



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Livermore, California	Accident Number:	WPR22LA287
Date & Time:	July 30, 2022, 08:00 Local	Registration:	N2591V
Aircraft:	Cessna 177RG	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

About 30 minutes after takeoff on a cross-country flight, the pilot noticed an increase in engine exhaust gas temperatures (EGTs) for all cylinders. The engine then briefly “stuttered,” and he decided to divert to an airport en route for a precautionary landing. The EGTs then returned to normal, and he decided to continue to the original destination. However, during the landing approach, the EGTs again began to rise; the engine lost all power; and the airplane landed short of the runway and struck approach lights, which resulted in substantial damage to the left wing and stabilator.

Data recorded by the airplane’s engine monitor showed the EGT increases that were reported by the pilot. Disassembly of the fuel injection servo revealed significant internal corrosion and corrosion deposits along with evidence of water ingestion. The corrosion deposits likely resulted in a partial blockage (restriction) of fuel to the cylinders, which manifested itself as a lean fuel mixture. This lean mixture was consistent with the observed increase in EGTs. During the final approach, the blockage likely became severe enough to result in the total loss of power.

The fuel injection servo manufacturer recommends by service bulletin that the unit should be overhauled either every 12 years or at the time of engine overhaul. The unit had last been overhauled 23 years before the accident, and it was not overhauled at the last engine overhaul 10 years before the accident. Additionally, the service bulletin stated that the unit should be overhauled in the event of water contamination. The unit had clearly ingested water at some point during its life, although it could not be determined when this occurred.

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 due to an inadequately maintained fuel injection servo.

Findings

Aircraft	Fuel control/carburetor - Not serviced/maintained
Aircraft	Fuel control/carburetor - Fatigue/wear/corrosion

Factual Information

History of Flight

Approach	Loss of engine power (total) (Defining event)
Landing-landing roll	Collision with terr/obj (non-CFIT)

On July 30, 2022, about 0800 Pacific daylight time, a Cessna 177RG, N2591V, sustained substantial damage when it was involved in an accident near Livermore, California. The pilot was not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 flight.

The pilot departed Salinas Airport (SNS), Salinas, California, en route to Livermore Municipal Airport (LVK) after an uneventful preflight check and engine runup. About 30 minutes after takeoff, he noticed that the engine monitor was indicating an increase in EGTs for all cylinders. The engine then briefly “stuttered,” and he decided to divert to an airport en route for a precautionary landing. He then adjusted the fuel mixture control, and the temperatures returned to normal, so he decided to continue to the original destination. About 10 minutes later, he initiated the landing descent to LVK by reducing engine power and moving the fuel mixture to full rich.

During the landing approach, the EGTs again began to rise, and the engine lost all power. The airplane sustained substantial damage to the left wing and stabilator after landing short of the runway and striking a set of instrument landing system lights.

Postaccident examination did not reveal any anomalies with the engine or airframe, and the engine could be operated at varying speeds during a ground run. Review of the data recorded by the airplane’s engine monitor indicated that the EGT rise was about 200° F, and during the periods of EGT rise, there was no discernible change in fuel flow. (The fuel flow transducer was installed at the inlet of the fuel injection servo, rather than the outlet to the flow divider.)

The airplane was equipped with a Bendix RSA-5AD1 fuel injection servo. The servo and flow divider were tested and examined at Precision Airmotive’s facility. The testing revealed that both units met the performance specifications required following a field overhaul.

However, disassembly of the fuel injection servo revealed significant internal corrosion and corrosion deposits throughout. The diaphragm cavities displayed “water lines” and corrosion on the metered and unmetered fuel sides, consistent with water contamination (figures 1 and 2). Corrosion deposits were present in the servo valve seat cavity and in the mixture control assembly (figures 3 and 4).

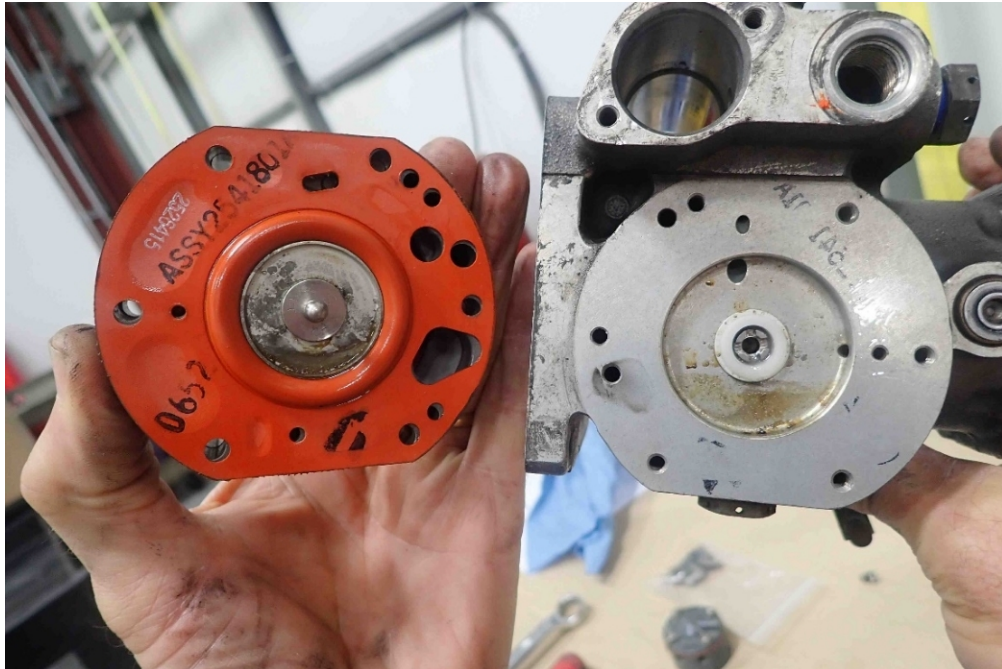


Figure 1 - Water line and corrosion on metered side



Figure 2 - Water line and corrosion on unmetered side



Figure 3 - Corrosion deposits on the lower side of the mixture control spring



Figure 4 - Corrosion on the surfaces of the idle and mixture valve housing bore

Precision Airmotive Service Bulletin PRS-97, revision 2, issued in August 2013, stated that the time between overhaul (TBO) for all fuel injection system components is either the same as the TBO specified by the engine manufacturer for the engine or 12 years since placed in service or last overhauled, whichever occurs first. The bulletin also stated that an overhaul is mandatory if the fuel system is contaminated with water.

Maintenance records indicated that the last rebuild of the fuel injection servo was performed in August 1999, 23 years before the accident while the engine was undergoing an overhaul. Another engine overhaul was performed in August 2012, and the corresponding logbook entry stated that no accessories were overhauled at that time.

The maintenance logbooks did not indicate the fuel system had been exposed to water; however, examination of the airplane indicated that the gascolator had recently been replaced. There was no maintenance entry to reflect this work, and the mechanic who performed the most recent annual inspection stated that he did not replace the gascolator at that time. There were no significant periods of inactivity noted in the logbook, although the owner stated that the airplane sat idle for 6 months before he purchased it in June 2020. He stated that the airplane was kept in a hangar for much of its recent life.

Pilot Information

Certificate:	Private	Age:	55, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	3-point
Instrument Rating(s):	None	Second Pilot Present:	
Instructor Rating(s):	None	Toxicology Performed:	
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	August 5, 2020
Occupational Pilot:	No	Last Flight Review or Equivalent:	May 11, 2021
Flight Time:	308 hours (Total, all aircraft), 168 hours (Total, this make and model), 212 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N2591V
Model/Series:	177RG	Aircraft Category:	Airplane
Year of Manufacture:	1974	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	177RG0627
Landing Gear Type:	Retractable - Tricycle	Seats:	4
Date/Type of Last Inspection:	August 1, 2022 Annual	Certified Max Gross Wt.:	2650 lbs
Time Since Last Inspection:	27.1 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	6033 Hrs as of last inspection	Engine Manufacturer:	LYCOMING
ELT:	C126 installed, not activated	Engine Model/Series:	IO-360-A1B6D
Registered Owner:	On file	Rated Power:	200 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:	KLVK, 393 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	08:04 Local	Direction from Accident Site:	259°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	Broken / 1500 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	3 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.93 inches Hg	Temperature/Dew Point:	17°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Salinas, CA (SNS)	Type of Flight Plan Filed:	None
Destination:	Livermore, CA	Type of Clearance:	VFR
Departure Time:	07:15 Local	Type of Airspace:	Class D

Airport Information

Airport:	LIVERMORE MUNI LVK	Runway Surface Type:	Asphalt
Airport Elevation:	399 ft msl	Runway Surface Condition:	Dry
Runway Used:	25R	IFR Approach:	None
Runway Length/Width:	5253 ft / 100 ft	VFR Approach/Landing:	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	1 None	Latitude, Longitude:	37.693789,-121.80988

Administrative Information

Investigator In Charge (IIC):	Simpson, Elliott
Additional Participating Persons:	Matthew DeSeelhorst; FAA; Oakland, CA
Original Publish Date:	August 23, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=105630

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](#).