Aviation Investigation Final Report

Location:	Gainesville, Georgia	**Accident Number:**	ERA19FA049
Date & Time:	November 17, 2018, 18:35 Local	**Registration:**	N8448J
Aircraft:	Lancair LEGACY RG	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The pilot/owner and flight instructor were returning from a cross-country flight and arrived in the vicinity of the airport after dark in visual meteorological conditions. The flight instructor requested (to the air traffic controller) and was cleared for a practice GPS approach to the runway, which was equipped with precision approach path indicator (PAPI) lighting. Flight data indicated the approach was flown using the autopilot. Just after the airplane passed the final approach fix, the flaps were partially extended, the pitch attitude decreased, and the airplane descended below the glidepath. The autopilot commanded nose up elevator and the airplane returned to slightly above the glidepath where it remained stable for about 16 seconds, before drifting to nearly a full-scale course deviation above the glidepath. The autopilot commanded the elevator to nose down, and the electric pitch trim to near the full nose-down position. The autopilot was then disconnected. Although the autopilot can automatically disengage in the event of a system failure, no failures were observed in the recorded data. Therefore, it was likely that the autopilot was manually disengaged. About 15 seconds later, the flaps were extended to full and then fully retracted. The descent rate increased, and the airplane descended below the glidepath, until the recorded data ended when the airplane was about 0.3 mile from the runway. The airplane then struck trees, crossed over a road, and impacted the left side of a localizer antenna platform before coming to rest in the grass short of the runway.

Examination of the wreckage and the recorded flight data did not reveal any preimpact electrical or mechanical anomalies that would have precluded normal operation. The pilot's guide for the autopilot system warned that with the autopilot engaged, a small amount of force on the pitch controls can result in the autopilot automatic trim entering an out-of-trim condition. As the airplane drifted above the glidepath, the autopilot attempted to command nose-down elevator, and the elevator servo met with some resistance, as evidenced by the increase in elevator servo torque, which was sufficient to activate the electric pitch trim. Given that there were no indications of a flight control malfunction, it is likely that one of the pilots was applying pressure to the elevator control in the cockpit, and the autopilot applied elevator trim to counteract that pressure, in its attempt to return to the glidepath.

At the time the autopilot was disengaged, the pitch trim was full nose down, which likely resulted in an unexpected increase in the (forward) force the pilot felt on the control stick, making it more difficult to control the airplane. The airplane's nose-down tendency would have increased further when the flaps were subsequently extended to full. This would have resulted in an even greater forward force on the control stick. It is likely that the pilot decided to then retract the flaps fully, due to the increased nose-down force on the control stick. However, the flap retraction resulted in an increased descent rate, and the airplane descended farther below the glidepath.

A witness and the flight instructor reported that the airplane rolled inverted before impact. The recorded flight data, which ended when the airplane was on the extended runway centerline about 0.3 mile from the runway and about 50 ft above the runway elevation, did not indicate that the airplane had rolled inverted. The struck trees were also located on the extended runway centerline, about 0.1 mile from the end of the runway. Therefore, it is unlikely that the airplane experienced any significant lateral course deviation or roll, between the end of the recorded data and the struck trees. It is likely that the roll occurred after the airplane struck the trees and before it impacted the localizer antenna platform.

The flight instructor had limited memory of the accident flight. He recalled that the pilot/owner was flying the airplane during the approach; however, the investigation was unable to determine which pilot was manipulating the controls at the time of the accident.

Probable Cause and Findings

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

The pilots' failure to execute a go-around when the nighttime autopilot-coupled approach became unstable, which resulted in a loss of control and subsequent impact with terrain. Also causal was the flight instructor's inadequate supervision of the pilot and his failure to perform remedial action. Contributing to the accident was the inadvertent application of pressure to the pitch control while the autopilot was engaged, which caused an out-of-trim condition that was not identified by either pilot and resulted in control difficulty when the autopilot was disengaged.

Findings

Aircraft	Descent/approach/glide path - Not attained/maintained
Personnel issues	Lack of action - Instructor/check pilot
Personnel issues	Lack of action - Pilot
Personnel issues	Aircraft control - Instructor/check pilot
Personnel issues	Aircraft control - Pilot
Personnel issues	Monitoring other person - Instructor/check pilot
Aircraft	Autopilot trim servo - Unintentional use/operation
Environmental issues	Dark - Effect on personnel
Personnel issues	Identification/recognition - Pilot
Personnel issues	Identification/recognition - Instructor/check pilot

Factual Information

History of Flight

Approach-VFR pattern final	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

This report was modified on December 15, 2020. Please see the docket for this accident to view the original report.

On November 17, 2018, about 1835 eastern standard time, an experimental amateur-built Lancair Legacy RG, N8448J, was substantially damaged when it was involved in an accident in Gainesville, Georgia. The private pilot owner of the airplane was fatally injured, and the flight instructor was seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

The accident occurred during the third flight of the day. The first flight was local and flown solo by the flight instructor; he performed three takeoffs and landings at Lee Gilmer Memorial Airport (GVL), Gainesville, Georgia. Both pilots flew the airplane on the second flight from GVL to Charleston Executive Airport (JZI), Charleston, South Carolina. The accident occurred on the third fight, which departed JZI about 1728, and arrived in the vicinity of GVL at 1835, about 1 hour after sunset.

As the airplane approached GVL, the flight instructor requested clearance from the air traffic controller for a practice GPS approach to runway 23, which the controller approved. Runway 23 was at an elevation of 1,276.9 ft mean sea level (msl) and equipped with a two-light precision approach path indicator (PAPI), located on the left side.

A witness in an airplane waiting to takeoff from runway 23 saw the accident airplane approach the runway. He indicated that he saw the landing lights, which "became dim and they appeared to roll 180 degrees" before the accident.

The flight instructor recalled that the pilot was flying the airplane on the approach when the airplane suddenly became inverted. He did not recall any further details.

According to flight data recorded by the airplane's primary flight display (PFD), while at an altitude of 3,500 ft msl with the autopilot engaged, the airplane arrived at the initial approach fix from the southeast and turned left onto the inbound course. About 12 seconds before the airplane reached the final approach fix, the autopilot vertical mode changed from altitude hold mode to glidepath mode. Just after the airplane passed the final approach fix at an indicated airspeed of 165 knots, the flaps were extended to 17°. The pitch attitude then changed from 0° to about 9°nose down, the indicated airspeed increased from 165 to 177 knots, and the airplane descended below the glidepath. The autopilot elevator servo began applying torque to the elevator in the nose-up direction, and the airplane then stabilized slightly above the glidepath for about 16 seconds. The pitch attitude then increased slightly, and the airplane

drifted above the glidepath, as the autopilot began applying torque to the elevator servo in the nose-down direction. About 2.6 nautical miles from the runway at an altitude of 2,200 ft msl (923 ft above the runway elevation) and an indicated airspeed of 138 knots, the landing gear were lowered and the airplane drifted farther above the glidepath. The elevator servo torque increased, and as a result, the electric pitch trim (controlled by the autopilot, when engaged) increased continuously from a value of 8 units to 67 units in the nose-down direction (which is at or near the full nose down position; it remained at this value until the recording ended), as the elevator servo continued to apply torque in the nose-down direction. The pitch attitude decreased to about 2.5° nose down, however the airplane remained above the glidepath. The course deviation indicator (CDI) increased to nearly the full scale "fly down" indication. The engine power parameter was 42%, where it remained for most of the approach. About 1.6 miles from the runway, at an altitude of 1,900 ft msl (623 ft above the runway) and an indicated airspeed of 127 knots, just as the pitch trim servo reached the value of 67 units, the autopilot was disengaged. About 15 seconds later, the flaps were extended to 40°, remained there for about 5 seconds, and were then fully retracted. As the flaps were retracting, the airplane was descending through the glidepath, the descent rate increased from about 600 ft per minute (fpm) to about 1,200 fpm, and the pitch attitude began to slowly increase from about 2° nose down to 2° nose up. The roll attitude varied between 8° left wing down and 3° right wing down after the flaps were retracted. The engine power was reduced to 32% about 4 seconds before the recorded data ended. The last recorded data point was captured when the airplane was about 0.3 mile from the runway, on the extended runway centerline, at an altitude of 1,323 ft msl (46 ft above the runway). The indicated airspeed was 110 knots, the descent rate was 1,029 fpm, the wings were level, and the pitch attitude was about 2.5° nose up. The CDI indicated full scale "fly up" indication.

About 0.1 mile from the runway, while on the extended runway centerline, the airplane struck tree tops that were about the same elevation as the runway (the trees were about 50 ft tall and located in a valley), at the edge of a 4-lane divided highway oriented perpendicular to the runway. The airplane descended and impacted terrain and a wooden platform that held the localizer antenna for runway 05, located about 500 ft from the approach end of runway 23.

A review of the PFD flight data for each flight on the day of the accident did not reveal any indications of preflight checks of the elevator trim or autopilot system.

Pilot Information

Certificate:	Private	**Age:**	68,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	December 5, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 289 hours (Total, all aircraft), 96 hours (Total, this make and model)		

Flight instructor Information

Certificate:	Airline transport; Flight instructor	**Age:**	69,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	July 7, 2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 7500 hours (Total, all aircraft), 52 hours (Total, this make and model)		

Examination of the pilot's logbook revealed the last entry was dated August 21, 2017, before he purchased the accident airplane. The logbook contained complex and high-performance endorsements. His experience in the accident airplane was documented in an airplane usage logbook and an email printout; both were found in the wreckage. The records indicated that he flew with another pilot for at least 92 of the 96 flight hours in the accident airplane but did not indicate the nature of those flights or details to document currency.

Aircraft and Owner/Operator Information

Aircraft Make:	Lancair	**Registration:**	N8448J
Model/Series:	LEGACY RG No Series	**Aircraft Category:**	Airplane
Year of Manufacture:	2015	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	L2K-338
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	December 3, 2017 Condition	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	149 Hrs	**Engines:**	Reciprocating
Airframe Total Time:	358 Hrs at time of accident	**Engine Manufacturer:**	Continental Motors
ELT:	C126 installed	**Engine Model/Series:**	IO-550-N8B
Registered Owner:		**Rated Power:**	310 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The two-seat, low-wing, composite, retractable tricycle design airplane was built in 2015. It was equipped with an autopilot and an electric pitch, roll, and yaw trim system.

According to a Lancair Owners and Builders Organization Lancair Legacy training manual, deployment of the flaps causes the nose to pitch down, requiring up-elevator trim. It further states that "flight without an operational pitch trim system is difficult."

According to the Garmin G3X Pilot's Guide, a section titled "Overpowering Autopilot Servos" reads:

In the context of this discussion, "overpowering" refers to any pressure or force applied to the pitch controls when the autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

Overpowering the autopilot during flight will cause the autopilot's automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

The pilot's guide also notes that in addition to being disengaged manually, the autopilot can also disengage automatically in the event of a system failure, invalid sensor data, or the inability to compute default autopilot modes. The guide did not indicate that the autopilot would disengage automatically due to excessive control or trim forces. No failures were noted in the recorded data, however the guide did not provide details on which failure conditions are captured by the recording system.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	GVL,1275 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	18:53 Local	**Direction from Accident Site:**	211°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	130°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.2 inches Hg	**Temperature/Dew Point:**	11°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Charleston, SC (JZI)	**Type of Flight Plan Filed:**	None
Destination:	Gainesville, GA (GVL)	**Type of Clearance:**	VFR
Departure Time:	17:28 Local	**Type of Airspace:**	Class G

According to U.S. Naval Observatory records, the sun had set at 1730, civil twilight ended at 1757, and the moon was in the waxing gibbous phase with 70% of the moons disk illuminated.

Airport Information

Airport:	Lee Gilmer Memorial GVL	**Runway Surface Type:**	Asphalt
Airport Elevation:	1275 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	23	**IFR Approach:**	Global positioning system
Runway Length/Width:	5500 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	34.278888,-83.824996

A 175-ft-long debris path extended from the localizer platform along a heading of 215° magnetic to the main wreckage which came to rest upright, on a heading of about 225°.

Additional debris were found near the struck trees on the approach path. Paint chips and small carbon fiber pieces were found at the base of the tree line. The left wingtip and one of the landing gear doors were found in the highway median. Tree branches and limbs were strewn from the tree line across the highway along the runway heading.

Examination of the wreckage revealed that all major components of the airplane were present at the accident site. The left wing was fractured and partially separated about 2 ft from the root, and the flap was completely separated from the wing. The right wing was fractured and partially separated at the root, and the right aileron and about 4 ft of the outboard section of the right wing were separated from the wing. The vertical stabilizer was fractured in several locations. An outboard section of the left elevator about 1-ft-long was separated from the remainder of the elevator. The elevator trim tab was deflected trailing edge upward (airplane nose down). The aileron trim tab, located on the left aileron, was faired. The left flap was separated from the wing. The right flap was found in the retracted position. All of the circuit breakers were in (inactivated) with the exception of the 3 amp starter relay breaker, which was in the out (activated) position.

The rudder controls were intact and continuous from the pedals to the rudder. The aileron controls were continuous from the control stick through several bending overload breaks in the push-pull tubes, to the aileron control horns. The elevator controls were continuous from the control stick through an overload fracture in the aft push-pull tube rod end. The elevator trim tab was found deflected 30°-35° trailing edge up relative to the elevator, which correlated to the airplane nose down direction.

Examination of the elevator trim tab servo motor revealed that the actuator arm was nearly in the full nose-down trim position. The motor functioned normally when electrical power was applied in both the nose-up and nose-down directions. Examination of the pitch trim switches on each of the control sticks (pilot side and copilot side) revealed that they functioned normally. The autopilot elevator servo motor rotated freely in both directions when manually rotated.

The engine remained attached to the airframe and the propeller remained attached to the crankshaft propeller flange. Chordwise scratches were present on all 3 propeller blades. There were leading edge gouges and aft bending with slight twisting on two blades. The top spark plugs were removed and exhibited light-colored combustion deposits. The spark plug electrodes exhibited normal-to-worn out signatures when compared to the Champion Check-A-Plug chart. The fuel pump remained attached to the engine, the drive coupling was intact, and the fuel pump discharged a small amount of fuel when turned by hand. The fuel nozzles were removed and found to be free of obstruction. The engine crankshaft was rotated by hand using the propeller. The magnetos produced spark on all six top ignition leads. Thumb compression and suction was noted on all six cylinders with proper valve movement established. Continuity throughout the engine and accessory section was established and no anomalies were noted with the engine that would have precluded normal operation prior to the accident.

Additional Information

On the evening after the accident, in response to a request from the airport manager, a contractor flew the GPS approach to runway 23 at GVL. He noted that the Precision Approach Path Indicator (PAPI) lighting system, which provides pilots with visual vertical guidance in relation to the approach path, appeared to be consistent with the GPS approach path that he flew.

Medical and Pathological Information

The Hall County Coroner's Office, Gainesville, Georgia conducted an autopsy on the pilot. The cause of death was generalized trauma.

Toxicology testing performed on the pilot by the FAA Forensic Sciences Laboratory identified Alfluzosin and Ibuprofen in urine. Alfluzosin is a prescription medication used to treat symptoms of an enlarged prostate and is not considered impairing. Ibuprofen is an over-the-counter medication used to reduce fever and to relieve minor aches and pain; it is also not considered impairing.

Tests and Research

A further review of the PFD flight data revealed that the previous four landing approaches were flown with the autopilot off. Similar to the accident flight, each approach was flown using the flaps in two steps, initially about 15-20°, and subsequently 35-40° before landing. During all four approaches, the initial flap deployment occurred at airspeeds that were slower than when deployed on the accident flight by 5 to 25 knots. At the time of initial flap deployments, the airplane's pitch attitude decreased between 1° and 3° on three of the approaches and did not change appreciably on one approach. The final flap selections were made at speeds similar to the accident approach. At the time of the flap movement, the airplane's pitch attitude decreased by 5° to 6° during three of the approaches, and by 3° to 4° degrees on one approach.

The recorded values for pitch trim during all the previous landings ranged from a low of -12 (nose up) units to a high of +22 (nose down) units.

A review of all recorded data (a total of 10 previous flights dating back to October 7, 2018), revealed limited use, for short durations, of the autopilot during flight. There were no flights, other than the accident flight, in which the autopilot was used during an approach to landing.

Administrative Information

Investigator In Charge (IIC):	Brazy, Douglass		
Additional Participating Persons:	Danny Cox; FAA/FSDO; Atlanta, GA Christopher Lang; Continental Motors; Mobile, AL		
Original Publish Date:	December 17, 2020	**Investigation Class:**	2
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98650		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.