Aviation Investigation Final Report

Location:	Boulder City, Nevada	**Accident Number:**	WPR19LA141
Date & Time:	May 7, 2019, 16:00 Local	**Registration:**	N423EB
Aircraft:	Flight Design CTLS	**Aircraft Damage:**	Substantial
Defining Event:	Aerodynamic stall/spin	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot departed on a local flight with a passenger to a nearby lake. As the airplane reached the lake, the pilot perceived a sudden increase in his indicated airspeed. He responded by retarding the throttle to the idle position then advancing the throttle back to full power, at which point he observed a warning light for an engine control unit "Lane B" failure and a message on the primary flight display (PFD), "Rotax: Land Aircraft." The pilot immediately returned to the airport and performed a rapid descent when he realized that he was high for the approach. He was unsuccessful in reducing his airspeed while over the first half of the runway and decided to execute a go-around maneuver as the airplane passed midfield. An eyewitness reported that when he observed the airplane attempt the go-around at the end of the runway, the engine did not "initially" sound like it reached full power. The airplane subsequently stalled and impacted terrain.

According to the engine manufacturer, the "Lane B" failure would not have affected engine performance, and recorded engine and aircraft parameters indicated the engine continued to run and respond to throttle position changes normally throughout the flight. The data showed the unexplained increase in airspeed occurred following a change in the throttle position and the resultant increase in engine rpm. The recorded data are consistent with the pilot's account of events leading up to the point the go-around was initiated. The data indicated that the throttle was moved to 95% about 20 seconds before the airplane stalled. The engine rpm increased, but the airspeed decreased from 52 knots to 35 knots and the angle of attack increased to 99% during that time. A postaccident examination of the airplane revealed no preimpact mechanical failures or anomalies that could have precluded normal flight.

The accident is consistent with the pilot failing to monitor the airplane's performance during the return to the airport, which resulted in the need to go around due to being too fast to land on the remaining runway. During the go-around maneuver, the pilot did not advance the throttle to 100%, which resulted in the airspeed decreasing and angle of attack increasing until the airplane stalled.

Probable Cause and Findings

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

The pilot's improper monitoring and failure to maintain airspeed during a critical phase of flight, which resulted in an exceedance of the airplane's critical angle of attack, an aerodynamic stall, and subsequent impact with terrain.

Findings

Personnel issues	Attention - Pilot
Aircraft	Airspeed - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Aircraft	Angle of attack - Not attained/maintained

Factual Information

History of Flight

Enroute	Sys/Comp malf/fail (non-power)
Approach-VFR go-around	Aerodynamic stall/spin (Defining event)
Approach-VFR go-around	Collision with terr/obj (non-CFIT)

On May 7, 2019, about 1600 Pacific daylight time, a Flight Design CTLS, N423EB, was substantially damaged when it was involved in an accident at Boulder City Municipal Airport (BVU), Boulder City, Nevada. The pilot was seriously injured, and the passenger received minor injuries. The airplane was operated as a Title *14 Code of Federal Regulations* Part 91 personal flight.

The purpose of the flight was to take the non-pilot passenger on a scenic flight over a nearby lake. According to the pilot, after the airplane reached the lake at a cruise altitude of 4,000 ft mean sea level (msl), which was about 1549, the engine rpm spontaneously increased, and the indicated airspeed subsequently increased to 134 knots. He stated the engine power setting was 5,000 rpm and indicated airspeed was 95 knots with autopilot engaged at the time of the increase. The pilot later reported that he did not actually verify the increase in engine power but, rather, assumed the power had increased due to the sudden increase in airspeed. The pilot "immediately" retarded the throttle to the idle position but observed no change in the rpm until about 8 seconds later, when the rpm reached idle. Following this event, the pilot re-advanced the throttle to 5,000 rpm and observed a warning message on the avionics display with the caption "Rotax: Land airplane" accompanied by the illumination of the "ECU Channel B" warning light on the annunciator panel.

The pilot discontinued the flight and returned to BVU. When he was about 5 nautical miles (nm) from the airport, he descended to 3,000 ft msl and reduced the throttle to idle to begin an extended approach, but could not slow the airplane to 80 kts, the maximum airspeed to deploy 15° of flaps. Additionally, he was unable to descend with "the appropriate nose attitude" and decided to execute the emergency descent checklist from the pilot's operating handbook (POH) by reducing the engine power to idle and initiating a slip maneuver. He did not deploy the wing flaps. As the airplane reached the touchdown zone of the runway, the pilot pitched the airplane into a slight nose-high attitude and overflew the runway at approximately 100 ft above ground level (agl). He then chose to discontinue the landing attempt as his airspeed was too fast to touch down on the remaining runway. After the airplane passed beyond the midpoint of the runway, the pilot observed that airspeed decrease below the maximum touchdown speed (70 knots), but the airplane was still 100 ft agl. At this time, he recognized that the remaining runway was insufficient to complete a safe landing and attempted a go-around maneuver by advancing the throttle to full power. Seconds later, as the airplane was crossing the departure end of the runway and the pilot was preparing to deploy 15° of flaps, he looked outside and observed the airplane in a high rate of descent. The pilot turned about 10° to the left in the three seconds that followed just before the airplane impacted a municipal pond. Before the impact he heard three beeps, which indicated

a high angle of attack. During a subsequent interview, the pilot added that he had been focused on his indicated airspeed throughout the landing attempt and was not monitoring his engine performance.

According to a witness who observed the accident from about halfway down the runway, the airplane caught his attention during its approach to the runway as it appeared to be excessively fast and high for its position on the final approach leg of the airport traffic pattern. As the airplane descended to the runway surface, it initially floated over the runway at the 1,000 ft marker for about 1,700 feet near the runway 09/27 intersection. At this point, the airplane appeared to initiate a go-around maneuver as the engine power increased and the airplane began a climb, but the engine did not "initially" sound like it advanced to full power. After it reached about 200 ft above ground level near the end of runway 15, the airplane entered a nose high attitude, which was immediately followed by a nose down dive in a slight left turn. The airplane impacted terrain beyond airport property.

Engine and airplane performance data was recovered from two Dynon Skyview primary flight displays (PFD), and fault warning data was recovered from an engine control unit (ECU). The Dynon engine data correlating to about the time the pilot reported the unexplained increase in airspeed shows the value associated with the throttle position increased from 83 at 1549:33 and stabilized at 88 at 1549:36. At 1549:35 the engine revolutions per minute (rpm) increased from about 4,450 rpm to about 4,900 rpm at 1549:44 and true airspeed (TAS) increased from about 98 kts to 122 knots during the same timeframe. The Dynon engine data indicated the engine responded accordingly to commanded throttle positions throughout the accident flight, and no anomalies with the engine's operation or performance were evident in the data.

The ECU continuously recorded any faults that were triggered while the engine was operating. The fault data were extracted from the ECU, which showed two failures during the accident flight. One failure was recorded approximately 7 minutes before the end of recorded data, which correlated to about the time the pilot experienced the Lane B failure near the lake. According to the software, this particular fault read "Nominal Current Not Reached"; however, the manufacturer reported that this fault would not have affected engine power. The second fault, represented as the last item in green text in figure 1 was captured when the engine shut down.

Cycle	Time	Category	FC_Class	FC_Type	FC_Test	FC_Error	Fault Reading
A 476	301:41:53	Failure	3: Component	5: FTPU	0: FTPU Test	1: Synchronization Lost	2
B 407	301:42:19	Failure	3: Component	5: FTPU	0: FTPU Test	1: Synchronization Lost	2
A 621	374:28:28	Failure	3: Component	5: FTPU	0: FTPU Test	1: Synchronization Lost	2
B 581	411:51:22	Failure	1: Sensor	11: Crank Bias Negative Voltage	2: Failure Test	1: Below Range	1.19741
B 672	462:15:37	Failure	3: Component	5: FTPU	0: FTPU Test	1: Synchronization Lost	2
B 796	582:57:36	Failure	3: Component	5: FTPU	0: FTPU Test	1: Synchronization Lost	2
B 883	**642:40:11**	**Failure**	**2: Actuator**	**5: Ignition 1 (Cyl 1 and 2)**	**1: TPU Test**	**1: Nominal Current Not Reached**	**30**
B 883	642:47:43	Failure	2: Actuator	7: Generator Select	3: Test While Not Commanding Gen	5: Generator Select In Failsafe	6.91866

Figure 1: Fault Codes from Rotax Software

The pilot began a descent at 1555:06 about 2.5 nm northeast of the airport from 3,500 ft msl (1,300 ft above ground level). Seconds later, the Dynon recorded the airplane's maximum airspeed during the accident flight, which was a true airspeed of 134 kts and 124 KIAS. At 1556:31, while on short final about 0.5 nm north of the airport and about 400 ft above the runway, the airplane's vertical speed rapidly increased momentarily about 30 seconds before the airplane reached the runway. At 1556:54, the airplane reached the runway touchdown zone and while over the first half of the runway the pilot's airspeed reduced from about 76 knots indicated airspeed to about 53 knots, and the engine power was reduced to about 1,600 rpm. In the last half of the runway the engine rpm advanced to 4,695 rpm with a corresponding throttle position of 95%, while the airspeed decreased further to about 47 knots. At the

end of the runway, the airplane's pitch attitude increased to about 14° nose up and the indicated airspeed decreased to about 35 knots. The airplane then descended into the ground.

The pilot stated that the airplane's stall speed was 42 knots with 15° of flaps and 45 kts with no flaps. According to the pilot's operating handbook (POH), the airplane's stall speed in a no flap configuration was 47 knots indicated airspeed.

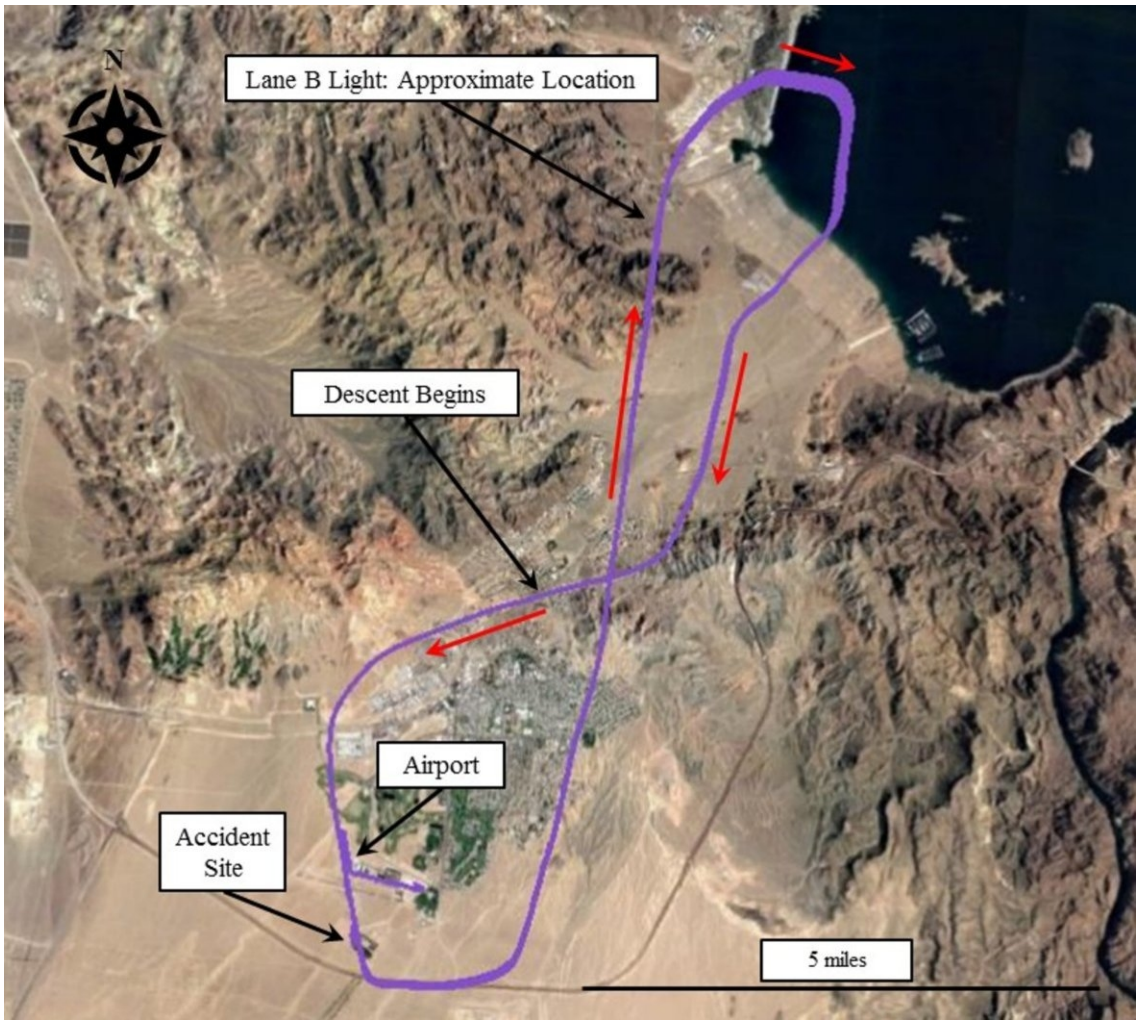

Figure 2: Flight Track Data from Dynon PFD

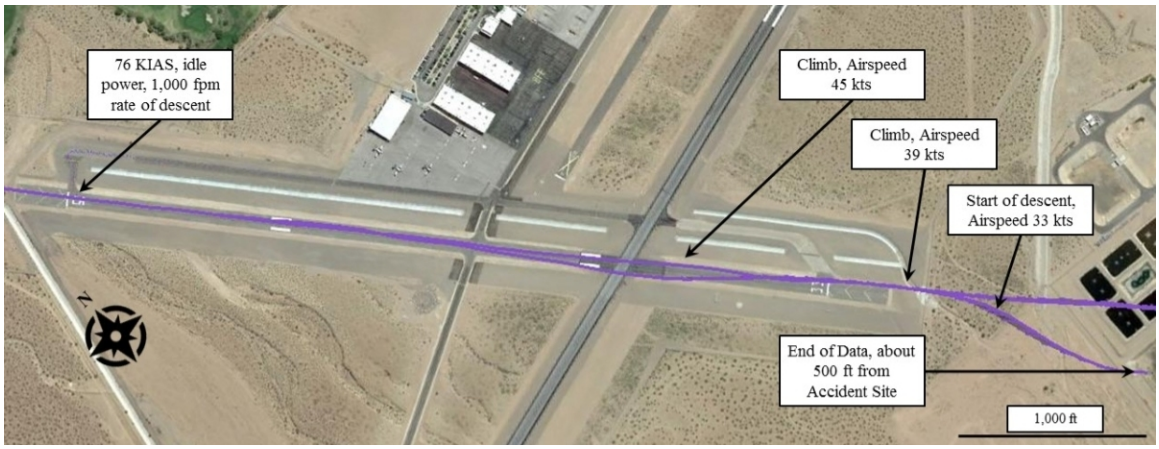

Figure 3: Final Moments of Flight, Track Data from Dynon PFD

A review of photographs furnished by the operator revealed substantial damage to the wings and fuselage.

Engine Control Unit (ECU)

According to a representative of Rotax, the ECU managed numerous engine parameters including, but not limited to engine speed, metered air/fuel ratio, ignition timing, fuel flow…etc. The Rotax Installation Manual stated that the ECU was comprised of two modules, Lane A and Lane B, redundancies that are each capable of controlling the engine. In an error-free operating environment, both lanes are engaged. While operating in Lane A, Lane B functions as a backup to ensure that engine operation can be maintained in the event of the failure or reduced functionality of Lane A. The ECU automatically selects a Lane to control the engine based on the activity and failure status of the engine. Rotax noted that Lane A is capable of managing all of the engine parameters, while Lane B is capable of managing a portion of those parameters.

In the event of a Lane failure, a warning light on the instrument panel annunciator display would appear. This panel was developed by the airframe manufacturer and located directly about the Dynon PFD. (see Photograph 1)

According to Dynon, the engine ECU provided numerous parameters that were transmitted to the SkyView panel display through a CAN bus interface. Dynon reported that the SkyView's internal software would present one of the following captions on the display based on guidance from the Rotax flight manual:

- ROTAX: LIMIT FLIGHT OP, which is displayed as a caution message with either the Lane A or Lane B light is flashing.
- ROTAX: LAND AIRCRAFT, which is displayed as a warning message when either the Lane A and Lane B lights or both are solid.

This information was based on SkyView software 15.1.0, which was released in March 2017, but was also valid for the version used by the accident pilot, 15.3.5. Dynon confirmed that a solid Lane B

warning lamp would have displayed the message “Rotax: Land Aircraft” after the pilot depressed the “Warning” button. The pilot did not recall depressing a button to see the message appear.

Figure 4: Annunciator Panel

Airplane and Engine Examination

Flight control continuity was confirmed from the cockpit to each of the airplane’s primary control surfaces. Additionally, throttle control continuity was verified from the throttle lever to the throttle body and displayed full travel from stop to stop when actuated by hand. The fuel system was not compromised.

Mechanical continuity was confirmed from the accessory case to the propeller through the crankshaft as the propeller was rotated by hand. Thumb compression and suction were verified for all four cylinders. Successful movement of the valvetrain was confirmed for cylinder nos. 2 and 4; however, the propeller seized before the remaining valves could be verified. Cylinder no. 4 displayed a buildup of lead deposits, which reduced the clearance between the no. 4 cylinder head and the piston. This inhibited the engine from achieving full rotation during the examination.

All three Neuform composite propeller blades were attached at the blade hub. One propeller blade was fractured at the blade root, another blade was fractured at the blade tip, and the final blade was intact, but cracked about midspan.

Engine Performance

The engine’s climb performance was computed using a performance data and chart from the engine manual and based on a computed density altitude of 1,389 m. At take-off power and 0 m density altitude, the engine could produce 100 hp and 5,800 rpm. On the day of the accident, the engine was limited to about 85 hp (64kW) and about 5,300 rpm. However, according to the airplane manufacturer, during manufacture the propeller pitch is set so that rpm will only reach 5,500 rpm at full throttle in flight. This translates to about 4,950 maximum static rpm, and 5,100 climb rpm. Factoring in the

airplane's manufacturer's pitch position, the engine would have been limited to about 4,600 climb rpm at the time of the accident.

Pilot Information

Certificate:	Private	**Age:**	61,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:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	September 1, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	January 4, 2019
Flight Time:	480 hours (Total, all aircraft), 232 hours (Total, this make and model), 480 hours (Pilot In Command, all aircraft), 15 hours (Last 90 days, all aircraft), 4 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Flight Design	**Registration:**	N423EB
Model/Series:	CTLS Undesignat	**Aircraft Category:**	Airplane
Year of Manufacture:	2013	**Amateur Built:**	
Airworthiness Certificate:	Normal; Special light-sport (Special)	**Serial Number:**	F-12-07-05
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	December 24, 2018 Annual	**Certified Max Gross Wt.:**	1320 lbs
Time Since Last Inspection:	41 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	511.9 Hrs at time of accident	**Engine Manufacturer:**	Rotax
ELT:	C126 installed, not activated	**Engine Model/Series:**	912 iS2
Registered Owner:		**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:	KBVU,2202 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	14:15 Local	**Direction from Accident Site:**	333°
Lowest Cloud Condition:	Scattered / 10000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	13 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.78 inches Hg	**Temperature/Dew Point:**	29°C / 0°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Boulder City, NV (BVU)	**Type of Flight Plan Filed:**	None
Destination:	Boulder City, NV (BVU)	**Type of Clearance:**	None
Departure Time:	15:37 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	Boulder City Muni BVU	**Runway Surface Type:**	Asphalt
Airport Elevation:	2203 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	15	**IFR Approach:**	None
Runway Length/Width:	3852 ft / 75 ft	**VFR Approach/Landing:**	Go around

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	35.936389,-114.85444

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	John Waugh; Federal Aviation Administration; Las Vegas, NV Bernhard Kobylik; Austrian Safety Investigation Authority Jordan Paskevich; Rotech Flight Safety; Vernon Arian Foldan; Flight Design; Woodstock, CT
Original Publish Date:	May 19, 2022 **Investigation Class:** 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99403