Aviation Investigation Final Report

Location:	Missoula, Montana	**Accident Number:**	WPR22LA231
Date & Time:	June 27, 2022, 10:02 Local	**Registration:**	N12VV
Aircraft:	JAMES C GEYMAN RV-9A	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot reported that he was performing flight testing after accumulating 9 hours of flight time on the recently constructed airplane. He departed with 16 gallons of fuel in the right tank and 8 gallons in the left tank. The pilot then flew for about 70 minutes with the fuel selector on the right tank. As the airplane approached the airport to land, a total loss of engine power occurred, and the pilot switched the fuel selector to the left fuel tank but did not activate the auxiliary fuel pump and his attempt to restart the engine was unsuccessful. The flight characteristics in the airplane's final moments suggest the airplane entered an aerodynamic stall when it began a steep left turn and rapidly descended into the ground.

Postaccident examination of the wreckage did not reveal any preimpact mechanical anomalies with the engine or airframe that would have precluded normal operation. The pilot departed with about 15 gallons of usable fuel in the selected tank, and then flew for about 70 minutes. The engine was likely consuming fuel at a rate of about 12 gallons per hour (gph), which would have yielded a total fuel consumption of about 14 gallons during this flight. Fuel flow data indicated that the engine-driven fuel pump likely cavitated just before the engine lost power, which was likely caused by an unporting of the right fuel tank pickup due to insufficient fuel in the selected fuel tank. It is likely that the pilot's improper fuel management resulted in fuel starvation and a loss of engine power. Further, the pilot's failure to activate the auxiliary fuel boost pump likely inhibited the engine restart.

Probable Cause and Findings

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

The pilot’s improper fuel management, which resulted in fuel starvation and a loss of engine power. Contributing to the accident was the pilot’s failure to activate the auxiliary fuel boost pump, which inhibited a successful engine restart.

Findings

Aircraft	Fuel - Fluid management
Personnel issues	Use of equip/system - Pilot
Aircraft	Fuel - Fluid level
Personnel issues	Decision making/judgment - Pilot
Aircraft	Fuel pumps - Not used/operated

Factual Information

History of Flight

Enroute	Fuel starvation (Defining event)
Emergency descent	Aerodynamic stall/spin

On June 27, 2022, about 1002 mountain daylight time, an experimental amateur-built Van's RV-9A airplane, N12VV, was substantially damaged when it was involved in an accident near Missoula, Montana. The pilot was seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the pilot (and builder of the accident airplane), he was performing flight tests on his airplane to break in the engine. The pilot reported that he completed one test flight on the morning of the accident and landed about 0800 to refuel the airplane. He then departed with the fuel selector positioned on the right fuel tank. The right fuel tank contained16 gallons of fuel; 8 gallons of fuel were in the left tank. Data retrieved from an onboard recording device showed that the airplane departed runway 29 at 0850. The pilot flew the airplane in a racetrack style pattern from the southeast to northwest in an area about 2 nautical miles (nm) west of his departure airport for about 1 hour 15 minutes. According to the parametric data, at 1000:10 the fuel flow became increasingly erratic with two spikes indicating a fuel consumption of about 42 gph. During this time, the engine speed, exhaust gas temperatures, and cylinder head temperatures decreased over time. The pilot contacted air traffic control to inform them that his engine was "surging" and was "probably about to quit." The controller then cleared the pilot to land on runway 8. After the engine quit the pilot switched fuel tanks from the right tank to the left tank and the engine restarted for about 2 seconds before it quit again.

An airport surveillance video showed the airplane descending from a low altitude as it approached the airport from the northwest. While passing near the approach end of runway 8, the airplane made a steep left turn from an estimated altitude of about 30 ft above ground level and descended rapidly towards the ground and impacted terrain, which resulted in substantial damage to the left wing. The airport manager stated that the wreckage came to rest between runway 12/30 and taxiway alpha between midfield and the approach end of runway 30. The wreckage was located about 0.5 nm east of the approach end of runway 8.

Wreckage examination

Postaccident examination of the airplane and engine did not reveal any preimpact mechanical anomalies. The fuel system was traced from each wing tank to the carburetor at the engine through the fuel selector, which rotated normally and was unobstructed. The fuel lines that had not been damaged from impact or removed to transport the airplane were secure.

Mechanical continuity was established throughout the rotating group, valvetrain, and accessory section as the crankshaft was manually rotated at the propeller by hand. Thumb compression was achieved at all four cylinders and the valves displayed normal lift when the crankshaft was rotated. Examination of the cylinders' combustion chamber interior components using a lighted borescope revealed normal piston face and valve signatures and no indications of catastrophic engine failure. The engine-driven fuel pump functioned normally when tested by hand.

Fuel Consumption

Data retrieved from a Garmin G3X onboard recording unit displayed the fuel quantities as 18 gallons in the right tank and 18 gallons in the left tank (totaling 36 gallons) from 0837 to 0849. At 0849, about when the engine was advanced to full power, the fuel quantities changed to 2 gallons in the left fuel tank and 13 gallons in the right fuel tank. These quantities were displayed for the remainder of the flight. The fuel flow advanced to about 10 gph during takeoff and remained between 10-14 gph until about 1000, at which time the fuel flow became erratic showing a minimum of 2 gph and a maximum of 42 gph at 1001:19. One second later, the engine speed began to reduce from 2,240 rpm to idle power and then 100 rpm.

According to the engine manual for an O-360-A1A, which is comparable to the engine that was installed on the accident airplane and had the same compression ratio, the fuel consumption is 9.5 gph at 65% power, 10.5 gph at 75% power, and 14.9 gph at 100% power. Using the recorded engine data, an average fuel consumption of 12 gph would have resulted in a total fuel burn of about 14 gallons.

The pilot reported that he was using 10.5 gph to determine the engine's fuel consumption for the flight and added that he did not activate the electric fuel pump after the engine quit. At 10.5 gph, the engine would have consumed a total of about 12.25 gallons in the airplane's 70 minutes of flight. According to the pilot, he had not yet determined the airplane's unusable fuel quantity, but assumed it was about 1 gallon. The pilot also noted that he was operating at higher power settings to break in the engine during the accident flight.

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):	Airplane	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 20, 2022
Flight Time:	1350 hours (Total, all aircraft), 800 hours (Total, this make and model), 1300 hours (Pilot In Command, all aircraft), 37 hours (Last 90 days, all aircraft), 27 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	JAMES C GEYMAN	**Registration:**	N12VV
Model/Series:	RV-9A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	93267
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	June 7, 2022 Condition	**Certified Max Gross Wt.:**	1750 lbs
Time Since Last Inspection:	8 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	9 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, activated, aided in locating accident	**Engine Model/Series:**	YO-360-EXP278
Registered Owner:	On file	**Rated Power:**	180
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:	KMSO,3195 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	340°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.23 inches Hg	**Temperature/Dew Point:**	19°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Missoula, MT (MSO)	**Type of Flight Plan Filed:**	None
Destination:	Missoula, MT	**Type of Clearance:**	VFR
Departure Time:	08:50 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	MISSOULA INTL MSO	**Runway Surface Type:**	Asphalt
Airport Elevation:	3205 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	30/12	**IFR Approach:**	None
Runway Length/Width:	9501 ft / 150 ft	**VFR Approach/Landing:**	Forced landing;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	46.916306,-114.09055

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Jeff Simmons; Federal Aviation Administration; Helena, MT Troy Helgeson; Lycoming Engines; Williamsport, PA
Original Publish Date:	April 18, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=105366