Aviation Investigation Final Report

Location:	Miami, Florida	**Accident Number:**	ERA12FA052
Date & Time:	October 29, 2011, 10:21 Local	**Registration:**	N58784
Aircraft:	INTERPLANE S R O SKYBOY	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Before the accident, the pilot had modified the airplane by installing vortex generators onto the airplane's wings. Following the installation, the pilot made an uneventful flight, and, shortly after, he departed on the accident flight. Several witnesses reported seeing the airplane, after a brief flight in the local area, flying directly over the airport at a very low speed. One witness reported that the airplane appeared to enter an aerodynamic stall and a left spin and then impacted the ground.

Postaccident examination of the wreckage revealed that the left elevator trim tab upper control cable exhibited significant corrosion and had separated. A detailed examination of the cable and the separation fracture surfaces revealed the presence of significant, unabated corrosion, which had resulted in the cable losing an estimated 90 percent of its strength before ultimately failing in overload. However, it could not be determined whether the failure of this cable occurred before, or as a result of, the airplane's impact with terrain or, what effect, if any, the in-flight failure of this cable could have had on the controllability of the airplane. The wreckage examination did not reveal any other evidence of preimpact mechanical discrepancies or malfunctions that would have prevented normal operation of the engine and airframe components. No evidence was found indicating whether the pilot had intended to perform or had completed a structured flight test of the airplane's performance following the installation of the vortex generators in accordance with its operating limitations (outside of the single, 7-minute solo flight that immediately preceded the accident flight) before operating a flight with a passenger onboard.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's failure to maintain control of the airplane while flying at low speed, which resulted in a subsequent aerodynamic stall, spin, and impact with terrain. Contributing to the outcome of the accident was the pilot's decision to operate the airplane with a passenger aboard before fully evaluating the airplane's handling characteristics after vortex generators were installed.

Findings

Aircraft	(general) - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	Decision making/judgment - Pilot

Factual Information

History of Flight

Maneuvering-low-alt flying	Loss of control in flight (Defining event)
Maneuvering-low-alt flying	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY

On October 29, 2011, about 1021 eastern standard time, an experimental Interplane SRO Skyboy, N58784, was substantially damaged when it impacted terrain during an uncontrolled descent near Richards Field (04FA), Miami, Florida. The commercial pilot and the passenger were fatally injured. Visual meteorological conditions prevailed, and no flight plan was filed for the local flight, which originated from 04FA. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

Witnesses stated that they observed the pilot and the passenger performing maintenance and installing vortex generators on the wings of the accident airplane for the two weeks preceding the accident flight.

On the morning of the accident flight, witnesses observed the accident pilot preparing the airplane before he departed on a brief solo, local flight in the vicinity of 04FA. During the flight, the accident flight passenger spoke with the pilot via radio, and the pilot advised her that the airplane was performing in a satisfactory manner. The pilot subsequently returned to the airport uneventfully, and advised witnesses on the ground that the airplane was "flying fine."

The pilot and passenger then departed on the accident flight, and after flying in the local area, returned to the vicinity of 04FA. Several witnesses observed the accident airplane as it overflew 04FA at an estimated altitude between 350 and 3,000 feet agl. One witness recounted that the airplane appeared to enter an aerodynamic stall, which was followed by a second stall from which the airplane did not recover. The airplane then began spiraling towards the ground in a corkscrew-like descent.

Several of the witnesses then responded to the accident site in order to provide assistance. They reported that both the pilot and passenger were wearing their restraints.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with ratings for airplane single- and multi- engine land, and instrument airplane. He was issued a Federal Aviation Administration (FAA) third-class medical certificate on April 28, 2009, with a limitation of "must wear corrective lenses for near and distant vision." He reported that he had accumulated 2,200 total hours of flight experience at that time. He also held a mechanic certificate with ratings for airframe and powerplant. His personal flight logs were not recovered.

AIRCRAFT INFORMATION

The high-wing airplane was of a tube and fabric construction, and featured two-place, side-by-side seating. The airplane was equipped with dual flight and engine controls. The airplane was powered by a Rotax 912ULS reciprocating engine that was mounted in a pusher configuration behind and above the airplane's cockpit and wings.

According to archived FAA airworthiness records, the airplane was issued a special airworthiness certificate in the experimental category for the purpose of exhibition. The airplane was issued operating limitations on April 16, 2004, which included the following limitations for flights during Phase I (initial flight test) and Phase II (flights outside the flight test area):

…

14. The cognizant FSDO [Flight Standards District Office] must be notified, and its response received in writing, prior to flying this aircraft after incorporation of a major change as defined by FAR 21.93.

….

20. No person must operate this aircraft unless within the preceding 12 calendar months it has had a condition inspection performed in accordance with the scope and detail of appendix D to part 43, or other FAA-approved programs, and was found to be in a condition for safe operation. This inspection will be recorded in the aircraft maintenance records.

The following limitations were applicable to all Phase II flights:

3. All proficiency/practice flights must be conducted in the geographical area described in the applicant's program letter and any amendments to that letter, but no portion of that area will be more than 150 nautical miles from the aircraft's home base airport. An exception is permitted for proficiency flying outside of the area stated above for organized formation flying, training, or pilot checkout in conjunction with a specific event listed in the applicant's program letter (or amendments). The program letter should indicate the location and dates for this proficiency flying.

5. The owner/operator of this aircraft must submit an annual program letter update to the local FSDO that lists airshows, fly-ins, etc., that will be attended during the next year, commencing at the time this aircraft is released into Phase II operation. The list of events may be amended, as applicable, by a letter or fax to the FSDO prior to the intended operation amendments. A copy of the highlighted aeronautical chart, when applicable, must be carried aboard this aircraft and be available to the pilot.

8. No person may be carried in this aircraft during the exhibition of the aircraft's flight capabilities, performance, or unusual characteristics at air shows, or for motion picture, television, or similar productions, unless essential for the purpose of the flight. Passengers may be carried during flights to and from any event outlined in the program letter or during proficiency flying, limited to the design seating capacity of the aircraft.

No current or archived program letters could be located during the course of the investigation. Additionally, a review of FAA documents from the two FSDOs closest to the accident site showed no evidence that the either of the offices had been provided with a program letter update detailing any events the airplane would have planned to attend, nor were any records notifying the offices of major changes to the airplane.

According to FAA registration records, the pilot purchased and registered the airplane in 2004. Registration records and witness statements indicated that the accident pilot transferred ownership of the airplane to another individual about 6 months prior to the accident. The new registered owner stated that the pilot continued to fly and perform maintenance on the airplane, and also held the airplane's maintenance records.

Review of the airplane's "Daily Operational Records" showed an entry dated May 12, 2004, certifying that the required flight test hours had been completed. Additional flights were logged in the record through July 15, 2005. According to the "Operational Record of Periodical Checking," several entries between April 2004 and March 2005 noted the installation of a replacement engine, installation of a transponder and altitude encoder, as well as periodic maintenance to the engine. No subsequent entries or other documents were found detailing any maintenance after March 26, 2005, nor were any maintenance records discovered that documented the completion of the prescribed 12 calendar month condition inspection. Additionally, no maintenance documentation was found relating to the installation of vortex generators, nor could any information documenting their origin or applicability to the airplane. No documents were recovered, nor were any witness statements provided, to suggest that the pilot had a structured plan in place to flight test the recently-installed vortex generators and document their effects on the airplane's performance.

METEOROLOGICAL INFORMATION

The weather conditions reported at Kendall-Tamiami Executive Airport (TMB), Miami, Florida, located 7 miles northeast of the accident site, at 1053, included wind from 200 degrees at 9 knots, gusting 16 knots, visibility 10 statute miles, few clouds at 2,000 feet, temperature 28 degrees Celsius (C), dew point 24 degrees C, and an altimeter setting of 29.87 inches of mercury.

FLIGHT RECORDERS

The airplane was not equipped with any flight data recording devices, nor was it required to be; however, a Garmin GPSMAP 496, handheld GPS receiver was recovered from the wreckage, and found to contain data pertaining to the accident flight. The data extracted from the device included 28 sessions from June 11, 2011 through October 29, 2011. The accident flight was recorded starting at 0957 and ending 1021. The flight immediately preceding the accident flight began at 0917 and ended at 0941.

The flight immediately preceding the accident flight began with the airplane performing a number of passes spanning the length of runway 9/27 at 04FA, at a slow speed and while still on the ground between 0920 and 0932. The airplane then departed toward the west at 0933, and circled the airport to the left at a GPS altitude of about 1,100 feet. After completing one left circuit, the airplane continued a second circuit around the airport that terminated in a return and landing on runway 27, at 0940. During the flight, the slowest GPS ground speed recorded was 29 knots, in the upwind to crosswind phase of the departure, while the airplane climbed through a GPS altitude of 837 feet.

The airplane departed from runway 27 on the accident flight at 1003. The airplane then flew about 3 nautical miles northwest of the airport and began maneuvering at a GPS altitude of about 1,000 feet. After maneuvering for about 10 minutes, the airplane began a gradual climb as it began tracking back toward the airport from the north. While heading toward the airport, the airplane maintained a relatively stable GPS groundspeed of about 45 knots, at a GPS altitude around 1,500 feet. At 10:18:59, the airplane began slowing until reaching a low GPS groundspeed of 21 knots about 1 minute later, while climbing to a GPS altitude of about 2,000 feet. At that point, the airplane was nearly over top of the runway at 04FA.

The airplane continued to track southwest over the next 35 seconds while maintaining a groundspeed between 35 and 26 knots, at an altitude of about 1,900 feet. At 10:20:45, the airplane had descended to 1,800 feet and slowed to a GPS groundspeed of 23 knots, while flying on a track of 246 degrees. Considering the reported wind conditions at TMB, the airplane's approximate calculated true airspeed at that point was 30 knots. The airplane subsequently began a rapid descent to the left, and data ceased recording at 10:21:01. The airplane's average calculated rate of descent prior to impact was greater than 5,600 feet per minute.

WRECKAGE and IMPACT INFORMATION

The wreckage displayed signatures consistent with nose low, slight right-wing-down impact, with the fuselage coming to rest on a 170-degree magnetic heading. The front of the airplane was crushed aft into the cockpit area. The wings separated from their respective attach points at the forward fuselage section. Vortex generators were found installed on the top surfaces of both wings. The tail boom was partially separated, downward, with a slight bend toward the right. One of the four propeller blades was separated at the blade root, consistent with contact between it and the tailboom.

Flight control continuity was traced from the cockpit to all flight control surfaces. The flaps appeared to be in the retracted position. The pre-impact position of the elevator trim could not be determined. The left elevator trim tab's upper cable was separated at the control horn interface, and corrosion was present at the separation. The trim tab, horn, and cable assembly were retained and forwarded to the NTSB Materials Laboratory for further examination.

According to the Materials Laboratory Factual Report, the control cables were attached to the trim tab control horn by pins through clevis fittings mounted on cylindrical, soldered cable ends. The upper cable was separated at its respective clevis fitting. Additionally, the clevis was frozen to the pin, the pin was frozen to the control horn, and all resisted movement by heavy hand pressure. The upper cable exhibited heavy red rust deposits, and no cable lubricant was noted on any area of the cable. The cable's construction and material composition were consistent with that of a zinc coated carbon steel wire rope with a 7 wire per strand, 7 strand construction. The cable's construction and composition were consistent with "Detail Specification" MIL-DTL-8342M3 Type I, Composition A wire rope." According to the specification, the wire rope had a minimum breaking load of 270 lbf.

Close examinations of the cable separation found that all of the individual wire fractures were located at the point where the cable passed through the clevis. The cable remained tightly wound at the separation with no fraying or significant spreading of the wires or strands. High magnification optical viewing uncovered only a few wires with clean, identifiable fracture faces. The separated ends of the vast majority of the wires were obscured by red and black rust deposits and fractures were not visible.

Ultrasonic cleaning in acetone removed much of the red rust deposits, but not the darker deposits. The cable was restrained with a swag fitting and cut about 1 inch forward of the separation, then cleaned in a deoxidizing solution. The individual strands were then partially unwound for better viewing. Examinations with a scanning electron microscope (SEM) revealed severe corrosion damage of the wires adjacent to the area of the separation. SEM examinations of the wire ends found that most were obliterated by corrosion and no features remained. The few wires where features remained (about 5 wires in total) were typical of overstress separations.

The lower trim tab cable also displayed corrosion on its surface. The corrosion was apparent along approximately the same length of the lower cable as on the upper cable, but did not appear to be as widespread. Close examination of the cable found that its diameter was reduced as it passed through the clevis.

MEDICAL AND PATHOLOGICAL INFORMATION

The Miami-Dade County Medical Examiner's Office, Miami, Florida, conducted a postmortem examination of the pilot. The stated cause of death was "multiple blunt traumatic injuries."

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, conducted toxicology testing on fluid and tissue specimens of the pilot. The tests were negative for carbon monoxide, cyanide, and ethanol. The testing found an unquantified amount of Amlodipine in the blood and liver specimens submitted.

ADDITIONAL INFORMATION

FAA Guidance on Aircraft Inspection

The following are excerpts from Advisory Circular 43.13-1B, "ACCEPTABLE METHODS, TECHNIQUES, AND PRACTICES, AIRCRAFT INSPECTION AND REPAIR," revised 1998, and are applicable in the absence of a manufacturer's guidance.

Chapter 6 Corrosion, Inspection and Protection

6-75. CONTROL CABLES.
a. Inspect control cables for bare spots in the preservative coating and corrosion.
b. If external corrosion is found, relieve tension on the cable and check internal strands for corrosion. Cables with corrosion on internal strands should be replaced. External corrosion should be removed by a clean, dry, coarse rag or fiber brush. A preservative should be applied after removal of external corrosion.

Chapter 7 – Aircraft Hardware, Control Cables, and Turnbuckles

7-147. REPLACEMENT OF CABLES. Replace control cables when they become worn, distorted, corroded, or otherwise damaged.

7-150. CORROSION AND RUST PREVENTION.
To ensure a satisfactory service life for aircraft control cables, use a cable lubricant to reduce internal friction and prevent corrosion.
a. If the cable is made from tinned steel, coat the cable with rust-preventive oil, and wipe off any excess. It should be noted that corrosion-resistant steel cable does not require this treatment for rust prevention.

FAA Guidance on Aircraft Flight Testing

FAA Advisory Circular 90-89A, Amateur-built Aircraft and Ultralight Flight Testing Handbook, provided suggestions and safety-related recommendations to assist experimental and ultralight aircraft builders in developing individualized aircraft flight test plans.While the accident airplane was not certificated as an experimental amateur-built aircraft, many of the same procedures and principles that applied to flight testing those type aircraft would apply to the modification of any experimental aircraft.

According to the handbook, "The most important task for an amateur builder is to develop a comprehensive FLIGHT TEST PLAN. This PLAN should be individually tailored to define the aircraft's specific level of performance. It is therefore important that the entire flight test plan be developed and completed BEFORE the aircraft's first flight." The handbook continued, "The objective of a FLIGHT TEST PLAN is to determine the aircraft's controllability throughout all the maneuvers and to detect any hazardous operating characteristics or design features."

With regard to testing the airplane's handling during stalls, the handbook recommended, "As with any unknown, approach slowly, incrementally, and follow the FLIGHT TEST PLAN. To improve safety and reduce the possibility of spins, the aircraft should be tested with a forward CG loading. Start the stall tests at 6,000 AGL. Make clearing turns and stabilize the airspeed and altitude. The first full stall should be conducted with power off, no flaps, and gear-up if applicable. After clearing the area, reduce the airspeed to 1.3 times the predicted stall speed and trim. (NOTE: Do not trim within 10 knots of stall)."

When testing the airplane's performance in slow flight, the handbook stated:

e. Slow Flight Test.

(1) For added safety, the slow flight tests should be performed at 6,000 AGL or higher to allow room for spin recovery. THE PRIMARY PURPOSE OF THESE TESTS IS FOR THE PILOT TO BECOME FAMILIAR WITH THE AIRCRAFT'S HANDLING QUALITIES AT THE MINIMUM GEAR UP/DOWN AIRSPEEDS AND POWER SETTINGS.

(2) The tests should be done with and without flaps. Start the tests at an airspeed of 1.3 times (X) the stall speed of the aircraft. Once the aircraft is stabilized and maintaining its altitude, reduce the airspeed by 5 mph/knots. Maintain the altitude. Keep reducing the airspeed until approaching a stall.

(3) Maintain 5 mph/knots above the previously determined stall speed. This figure is the initial slow flight airspeed. Practice with each flap setting, noting its effect on the aircraft's performance. If the aircraft has retractable gear, test in all gear and flap combinations. These tests will have to be run later in the flight test program but with the AIRCRAFT AT GROSS WEIGHT to determine the actual slow flight airspeed and stall speeds.

(4) Remember, to help reduce the possibility of unplanned stalls in slow flight configurations, avoid bank angles of more than 5 degrees. When all the test data has been evaluated, and if the aircraft is equipped with a stall warning horn or indicator, set the stall warning at 5 mph/knots above the aircraft's highest stall speed.

Regarding flight testing at maximum gross weight, the guide cautioned:

The pilot should avoid the temptation to take a live ballast weight up for a ride for three reasons:
(1) The aircraft has not been proven safe for the higher gross weights.
(2) The pilot and passenger are at great risk. It is a sure sign the pilot has become complacent and sloppy in his flight test program.
(3) The pilot will be breaking a contract (Operating Limitations) with the U.S. Government, which is known not to look kindly on such matters.

Pilot Information

Certificate:	Commercial	**Age:**	57
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	April 28, 2009
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 2200 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	INTERPLANE S R O	**Registration:**	N58784
Model/Series:	SKYBOY	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	082/2004
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	1232 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	ROTAX
ELT:	C91A installed, activated, did not aid in locating accident	**Engine Model/Series:**	912 ULS
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:	TMB,8 ft msl	**Distance from Accident Site:**	7 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	45°
Lowest Cloud Condition:	Few / 2000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots / 16 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.87 inches Hg	**Temperature/Dew Point:**	28°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Miami, FL (04FA)	**Type of Flight Plan Filed:**	None
Destination:	Miami, FL (04FA)	**Type of Clearance:**	None
Departure Time:	10:03 Local	**Type of Airspace:**	

Airport Information

Airport:	Richards Field 04FA	**Runway Surface Type:**	
Airport Elevation:	9 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

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:**	25.55861,-80.514999(est)

Administrative Information

Investigator In Charge (IIC):	Obregon, Jose
Additional Participating Persons:	Edward Cardenas; FAA/FSDO; Miramar, FL
Original Publish Date:	May 22, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=82195