Aviation Investigation Final Report

Location:	Santa Maria, California	**Accident Number:**	WPR12LA141
Date & Time:	March 20, 2012, 15:30 Local	**Registration:**	N629BJ
Aircraft:	GRIMM RV-9A	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

After the pilot leveled the experimental amateur-built airplane for cruise flight, the engine began to vibrate and lose power. He immediately applied full rich fuel mixture, then conducted a series of troubleshooting procedures, including recycling power to the electronic ignition system and switching between the left and right electronic magneto. The vibration continued with no increase in engine performance, and, unable to maintain altitude, he performed a forced landing into a plowed field, where the airplane sustained substantial damage.

Subsequent examination of the engine revealed no anomalies that would have precluded normal operation. The ignition modules were examined and tested, and, while one unit exhibited wear consistent with imminent failure, both units functioned correctly. If one of the ignition units had failed in flight and lost its timing reference, it could have resulted in the observed engine vibration. However, if this was the case, the troubleshooting steps performed by the pilot would have remedied the problem. During examination, compression was not attained for one of the engine cylinders. This was most likely due to postaccident cylinder contamination and did not cause the loss of engine power.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A partial loss of engine power during cruise flight for reasons that could not be determined because postaccident examination and testing did not reveal any anomalies that would have precluded normal operation.

Findings

Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Enroute-cruise	Loss of engine power (partial) (Defining event)
Enroute-cruise	Off-field or emergency landing
Landing-landing roll	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On March 20, 2012, about 1530 Pacific daylight time, a Grimm (Vans Aircraft) experimental amateur-built RV-9A, N629BJ, collided with a berm during a forced landing near Santa Maria Public Airport/Captain G Allan Hancock Field, Santa Maria, California. The pilot/builder was operating the airplane under the provisions of 14 Code of Federal Regulations Part 91. The certificated commercial pilot and pilot-rated passenger were not injured. The airplane sustained substantial damage during the accident sequence. The local flight departed Oceano County Airport, Oceano, California, about 15 minutes prior. Visual meteorological conditions prevailed, and no flight plan had been filed.

The pilot reported that after departure, at an altitude of about 2,000 feet mean sea level (msl), he trimmed the airplane for cruise flight, and began to adjust the fuel mixture control. As he leaned the mixture, the engine began to lose power and vibrate. He immediately applied full rich mixture, but the vibrations continued. He began a series of troubleshooting procedures, including switching the fuel tank selector valve, recycling power to the electronic ignition system, switching between the left and right ignition systems, and adjusting the throttle and mixture controls, but the vibration continued with no increase in engine performance. The pilot described the vibrations as so violent that they caused the airframe to shake in a manner he had never experienced before. He initiated a turn toward Santa Maria Airport, and unable to maintain altitude, declared an emergency to the tower controller about 1 minute later.

The pilot subsequently performed a forced landing into a plowed field. During the landing roll, the airplane struck a berm, and came to rest nose-down. The airplane sustained substantial damage to the forward fuselage structure and both wings during the accident sequence.

AIRCRAFT INFORMATION

The low-wing, two-seat airplane was equipped with an O-320-E3D four-cylinder Lycoming engine, serial number L-46401-27A, and a fixed-pitch Sensenich propeller.

FAA records indicated that the airplane was issued its special airworthiness certificate in May 2006. The engine had been overhauled in 2004, and installed on the airframe prior to certification.

Maintenance records revealed that the airframe and engine had undergone a conditional inspection on March 28, 2011, at a total flight time of 406.2 hours. The airplane had accrued an additional 72 flight hours between the inspection and the accident.

TESTS AND RESEARCH

The NTSB investigator traveled in support of this investigation, and performed an examination of the engine and airframe subsequent to recovery.

Engine

The engine sustained minimal damage during the accident sequence and remained attached to its mount. The propeller sustained aft bending to one of its blades, and no sections of the blades were missing.

The crankcase, cylinder heads, and pushrods were free of obvious indications of distress. Examination of the dipstick revealed an appropriate quantity of dark-colored translucent oil to be present within the crankcase. The engine was equipped with two E-Mag electronic ignition units, which remained, along with the fuel pump and carburetor, firmly affixed to their respective mounting pads. The inner surfaces of the exhaust pipes exhibited tan-colored deposits, and were free of oil residue.

The airplane was equipped with NGK BR8ES automotive spark plugs. The plugs were removed for examination, and exhibited black sooty deposits, with no mechanical damage. The bottom spark plugs for cylinder number three and four were “lead fouled” when compared to the Champion AV-27 Check-A-Plug guide. These plugs were tested utilizing an ohmmeter, and there was no short circuit between the plug electrode and ground.

The engine cylinder chambers were examined via the spark plug bore holes utilizing a Borescope. No mechanical damage was observed, and both the piston crowns and cylinder head surfaces exhibited tan-colored deposits. Cylinder number three exhibited lead buildup around the inner surfaces of the head, and on the exhaust valve.

The rocker covers were removed, and the valve springs, piston stems, and rockers were intact and covered in oil. The engine crankshaft was rotated by hand via the propeller. The engine rotated smoothly, and all valves and rockers moved. Compression was confirmed in firing order for all cylinders except number three. The exhaust and inlet manifolds for cylinder number three were removed, and the spark plugs were reinstalled. During subsequent crankshaft rotation, air was heard to leak past the number three exhaust valve seat.

Cylinder number three was subsequently removed and inspected in accordance with the Lycoming Mandatory Service Bulletin SB388C “Procedure to Determine Exhaust Valve and Guide Condition.” The exhaust valve did not exhibit any indications of excessive wear or

carbon buildup. Subsequent examination revealed that fragments of carbon and lead deposits (dislodged from within the cylinder head during the impact sequence) were present on the exhaust valve seat, and most likely the reason for the leak. Further examination of the valve guides revealed that they were of the “Hi-Chrome” type, referenced in Lycoming Service Instruction 1485 “Exhaust Valve and Guide Identification Procedure." Installation of such guides increases the time between compliance for SB388C from 400 to 1,000 hours.

Electronic Ignition

The two E-MAG Ignition units were the “P-Model”, P113 type. Both were tested, disassembled, and examined at the facilities of E-MAG Ignitions, in the presence of the IIC. The manufacturer’s records indicated that both units had been returned for service in April 2011, at which time they were overhauled, and modified in accordance with the “Position Sensor Magnet Mount Mandatory Service Bulletin (9/12/08).” The service bulletin documents a modification to the sensor magnet mount assembly, which reduces the likelihood of an assembly failure, and subsequent loss of ignition timing. Based on airframe maintenance records, the ignition units had sustained about 200 hours of operation since the overhaul.

Both ignition units were functionally tested, and operated normally, passing self-tests, and retaining their timing position after multiple rotations. The left unit was disassembled, and no anomalies were noted. Disassembly of the right unit revealed brown dust and metallic particles on the underside of its circuit control board, and within the cavity of the stator and coil. The magnetic rotary encoder chip was intact, and free of damage. The unit’s stator and coil remained intact within the case, with the stator exhibiting light radial scoring to its inner layered surface. The upper nose bearing rotated smoothly when turned by hand, but appeared loose on the shaft, with excessive play (0.5mm – 1mm) at the shaft. The E-MAG Ignitions representative stated that he had not seen this type of damage before, and that the bearing should be a light press-fit on the shaft.

A complete examination report is contained within the public docket.

Pilot Information

Certificate:	Commercial	**Age:**	66,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	None None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 20, 2009
Flight Time:	1600 hours (Total, all aircraft), 478 hours (Total, this make and model), 25 hours (Last 90 days, all aircraft), 5 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	GRIMM	**Registration:**	N629BJ
Model/Series:	RV-9A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	91051
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	March 28, 2011 Condition	**Certified Max Gross Wt.:**	1850 lbs
Time Since Last Inspection:	72 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	478 Hrs at time of accident	**Engine Manufacturer:**	LYCOMING
ELT:	C91A installed, activated	**Engine Model/Series:**	O-320
Registered Owner:	GRIMM WILLIAM H	**Rated Power:**	150 Horsepower
Operator:	GRIMM WILLIAM H	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KSMX,261 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	15:51 Local	**Direction from Accident Site:**	45°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	15 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.12 inches Hg	**Temperature/Dew Point:**	17°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Oceano, CA (L52)	**Type of Flight Plan Filed:**	None
Destination:	Santa Maria, CA (SMX)	**Type of Clearance:**	None
Departure Time:	15:15 Local	**Type of Airspace:**	

Airport Information

Airport:	Santa Maria SMX	**Runway Surface Type:**	Asphalt
Airport Elevation:	261 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	12	**IFR Approach:**	None
Runway Length/Width:	6304 ft / 150 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	34.884998,-120.393058(est)

Administrative Information

Investigator In Charge (IIC):	Simpson, Eliott
Additional Participating Persons:	Mohammad Salahuddin; Federal Aviation Administration FSDO; Van Nuys, CA
Original Publish Date:	February 12, 2013
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=83185