Aviation Investigation Final Report

Location:	West Jordan, Utah	**Accident Number:**	WPR12FA001
Date & Time:	October 4, 2011, 13:15 Local	**Registration:**	N91BV
Aircraft:	VAUGHN PULSAR	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

On the morning of the accident, the pilot and the new owner arrived at the airport to pick up the airplane. The previous owner saw that their total weight was greater than he had been told during an earlier inquiry and advised the flight instructor and the new owner that their total weight might put the airplane near its maximum allowable gross weight. He also advised them not to add any more fuel than was already onboard, and then handed them the weight and balance sheet for the airplane. Subsequently, witnesses saw the airplane take off and ascend at an extremely low rate of climb. When another pilot waiting to take off asked whether they were having any technical difficulties, the accident pilot responded that there was nothing wrong but that it was just a “weak airplane.” About 1/2 mile after passing the departure end of the runway, the pilot initiated a right turn but failed to maintain sufficient airspeed, resulting in the airplane stalling and descending into the terrain. The postaccident investigation determined that the airplane was being operated above its maximum allowable gross weight and that it was being operated in a density altitude that was 2,120 feet higher than the field elevation. An engine teardown examination determined that both of its carburetors had jet needles installed that produced a richer-than-normal fuel-air mixture. This was due to an incorrect reassembly after an overhaul of the carburetors. The weight of the airplane, the high density altitude, and the overly rich fuel-air mixture most likely combined to significantly reduce the performance of the airplane.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot’s failure to maintain sufficient airspeed and airplane control while initiating a turn during the initial climb after takeoff in a high density altitude environment, above the airplane’s maximum allowable gross weight, and with an overly rich fuel-air mixture due to improper

carburetor maintenance.

Findings

Aircraft	Airspeed - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Environmental issues	High density altitude - Contributed to outcome
Aircraft	Maximum weight - Capability exceeded
Personnel issues	Incorrect action performance - Maintenance personnel
Aircraft	Fuel control/carburetor - Incorrect service/maintenance
Personnel issues	Weight/balance calculations - Pilot

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)
Initial climb	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On October 4, 2011, about 1315 mountain daylight time, an experimental Vaughn Pulsar airplane, N91BV, impacted the terrain about one-half mile south of the departure end of Runway 16, at South Valley Regional Airport, West Jordon, Utah. Both the certified flight instructor and his passenger received fatal injuries, and the airplane, which had been purchased earlier that day by the passenger, sustained substantial damage. The pilot of the 14 Code of Federal Regulations Part 91 personal flight was departing South Valley Regional Airport in visual meteorological conditions, with an intended destination of Nephi, Utah. No flight plan had been filed.

According to the previous owner, the individual who he sold the airplane to on the day of the accident had come to see it about two weeks earlier. Although the airplane was not flown at that time, the owner, accompanied by the potential buyer, started it up, taxied it along the taxiway, performed an engine run-up check, and then taxied it back to the hangar. Reportedly, the engine ran well on that day, and subsequently, the potential buyer advised the owner that he was going to purchase the airplane. The buyer also told the owner that he would have to make arrangements for someone else to come pick up the airplane because he was not a rated pilot. He later advised the owner that he and a flight instructor would come pick up the airplane, and that the flight instructor would later be using the airplane to give him the instruction necessary to earn his Sport Pilot license.

According to the previous owner, who knew the gross weight limitations of the airplane, when the purchaser called to advise him that he and the flight instructor would be picking up the airplane together, he asked him what their approximate weights were. Reportedly, the purchaser said that they were each in the 180 to 190 pound range. But, when the buyer and the flight instructor arrived on the day of the accident, it appeared to the owner that the weight of the flight instructor was higher than he had been told. He therefor advised the new owner and the flight instructor that they may be near the maximum gross weight limit of the airplane, and told them they should not add any more fuel to the 9 gallons already onboard. The seller also handed the instructor pilot a copy of the weight and balance sheet, so that he could perform an accurate gross weight calculation. Then, after giving the new owner the keys to the airplane and a box full of airplane associated paperwork, the seller spent a little time talking to both individuals about the airplane and its systems. He then left the airport to go back to work. He

was not there when the new owner and the instructor pilot entered the airplane to prepare for departure.

Although the investigation did not find any witnesses who observed the two individuals again until they taxied out for takeoff, no records where found at the airport of any additional fuel being added prior to departure. The next time the airplane and its occupants were spotted was about 5 minutes before they took off, when the airplane was seen taxiing to the northern end of runway 16. There, according to witnesses, the pilot stopped in the run-up area before taking off, but it is unknown whether an engine run-up check was completed. The pilot then taxied onto runway 16, where he initiated the takeoff roll.

When the instructor pilot was taxiing out for takeoff, the airplane passed near a flight instructor who had seen it fly before, and who had a friend who had expressed a possible interest in purchasing the airplane. After the airplane taxied by, the flight instructor went inside a nearby building to advise his friend that it appeared the airplane was taxiing out for takeoff. Then the flight instructor and his friend went back outside for the specific purpose of watching the airplane takeoff. According to that flight instructor, when it came by their location, which was about half way down the 5,860 foot runway, the airplane had already lifted off the runway, and its engine sounded to them like it was making full power. At that point the airplane was just above the runway surface and still appeared to be in ground effect. It was reportedly just barely climbing, and was in a repeated porpoising sequence; whereupon each time the airplane's nose was raised, it would climb only a few feet before the pilot lowered it again to near a level flight attitude. As the airplane neared the departure end of the runway, another flight instructor, who was waiting to takeoff next, transmitted over the radio, "Experimental aircraft on departure, are you having technical difficulties?" To that transmission, the accident pilot responded, "No, it's just a weak aircraft." The porpoising sequence then continued until the airplane reached a point about one-half mile off the end of the runway about 75 feet above ground level (agl). It then appeared that the pilot established a shallow right turn, followed soon thereafter by an increase of the bank angle to near 90 degrees and a drop of the nose to about 45 degrees below the horizon. The airplane then made a rapid descent into the terrain.

PESONNELL INFORMATION

The pilot was a 28 year old male, who held both a commercial pilot certificate and a certified flight instructor certificate. His pilot ratings were for single-engine land airplanes and multi-engine land airplanes, and he held an airplane instrument rating. His instructor ratings were for instruction in single-engine airplanes, multi-engine airplanes, and instrument instruction in airplanes. His last airman's medical, a Class 1 without waivers or limitations, was completed on September 16, 2011. Based upon information provided by his airman's medical, it is estimated that he had accumulated a total of about 2,100 hours of flight time. It is not known if he had accumulated any flight time in the make and model of airplane involved in the accident.

AIRCRAFT INFORMATION

The airplane was a 1992 kit-built experimental Vaughn Pulsar with a total engine and airframe time of about 250 hours. Its engine was a Rotax 582 Mod 90 of 65 horsepower, with a model 3M23 fixed-pitch composite propeller. Its last recorded 100 hour inspection was signed off on June 30, 2011. Its original maximum allowable gross weight was 870 pounds, but an undated pen and ink notation on the original weight and balance sheet indicated that the maximum allowable gross weight had been increased to 1,000 pounds as per information from Aero Designs (the kit manufacturer). The investigation also discovered a weight and balance calculation sheet from an earlier undated dual instructional flight which listed the actual total ramp weight for that fight as 963 pounds, and the maximum allowable gross weight as 1,000 pounds.

METEOROLOGICAL INFORMATION

About 20 minutes prior to the accident, the 1253 recorded aviation surface weather observation (METAR) at Salt Lake City International Airport (KSLC), which is located about 10 miles north of South Valley Regional Airport, indicated a wind from 200 degrees at 14 knots gusting to 19 knots, 10 miles visibility, few clouds at 6,000 feet, scattered towering cumulus clouds with bases at 9,000 feet, scattered clouds at 20,000 feet, a temperature of 23 degrees C, a dew point of 08 degrees C, and an altimeter setting of 29.86 inches.

The KSLC special METAR taken at 1338, approximately 25 minutes after the accident, indicated a wind varying in direction from 200 degrees to 270 degrees at 09 knots gusting to 21 knots, 10 miles visibility, thunderstorms with light rain, few cumulonimbus clouds with bases at 4,300 feet, scattered clouds at 7,000 feet, a broken layer at 10,000 feet, a broken layer at 20,000 feet, a temperature of 22 degrees C, a dew point of 08 degrees C, and an altimeter setting of 29.83 inches. The METAR also included the remark that the peak wind since the last METAR had been from 170 degrees at 27 knots at 1311. It further remarked that there was occasional lightening in clouds to the southwest and west, and that there were thunderstorms to the west and southwest moving north.

According to the flight instructor who made the aforementioned radio transmission and then took off as soon as he saw the airplane descend into the terrain, the Automated Weather Observation System (AWOS) information being transmitted at the time of the accident indicated a wind from 150 degrees at 12 knots gusting to 18 knots, a visibility of 10 miles, scattered clouds at 10,000 feet, a temperature of 23 degrees C, a dew point of 7 degrees C, and an altimeter setting of 29.88 inches. He also remarked that during his takeoff, and while he was overhead the accident site, the air was smooth, without a single bump or downdraft.

The flight instructor, who with his friend, had watched the takeoff from the ground, reported that he had been working around the airport since 0700, and had witnessed multiple small rain cells move through the area. But, he further reported that at the time of the accident, there was no cell over the airport or the accident area, and that the wind was nearly steady about 15 knots (varying about 1 to 3 knots), and almost directly down the runway. He did observe one rain cell to the southwest, but he did not believe that it had resulted in any wind gusts or

microburst activity in the area of the airport at the time of the accident.

Based upon a field elevation of 4,670 feet, a temperature of 23 degrees C, a dew point of 8 degrees C, and an altimeter setting of 29.83 inches, the density altitude at the time of takeoff was calculated to be 6,790 feet.

COMMUNICATIONS

The only known radio communication between an occupant of the accident airplane and someone else, was what appeared to be the instructor pilot's response to transmitted question from the instructor pilot waiting to take off. In response to that query about whether they were having any technical difficulties, the response was, "No, it's just a weak aircraft." There were no further transmissions from the accident airplane.

AIRPORT INFORMATION

South Valley Regional Airport is a non-controlled airport with a single runway (16-34). The surface of the 5,860 foot runway was paved with asphalt, with a 238 foot displaced threshold at its southern end. The airport's field elevation is 4,607 feet above sea level.

WRECKAGE AND IMPACT INFORMATIONS

The airplane impacted flat grassy terrain in a complex of soccer fields about one-half mile south-southeast of the departure end of runway 16. The initial point of impact was at 40 degrees, 36 minutes, 17.39 seconds North, by 111 degrees, 59 minutes, 40.95 seconds West. At the point of initial impact there was one primary ground scar which had cut through the grass to a depth of about 6 inches. The scar was about one foot wide and about three feet long. From that point, to a point about 40 feet west of the initial impact, there was a 20 foot wide swath of wreckage material comprised primarily of broken pieces of wing skin, lower engine cowling, and blue colored Styrofoam associated with the structure of the wing ribs. The majority of the remainder of the aircraft structure came to rest in one location about 40 feet to the west of the initial point of impact. The wings, which were broken into numerous pieces, had separated from the fuselage. The cabin, which was no longer connected to the fuselage aft of the pilot and passenger seats, had broken into several separate pieces, and both the main landing gear structure and the engine had separated from the cabin section. Both occupants had been thrown from the cockpit. The fuselage, from just forward of the baggage area to the aft end of the empennage, maintained its undamaged structural integrity, except for a crack in the skin that ran vertically down from the bottom of the left baggage compartment window to the belly of the airplane. The left horizontal stabilizer and elevator, as well as the vertical stabilizer and rudder were undamaged and still attached to the fuselage. The right horizontal stabilizer and elevator had been torn loose from the empennage, and were lying on the ground adjacent to where they had been attached. All portions of the airframe structure were present at the accident site.

After an on-site examination by the FAA and local law enforcement officials, the wreckage was recovered by airport personnel to a hangar owned by South Valley Regional Airport, where it later underwent further examination by the NTSB Investigator-In-Charge (IIC). That examination revealed flight control continuity from the aft part of the cockpit to the rudder and left elevator, as well as to the remaining structure of the right elevator actuating system. Flight control continuity to the ailerons could not be established due to the extent of the damage to the wings. The fuel selector was found in the FUEL (on) position, and the in-line wire mesh fuel filter was found to be uncontaminated, with its clear plastic body being undamaged. The induction air foam air filter had been crushed and distorted, but it was free of contamination except for fresh green grass clippings associated with the turf of the soccer field complex. The fixed pitch composite propeller was still attached to the engine crankshaft, with the curved face of each blade being fractured longitudinally from the flat face along it span. The metallic leading edge anti-abrasion strip on the most outboard one-third of each blade both showed evidence of direct rearward crushing and/or gouging. The composite structure of one of the blades had fractured from its hub at its base, but was still attached to the hub and the other blade by the steel rod that ran through its core. The steel rod itself had been bent against the direction of propeller rotation through an arc of about 135 degrees.

The engine, which underwent a teardown inspection, had sustained severe impact damage, resulting in the gearbox becoming partially separated. The gearbox itself was extensively damaged. The ignition system was examined, and the only anomaly was the chafing of some wires; but it could not be determined if the chafing was a preimpact condition. The cylinder head was removed, and no mechanical anomalies were found associated with the head, the cylinders, the pistons, the connecting rods, or the bearings. The exhaust system, which is tuned at the time of manufacture for a specific engine and performance range, was examined and found to be altered from its original condition. The modification had been made in the mid length of the inlet tube between the exhaust flange and the muffler, which according to the Rotax installation manual could negatively affect power output. It was also determined that the magneto-end crankshaft seal had been leaking, which according to the manufacturer could reduce the engine's performance.

As part of the teardown, the four sparkplugs were removed from the engine and examined. Each plug was of the proper type (BR8ES), showed normal wear patterns, and their electrodes were set within the correct gap range. Although none of the plugs showed any evidence of their electrodes shorting across a contaminant particle, all four were heavily sooted to a degree consistent with an abnormally rich fuel-air carburetor mixture. An examination of both of the carburetors revealed that each had 180 main jets, which allow more fuel to be introduced to the engine than the stock 165 jets. According to the manufacturer, this would result in a richer than normal fuel-air mixture. A further examination of the carburetors revealed that the jet needles in both had been incorrectly placed above the retaining cup instead of underneath the cup, resulting in a much richer than normal fuel-air mixture. This condition, according to the manufacturer, would significantly reduce the power output of the engine, especially at higher altitudes. A review of the engine log book revealed that both carburetor's had been "rebuilt" by an Airframe and Powerplant mechanic on 10/15/2008, at which time the

engine had accumulated about 235 hours since new.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot by the Utah Department of Health Office of the Medical Examiner. The manner of death was determined to be accidental, and the cause of death was determined to be blunt force injuries to the head, neck and trunk. The medical examiner also completed a forensic toxicology examination on specimens taken from the pilot. The results were negative for Ethanol, Acetone, Isopropanol, Methanol, Methamphetamine, Morphine, Tetrahydrocannabinol, and Cocaine. The results were positive for Lidocaine, but no concentration level was reported.

The Federal Aviation Administration's Civil Aeromedical Institute also performed a forensic toxicology examination on specimens taken from the pilot. The standard tests for Carbon Monoxide and Cyanide were unable to be performed. The test for Ethanol in the urine was negative. The test for screened drugs was positive for an undetermined low level concentration of Ephedrine in the urine and muscle tissue.

ADDITIONAL INFORMATION

TAKEOFF GROSS WEIGHT

According to the autopsy report, the weight of the instructor pilot was 116 kilograms (256 pounds), and the weight of the passenger/owner was 88 kilograms (194 pounds), for a total occupant weight of 450 pounds. The weight of the 9 gallons of fuel that were reportedly onboard, mixed at a rate of 50/1 with two-cycle engine oil, was calculated to be 55 pounds. The empty weight of the airplane, according to the most current airplane weight and balance sheet, was 526 pounds. The takeoff gross weight was therefore calculated to be 1,031 pounds (450+55 +526), which was 31 pounds over the airplane's maximum allowable gross weight.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	28,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	September 16, 2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 2100 hours (Total, all aircraft), 100 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	VAUGHN	**Registration:**	N91BV
Model/Series:	PULSAR	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	146
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	June 30, 2011 Condition	**Certified Max Gross Wt.:**	1000 lbs
Time Since Last Inspection:	1 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	248 Hrs as of last inspection	**Engine Manufacturer:**	Rotax
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	582-90
Registered Owner:	SUNDSTROM CHRISTOPHER R	**Rated Power:**	65 Horsepower
Operator:	Jared K. Despain	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KSLC,4227 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	340°
Lowest Cloud Condition:	Few / 6000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / 19 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.86 inches Hg	**Temperature/Dew Point:**	23°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	West Jordan, UT (U42)	**Type of Flight Plan Filed:**	None
Destination:	Nephi, UT (U14)	**Type of Clearance:**	None
Departure Time:	13:14 Local	**Type of Airspace:**	

Airport Information

Airport:	South Valley Regional U42	**Runway Surface Type:**	Asphalt
Airport Elevation:	4608 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	16	**IFR Approach:**	None
Runway Length/Width:	5860 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	40.604442,-111.982223(est)

Administrative Information

Investigator In Charge (IIC):	Anderson, Orrin
Additional Participating Persons:	Scott Hartley; Salt Lake FSDO; Salt Lake City, UT Jordan Paskevich; Rotech Flight Safety; Vernon, BC, Canada
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Note:	
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