National Transportation Safety Board
Aviation Accident Final Report

Location:	Santa Paula, CA	**Accident Number:**	WPR17LA197
Date & Time:	09/04/2017, 1358 PDT	**Registration:**	N75753
Aircraft:	BOEING A75N1(PT17)	**Aircraft Damage:**	Substantial
Defining Event:	Unknown or undetermined	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The commercial pilot departed on a sightseeing flight with a passenger onboard; the airplane was near its published gross weight. The pilot had experienced some difficulty starting the engine before takeoff, which he resolved after removing and reinstalling the primer several times. The takeoff roll and departure were uneventful; however, when the airplane transitioned to initial climb, its climb performance reduced, and when it reached about 500 ft mean sea level, the airplane stopped climbing, which the pilot reported that he believed was due to a partial loss of engine power. Subsequently, the pilot turned the airplane back toward the departure airport, but after realizing that it would not reach the airport, he chose to conduct an off-airport forced landing. The airplane touched down in a dry riverbed, and it impacted brush and then nosed over and came to rest inverted, which resulted in substantial damage to the upper and lower wings.

The airplane had sufficient fuel for the accident flight. Postaccident examination of the engine revealed numerous preimpact anomalies, including a leak in the engine primer line, which had developed over time due to its repetitive contact with the engine exhaust adjacent to it. The leak likely resulted in the pilot needing to add an excessive number of primer shots to start the engine before departure and led to some of his failed engine start attempts. Further, examination of the engine revealed that the cold compression on the No. 3 cylinder was low, that a spark plug was defective, that two ignition cables had significantly low insulation resistance, and that several of the forward ignition harness elbows were bent. Low compression is not an isolated incident, and it is possible that the pilot had been operating the airplane with low cold compression on the No. 3 cylinder for some time; therefore, it could not be determined if this contributed to the power loss. Although a defective spark plug could have resulted in a negligible power loss, it likely would not have prevented the airplane from climbing during the accident flight. Further, it could not be determined if the ignition harnesses were bent during the impact sequence; therefore, it could not be determined whether the condition of the ignition system contributed to the loss of engine power.

Although the atmospheric conditions at the time of the accident were conducive to the accumulation of serious icing at glide power, it could not be determined if carburetor ice had formed while the airplane was idling on the ground. The reason for the loss of engine power could not be determined.

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 initial climb for reasons that could not be determined based on the available information.

Findings

Environmental issues	Object/animal/substance - Contributed to outcome
Not determined	Not determined - Unknown/Not determined (Cause)

Factual Information

History of Flight

Enroute-climb to cruise	Unknown or undetermined (Defining event) Loss of engine power (partial)
Landing	Off-field or emergency landing
Emergency descent	Collision with terr/obj (non-CFIT)
Landing	Nose over/nose down

On September 4, 2017, about 1358 Pacific daylight time, a Boeing A75N1 airplane, N75753, was substantially damaged when it impacted a dry river bed near Santa Paula Airport (SZT), Santa Paula, California. The commercial pilot received serious injuries and the passenger received minor injuries. The airplane was registered to and operated by a private individual as a personal flight, conducted under the provision of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and a flight plan was not filed for the local flight, which was originating at the time of the accident.

According to the pilot, and owner of the non-profit organization Fly-Hope-Dream, this was his fourth total flight of the day and third consecutive flight. According to their website, Fly-Hope-Dream provides free flights to children with life-threatening medical conditions and their siblings, families who are survivors of the "Thomas" wildfire, and families who have lost a child. The passenger of the accident flight, her husband, and their daughter had scheduled flights with the pilot on the day of the accident. Her husband's flight departed about 1400 after some difficulty with the primer pump, which he removed and replaced about 5 times before the engine started. That flight and the subsequent flight with accident passenger's daughter were uneventful.

After his passenger was secured in the cockpit, the pilot taxied the airplane to runway 22 for departure. The airplane's takeoff roll and departure were uneventful; however, the airplane's climb performance was reduced after the airplane transitioned to its initial climb. As the airplane reached about 500 ft mean sea level (250 ft above ground level (agl)), the airplane stopped climbing, so the pilot turned the airplane to the left over the downwind leg of the airport traffic pattern. He noted the airplane had encountered a partial loss of engine power, but did not recall how much power was lost. Although the takeoff runway was in view, the pilot determined the airplane would not reach the runway as a result of the airplane's rapid sink rate and elected to conduct an off-airport forced landing. The pilot completed a stabilized approach and landed in a three-point-attitude, but during touchdown the airplane contacted thick brush, nosed over, and came to rest inverted in a dry riverbed.

Postaccident photographs of the airplane captured by the recovery team showed substantial damage to the upper and lower wings.

The pilot could not say with any certainty that he completed an engine run-up, and witnesses did not recall seeing him perform one. A witness reported that the airplane began a left turn

about 1/8 of a nautical mile from the departure end of runway 22. Simultaneously, the airplane's pitch attitude gradually increased until the left wing suddenly dropped, but the airplane subsequently returned to a standard rate turn configuration. This could not be corroborated by the other witnesses. As the airplane rolled out on the downwind leg of the airport traffic pattern, it began to descend in a nose high attitude. The witness reported that he could not hear the engine, but observed the propeller spinning throughout the airplane's descent. According to the pilot, the mixture was in the full rich position during takeoff.

Pilot Information

Certificate:	Commercial	**Age:**	57, Male
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 With Waivers/Limitations	**Last FAA Medical Exam:**	09/29/2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	06/18/2016
Flight Time:	814.6 hours (Total, all aircraft), 331.7 hours (Total, this make and model), 722 hours (Pilot In Command, all aircraft), 4.4 hours (Last 90 days, all aircraft), 3.2 hours (Last 30 days, all aircraft), 1.5 hours (Last 24 hours, all aircraft)		

The pilot, age 57, held a commercial pilot certificate with ratings for single-engine land and instrument airplane. The pilot's most recent second-class medical certificate was issued on September 29, 2016, which included the limitation, "must wear corrective lenses." According to the pilot, his flight time included 814 hours of total flight time in all airplanes, of which 331 hours had been accumulated in the airplane make and model at the time of the accident.

Fly Hope Dream

The pilot founded an organization in August 2014 known as Fly Dream, Inc. According to the organization's website, the 501(c)3 non-profit organization "provides opportunity to see life from a new perspective and find hope for the future" by participating in a once-in-a-lifetime "Dream Flight." These flights are offered to the families of children battling life-threatening medical conditions and those grieving the loss of a child. Participants are not charged anything for the flight, but are encouraged to donate to the organization.

Federal Aviation Administration (FAA) records indicate that the organization had been issued a Letter of Authorization (LOA) to perform commercial air tour operations under 14 *Code of Federal Regulations* Part 91.147 on August 31, 2017. The LOA authorizes the accident airplane to be used in the organization's commercial air tour operations.

Aircraft and Owner/Operator Information

Aircraft Make:	BOEING	**Registration:**	N75753
Model/Series:	A75N1(PT17) UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	1942	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	75-3521
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	09/02/2016, Annual	**Certified Max Gross Wt.:**	2950 lbs
Time Since Last Inspection:	22 Hours	**Engines:**	1 Reciprocating
Airframe Total Time:	4819 Hours at time of accident	**Engine Manufacturer:**	Continental
ELT:	C91 installed, not activated	**Engine Model/Series:**	W670-6A
Registered Owner:	On file	**Rated Power:**	220
Operator:	On file	**Operating Certificate(s) Held:**	Certificate of Authorization or Waiver (COA)

The airplane was manufactured in 1942 and registered to the accident pilot on November 18, 2010. The airplane was powered by a Continental W670-6A, air cooled, 220 horsepower radial engine. Maintenance records indicated that the engine was rebuilt in accordance with the Continental W670 overhaul manual. At the time of the accident, the engine had accumulated a total of 31 hours total time in service since the airplane's most recent engine rebuild, which took place on April 26, 2016. An annual airframe inspection was completed on September 2, 2016 at a tachometer time of 985 flight hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	CMA, 76 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	1355 PDT	**Direction from Accident Site:**	180°
Lowest Cloud Condition:		**Visibility**	10 Miles
Lowest Ceiling:	Overcast / 2300 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.92 inches Hg	**Temperature/Dew Point:**	26°C / 19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	SANTA PAULA, CA (SZP)	**Type of Flight Plan Filed:**	None
Destination:	SANTA PAULA, CA (SZP)	**Type of Clearance:**	None
Departure Time:	1358 PDT	**Type of Airspace:**	Class G

The 1355 recorded weather observation at Camarillo Airport, Camarillo, California, included wind 200° at 11 knots, visibility 10 statute miles, overcast 2,300 ft, temperature 26° C, dew point 19° C, and an altimeter setting of 29.92 inches of mercury.

FAA Special Airworthiness Information Bulletin CE-09-35, "Carburetor Icing Prevention," includes a chart indicating conditions were conducive to carburetor icing. For the approximate ambient temperature and dew point at the time of the accident, the flight was conducted in "Serious icing (glide power)" conditions. The pilot reported that he did not use carburetor heat at any point during the accident flight.

Airport Information

Airport:	SANTA PAULA (SZP)	**Runway Surface Type:**	Asphalt
Airport Elevation:	248 ft	**Runway Surface Condition:**	Dry; Rough; Vegetation
Runway Used:	22	**IFR Approach:**	None
Runway Length/Width:	2713 ft / 60 ft	**VFR Approach/Landing:**	Forced Landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	34.338889, -119.056111 (est)

In the day that followed, a witness reported fuel staining in the sand below the fuel tank cap.

The airplane was recovered and stored by a salvage facility in Santa Paula, California. A postaccident examination of the airplane and engine was completed on November 28 and 29, 2017 by a certificated airframe and powerplant mechanic under the supervision of a representative of the FAA and the National Transportation Safety Board Investigator-in-Charge.

The airplane was photographed in its post-recovery condition with the wings and tail removed. Fuel staining was observed on the bottom trailing edge of the upper wing aft of the fuel tank. Additionally, the fuel sight gage indicated a fuel load of 0 gallons. Once the airplane's external condition was documented, the engine cowling was removed.

The engine mounts were unremarkable and the engine case was intact. A visual inspection of the accessories revealed that the left magneto top cover was not fully seated as one retaining screw was not secured and the other retaining screw was found on the lower engine cowl. Additionally, the left magneto P lead nut was finger tight. The right magneto P lead was loosened with a wrench. A white wire sheath on the left magneto distributor displayed a tear.

Continuity of the mixture and throttle controls were confirmed from the cockpit to their respective arms on the carburetor. The mixture control arm moved freely through its cockpit control lever from the lean position to full rich and the throttle moved freely through its control lever the idle position to full throttle.

A visual inspection of the induction tube did not yield any loose matter and the couplings appeared secure.

Each of the engine's 7 forward spark plugs were removed and exhibited normal wear when compared to the Champion check a plug chart with the exception of the no. 4 spark plug, which was oil fouled. The no. 4 cylinder sits at the low point of the engine and was later found to have collected oil. Several forward ignition harness elbows were bent.

A thumb compression test was performed for each cylinder in the proper firing order: 1, 3, 5, 7, 2, 4, 6. Each cylinder displayed normal compression with the exception of the no. 3 cylinder, which was 34 psi. During each of the 4 tests, air expelled through the exhaust pipe and some through the oil sump.

Fuel System

A total of 2.5 gallons of fuel that resembled 100 low lead aviation grade gasoline were drained through the fuel strainer. The fuel sight gage erroneously displayed 25 gallons and there was no evidence of damage to the sight tube or buckling to the fuel tank. The fuel valve moved normally from the ON and OFF position. Fuel flowed through the strainer and exited the fuel sump when the valve was in the ON position and stopped when the valve was moved to the OFF position. The fuel strainer was disassembled and no debris or contaminants were observed in the fuel screen. The carburetor butterfly rotated freely between the lean and rich positions. Fuel was discharged when the butterfly was moved to the full rich position.

The carburetor gaskets were in good condition and the palnuts and bolts were secure.

Flight Control System

The cockpit flight controls were traced to their respective control surfaces at the ailerons, elevator, and rudder.

Engine Test

The airplane tail was secured to a forklift and about 10 gallons of 100 low lead aviation grade gasoline were added to the airplane's fuel tank to facilitate an engine run.

The propeller was turned and 6 shots of primer were delivered to the engine. A fuel leak was discovered at the primer line of the no. 1 cylinder. Visual inspection showed fretting of the primer line and polishing of the exhaust tube next to the primer line. The engine failed to start despite the introduction of additional primer, adding several ounces of 100LL into the induction air tube at the air filter, removing the magneto P leads, and cleaning the spark plugs. Both the cylinder no. 2 front and rear spark plugs fired normally when an engine start was attempted. The cylinder no. 3 rear spark plug also fired, but the cylinder's front spark plug did not display any spark. The ignition harness springs for both the cylinder no. 2 and 3 rear spark plugs fired when the engine starter was engaged.

Magnetos and Ignition Harness

The magnetos and ignition harness were removed from the engine accessory case. The right magneto distributor blocks displayed some grease deposits and the left magneto switch wire had been wired to a ground wire through a rubber shielding. Each magneto was placed on a test bench and tested separately after being connected to a sample set of distributor blocks and ignition harness. All 7 electrodes fired continuously as the right and left magnetos were powered up to about 1,500 rpm.

The ignition harness and distributor blocks from the accident airplane were then connected to the right magneto, which normally feeds the electrical current to the front spark plugs through the ignition harness. Spark was observed at each ignition harness coil and as well as each coil elbow. During the harness removal, it was noted that the harness wires had been tie wrapped to the metal shielding between the cylinders and engine case.

Carburetor Examination

The carburetor was examined by a test and overhaul facility with oversight from a FAA inspector. The unit was unboxed in the presence of the FAA inspector and a visual inspection of the carburetor did not show any damage.

The carburetor assembly was split at the mating surfaces and all seals were found to be in good condition. A leak check did not find any leaks and no holes were found in the float. The inlet screen did not display any debris and all linkages were found intact and working correctly.

Ignition System Examination

Two magnetos, an ignition harness, and fourteen spark plugs were examined by the NTSB Materials Laboratory.

The spark plugs' electrical resistance was measured from the terminal to the center electrode and from the center electrode to the ground electrode. One of the spark plugs exhibited an open circuit between the terminal and center electrode. The other spark plugs displayed nominal resistance measurements.

Ignition harness continuity was measured using a digital volt meter and the integrity of the insulation was assessed using a digital mega ohm meter with a test voltage of 1kV. Electrical resistance was measured between the ignition cable conductor and the cable's insulation jacket. Additionally, the mega ohm meter was used to measure the resistance between the ignition cable conductors and the elbows of the spark plug ends of the cables. The elbows of all the top spark plugs were bent at various angles beyond 90° and exhibited buckling and deformation of the brass elbow tubing. The end to end resistance measurements (spark plug to distributor block) for each cable was unremarkable. Conductor to insulation resistance was also unremarkable. The conductor to elbow resistance was inconsistent; two of the cables displayed low resistance measurements of 0.8 ohms and 0.0001 ohms, from the T3 and T6 spark plug ends, respectively. However, it is unknown if the harness elbow damage occurred before or after the accident. According to the NTSB materials laboratory, an ignition cable with low insulation resistance would be prone to either not providing current to the spark plug or providing less current.

The magnetos did not exhibit any external damage and their rotors turned smoothly. An area of arcing was observed on the distributor rotor of the right magneto. The cause of this arcing could not be confirmed.

Additional Information

Weight and Balance

The airplane was refueled with 32 gallons of 100 low lead aviation grade gasoline at 0735 on the day of the accident. With the pilot's empirically gathered fuel consumption calculation of 14 gal/hr, the airplane would have had 7.5 gallons remaining if it started the day with 32 gallons of fuel onboard and 21.5 gallons remaining if it started the day with its total fuel capacity. Two airplane weight and balance computations were performed using the airplane pilot's operating handbook; one calculation was performed with 32 gallons of fuel onboard and another with the airplane's maximum fuel quantity of 46 gallons. With a total fuel quantity of 57 lbs, an airplane empty weight of 2,161 lbs, a pilot weight of 170 lbs, a passenger weight of 175 lbs, and an oil weight of 30 lbs, the airplane's total weight was 2,585 lbs. Using a fuel quantity of 141 lbs, with the same empty weight, occupant weights and oil weight, the airplane's total weight would have been 2,677 lbs, exceeding the airplane's maximum gross weight of 2,671 lbs.

The airplane's flight manual included a loading chart, "Index Unit vs. Gross Weight" with a shaded "RECOMMENDED BALANCE AREA." In both configurations, with the airplane loaded to 2,585 lbs and 2,677 lbs, the airplane was near to, but did not exceed the airplane's recommended loading limitations.

Fuel Computations

A fuel performance computation was performed using the pilot's reported cruise flight fuel consumption of 14 gph at 70% power and the fuel consumption at full power, 21.5 gph, captured by the fuel performance chart in the airplane's flight manual. According to the pilot, he normally flew the airplane at a 2,000 ft cruise altitude during scenic flights, which took about 4 minutes to achieve. The computation showed that the airplane would have burned a total of 24.5 total gallons of fuel in the approximate 1.6 hours of flight time that took place prior to the accident after the airplane was refueled. With 32 total gallons of fuel onboard after the airplane was refueled that morning, the airplane would have had 7.5 total gallons of fuel remaining at the time the accident flight began; 21.5 gallons onboard at the time the accident flight began had the airplane been refueled to its full capacity.

According to an industry specialist who provided mechanic services during the engine examination, the absence or loss of one spark plug may not be noticeable unless a magneto check is performed. After speaking with other Stearman owners, he further remarked that a loss of one spark plug may result in negligible rpm loss that would not impede the airplane's ability to maintain altitude at full power. According to conversations the specialist had with witnesses, he noted that the engine sounded anemic, as opposed to having a misfiring cylinder.

Several months later, the industry specialist reported that marginal slippage of the cam timing could also have prevented the pilot from starting the airplane and caused a running engine to be sluggish.

Another industry specialist reported that the Continental W670 is an inherently anemic engine. A cylinder misfire would have been noticeable. A hole in the primer line would result in an induction leak for cylinders 1, 2, 6, and 7, resulting in an overly lean fuel/air mixture.

Corrective Measures

The investigation found that the pilot had not furnished any of the family members with instructions for operating the seat belt system, but instead fastened each passengers' seat belt for them. The accident passenger further remarked that she was not prepared for the emergency with an evacuation plan. During a subsequent conversation, the NTSB Investigator-in-Charge suggested to the owner that he should develop an egress strategy that should be communicated to passengers prior to each flight. Additionally, it was suggested that he provide operating instructions for the seat belt system and have passengers demonstrate their understanding of the seat restraint prior to each flight. The pilot stated that he planned to incorporate these strategies during future flights.

Administrative Information

Investigator In Charge (IIC):	Stephen R Stein	**Report Date:**	11/06/2019
Additional Participating Persons:	Frank Motter; Federal Aviation Administration; Van Nuys, CA		
Publish Date:	11/06/2019		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=95934		