoll; BFU; Germany
Original Publish Date:	April 28, 2011
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=73273

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).