Aviation Investigation Final Report

Location:	Plainville, Connecticut	**Accident Number:**	ERA18FA189
Date & Time:	July 12, 2018, 10:42 Local	**Registration:**	N17DR
Aircraft:	Rutan Defiant	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot, who was one of the builders of the twin-engine, experimental, amateur-built airplane, was conducting a local flight in the airport traffic pattern. A wing-mounted camera captured the ground operations and accident flight. After seemingly normal engine start and runup checks, the pilot departed to the north, remaining in the airport traffic pattern for a subsequent landing. While over the runway threshold on landing approach, he initiated a go-around. The airplane climbed left of the runway centerline, then entered a steep, descending left turn at varying angles of bank, some exceeding 60º. The airplane continued to descend in an erratic manner until it impacted the ground.

An examination of the aircraft systems and engines revealed no evidence of a preimpact anomaly or failure. There was ample fuel on board for the flight. The forward engine wooden propeller showed evidence of rotational damage. Although the aft engine propeller was generally undamaged, the crash dynamics and the aft mounting of the propeller assembly likely shielded it from damage during impact. Although conditions at the time of the accident were conducive to serious carburetor icing at glide power, an electronic engine monitor showed no evidence of a loss of engine power, nor did a sound spectrum study of the wing-mounted camera audio.

Autopsy and toxicology testing of the pilot revealed no evidence of physiological impairment or incapacitation, and the reason for the pilot's erratic and aggressive maneuvering after the go-around could not be determined.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's loss of airplane control during climb for reasons that could not be determined based on the available information.

Findings

Personnel issues	Aircraft control - Pilot
Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

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

On July 12, 2018, about 1042 eastern daylight time, an experimental, amateur-built Rutan Defiant airplane, N17DR, was substantially damaged in an accident near Robertson Field Airport (4B8), Plainville, Connecticut. The private pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to a receipt recovered from the wreckage, the pilot purchased 20 gallons of 100 low lead aviation gasoline the day before the accident.

A GoPro camera was mounted on the left, rear wing, facing aft over the trailing edge. The camera had a view of a portion of the wing and the top of a flight control surface. Scenery behind the airplane indicated that the airplane was parked on the ramp on the west side of runway 2. About 1030, a voice was heard yelling, "clear prop," and an engine could be heard starting. About 2 minutes later, the second engine was started. The pilot began to taxi the airplane to the runway at 1033. After noises consistent with engine runup and magneto checks on both engines, the pilot taxied onto the runway and began the takeoff roll about 1037.

The airplane became airborne near the 1,000 ft markers on the runway. As the airplane climbed, its flight path moved immediately to the left of the runway centerline. The pilot then corrected back to the runway centerline, and the airplane subsequently moved to the right of the centerline. About 1 minute after takeoff, the pilot initiated a left turn onto the crosswind leg of the traffic pattern for runway 2. The airplane continued onto a left downwind, followed by a left base leg for runway 2. About 1041, the airplane crossed over the runway 2 threshold. At that point, the pilot initiated a go-around and the engine noise increased. The airplane was noticeably left of the runway centerline as it climbed away from the runway threshold.

The airplane continued to track more than 60° left of the runway centerline and continued in an erratic, primarily descending, left turn. Engine power was audible; engine noise was generally consistent with at least one engine producing power. The airplane continued in a steep left descending turn, at times estimated to be more than 60° of bank. Engine noise lessened as it descended over a housing development. The airplane impacted the ground about 1042. First responders arrived at the site about 6 minutes later.

A witness reported that he was on the ramp at 4B8 preparing for an instructional flight. He saw the accident airplane climb out from runway 2 and immediately veer to the left. The airplane was 150-200 ft above the ground near the fixed base operator. The airplane continued in a steep left bank until it disappeared below the horizon and crashed. He may have heard at least one engine operating at the time of the accident. There was no smoke trailing the airplane.

Another witness was in his kitchen with the sliding glass door open. He heard a low-flying airplane, then went outside and saw the airplane flying directly over his condo. The airplane appeared to be in a "downward descent" about 40 ft above the ground. The airplane then banked hard to the left such that he could see the underside of the airplane. He then heard a loud crash; however, he did not see the impact.

Pilot Information

Certificate:	Private	**Age:**	67,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	BasicMed	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 6, 2016
Flight Time:	(Estimated) 765 hours (Total, all aircraft), 225 hours (Total, this make and model), 4 hours (Last 90 days, all aircraft), 0 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

The pilot's multi-engine rating was valid for the Rutan Defiant only. The pilot was listed in Federal Aviation Administration (FAA) airworthiness records as one of the builders of the airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	Rutan	**Registration:**	N17DR
Model/Series:	Defiant	**Aircraft Category:**	Airplane
Year of Manufacture:	2004	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	7007
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	December 1, 2017 Condition	**Certified Max Gross Wt.:**	3000 lbs
Time Since Last Inspection:	4 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	286 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C91A installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-320-D3G
Registered Owner:		**Rated Power:**	160 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The engine service times could not be determined by the aircraft maintenance records. The forward engine was originally delivered with a carburetor; however, an aftermarket fuel injection system was added before installation on the airframe. According to the engine logbook, the engine had accumulated 4,421 hours as of September 21, 2000; no overhaul information was available. At the time of installation on the accident airplane on July 10, 2004, the logbook entry indicated 30.3 hours time in service.

The aft engine was carbureted. When installed on July 10, 2004, the logbook entry indicated 1,009 hours since major overhaul; the total time in service was not recorded.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KHFD,18 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	360°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.18 inches Hg	**Temperature/Dew Point:**	24°C / 11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Plainville, CT (4B8)	**Type of Flight Plan Filed:**	None
Destination:	Plainville, CT (4B8)	**Type of Clearance:**	None
Departure Time:	10:37 Local	**Type of Airspace:**	Class E

According to the carburetor icing probability chart in FAA Special Airworthiness Information Bulletin CE-09-35, Carburetor Icing Prevention, dated June 30, 2009, the temperature/dew point at the time of the accident was conducive to the development of serious carburetor icing at glide power.

Airport Information

Airport:	Robertson Airport 4B8	**Runway Surface Type:**	Asphalt
Airport Elevation:	201 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	02	**IFR Approach:**	None
Runway Length/Width:	3665 ft / 75 ft	**VFR Approach/Landing:**	Go around;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	41.683887,-72.870002(est)

The airplane collided with upsloping terrain inside a city-owned landfill about 0.4 mile southwest of the airport center. The wreckage path was oriented on a 150° heading and was about 105 ft long and about 25 ft wide. The airplane came to rest on a 060° heading. There was no fire.

Flight control continuity was established from the aft-mounted wing/rudder assembly control surfaces to the cockpit. The left wing spar was broken and pushed aft about 20° at the outboard junction with the left fuel tank; however, the wing remained attached by fiberglass skin. The right wing remained attached to the fuselage. Control surface continuity from the forward-mounted canards to the cockpit was not established due to postimpact damage. The left elevator was separated from the canard during the accident sequence. The right canard and elevator remained attached to the fuselage.

The nose landing gear was separated during the impact sequence. The left and right main gear struts remained attached to the fuselage. The right main gear tire remained attached to the right strut; the left main gear tire separated during the accident sequence and was located adjacent to the left wing tip.

The left and right fuel tank selector handles were in the OFF positions; however, first responders reportedly turned them off and removed the battery. Both fiberglass main fuel tanks were breached. A total of 2 gallons of clean, blue-colored fuel was recovered from the tanks. Both fuel filler caps were secure, and the seals were pliable and undamaged.

The forward engine partially separated from the fuselage, remaining attached by wires, cables, and hoses. The propeller hub remained attached to the engine. The wooden blades shredded and splintered during the impact sequence and were found in several areas of the wreckage path. The engine was not examined on scene due to the inaccessibility of the wreckage.

The aft engine remained attached to the fuselage and the engine mount was uncompromised. The propeller remained attached to the crankshaft. The wooden blades were undamaged except for superficial, non-rotational scratches. The engine was not examined on scene due to the inaccessibility of the wreckage.

The front left 3-point seat belt remained attached to its buckles. The anchor was pulled away from the fiberglass wall by impact forces.

The wreckage was recovered to a secure storage facility for additional examination of the engines and propellers.

Forward Engine

As first viewed, the forward engine was missing the oil filter assembly, oil dipstick, and a portion of the engine-driven fuel pump. The fuel servo was detached from its mount and hanging by its fuel-carrying lines below the engine.

The engine was equipped with an aftermarket, experimental fuel injection system. The airflow performance system was comprised of a flow divider that was securely installed to the top of the engine, fuel injection nozzles in each cylinder, and a fuel servo that was found impact-separated from the lower side of the engine but remained attached to its fluid-carrying lines.

The engine-driven fuel pump was impact-separated from the rear of the engine. The fuel pump mating flange remained securely installed with its attaching hardware; however, the lower half of the pump body was separated.

The magnetos were both found secured to the engine with some impact damage noted. After removal, both magnetos produced spark at all points when rotated manually using an electric drill. The ignition harness exhibited impact damage and was not tested.

The spark plugs for the Nos. 1 and 3 cylinders displayed carbon fouling signatures; the spark plugs for the Nos. 2 and 4 cylinders had normal signatures when compared to a Champion Check-a-Plug chart.

The oil filter and oil filter adapter were fractured from the accessory housing and missing.

Minor impact damage was noted on the rocker box covers and induction and exhaust pipes. The airbox was crushed upwards and into cylinder No. 2.

Thumb compression was confirmed on all cylinders when the crankshaft was rotated by hand with the top spark plugs removed. Continuity was confirmed throughout the engine, including the valve train and accessory sections. A lighted borescope inspection of all cylinders was unremarkable.

Fuel injection nozzles were found installed in each cylinder with corresponding injection lines securely installed. The nozzles were removed, inspected, and found to be unobstructed.

Aft Engine

As first viewed, the aft engine was found attached to its engine mount, which was attached to the rear firewall. The engine mount showed signs of impact damage with various bends. The engine mount was cut to allow engine separation for examination purposes.

The carburetor was found secured to the engine and attached to the engine's airbox. Upon disassembly, a trace amount of fuel was found within the float bowl. The brass floats did not reveal any signatures of hydraulic crushing. No other anomalies were noted with the carburetor. The fuel pump was actuated by hand and produced suction and compression at its corresponding inlet and outlet ports.

The magnetos were both found securely installed to the engine at the time of the examination. Timing was checked and left magneto was found at 26-degrees and the right magneto at 28-degrees before top dead center.

The aft engine spark plugs did not exhibit the same carbon fouled/rich condition signatures as the forward engine. The Nos. 2, 3, and 4 plugs were heavily corroded at the time of the exam. No damage to the electrodes were noted.

The ignition harness exhibited minor impact damage to some of the lower plug connections. The harness was not tested or retained for further examination.

There were no signs of metal particulates found in the engine. The oil suction screen was removed and found to be clean and unobstructed. The oil filter was present, but was not cut open and inspected. The oil cooler was found attached with lines secured, and no anomalies were noted.

The exhaust pipes for cylinder Nos. 1 and 3 showed signs of impact damage. All four intake pipes were removed and found to be unobstructed.

A lighted borescope inspection revealed lead deposits on all piston faces; no other anomalies were noted.

Thumb compression and valve train continuity were confirmed on all four cylinders by manually rotating the propeller with the top spark plugs removed.

Signs of a preexisting oil leak were present on cylinder Nos. 3 and 4 at the top side of the cylinder around the spark plug hole and cooling fins. The shroud tubes on these cylinders had an orange RTV-type sealant applied between the crankcase and cylinder heads.

Additional Information

Engine Data Monitor

The airplane was equipped with a J.P. Instruments Engine Data Monitor 760 (EDM-760) mounted in the cockpit. The EDM-760 was removed from the wreckage and sent to the NTSB Vehicle Recorders Laboratory for examination.

The EDM-760 was damaged from impact and would not power up. The device was then disassembled and five memory chips were read. The retrieved data contained 18 flights, including the accident flight. The duration of the data on the accident flight was 12 minutes 18 seconds. Exhaust gas temperature (EGT) and cylinder head temperature (CHT) were recorded for each cylinder on both engines. The EDM-760 was configured to record a new set of data every 6 seconds. A final set of data would have been recorded about 2 seconds before ground impact; however, these data could not be recovered, and the last data set was recorded about 8 seconds before ground impact.

The EGT and CHT values showed that, while in flight, cylinder No. 2 on the forward engine tracked lower than other cylinders; however, observations of the previous 17 flights showed the same trend.

The EGT and CHT values during the 25-second time period between the go-around and ground impact were also examined. The values indicated no significant drop in either CHT or EGT for either engine during this period. The EGT for the aft engine showed a slight increase during the final 10 seconds of recorded data, while the CHT remained generally stable. The CHT for the forward engine increased slightly during the last 10 seconds, while its corresponding EGT remained generally stable.

Sound Spectrum Study of GoPro Video

The audio portion of the GoPro video was evaluated in an attempt to determine engine operating speeds during flight. It was noted that, while the airplane was in the traffic pattern, wind noise often obfuscated

propeller blade passage frequency (BPF). In two portions of the sound spectrum, BPF reached about 78 Hertz (Hz), which equated to an engine speed of 2,340 rpm. It was not possible to individually isolate the sound of each engine's noise during the accident flight; however, there were no audio indications from the study that one engine lost power relative to the other during the flight.

Medical and Pathological Information

The Office of the Chief Medical Examiner of the State of Connecticut performed the autopsy of the pilot. The cause of death was blunt impact injuries of the head and torso.

The FAA Forensic Sciences Laboratory performed toxicology testing on specimens from the pilot. Testing was negative for carbon monoxide, ethanol, and drugs of abuse. Testing for cyanide was not performed.

Administrative Information

Investigator In Charge (IIC):	Hicks, Ralph
Additional Participating Persons:	Daniel Ballou; FAA/FSDO; Windsor Locks, CT David Harsanyi; Lycoming Engines; Williamsport, PA
Original Publish Date:	May 19, 2020
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97742