



# Aviation Investigation Final Report

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<b>Location:</b>	Chuckey, Tennessee	<b>Accident Number:</b>	ERA13FA017
<b>Date &amp; Time:</b>	October 11, 2012, 13:50 Local	<b>Registration:</b>	N290AL
<b>Aircraft:</b>	Arion Lightning	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of control in flight	<b>Injuries:</b>	1 Serious, 1 Minor
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

The experimental amateur-built airplane accelerated normally during the takeoff roll for the Phase 1 test flight before pitching up sharply and beginning a slow climb to about 50 to 60 feet above the ground. The wings rocked back and forth as it drifted off the left side of the runway. Witnesses reported that the airplane appeared out of control and off center. The airplane was heading toward trees and a residence when the pilot-rated passenger, who was on board to record information during the test flight, took control of the airplane, lowered the nose, and turned away from obstructions; however, the nose abruptly dropped and the airplane struck the ground. Postaccident examination of the airplane did not reveal any preimpact malfunctions or failures that would have precluded normal operation. The flaps were found in the fully extended position and, given reports of the airplane's behavior after the takeoff, were likely fully extended during takeoff and at the time of impact. The owner/builder reported that the normal takeoff procedure called for a 10-degree flap setting and that the airplane did not have a pretakeoff checklist, which would be developed during the flight testing. An estimated weight and balance calculation for the accident flight placed the airplane about 30 pounds over its published maximum gross weight and about a 1/2 inch from its aft center of gravity limit; however, the maximum gross weight is about 75 pounds below the general specifications listed by the kit manufacturer. The owner and pilot-rated passenger stated that they did not discuss or perform weight and balance calculations before the accident flight.

The airplane had been operated for about 15 hours since new and since its most recent condition inspection, which was performed about 1 month before the accident. The pilot's total flight experience in make and model consisted of about 3 hours with a flight instructor and about 4 hours of solo flight experience. Given the lack of a pretakeoff checklist and the pilot's minimal flight experience in the airplane make and model, it is likely that he began the takeoff with flaps fully extended, which combined with the airplane's high gross weight and near-limit aft center of gravity, resulted in the loss of airplane control.

## Probable Cause and Findings

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

The pilot's inadequate preflight planning, which resulted in an attempted takeoff at a high gross weight, near the limit of its aft center of gravity, and with the airplane incorrectly configured with fully extended flaps. Contributing to the accident was the lack of a pretakeoff checklist and the pilot's lack of total flight experience in make and model.

### Findings

<b>Personnel issues</b>	Weight/balance calculations - Pilot
<b>Personnel issues</b>	Aircraft control - Pilot
<b>Aircraft</b>	TE flap control system - Incorrect use/operation
<b>Personnel issues</b>	Use of checklist - Not specified
<b>Personnel issues</b>	Total experience w/ equipment - Pilot

## Factual Information

### History of Flight

<b>Prior to flight</b>	Preflight or dispatch event
<b>Takeoff</b>	Loss of control in flight (Defining event)
<b>Uncontrolled descent</b>	Collision with terr/obj (non-CFIT)

On October 11, 2012, about 1350 eastern daylight time, an experimental amateur-built Arion Lightning, N290AL, operated by a private individual, was substantially damaged when it impacted the ground during takeoff from Hensley Airpark (04TN), Chuckey, Tennessee. The commercial pilot was seriously injured and a pilot-rated passenger sustained minor injuries. Visual meteorological conditions prevailed and no flight plan had been filed for the local personal flight that was conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

The airplane was based in a residential aviation community at 04TN.

The owner/builder of the airplane reported that it was purchased as a kit about 3 or 4 years prior to the accident and he took it to the Arion Lightning factory located at the Shelbyville Municipal Airport (SYI), Shelbyville, Tennessee, to participate in a builder assist program during the summer prior to the accident. The airplane was issued a Federal Aviation Administration (FAA) special airworthiness certificate on September 14, 2012, and he estimated that it was flown for about 20 hours around Shelbyville, before returning to 04TN, about 1 week prior to the accident.

The airplane's operating limitations called for the airplane to be flown for 40 hours for Phase 1 flight testing. On the day of the accident, the pilot, who was a friend of the owner/builder, was planning to conduct a local flight to practice maneuvers such as slow flight and stalls, while the passenger recorded information during the flight. Both occupants were wearing parachutes as back support because the interior was not complete. A preflight check of the airplane's fuel level revealed about 15.5 gallons.

Witnesses observed the airplane taking off from runway 1, a 2,900-foot-long, 50-foot-wide, asphalt runway. Several witnesses reported that the airplane's engine sounded as if it was developing full power, and the nose gear lifted off the runway, then settle back onto the runway, before the airplane "pitch-up sharply." The airplane began to slowly climb, with its wings "wobbling" back and forth, and it drifted to the left of the runway. One witness stated that the airplane looked "slow" and was in a nose high attitude when its right wing dipped, struck the ground, and the airplane cartwheeled.

The passenger reported that pilot applied full engine power and that the airplane accelerated normally. The airplane lifted off about 800 to 1,000 feet down the runway without hesitation. He thought the rotation was faster than he expected and that the pilot may have over-rotated. He could not see any of the instrument readings on the primary flight display (PFD) from his position. The airplane slowly climbed to an altitude of about 50 to 60 feet above the ground and was "wallowing." The pilot made a comment about the airplane "not feeling right." The airplane seemed to be in slow flight; with the wings rocking. It drifted off the left side of the runway and was heading toward trees and a residence when the

passenger elected to assume control of the airplane, which the pilot relinquished. The passenger lowered the nose and started a right bank toward an opening in the tree line; however, the airplane's nose abruptly dropped to 45 to 60 degrees, and the airplane struck the ground.

### Pilot Information

<b>Certificate:</b>	Commercial; Flight instructor	<b>Age:</b>	67
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane; Helicopter	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	Airplane single-engine	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 With waivers/limitations	<b>Last FAA Medical Exam:</b>	August 17, 2009
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 4800 hours (Total, all aircraft), 7 hours (Total, this make and model), 7 hours (Last 90 days, all aircraft), 7 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

### Pilot-rated passenger Information

<b>Certificate:</b>	Airline transport; Commercial; Flight engineer; Flight instructor	<b>Age:</b>	49
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	Airplane multi-engine; Airplane single-engine	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 1 With waivers/limitations	<b>Last FAA Medical Exam:</b>	May 3, 2012
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	17100 hours (Total, all aircraft), 0 hours (Total, this make and model)		

The pilot, age 67, held a commercial pilot certificate, with ratings for airplane single-engine land, and airplane multiengine land. He also held a flight instructor certificate, with a rating for airplane single-engine land. The pilot reported 4,750 hours of total flight experience on his most recent FAA third-class medical certificate, which was issued on May 10, 2011.

During the 30 days preceding the accident, the pilot received flight training at the Arion Aircraft factory in Shelbyville, Tennessee. The training consisted of about 3 hours with a flight instructor and about 4 hours of solo flight experience. The flight time was split between the accident airplane and a factory demo airplane.

The pilot was critically injured and was unable to provide any information about the accident.

The pilot-rated passenger held an airline transport pilot certificate with ratings for airplane single-engine land and airplane multiengine land. He reported about 17,100 hours of total flight experience. He estimated that he had flown about 1,500 hours in light general aviation airplanes, which included about 500 hours in a Vans RV-7A, which he built.

### Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Arion	<b>Registration:</b>	N290AL
<b>Model/Series:</b>	Lightning	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	2012	<b>Amateur Built:</b>	Yes
<b>Airworthiness Certificate:</b>	Experimental (Special)	<b>Serial Number:</b>	76
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	2
<b>Date/Type of Last Inspection:</b>	September 14, 2012 Condition	<b>Certified Max Gross Wt.:</b>	1320 lbs
<b>Time Since Last Inspection:</b>	15 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	15 Hrs at time of accident	<b>Engine Manufacturer:</b>	Jabiru
<b>ELT:</b>	C126 installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	3300A
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	120 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The two-seat, low-wing airplane, serial number 76, was primarily constructed of composite material. It was powered by a Jabiru Aircraft 3300A, serial number 33A-1813, 120-horsepower engine, equipped with a Sensenich WC62FK-58 wooden propeller assembly.

Examination of maintenance records revealed that the airplane's most recent condition inspection was performed on September 14, 2012. The airplane had been operated for about 15 hours since new and since the condition inspection.

A search of the accident site did not reveal any checklists associated with the airplane. When specifically asked about a pretakeoff checklist, the owner/builder stated that there was none, and it would be developed as part of the Phase 1 flight testing.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	TRI,1519 ft msl	<b>Distance from Accident Site:</b>	22 Nautical Miles
<b>Observation Time:</b>	13:53 Local	<b>Direction from Accident Site:</b>	40°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	3 knots /	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>		<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	30.22 inches Hg	<b>Temperature/Dew Point:</b>	18°C / 3°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Chuckey, TN (04TN)	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Chuckey, TN (04TN)	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	13:50 Local	<b>Type of Airspace:</b>	Class G

The weather reported an airport located about 22 miles northwest of the accident site, at 1353, was: wind variable 3 knots; visibility 10 statute miles; clear skies; temperature 18 degrees Celsius (C); dew point 3 degrees C; altimeter 30.23 inches of mercury.

## Airport Information

<b>Airport:</b>	Hensley Airpark 04TN	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	1430 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	01	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	2900 ft / 50 ft	<b>VFR Approach/Landing:</b>	None

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Serious	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	1 Minor	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Serious, 1 Minor	<b>Latitude, Longitude:</b>	36.183334,-82.678886(est)

The airplane came to rest on a heading of about 250 degrees, on grass, about 150 feet left of and just prior to the northern end of the runway. A ground scar was observed about 100 feet south of the main wreckage. All major portions of the airplane were accounted for at the accident site. The canopy and the portion of the fuselage forward of the cockpit seats were separated and the left and right wing assembly was canted downward about 45-degrees. The nose gear and engine were located about 25 feet south of the main wreckage.

Examination of the airframe, which included flight control continuity checks and the engine, which included continuity and compression checks, did not reveal any mechanical malfunctions that would have precluded normal operation.

The airplane's flaps were observed at or near the fully-extended position of 40 degrees. The flap actuator jackscrew was measured and the flap system photographed. The information was provided to a representative of the kit manufacturer who indicated that the information was consistent with the flaps having been placed in the fully extended position prior to the impact.

The flap setting was controlled by a switch on the instrument panel and electronically displayed on a PFD. The display consisted of four boxes which would fill-in as the desired flap setting was reached. The passenger reported that the flaps were in the retracted position during the preflight and he did not recall the pilot adding flaps prior to the flight. The owner/builder reported that the normal takeoff procedure called for a 10-degree flap setting.

The airplane was equipped with a Grand Rapids Technology (GRT), Engine Information System (EIS) 6000, and Electronic Flight Information System (EFIS) Sport SX PFD, which were forwarded to the NTSB Vehicle Recorders Division, Washington, DC for data download.

## **Additional Information**

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### Cockpit Displays

Examination of the GRT EIS 6000 engine monitor revealed that it did not contain any internal memory for the recording of engine information. After power was applied to the device, the unit displayed a total engine hours of 15.1 and a prior flight time of 0:08:00.

Examination of the EFIS Sport SX PFD revealed that it contained non-volatile memory and was capable of recording parameter information onto a USB memory device, if inserted into the rear of the unit. The owner/builder was not aware of the USB function and no USB devices were recovered from the accident site. The unit did not record any flight parameters, including flap position to internal memory. The unit flight logbook page showed that the most recent flight prior to the date of the accident occurred on September 29, 2013, when the airplane was flown from SYI to 04TN.

### Weight and Balance

According to documentation provided by the builder\owner, the airplane's maximum gross weight was 1,320 pounds and center of gravity range was 29.5 to 34.0 inches. Estimated weight and balance calculations for the accident flight placed the airplane's gross weight at about 1,350 pounds and its center of gravity at about 33.55 inches, at the time of the accident.

The owner and passenger stated that there were no discussions or calculations performed pertaining to weight and balance prior to the accident flight.

It was noted that Arion Aircraft provided both a light-sport aircraft (LSA) and an experimental-amateur-built (EAB) version of the Arion Lightning. General specification information for the LSA and EAB versions of the lightning listed the maximum gross weights as 1,320 and 1,425 pounds; respectively.

#### Operating Limitations

The airplane's operations limitations called for the airplane to be flown for 40 hours for Phase 1 flight testing to meet the requirements of FAA Federal Aviation Regulation Part 91.319(b). The airplane's operating limitations were issued on September 14, 2012, and stated, in part:

"...During the flight-testing phase, no person may be carried in this aircraft during flight unless that person is essential to the purpose of the flight."



## Administrative Information

<b>Investigator In Charge (IIC):</b>	Schiada, Luke
<b>Additional Participating Persons:</b>	Rocky Davidson; FAA\FSDO; Nashville, TN Nick Otterback; Arion Lightning LLC.; Shelbyville, TN
<b>Original Publish Date:</b>	March 24, 2014
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	
<b>Investigation Docket:</b>	<a href="https://data.ntsb.gov/Docket?ProjectID=85309">https://data.ntsb.gov/Docket?ProjectID=85309</a>

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

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](#).