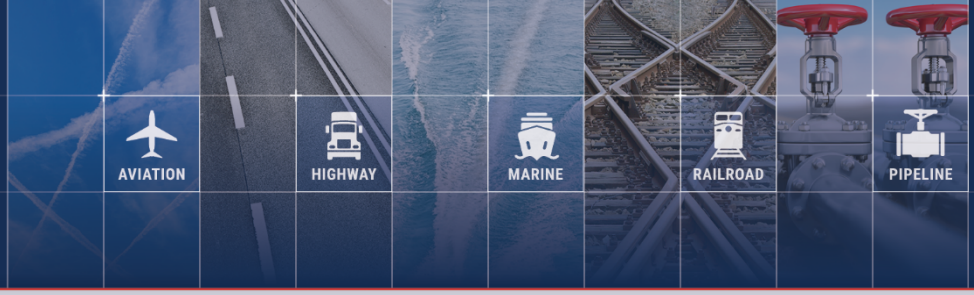

Aviation Investigation Factual Report

Location:	Mosquero, New Mexico	**Accident Number:**	DEN07FA136
Date & Time:	August 15, 2007, 09:53 Local	**Registration:**	N808GS
Aircraft:	Zlin Aviation s.r.o. Savage	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Factual Information

This report was modified on May, 13, 2008.

HISTORY OF FLIGHT

On August 15, 2007, at 0953 mountain daylight time, a Zlin Aviation s.r.o. Savage special light sport airplane (S-LSA), N808GS, owned and piloted by a private pilot, was substantially damaged when it impacted terrain 3 miles northwest of Mosquero, New Mexico. Visual meteorological conditions prevailed at the time of the accident. The personal flight was being conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91 without a flight plan. The private pilot and passenger were fatally injured. The local flight departed Bell Ranch Airport, Bell Ranch, New Mexico at 0930.

According to Global Positioning System (GPS) data recovered from the airplane, the airplane departed Bell Ranch Airport at 0930:55 and flew northeast into rugged terrain located between Bell Ranch Airport and Mosquero. At 0935:20 the airplane executed two right-hand 360 degree turn maneuvers while flying between 5,700 to 6,050 feet GPS altitude. The airplane then flew approximately 2 miles to the northeast to a position adjacent to County Road J-1 and executed eight to nine alternating left and right hand 360 degree turns while flying between approximately 5,750 to 5,850 feet GPS altitude (about 200 to 500 feet agl). The airplane flew a short zigzag course to the west crossing two ridges before turning southwest and flying down a valley in the direction of Bell Ranch Airport. At approximately 0951, the airplane turned to the north and flew up a valley for approximately 2.7 miles. At approximately 0953, the airplane executed one left 360 degree turn while flying at approximately 350 feet agl. At 0953:23, the airplane began to descend rapidly - accelerating from negative 2,200 to negative 3,300 feet per minute based on GPS altitude data. The last GPS position location fix was recorded at 0953:28 and placed the airplane at 35 degrees 46.102 minutes north and 103 degrees 59.656 minutes west at a GPS altitude of 5,482 feet (about 137 feet agl). The last calculated groundspeed and course of the airplane was 59 mph and 353 degrees true.

According to the Bell Ranch manager, the pilot and his passenger were surveying the ranch in order to find an ideal location for a new road. When the flight did not return to the ranch airport, a search was initiated. An aerial search located the airplane approximately 1800.

PERSONNEL INFORMATION

The pilot, age 57, held a private pilot certificate with an airplane single-engine land and instrument rating, last issued on March 10, 2006. He was issued a third class airman medical certificate on August 7, 2007. The certificate contained the limitation "must have available glasses for near vision." At the time of application, the pilot estimated his flight experience as

3,900 hours total time; 90 hours of which was logged in the previous 6 months.

The family provided the National Transportation Safety Board (Safety Board) Investigator-In-Charge (IIC) excerpt copies of the pilot's flight logbook. A review of the logbook indicated that the pilot had logged 3,400 hours total time. He had logged no less than 5 hours in the Savage. According to the family, the pilot successfully completed the requirements of a flight review at Flight Safety International, in Texas, in December of 2006.

According to the pilot's logbook, he had performed a checkout in the accident airplane on August 10, 2007. The flight check lasted for 1 hour and included 3 landings. According to the flight instructor who performed the checkout, the accident pilot was an excellent pilot. He stated that they spent time performing stalls and touch-and-go landings to a full stop. He stated that during the ground school they reviewed weight and balance and the flight manual. He was impressed with the pilot's knowledge of the flight manual materials. The flight instructor stated that upon completion of the checkout, he had no doubt in his mind that the accident pilot was a safe pilot.

AIRCRAFT INFORMATION

The accident airplane was a Zlin Aviation s.r.o. Savage S-LSA (serial number 0073) manufactured in 2005 in the Czech Republic. It was registered with the Federal Aviation Administration (FAA) on a special airworthiness certificate for light sport operations in November of 2005. A ROTAX 912 ULS engine, rated at 100 horsepower at 5,500 rpm, powered the airplane. The engine was equipped with a 2-blade, Tonini GT 130 wooden-composite propeller.

On November 12, 2005, the FAA issued "Light-Sport Category Aircraft Operating Limitations" on the accident airplane. These limitations stated the following in part: "(13) Aircraft instruments and equipment installed and used under Part 91.205 must be inspected and maintained in accordance with the requirements of Part 91. Any maintenance or inspections of this equipment must be recorded in the aircraft maintenance records. (14) No person will operate this aircraft unless within the preceding 12 calendar months it has had a condition inspection performed in accordance with the manufacturer's maintenance and inspection procedures, and was found to be in a condition for safe operation. As part of the condition inspection, cockpit instruments must be appropriately marked and needed placards installed in accordance with Part 91.9. This inspection will be recorded in the aircraft maintenance records."

The airplane was registered to a private individual and operated by the pilot. According to the pilot's family, he had just purchased the airplane on August 8, 2007. The family provided the Safety Board IIC with a copy of the maintenance records they had received with the airplane. The last maintenance performed on the airplane took place on July 10, 2007, at an airframe total time of 28.1 hours. The records indicated a heat shroud had been installed in accordance with the manufacturers' specifications. Aside from a brake installation in November of 2006

and the initial airplane assembly upon its arrival in the United States, there was no record of an annual condition inspection or 6 month, 12 month, or 18 month inspections as required by the manufacturer in the maintenance manual.

The previous owner purchased the airplane new in November of 2005. He stated that one condition inspection was conducted while he owned the airplane. This inspection was conducted at Aero Engines of Winchester, Inc., in Winchester, Virginia. He stated that he had received a piece of paper documenting this inspection, but had not "attached" it to the maintenance manual.

Aircraft Maintenance

Each S-LSA is required to have a condition inspection each year in accordance with inspection procedures developed by the aircraft manufacturer, (FAR 91.327, (b), (2)). According to the American Society for Testing and Materials (ASTM) F 2483 - 05, 3.1.1 the aircraft manufacture must specify, in the airplane's required maintenance manual, the inspection procedures to be followed to perform a 100-hour inspection and an annual condition inspection. According to the "Savage ROTAX 912S" Maintenance Manual, Section 9, the "schedule of inspection periods" included the following: every 50 hours or 6 months; every 100 hours or 12 months; every 200 hours or 18 months; every 600 hours and every 1,200 hours.

METEOROLOGICAL INFORMATION

The closest official weather observation station was Tucumcari Municipal Airport (TCC), Tucumcari, New Mexico, located 46 nautical miles (nm) southeast of the accident site. The elevation of the weather observation station was 4,065 feet mean sea level (msl). The routine aviation weather report (METAR) for TCC, issued at 0953, reported winds, 220 degrees at 16 knots, gusting to 24 knots; visibility, 10 miles; sky condition, clear; temperature 31 degrees Celsius (C); dewpoint, 11 degrees C; altimeter, 30.07 inches.

The routine aviation weather report (METAR) for Las Vegas Municipal Airport (LVS), Las Vegas, New Mexico, located 45 nm east of the accident site reported winds calm; visibility, 10 miles; sky condition, clear; temperature, 25 degrees C; dewpoint, 06 degrees C; altimeter, 30.25 inches.

Calculations revealed a density altitude, at the accident site, between 7,450 and 8,360 feet.

FLIGHT RECORDERS

A Garmin 396 GPS receiver was found within the airplane wreckage. The GPS was removed from the airplane by the Safety Board IIC and sent to the Safety Board vehicle recorders division in Washington D.C. for data extraction. After repairs were made, recorded tracklog data was recovered corresponding to one flight on the date of the accident. The duration of the flight was 23 minutes.

WRECKAGE AND IMPACT INFORMATION

The accident site was located in rocky, uneven, up-sloping terrain vegetated with various trees and bushes. The accident site was at an elevation of 5,350 feet msl and the airplane impacted on a magnetic heading of 320 degrees.

The wreckage consisted of the left and right wings, empennage, fuselage, and engine assembly. The airplane came to rest in a nose down attitude. The right wing remained attached to the fuselage and was crushed aft and tangled in a tree, directly adjacent to the main wreckage. The empennage was angled up, approximately 70 degrees. A shallow ground scar was found just forward of the left wing. The scar was consistent in length with the leading edge of the left wing. Yellow paint chips were found within the scar and red lens fragments were found at the west most end of the scar.

The fuselage, to include the engine and propeller assembly, the cabin, and instrument panel, was crushed aft. The engine separated from the fuselage and was found adjacent to the left side of the fuselage, under the left wing. The propeller remained partially attached at the propeller flange. The propeller blades were labeled "A" and "B" for identification purposes. Blade A was splintered and broken and remained attached at the spinner hub. Blade B separated from the hub and was splintered and fragmented. The instrument panel was destroyed and the cabin was crushed up and aft, reducing the survivable space with the cabin.

The airplane's cabin instruments displayed the following indications:

Altimeter - 5,520 feet
Kollsman Window - 30.26
Airspeed Indicator - 119 miles per hour
Vertical Speed Indicator - 1,000 feet per minute descent

The airplane's engine instruments displayed the following indications:

Engine cylinder head temperature - 135 degrees C
Engine rpm - destroyed
Hour Indicator - 60 hours and 30 minutes of operations

The left wing, to include the left aileron and flap, remained attached to the fuselage. The entire left wing exhibited aft accordion crushing along the entire leading edge and aft diagonal crushing along the entire span. The left fuel tank was compromised. The existence of residual fuel was noted. The smell of fuel was strong, all around the accident scene.

The right wing, to include the right aileron and flap, remained partially attached to the fuselage at the wing root. The right wing was twisted within the tree branches and crushed up and aft. The tubing structure was bent and broken and the fabric was torn. The right wing flap was bent

up approximately 70 degrees at midspan and the aileron separated partially at the outboard hinge point. The right fuel tank was compromised. Residual fuel was present in the tanks; however, the amount could not be accurately measured.

The empennage, to include the elevator, horizontal stabilizer, vertical stabilizer, and rudder remained attached to the fuselage. The elevator control horns separated from the elevator control tube. Fabric in the same region was torn on the right side of the fuselage. The elevator pushrod was jammed aft (elevator up). The left horizontal and vertical stabilizers were unremarkable. The skin on the right horizontal stabilizer was wrinkled.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot by The University of New Mexico - Health Science Center - Office of the Medical Examiner on August 16, 2007. The autopsy revealed the cause of death as "multiple blunt force injuries."

During the autopsy, specimens were collected for toxicological testing to be performed by the FAA's Civil Aerospace Medical Institute, Oklahoma City, Oklahoma (CAMI Reference #200700193002). Tests for carbon monoxide and cyanide were negative. Ibuprofen and 61 mg/dL of ethanol were detected in the liver and 9 mg/dL of ethanol was detected in the muscle tissue. Putrefaction was noted.

TESTS AND RESEARCH

Wreckage Examination

The wreckage was recovered on August 18, 2007, and relocated to a storage facility in Greeley, Colorado, for further examination. The Safety Board IIC and a representative from Zlin Aviation examined the wreckage on August 21, 2007.

Due to impact damage, control continuity could not be verified through movement of the control stick or control surfaces. The elevator pushrod was continuous from the control stick aft to the elevator. The rod was bent aft and crushed in multiple locations. The rudder cables were continuous from the rudder pedals in the cabin, aft to the rudder control surface. Examination of the aft portion of the fuselage revealed hose clamps being used to guide the rudder cable travel. Examination of the rudder cable revealed slight chafing in this area. The ailerons were continuous from the control stick, through the pushrod, and outboard to both cables attached at the aileron.

The Safety Board IIC and a representative from ROTAX Flying and Safety Club examined the engine on September 17, 2007. The top bank of spark plugs, the rocker box covers, and gear reduction box were removed and the engine was rotated at the crankshaft. The crankcase, at the gear reduction box mounting point, exhibited rotational scoring. Engine continuity was confirmed and tactile compression was noted on all four cylinders.

Airspeed Indicator

Examination of the airspeed indicator revealed arc markings painted on the face of the instrument glass. The glass was fixed and did not move. The following arc markings were noted:

White arc - 36 through 71 mph
Green arc - 39 through 101 mph
Yellow arc - 101 through 115 mph
Red arc - 115 through 150 (max indication for the gauge) mph

The airspeed indicator was removed from the wreckage by the Safety Board IIC, attached to a RUSKA Calibration Computer, and checked for accuracy. No anomalies were noted.

ADDITIONAL INFORMATION

Flight Manual - Airspeeds

According to the Savage flight manual, the operating airspeeds are as follows:

Never Exceed Speed (VNE) - 127 mph
Maximum Structural Cruising Speed (VNO) - 99 mph
Maneuvering Speed (VA) - 83 mph
Maximum Flap Extended Speed (VFE) - 69 mph
Stall Speed - Landing Configuration (VSO) - 38 mph (As defined in Section 3 of the flight manual)
Stall Speed - Landing Configuration (VSO) - 31 mph (As defined in Section 9 of the flight manual)
Stall Speed - Zero Flaps - 43 mph
Stall Speed - Maximum weight with flaps retracted (VS) - 37 mph

The flight manual defines the airspeed instrument markings as follows:

White Arc - 31 through 69 mph
Green Arc - 37 through 99 mph
Yellow Arc - 99 through 111 mph
Red Line - 127

The white arc is defined by the manufacturer as "Flap Operating Range: Bottom of white arc is MTOW {Maximum Takeoff Weight} VSO in landing configuration. Upper limit of white arc is maximum speed permissible with flaps extended." The green arc is defined as "normal operating range. Lower limit is maximum weight VS with flaps retracted. Upper limit is maximum structural cruising speed." The yellow arc has the operational significance that

"operations must be conducted with caution and only in smooth air." The red line was defined as VNE. The flight manual provided no definition for the red arc.

CFR Part 23.1545 defines airspeed instrument markings as follows:

Flap Operating Range - A white arc with the lower limit as VSO and the upper limit at VFE
Normal Operating Range - A green arc with the lower limit at VS1 and the upper limit at VNO
Caution Range - A yellow arc extending from the red line to the upper limit of the green arc

CFR Part 23.1543 states that "when markings are on the cover glass of the instrument, there must be means to maintain the correct alignment of the glass cover with the face of the dial."

Section 8.2.1, entitled "Required Equipment," of the ASTM 2245-04 standard under which the accident airplane was designed, cites a requirement that the airplane "...shall be designed [with an]...airspeed indicator," with no further details regarding what markings, if any, should be on the indicator. However, Section 9.10.1 of the standard, entitled "Pilot Operating Handbook" cites a requirement that "airspeed indicator range markings" be addressed in the POH as a section heading with related information within the POH.

Passenger Warnings

ASTM 2245-04 Section 9.10 "Required Placards and Markings" required a passenger warning that stated "This aircraft was manufactured in accordance with Light Sport Aircraft airworthiness standards and does not conform to standard category airworthiness requirements." This portion of the standard requires this information be included in the Pilot Operating Handbook provided by the manufacturer. The location of the placard or the direct requirement for this placard is not addressed in any other part of the standard.

CFR 91.327 (e) states "Each person operating an aircraft issued a special airworthiness certificate in the light-sport category must advise each person carried of the special nature of the aircraft and that the aircraft does not meet the airworthiness requirements for an aircraft issued a standard airworthiness certificate." In the final ruling for the "Certification of Aircraft and Airmen for the operation of Light- Sport Aircraft, Passenger warnings (now part 91.327 (e)" the FAA elaborated stating "Placards are acceptable if displayed so that a passenger can readily see and take note of the warning."

The Zlin Flight Manual, Section 9 in the flight manual, cites the passenger warning requirements as outlined in the ASTM standards. According to the current United States distributor for this airplane, it is installed on the left side of the airplane to the left of the passenger, right above the words "light-sport." Evidence of this placard was not located within the wreckage. The area where it was supposed to be installed was destroyed.

Stall Information

According to the Flight Manual Section 5 "Performance", the stall speeds (VS) with "power off at maximum takeoff and landing weight" were as follows:

Zero Flaps - 43 mph
1st Position of Flaps - 41 mph
2nd Position of Flaps - 38 mph

The manual stated that "aircraft buffeting will announce an impending stall." The manufacturer stated in Section 7 - Normal Procedures that "the natural tendency after the wing stalls is to pitch nosedown." The manual continued to state that the airfoil is "noted for its early warning of an impending stall and the benign stall characteristics after it occurs."

Several experienced pilots, interviewed by the Safety Board IIC during the course of the investigation, stated that they had experienced stall conditions in the Zlin Savage well above the published stall speeds. One flight instructor stated that while climbing out he encountered what he felt was a downdraft and the airplane "began an enormous descent." He stated that the airplane handled as though it "were in a deep and unrecoverable stall." Another flight instructor with extensive experience in various S-LSA aircraft experienced a stall in the Zlin Savage around 58 mph, well above the published stall speed. He stated that during this particular flight he was climbing in smooth air, wings level. Other owners and pilots with experience in the Zlin Savage characterized the stall as docile and slow.

Rudder Cable Hose Clamps

As a result of the discovery of the unapproved hose clamps, Zlin Aviation s.r.o. issued Service Bulletin number 1. This directed owners to inspect their airplane for the unapproved hose clamps and removed them if installed. In addition, the bulletin directed owners to examine the rudder cable for any wear that may have resulted due to the hose clamp.

In an interview with the distributor for the accident airplane, he stated that these hose clamps were installed by the mechanic who performed the condition inspection. The mechanic would not sign the airplane off for this inspection without these being installed, due to the "slop" in the rudder cables. He stated further that the cables easily came out of the pulley track and the hose clamp helped ensure the cable would stay in the track.

Pilot Information

Certificate:	Private	**Age:**	57,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	August 1, 2006
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 1, 2006
Flight Time:	3400 hours (Total, all aircraft), 5 hours (Total, this make and model), 50 hours (Last 90 days, all aircraft), 28 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Zlin Aviation s.r.o.	**Registration:**	N808GS
Model/Series:	Savage	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Special light-sport (Special)	**Serial Number:**	0073
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	July 1, 2007	**Certified Max Gross Wt.:**	1235 lbs
Time Since Last Inspection:	32.4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	60.5 Hrs at time of accident	**Engine Manufacturer:**	Rotax
ELT:	Installed, not activated	**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:	TCC,4065 ft msl	**Distance from Accident Site:**	46 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	143°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	16 knots / 24 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.06 inches Hg	**Temperature/Dew Point:**	31°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Bell Ranch Apt, NM (PVT)	**Type of Flight Plan Filed:**	None
Destination:	Bell Ranch Apt, NM (PVT)	**Type of Clearance:**	None
Departure Time:	09:30 Local	**Type of Airspace:**	

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:**	35.768054,-103.984169

Administrative Information

Investigator In Charge (IIC):	Kaiser, Jennifer
Additional Participating Persons:	Bruce L Jeffcoat; FAA Flight Standards District Office; Albuquerque, NM Keith Hartlaub; Savage Aircraft Sales; Manitowoc, WI Eric Tucker; Rotax Flying & Safety Club; Nassau - Bahamas
Report Date:	April 2, 2008
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=66444