



National Transportation Safety Board Aviation Accident Final Report

Location:	Scottsdale, AZ	Accident Number:	WPR18FA119
Date & Time:	04/09/2018, 2048 MST	Registration:	N9456P
Aircraft:	PIPER PA 24-260	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	6 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The airline transport pilot, student pilot, and four passengers departed on a cross-country flight with the airline transport pilot occupying the front right seat, the student pilot occupying the front left seat, and the four passengers occupying the two middle row and two aft row seats. Even though the student pilot was seated in the left seat, the investigation could not determine who was manipulating the flight controls when the accident occurred.

Witnesses and airport surveillance camera video indicated that the airplane's wings were rocking during the departure and shortly after rotation. The controller asked if the airplane was experiencing any difficulties; according to the controller, the pilot responded, "we're good. We're just in training mode." One witness reported that the engine sounded as if it was not developing enough power. The last recorded radar data point indicated that the airplane's altitude was about 200 ft above ground level. A traffic camera, located about 0.5-mile northwest of the end of the runway, showed the airplane in a left bank turning left. As the turn progressed, the bank angle increased, and the airplane started to descend. The airplane's wings were nearly vertical before the airplane impacted terrain. A postcrash fire ensued.

Evidence indicated that, at the time of departure, the airplane was 135 pounds over its maximum gross weight and was loaded 2.22 inches beyond its aft center of gravity (CG) limit. The CG is an important factor in flight performance. If the CG is too far aft, the airplane could rotate prematurely on takeoff, and longitudinal stability could be reduced. It is likely that during the initial climb, the pilot was unable to maintain airspeed which resulted in a loss of control.

Postaccident examination of the engine revealed that the No. 3 cylinder intake outer valve spring was broken. The fracture surfaces had signatures consistent with fatigue growth before failure. The surface damage observed on the springs indicated that the failure had likely occurred at some point before the accident and had gone undetected. It is likely that the failure reduced the available engine power that, although not detectable during previous flights, was

more critical with the overloaded condition of the accident flight. No other preimpact anomalies were noted that would have precluded normal operation of the engine and airframe.

The inactive cocaine metabolite benzoylecgonine was found in the student pilot's blood specimens at fairly low or nondetectable concentrations and without any detection of cocaine, which indicated past and not immediate cocaine use. Although the timing of the student pilot's cocaine use could not be determined, cocaine has a very short half-life, so, unless the student pilot was a chronic user, this drug would have a negligible effect after 6 hours. Similarly, the detection of methylenedioxymethamphetamine (ecstasy) in the student pilot's urine but not blood specimens indicated past and not immediate use of this drug. Thus, the student pilot's cocaine and ecstasy use were not a factor in this accident.

Probable Cause and Findings

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

The flight instructor's failure to maintain airplane control during the initial climb as a result of the airplane being loaded above its maximum gross weight and beyond its aft center of gravity limits. Contributing to the accident was a degraded engine power output due to a preexisting engine cylinder intake valve spring failure, which further reduced the airplane's climb capability.

Findings

Aircraft	CG/weight distribution - Capability exceeded (Cause)
	Maximum weight - Capability exceeded (Cause)
	Recip eng cyl section - Fatigue/wear/corrosion (Factor)
Personnel issues	Aircraft control - Pilot (Cause)
	Weight/balance calculations - Pilot

Factual Information

HISTORY OF FLIGHT

On April 9, 2018, about 2048 mountain standard time, a Piper PA-24-260 airplane, N9456P, was destroyed when it impacted terrain shortly after takeoff from Scottsdale Airport (SDL), Scottsdale, Arizona. The airline transport pilot, the student pilot, and four passengers were fatally injured. The airplane was registered to N9456P LLC and was operated by the pilots as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Nighttime visual meteorological conditions prevailed, and no flight plan was filed for the cross-country flight, which was destined for North Las Vegas Airport (VGT), Las Vegas, Nevada.

Earlier that evening, the airline transport pilot flew the airplane from VGT to SDL to pick up the student pilot and the passengers and fly them to VGT. The inbound flight, which was the airline transport pilot's first flight in the airplane, departed from VGT at 1842 mst and landed at SDL at 2018.

A video surveillance camera at SDL located on the ramp where the airplane was parked captured the occupants as they began to board the airplane about 2028. The surveillance video, along with photographs and videos posted to social media by one of the occupants, revealed that the student pilot occupied the front left seat and that the airline transport pilot occupied the front right seat.

A video surveillance camera located midfield on the west side of the runway captured the airplane's departure from runway 03. The video showed that the airplane's wings were rocking during and shortly after rotation.

The tower controller reported that, as the airplane began the departure roll, the lights on the wings were alternating up and down as if the pilot was rocking the wings. The controller also reported that, as the airplane passed the tower, the wings appeared to be stable but that the engine sounded as if it was not producing enough power. At that time, the controller asked the pilot if the airplane was experiencing any difficulty. According to the controller, the pilot responded, "we're good. We're just in training mode." The controller observed the airplane continue straight out but noted that it did not appear to be climbing. Over the departure end of the runway, the airplane made a left turn. A review of radar data revealed that the airplane's last depicted altitude, between 2046:18 and 2046:28, was about 200 ft above ground level, which occurred during the left turn. As the airplane continued in the left turn, the controller observed the airplane enter a nose-down attitude.

A traffic camera located about 0.5-mile northwest of the end of the departure runway recorded the airplane in a left bank. The bank angle continued to increase as the airplane descended, and its wings were nearly vertical. The camera then depicted the airplane's impact with terrain and a fireball.

Video captured by the traffic camera and the airport tower camera were used to estimate the trajectory and speed of the airplane. The airplane's ground speed was estimated at 75 ± 4 knots

shortly after takeoff, and its climb rate was 270 ft per minute (fpm). Twelve seconds later, as the airplane entered the left turn near the end of the runway, its ground speed decayed to 50 ± 4 knots. The airplane began to descend and impacted the ground several seconds later. The airplane was airborne for about 70 seconds.

A witness located near the departure end of the runway was listening to the tower frequency and overheard the controller asking the pilot if the airplane was experiencing any difficulties. The witness looked down the runway and observed the airplane proceeding toward him. As the airplane flew by, the witness noted that the airplane appeared to drift toward the west side of the runway safety area while at low altitude and that the engine sounded as if it was not developing full power. The witness stated that the airplane, before reaching the end of the runway, started "an early left crosswind turn." The witness also stated that the airplane continued in the turn and started to descend just before disappearing from sight behind buildings and trees. Seconds later, the witness heard an explosion and saw a plume of smoke and fire.

Another witness located on the ramp observed the boarding process and watched the airplane taxi toward the runway. The witness lost sight of the airplane but was able to hear what sounded like a typical preflight engine run-up. The witness then observed the airplane accelerate down the runway and stated that, about midway, the wings began to roll in an "extreme" motion. The witness reported that the oscillations eventually diminished, and that the airplane began to climb, reaching an altitude that was about level with the top of the adjacent airport buildings. The airplane continued at an altitude that was about the same altitude and then began a climbing left turn, which appeared similar but lower than most aircraft departing the traffic pattern. As the turn progressed, the airplane's attitude changed to pitch down, and the airplane disappeared from sight. A fireball ensued. The witness did not hear any unusual sounds or see the airplane emitting smoke, fire, or vapors, and she stated that the engine sounded similar to the airplanes that she observes.

PERSONNEL INFORMATION

The pilot held an airline transport pilot certificate with airplane single-engine land and multiengine land ratings. He also held a flight instructor certificate with ratings for airplane single engine, airplane multiengine, and instrument airplane. On February 7, 2018, the pilot received a special issuance first-class medical certificate with the following limitation: "Not valid for any class after 08/31/2018." At the time of his most recent medical application, the pilot reported that he had 5,200 hours of total flight experience, 500 hours of which were in the previous 6 months. The pilot's employer reported that, from August 24, 2017 (his start date with the company), to April 8, 2018 (the day before the accident), the pilot had accumulated 161 hours of flight time, 69 hours of which were in 2018. The pilot had accumulated about 2 hours of flight time in the accident airplane.

The student pilot had been receiving lessons from another flight instructor. He did not possess a student pilot or airman medical certificate. The student pilot's total flight experience could not be determined.

AIRCRAFT INFORMATION

The single-engine, retractable gear airplane was manufactured in 1970 and was powered by a 260-horsepower, 6-cylinder, fuel-injected Lycoming IO-540-N1A5 engine and a two-blade constant-speed Hartzell propeller. The airplane was equipped with six seats.

The last entry in the airframe logbook indicated that the airplane received an annual inspection on December 1, 2017, at a total airframe time of 6,158 hours.

According to a logbook entry dated August 1, 1973, the airplane's empty weight was 2,007 pounds, the useful load was 1,193 pounds, and the empty weight center of gravity (CG) was 87.22 inches. No additional weight and balance data were located. The airplane flight manual listed a maximum allowable gross weight of 3,200 pounds and a CG range between 80.5 and 93.0 inches aft of datum.

The last obtained fuel receipt was dated April 3, 2018, from VGT. A search of commercially available flight software indicated that the flight from VGT to SDL on the day of the accident was the first flight after the last refueling.

The combined weight of the pilot and the student pilot was about 375 pounds, the combined weight of the two passengers (a male and female) located in the middle row was about 320 pounds, and the combined weight of the two passengers (both female) in the aft row was about 252 pounds. All of the estimated weights included 15 pounds of carry-on baggage per person. An estimated fuel load of 63.44 gallons was calculated based on the maximum usable fuel (86 gallons) subtracted by the fuel burned during the flight from VGT to SDL (22.56 gallons based on an in-flight power setting of 75%).

Given the passenger weights along with the estimated fuel at the time of initial taxi, the airplane would have weighed about 3,335 pounds at the time of takeoff, and its CG would have been 95.22 inches aft of datum. These values were 135 pounds above the airplane's maximum gross weight and 2.22 inches aft of the CG.

With a calculated density altitude of 3,300 ft (based on meteorological conditions about the time of the accident), an airplane weight of 3,200 pounds, flaps at 15°, and the landing gear extended, the expected rate of climb is 700 fpm. When the airplane is in a clean configuration with the same weight and density altitude, the expected rate of climb is 1,110 fpm.

METEOROLOGICAL INFORMATION

The 1953 SDL weather observation included wind from 160° at 3 knots, visibility 10 miles, clear skies, temperature 28°C, dew point -5°C, and altimeter setting 29.94 inches of mercury. Based on these values, the calculated density altitude was about 3,300 ft.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest in a golf course about 1/4-mile northwest of the end of the runway 03 at an elevation of 1,484 ft. All major sections of the airplane were recovered at the accident site. The main wreckage sustained extensive impact and thermal damage and was contained within a debris field about 180 ft in length and 40 ft wide. The right wing, which remained partially

attached to the fuselage, appeared to have struck a tree during the impact sequence. The left wing had fragmented into several sections and had separated from the fuselage. Both the left and right main landing gear had detached from their respective wings.

The empennage was intact and had separated from the aft fuselage due to thermal damage. The stabilator and rudder remained secured at their respective attach points. The rudder cables remained attached to the rudder horn. The stabilator cables remained attached to the stabilator horn tube. The stabilator trim drum exposed 0.25 inch of the jackscrew, which corresponded to a slight nose-down trim setting.

The fuselage section came to rest in an upright position. The forward cockpit and instrument panel were destroyed by fire, and the engine remained attached to the firewall. Flight control continuity was established from all flight control surfaces to the respective cockpit controls. The landing gear retraction transmission screw exhibited 30 threads, which was consistent with a landing-gear-retracted position at impact.

The electric flap system sustained extensive fire damage. The transmission assembly coupling exhibited nine exposed threads, which was consistent with the flaps in the retracted position at impact. The fuel selector handle and valve assembly sustained fire damage and were found in the left main fuel tank position.

The four cockpit and middle row seat assemblies sustained impact and fire damage. The seats had detached from the floor tracks, most of which were destroyed. The seat fabric and belt webbing material were consumed by fire. The aft row seat assemblies were completely consumed by fire and could not be examined.

The engine crankshaft was manually rotated at the flywheel, and compression was obtained on all six cylinders. Valve and gear train continuity was established. The color of the top spark plug electrodes was consistent with normal operation. The rear accessory case sustained thermal damage, partially consuming most of its associated components. The accessory gears, including the crankshaft gear, bolt, and dowel, were intact and undamaged. The left and right magnetos, which were observed at their respective mounting pads, sustained fire damage, so the magnetos could not be functionally tested. The fuel pump, vacuum pump, and oil filter were destroyed by postcrash fire. The injector fuel screen was clean, and the throttle and mixture arms were attached.

The propeller had separated from the crankshaft flange at the hub. The fracture surfaces exhibited signatures consistent with overload. The spinner was attached to the propeller. The propeller blades remained attached at the hub and displayed significant leading-edge gouging, torsional twisting, chordwise striations across the cambered surface, and trailing edge "S" bending. One blade was rotated about 180°. The propeller governor was intact, the linkage was attached, and the governor gasket screen was clear.

The engine examination revealed that the No. 3 cylinder outer intake valve spring was broken. The cylinder was removed, disassembled, and visually examined. The spring had broken into four pieces and exhibited a polished and pitted appearance. Examination of the intake and exhaust springs for the other five cylinders revealed no anomalies.

The spring fragments from the No. 3 cylinder were sent for further examination to the National Transportation Safety Board's Materials Laboratory.

Examination of the three fracture faces using a scanning electron microscope revealed that two of the fractures initiated at pits on the inside diameter of the helix and propagated due to fatigue crack growth through about 40% to 50% of the diameter before final fracture due to overstress. The fracture surfaces on the third fracture were obscured by mechanical damage; therefore, the fracture origin could not be determined.

MEDICAL AND PATHOLOGICAL EXAMINATION

The Maricopa County Office of the Medical Examiner, Phoenix, Arizona, performed autopsies on the pilot and the student pilot. Their cause of death was blunt force injuries and thermal trauma.

Toxicology testing at the FAA's Forensic Sciences Laboratory was conducted on specimens from the pilot and student pilot. For the pilot, the results were negative for carbon monoxide, ethanol and all drugs tested.

For the student pilot, the testing identified benzoylecgonine in his blood (0.03 mg/L) and urine (2.608 mg/L) specimens and ecgonine methyl ester and methylenedioxymethamphetamine (MDMA) in his urine samples. No carbon monoxide or ethanol was detected.

Benzoylecgonine and ecgonine methyl ester are inactive metabolites of cocaine, which is a central nervous system stimulant. The half-life of cocaine is about 1 hour. The half-life of benzoylecgonine is 6 hours and it may persist in the urine at detectable concentrations from 2 to 4 days. A study found that after intranasal administration of 106 mg of cocaine, average peak plasma concentrations of cocaine and benzoylecgonine were 0.22 mg/L at 30 minutes and 0.61 mg/L at 3 hours, respectively.

MDMA is a controlled substance (ecstasy) used recreationally for its stimulant, mild hallucinogenic, and empathogenic properties. MDMA is rapidly absorbed and has a half-life of about 7 hours. Peak concentrations of MDMA are observed 1.5 to 2 hours after administration. No clear correlation exists between MDMA blood concentrations and effects. The onset of desired effects occurs after 20 to 30 minutes and lasts about 1 hour; other general effects may last 2 to 3 hours.

The use of MDMA is associated with cognitive and perception impairments. Users may experience fatigue, decreased fine motor skills, slowed reactions, impulsivity, and difficulty maintaining attention and performing complex tasks. In a study of subjects who were arrested for driving under the influence, MDMA was detected at blood concentrations of less than 0.05 to 0.58 mg/L.

History of Flight

Prior to flight	Aircraft loading event
Initial climb	Loss of engine power (partial) Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline Transport	Age:	32, Male
Airplane Rating(s):	Multi-engine Land; Multi-engine Sea	Seat Occupied:	Right
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 With Waivers/Limitations	Last FAA Medical Exam:	02/07/2018
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	5200 hours (Total, all aircraft)		

Student Pilot Information

Certificate:	Student	Age:	28
Airplane Rating(s):	None	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	None	Last FAA Medical Exam:	
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	PIPER	Registration:	N9456P
Model/Series:	PA 24-260 260	Aircraft Category:	Airplane
Year of Manufacture:	1970	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	24-4964
Landing Gear Type:	Tricycle	Seats:	6
Date/Type of Last Inspection:	12/01/2017, Annual	Certified Max Gross Wt.:	3200 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	6158 Hours as of last inspection	Engine Manufacturer:	LYCOMING
ELT:		Engine Model/Series:	T10-540-N1A5
Registered Owner:	On file	Rated Power:	310 hp
Operator:	On file	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night
Observation Facility, Elevation:	KSDL, 1473 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	1953 MST	Direction from Accident Site:	221°
Lowest Cloud Condition:	Clear	Visibility	
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	Calm /	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.94 inches Hg	Temperature/Dew Point:	28°C / -5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Scottsdale, AZ (SDL)	Type of Flight Plan Filed:	None
Destination:	LAS VEGAS, NV (VGT)	Type of Clearance:	None
Departure Time:	2047 MST	Type of Airspace:	

Airport Information

Airport:	SCOTTSDALE (SDL)	Runway Surface Type:	N/A
Airport Elevation:	1510 ft	Runway Surface Condition:	
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	4 Fatal	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	On-Ground
Total Injuries:	6 Fatal	Latitude, Longitude:	33.635556, -111.897778 (est)

Administrative Information

Investigator In Charge (IIC):	Maja Smith	Report Date:	05/19/2020
Additional Participating Persons:			
Publish Date:	05/19/2020		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=97006		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).