



# Aviation Investigation Final Report

<b>Location:</b>	Gilbert, Arizona	<b>Accident Number:</b>	WPR16FA183
<b>Date &amp; Time:</b>	September 17, 2016, 19:18 Local	<b>Registration:</b>	N20844
<b>Aircraft:</b>	Cessna 182P	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Explosion (non-impact)	<b>Injuries:</b>	1 Serious, 1 Minor, 4 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Skydiving		

## Analysis

The commercial pilot was conducting a skydiving flight with a night aerial pyrotechnic display. According to the pilot and the lead jumper, who was also one of the airplane's co-owners, a pyrotechnic box was installed on a step on the airplane's left main landing gear assembly spring leg just before the flight. The pilot and the lead jumper reported that, after departure and as the airplane arrived at the planned jump area and altitude, the skydivers were given the go-ahead to jump, and one of the jumper's activated the sparklers in the pyrotechnic box. Shortly thereafter, they heard an explosion and then saw damage to the bottom of the left wing with fuel pouring out of it. The left wing became engulfed in flames, and the skydivers successfully jumped out of the airplane. The pilot shut off the fuel and performed a slip maneuver in an attempt to extinguish the fire to no avail. After realizing that the airplane would not be able to reach the nearest airport, he tried to aim the airplane toward a field and then jumped out of the airplane. The airplane subsequently impacted a house, and most of the airplane and the house's interior were consumed by fire.

Examination of aluminum metal pieces from the pyrotechnic box revealed a high degree of fragmentation, fractures along the fold lines, outward deformation, curling of some of the edges, and cratering from high-velocity particle impact, consistent with an explosion originating from inside the pyrotechnics box. Shrapnel from the box, which was located near the left wing, likely punctured the left wing fuel tank, which led to the subsequent fuel leakage and fire.

The pilot reported that there were no mechanical malfunctions or failures with the airplane before the explosion. The pilot added that the co-owner told him the pyrotechnic box was approved and properly tested. When he asked the co-owner about the box, the co-owner said that it was a sparkler box and that its installation was considered a minor alteration because it could be easily removed and that it did not need a field approval. The pilot stated that, although he checked the security of the box during the preflight inspection, he did not read the certificate of approval (COA) for the flight given the co-owner's statements indicating that it was airworthy and approved correctly. He stated that this was his second

flight with the company using pyrotechnics. The co-owner reported that the Federal Aviation Administration (FAA) was not aware of the box installation.

Although the FAA had provided a COA for the night parachute operation, the COA did not include a special provision for night airborne pyrotechnics; therefore, the accident flight did not have the necessary authorization for flight. Further, a review of maintenance records revealed no documentation for a supplemental type certificate or field approval for the installation of the pyrotechnic box, both of which were required for this type of installation and operation. The FAA had not examined the box before the flight to determine its safety or whether the airplane was airworthy.

The owners were responsible for ensuring the airworthiness of the airplane. Further, per federal regulations, the pilot is responsible for the overall safety of the flight, including ensuring the flight complies with all applicable regulations. The owners' failure to attain proper authorization and approval to install the pyrotechnic box and use it during the flight and the pilot's failure to ensure that the use of pyrotechnics during the flight was properly authorized and approved before the flight led to the airplane being operating in an unsafe manner and contributed to the accident.

## Probable Cause and Findings

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

An inadvertent explosion of pyrotechnics, which were contained in a box that had been installed on the airplane's left main landing gear assembly spring leg which resulted in shrapnel striking the airplane's left wing and breaching the left wing fuel tank, which led to a subsequent fuel leak and fire. Contributing to the accident was the airplane owners' improper decision to install an untested pyrotechnic box and his failure to attain proper authorization to use it during the flight.

### Findings

<b>Aircraft</b>	(general) - Incorrect service/maintenance
<b>Aircraft</b>	(general) - Damaged/degraded
<b>Aircraft</b>	Fuel storage - Damaged/degraded
<b>Personnel issues</b>	Decision making/judgment - Owner/builder
<b>Personnel issues</b>	Unauthorized maint/repair - Owner/builder
<b>Personnel issues</b>	Modification/alteration - Owner/builder



## Factual Information

### History of Flight

<b>Prior to flight</b>	Aircraft maintenance event
<b>Enroute-cruise</b>	Explosion (non-impact) (Defining event)
<b>Enroute-cruise</b>	Attempted remediation/recovery
<b>Emergency descent</b>	Collision with terr/obj (non-CFIT)
<b>Enroute-cruise</b>	Fire/smoke (non-impact)

On September 17, 2016, about 1918 mountain standard time, a Cessna 182P airplane, N20844, was destroyed when it impacted a residential structure, following an inflight fire near Gilbert, Arizona. The commercial pilot was seriously injured, and the four passengers were not injured. One of the two occupants of the house sustained a minor injury. The airplane was registered to and operated by P & T Aerial Services LLC under the provisions of Title 14 *Code of Federal Regulations* (CFR) Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the local skydiving flight that departed Chandler Municipal Airport (CHD) Chandler, Arizona, about 1904.

The airplane was participating in the Gilbert's Annual Constitution Fair, a private event, which involved a night aerial pyrotechnic display and four skydivers parachuting into a predetermined drop zone. According to the pilot and the lead jumper, as the airplane arrived at the planned jump area and altitude of 5,000 ft mean sea level (msl), they were given the go-ahead to jump. The sparklers in a pyrotechnic box located on the left side of the airplane, were activated by a jumper, and shortly thereafter they heard a loud boom off to the left of the airplane, which the pilot described as an explosion. Afterwards, both the pilot and the lead jumper noticed damage to the underside of the airplane's left wing, evidenced by fuel pouring out. The lead jumper stated that there was jagged metal protruding out of a big hole about 2 ft from the pilot's left window. As the leaking fuel and the left wing became engulfed with flames, the skydivers successfully jumped out of the airplane's right-side door. The pilot stated he shut off fuel to the airplane's left tank and attempted a slip maneuver, which he thought might extinguish the fire. He initially considered landing at CHD but realized he would not make the airport, since the fire and resulting heat had worsened. The pilot then radioed a distress call and egressed and parachuted out of the airplane as it was becoming unflyable. The airplane subsequently impacted a house in a residential area about 4 miles north of CHD.

On the night of the accident, one of the airplane's co-owners, who was also the lead jumper, stated to an investigator with the National Transportation Safety Board (NTSB), that he thought it was possible that an issue with the pyrotechnic box had caused the puncture in the wing and resultant fire. Further, during an interview with a law enforcement officer on the night of the accident, the pilot stated that he believed there was a malfunction or premature deployment of the pyrotechnics that caused the airplane to catch fire. He further reported that there were no mechanical issues with the airplane prior to the explosion.

Radar data showed the airplane departing CHD and performing a climbing right turn towards Gilbert, Arizona. Two clockwise patterns were flown around the vicinity of the Gilbert Civic Center, where the

landing zone for the skydivers was located. At 1916:44, a peak altitude of 5,725 ft mean sea level (msl) was attained, and the groundspeed indicated 96 knots. At 1917:27, the altitude began to decrease and the pilot advises air traffic control that he has an emergency situation and fire on the wings. The controller acknowledges the transmission and asks the pilot if he wants to go to Chandler. The pilot does not respond and there are no further transmissions from the pilot. The last recorded data was at 1917:55, at an altitude of 3,350 ft msl, and a groundspeed of 105 knots.

### Pilot Information

<b>Certificate:</b>	Commercial; Private	<b>Age:</b>	31, Male
<b>Airplane Rating(s):</b>	Single-engine land; Single-engine sea; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Unknown
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	October 9, 2015
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	May 20, 2015
<b>Flight Time:</b>	(Estimated) 875 hours (Total, all aircraft), 200 hours (Total, this make and model)		

### Passenger Information

<b>Certificate:</b>		<b>Age:</b>	Male
<b>Airplane Rating(s):</b>		<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>		<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>		<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>		<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>		<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>			

### Passenger Information

<b>Certificate:</b>		<b>Age:</b>	Male
<b>Airplane Rating(s):</b>		<b>Seat Occupied:</b>	Unknown
<b>Other Aircraft Rating(s):</b>		<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>		<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>		<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>		<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>			

## Passenger Information

<b>Certificate:</b>	<b>Age:</b>	Male
<b>Airplane Rating(s):</b>	<b>Seat Occupied:</b>	Unknown
<b>Other Aircraft Rating(s):</b>	<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>		

## Passenger Information

<b>Certificate:</b>	<b>Age:</b>	Female
<b>Airplane Rating(s):</b>	<b>Seat Occupied:</b>	Unknown
<b>Other Aircraft Rating(s):</b>	<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>		

The pilot held a commercial pilot certificate with airplane multi-engine land, single-engine land, single-engine sea, and instrument airplane ratings. He was issued a second-class airman medical certificate on October 9, 2015, without limitations/waivers. The pilot reported that he had accumulated about 875 total flight hours, with about 200 hours in the same make and model as the accident airplane.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N20844
<b>Model/Series:</b>	182P NO SERIES	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1972	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	182261251
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	1
<b>Date/Type of Last Inspection:</b>	November 23, 2015 Annual	<b>Certified Max Gross Wt.:</b>	2950 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	3458 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Continental
<b>ELT:</b>	C91 installed, not activated	<b>Engine Model/Series:</b>	O-470 U
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	215 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The high-wing all metal airplane was manufactured in 1972. A review of the airframe logbooks revealed that the last annual inspection was accomplished on November 23, 2015, at a total airframe time of 3,458.0 hours.

During interviews with NTSB investigators, the airplane co-owner stated that the airplane was equipped with a pyrotechnic box that was mounted to the airframe step on the left side of the airplane. He stated that the pyrotechnic box would typically be operated during the night jumps for a visual effect for those observing on the ground, and that there were no previous problems with the box. He further stated that two pyrotechnic devices were installed in the box that would sparkle as the jumpers egressed. He estimated that the pyrotechnic devices to be about 8 inches long and have a diameter of about 2 ½ inches. The devices had between a 22-30 second burn duration and were activated by a switch box on the airplane's floor by one of the jumpers about 30 seconds prior to the jump.

The airplane was modified and converted for use in skydiving operations by the current owners in what they described as a standard configuration of an airplane used in the skydiving industry. A total of eight modifications were accomplished in accordance with Title 14 *CFR* Part 43 through the use of two Major Repair and Alteration, FAA Form 337's, both dated September 19, 2012. A separate FAA Form 337, dated January 11, 2014, located in the airworthiness history for the airplane stated, "this document is an amendment for FAA Form 337, dated 19 Sept. 2012." This form did not stipulate which previous Form 337 was being amended, however it appeared to encompass all areas contained within the previous two 337s, and referenced FAA Form 8110-3, which was not previously mentioned. It was approved by the FAA on November 5, 2014. However, a review of the airplane's maintenance logbook found no supporting documentation for a Supplemental Type Certificate, field approval, or logbook entry, for the installation of the pyrotechnic box on the factory equipped left step located on the left main landing gear spring assembly (leg).

According to the airplane's co-owner and the accident pilot, the pyrotechnic box was attached to the airplane's left main landing gear step, just prior to the accident flight. The pilot stated that the co-owner

told him that the box was approved and properly tested. When he asked the co-owner about the installed box, the co-owner said that it was a sparkler box that was considered a minor alteration and did not need a field approval since it could easily be removed. The pilot stated he checked the security of the box on his preflight but did not check for its approval in the airplane's paperwork based on the co-owner's statements. The pilot stated that this was his second skydiving night flight that used pyrotechnics with the company. The co-owner stated that three bolts and nuts were used to secure the box and that the FAA was not aware of the box installation.

### Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Night
<b>Observation Facility, Elevation:</b>	KCHD, 1243 ft msl	<b>Distance from Accident Site:</b>	4 Nautical Miles
<b>Observation Time:</b>	19:18 Local	<b>Direction from Accident Site:</b>	206°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	15 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	5 knots / None	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>		<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	29.86 inches Hg	<b>Temperature/Dew Point:</b>	35°C / -1°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Chander, AZ (CHD)	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Chander, AZ (CHD)	<b>Type of Clearance:</b>	VFR
<b>Departure Time:</b>	19:04 Local	<b>Type of Airspace:</b>	Class B

A review of data from the CHD automated weather observation station, located about 4 miles south of the accident site revealed that at 1918 conditions were winds variable at 5 knots, visibility 10 statute miles, clear sky, temperature 35°C, dew point -1°C, and an altimeter setting of 29.86 inches of mercury.

### Airport Information

<b>Airport:</b>	CHANDLER MUNI CHD	<b>Runway Surface Type:</b>	
<b>Airport Elevation:</b>	1243 ft msl	<b>Runway Surface Condition:</b>	
<b>Runway Used:</b>		<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>		<b>VFR Approach/Landing:</b>	None



## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Serious	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>	4 None	<b>Aircraft Fire:</b>	Both in-flight and on-ground
<b>Ground Injuries:</b>	1 Minor	<b>Aircraft Explosion:</b>	In-flight
<b>Total Injuries:</b>	1 Serious, 1 Minor, 4 None	<b>Latitude, Longitude:</b>	33.324722,-111.780281(est)

Examination of the accident site by the NTSB investigator-in-charge revealed that the airplane penetrated through a roof of a single-story residential house at an elevation of about 1,247 ft msl. A postimpact fire ensued, which consumed most of the airplane and interior of the house. The airplane impacted the residence at a steep nose down attitude. All major components of the airplane were contained within the wreckage site. Most of the wreckage debris was scattered in the back half of the house and backyard. Behind the backyard fence there was an open field.

The majority of both wings were located in the backyard. The wings sustained thermal damage and substantial leading-edge compression. The engine and parts of the propeller dome were located at the point of ground impact. Due to thermal damage, flight control continuity could not be established. The instrument control panel and cabin area were mostly consumed by the postimpact fire. Following the on-scene examination, the airplane wreckage was recovered to a secure facility for further examination.

Further examination of the airplane revealed that the remnants of the interior structure of the left wing, where the fuel tank was located, showed no outward buckling or other similar damage. Portions of the upper and lower left wing skins and all of the left main fuel tank were destroyed by thermal damage.

Examination of the left main landing gear leg revealed holes with wires that ran from the pyrotechnic box along the gear leg, under the gear leg fairing, through a hole in the landing gear bulkhead, and then through a hole drilled in the cabin floor inspection plate, into the cabin.

## Medical and Pathological Information

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing on the pilot. Testing was negative for ethanol. The following drugs were tested for: amphetamines, opiates, marijuana, cocaine, phencyclidine, benzodiazepines, barbiturates, antidepressants, and antihistamines. Positive results for morphine and ondansetron were present. Tests were negative for the remainder of the drugs.

A review of the pilot's postaccident medical care by the NTSB's Chief Medical Officer revealed that the pilot was administered amounts of morphine for pain during his evacuation from the accident scene and ondansetron during his evaluation at the emergency department. The positive toxicology results were consistent with the medications administered to the pilot during his postaccident treatment.

## Tests and Research

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Several pieces of aluminum sheet metal, the mounting bracket, and remnants of a pyrotechnic device, were located on the ground near the drop zone. The aluminum metal pieces were examined by specialists in the NTSB Materials Laboratory. A complete report is contained in the public docket. The recovered aluminum metal pieces were consistent with the pyrotechnic box that was constructed with folded and riveted aluminum sheet metal, to contain two pyrotechnics devices, and attached to the airplane, on a step, on the left main landing gear leg.

Two recovered aluminum pieces of the sheet metal had circular holes in them, consistent with those used to mount the pyrotechnic box to the step on the left main landing gear leg. The top of the pyrotechnic box appeared to have a top with a long piano hinge on one side, presumably to access the box. Three recovered pieces of aluminum sheet metal had screw holes for the piano hinge distributed along their top edge.

Examination of the aluminum metal pieces revealed a high degree of fragmentation, fractures along the fold lines, outward deformation, pedaling and curling of some of the edges, and cratering from high velocity particle impact, that were consistent with an explosion that originated from the inside of the pyrotechnics box. The aluminum metal pieces were consistent with shrapnel from the explosion.

## Additional Information

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According to Title 14 *CFR* Part 105, section 105.21: "no person may conduct a parachute operation, and no pilot in command of an aircraft may allow a parachute operation to be conducted from that aircraft, over or into a congested area of a city, town, or settlement, or open-air assembly of persons, unless a certificate of authorization for that parachute operation has been issued."

An FAA Certificate of Authorization (COA) was approved for the night of the accident flight that authorized parachute operations at Gilbert, Arizona, between 19:00 to 20:00 by the Arizona Skyhawk Parachute Demonstration Team. The planned parachute operation listed was for one pass with four jumpers, at an altitude of 4,000 ft msl, or as authorized by ATC (higher if possible). The FAA National Aviation Events Program's website lists examples of night airborne pyrotechnic special provisions that should be included in the COA for those events conducted at night. However, there was no special provision in the approved COA for the accident night, that authorized the use of pyrotechnics by the airplane.

The authorization included a provision where the airplane owner would contact Lockheed Martin Prescott Flight Service Station (FSS) of the date, time, place, areas, altitudes, nature of activity, duration, and request a NOTAM be issued. However, a NOTAM search by the FSS failed to locate any NOTAMs

issued for the accident flight and jump.

The pilot stated that he was unaware that the use of pyrotechnics during the flight was not authorized by the FAA. He further stated that he did not read the COA for the parachute jump event. The airplane's co-owner and lead jumper also stated that the four jumpers had a small pyrotechnic device that they mounted to their ankle, similar but smaller to that on the airplane, that would sparkle as they jumped.

According to Title 14 *CFR* Chapter 1, Subchapter A, Part 1, section 1.1, the definition of the pilot-in-command (PIC): "means the person who has the final authority and responsibility for the operation and safety of the flight." The PIC is responsible for the overall safety of the flight, including ensuring the flight is in compliance with all applicable regulations. The language of a former NTSB decision stated factors to consider when determining the extent of a PIC's responsibilities: "As a general rule, the PIC is responsible for the overall safe operation of the aircraft. However, a particular task is the responsibility of another, if the PIC has no independent obligation (e.g. based on operating procedures or manuals) or ability to ascertain the information, and if the captain has no reason to question the other's performance, then and only then will no violation be found." (FAA letter to Mr. Johnson, February 13, 1997).

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Nixon, Albert
<b>Additional Participating Persons:</b>	Christopher Kennedy; Federal Aviation Administration; Scottsdale, AZ Henry Soderlund; Textron Aviation; Wichita, KS
<b>Original Publish Date:</b>	November 6, 2019
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.ntsb.gov/Docket?ProjectID=94030">https://data.ntsb.gov/Docket?ProjectID=94030</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](#).