



# Aviation Investigation Final Report

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<b>Location:</b>	Burlington, Washington	<b>Accident Number:</b>	WPR21LA002
<b>Date &amp; Time:</b>	October 1, 2020, 15:00 Local	<b>Registration:</b>	N601SA
<b>Aircraft:</b>	Zenith CH601	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of engine power (total)	<b>Injuries:</b>	1 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Flight test		

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## Analysis

The pilot of the experimental, amateur-built airplane reported that he remained in the airport traffic pattern after departure and, while turning from base to final during landing, the engine lost total power. The airplane impacted terrain short of the runway and sustained substantial damage to the fuselage. The pilot provided conflicting statements regarding which fuel tank was selected at the time of the accident, and also drained fuel from the tanks before the airplane was examined; therefore, the amount of fuel onboard at the time of the accident was not determined.

Examination of the fuel system confirmed continuity from each tank to the fuel selector. The exterior of the gascolator exhibited a green film that saturated the fuel line from the gascolator to the engine-driven fuel pump. The fuel line from the gascolator to the carburetor was disconnected and purged. With the fuel selector in the right tank position, no fuel could be extracted from the fuel line. With the fuel selector in the left tank position, about 1 pint of a lime green-colored substance was purged from the fuel line. Examination of the throttle body also revealed the presence of the lime green substance. The liquid was consistent with 100LL aviation fuel; however, the lead content was higher than specification, which may have been the result of a lead-scavenging additive that the pilot used. The reason for its abnormal color could not be determined with the sample amount available.

The wreckage was released to the pilot, who reported that he tested the ignition system and suggested that a coil selector anomaly may have resulted in the loss of power. However, his test was incomplete and unconfirmed. The reason for the loss of engine power could not be determined based on available evidence.

# Probable Cause and Findings

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

The total loss of engine power for reasons that could not be determined based on the available information.

## Findings

<b>Aircraft</b>	Fuel - Unknown/Not determined
<b>Aircraft</b>	(general) - Unknown/Not determined

## Factual Information

### History of Flight

Approach-VFR pattern base	Loss of engine power (total) (Defining event)
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On October 01, 2020, about 1500 Pacific daylight time, an experimental, amateur-built Zodiac 601XL, N601SA, was substantially damaged when it was involved in an accident in Burlington, Washington. The private pilot was not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 test flight.

The pilot reported that, before takeoff, he added fuel that contained a lead scavenging additive. He departed and remained in the airport traffic pattern. While turning from base to final about 300 ft above ground level (agl), the engine lost total power. He reported that he immediately retracted the flaps and engaged the starter in an unsuccessful attempt to restart the engine. The airplane impacted the ground about 1,500 ft short of the runway. As the airplane's ground speed decreased, the airplane transitioned from the dirt surface to an asphalt surface road that ran perpendicular to the direction of travel. The airplane came to rest upright and sustained substantial damage to the lower fuselage longerons.

Federal Aviation Administration (FAA) aviation safety inspectors arrived at the accident site and interviewed the pilot. The pilot stated that when the engine lost power, the fuel selector was operating on the left wing fuel tank. Later, the pilot provided a written statement which indicated that at the fuel selector was on the right wing fuel tank at the time of the accident.

The night of the accident, the inspectors observed minimal fuel in the left wing tank, as the fuel level was about 1/2 inch from the fuel tank pickup. The right wing fuel tank contained considerably more fuel. Three weeks after the accident, during the FAA examination of the airplane's fuel system, 5.5 gallons of fuel was drained from the right wing fuel tank, and about two gallons of fuel were drained from the left wing fuel tank. The pilot later stated that he drained fuel from the wing tanks before the examination took place. The amount of fuel onboard at the time of the accident could not be determined.

The fuel tanks were intact, and the fuel quantity indicators were accurate. Continuity of the fuel lines from the left and the right wing tanks was observed to the three-way fuel selector. The fuel selector valve was operational, and the fuel selector had three positions: Off, Left, and Right. The exterior of the gascolator was not damaged but exhibited a green film that saturated the fuel line from the gascolator to the engine-driven fuel pump. The fuel line from the gascolator to the carburetor was disconnected and purged. With the fuel selector in the Right position, no fuel could be extracted from the fuel line. With the fuel selector in the Left position, about one pint of a lime green-colored substance was purged from the fuel line. Examination of the throttle body also revealed the presence of the lime green substance.

NTSB Materials Laboratory Senior Chemist examined the lime green substance, which revealed an artificially high-octane level. The cause for the out-of-specification finding could not be determined. The results for the D86 Distillation were within the specified ranges for

Avgas 100LL. The Fourier Transform Infrared (FTIR) spectrum and the distillation results indicate that the liquid was aviation gasoline and showed that the green-colored fuel should have been able to support combustion in an internal combustion engine.

According to an aviation gasoline manufacturer, for Avgas 100LL to turn green, “some contaminant that is broadly yellow through to red in colour” could be the cause for the color change. The presence of a fine ferrous particulate material or copper particulate material are examples of possible contaminants. Another possibility is fuel standing in the selector for a long period and the fuel itself degrading. According to the manufacturer, this would be unusual, but it could be possible if the selector has fuel wetted surfaces that are made of a catalytic metal such as copper.

The fuel manufacturer did not recommend the use of an additional lead scavenging additive since the fuel itself is formulated with additives specifically designed to reduce lead build-up on engine components.

Additional material testing could not be performed with the available fuel sample; therefore, the exact cause of the fuel color change could not be determined.

The airplane was released to the pilot, and he performed an examination of the airplane’s ignition system. The examination identified an instrument panel with an ignition switch A (Ignition A), and ignition switch B (Ignition B). In the airplane and affixed to the instrument panel, a placard identified Ignition A, and was additionally placarded with the word ‘Start’. About 1/2 inch to the right, was Ignition B along with an additional placard with the word ‘Run’. Ignition A was used to start the engine, while Ignition B was used for continuous engine operation, to run the engine. Examination of the ignition system was accomplished with the engine operating about 1,000 rpm. When Ignition A was independently operated in the ‘On’ position, operation was normal. When Ignition B was operated in the ‘On’ position, the system also presented as normal operation. However, with Ignition B ‘On’, when Ignition A was turned to the ‘Off’ position, the engine lost total power.

The pilot provided the results of his ignition system test and cited the coil selector as the cause of the ignition system failure. The pilot reported that Ignition A and Ignition B were connected by Mallory 29000 coil selector. The Mallory coil selector is a directional dual inlet, single outlet coil selector engineered for high performance enthusiasts or racing applications operating a dual ignition system. To isolate the Ignition B failure, the coil wires for Ignition A and Ignition B were interchanged. A successful engine start was accomplished with Ignition A in the ‘On’ position and remained operating with Ignition B in the ‘On’ position. Once again, when Ignition A was turned to the ‘Off’ position, the engine lost total power. Next, the wires identified as ‘R’ and ‘Y’ were disconnected and relocated to Coil A and wire ‘G’ was disconnected and interchanged with Coil B. The circuit breaker toggle switches installed to operated Ignition A and B, remained closed and did not trip during the test. However, the pilot’s test of the ignition system did not examine the distributor or the ignition control box.

## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	80, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	
<b>Medical Certification:</b>	Sport pilot With waivers/limitations	<b>Last FAA Medical Exam:</b>	October 31, 2002
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	August 1, 2020
<b>Flight Time:</b>	(Estimated) 111 hours (Total, all aircraft), 41 hours (Total, this make and model), 38 hours (Pilot In Command, all aircraft), 4 hours (Last 90 days, all aircraft), 4 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Zenith	<b>Registration:</b>	N601SA
<b>Model/Series:</b>	CH601 XL	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	2019	<b>Amateur Built:</b>	Yes
<b>Airworthiness Certificate:</b>	Experimental light sport (Special)	<b>Serial Number:</b>	6-6288
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	2
<b>Date/Type of Last Inspection:</b>		<b>Certified Max Gross Wt.:</b>	1320 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	3.7 Hrs at time of accident	<b>Engine Manufacturer:</b>	Aeromax (Azalea Aviation LLC)
<b>ELT:</b>	C126 installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	A100
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	100 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KBVS,140 ft msl	<b>Distance from Accident Site:</b>	0 Nautical Miles
<b>Observation Time:</b>	14:55 Local	<b>Direction from Accident Site:</b>	128°
<b>Lowest Cloud Condition:</b>		<b>Visibility</b>	9 miles
<b>Lowest Ceiling:</b>		<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	/	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>		<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	30.16 inches Hg	<b>Temperature/Dew Point:</b>	22°C / 14°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Burlington, WA	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Burlington, WA	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>		<b>Type of Airspace:</b>	Class G

## Airport Information

<b>Airport:</b>	Skagit Regional Airport BVS	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	145 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	29	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	5480 ft / 100 ft	<b>VFR Approach/Landing:</b>	Forced landing;Traffic pattern

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 None	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 None	<b>Latitude, Longitude:</b>	48.469333,-122.4215

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Hicks, Michael
<b>Additional Participating Persons:</b>	Henry Tscha; FAA; Des Moines, WA
<b>Original Publish Date:</b>	September 16, 2022
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class 3</a>
<b>Note:</b>	The NTSB did not travel to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.ntsb.gov/Docket?ProjectID=102072">https://data.ntsb.gov/Docket?ProjectID=102072</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](#).