



National Transportation Safety Board Aviation Accident Final Report

Location:	Reno, NV	Accident Number:	WPR16FA178
Date & Time:	09/11/2016, 1813 PDT	Registration:	N821ET
Aircraft:	PIPER PA 28R-201T	Aircraft Damage:	Destroyed
Defining Event:	Aircraft loading event	Injuries:	3 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The private pilot and two passengers were departing on a cross-country flight to transfer the rear-seat passenger to California, where a series of warrants had been issued for her arrest. A California-based bail bondsman was seated in the front right seat and the pilot was seated in the front left seat. The arrested passenger was restrained on the rear left seat by the lap belt.

Witnesses, surveillance camera footage, and recorded data from on board the airplane indicated that the airplane began its takeoff roll and climbed to about 200 ft above ground level (agl) before leveling off. One witness stated that the airplane immediately began to rock its wings, and the nose pitched up to a high angle and remained in that attitude as the airplane continued to fly over the runway. About 2/3 of the way down the runway, the airplane began to veer right of the runway centerline and entered a right, descending turn. The last recorded data showed the airplane in a 41° right bank with a 64° nose-down attitude. The airplane impacted a lamppost, vehicles, and the ground in a parking lot with the landing gear extended.

Postaccident examination did not reveal any anomalies with the airframe or engine that would have precluded normal operation. Sound spectrum analysis of the background noise recorded during the pilot's radio transmissions, along with examination of the propeller's internal and external witness signatures, revealed that the engine was likely producing takeoff power throughout the flight. The rear-seat passenger was found buckled in her seat after the accident; her legs were cuffed by leg-chains, and her hands were cuffed to her waist through a belly chain, thus, there was no evidence to suggest that the rear seat passenger interfered with the flight.

The pilot fueled the airplane almost to capacity before he definitively established the total weight of all occupants for the accident flight. Furthermore, he added more fuel than originally requested to avoid paying a facility fee to the fixed base operator (FBO). Further, the pilot's statements to FBO personnel indicated that he was concerned about the airplane being overweight. Although the pilot could have defueled the airplane in order to remain within weight and balance limitations, this would have been a time-consuming process, and it is likely

that he felt pressured to proceed with the flight as planned in order to return the passenger to California that evening. Also, the time spent defueling would have resulted in the flight taking place in night conditions over mountainous, dark, uninhabited terrain.

The airplane was about 178 lbs over its maximum gross weight and loaded at or just beyond its aft center of gravity limit when it departed on the flight. Under such conditions, the airplane likely encountered longitudinal instability during takeoff and altitude and pitch oscillations. Strong gusty wind conditions and high density altitude (6,900 ft) further exasperated the situation and likely resulted in the pilot's difficulty controlling the airplane during the initial climb, which ultimately led to a loss of control.

The airplane was fitted with an aftermarket turbo intercooler system. Its manufacturer did not provide specific performance data, instead stating that the engine performance would have been "equal to or better than" standard equipment. It is possible that the pilot felt this system would have given the airplane increased performance capability.

Toxicology testing indicated the pilot had recently used 3 separate opioid drugs in addition to a sedating benzodiazepine (diazepam), and either meprobamate or its parent drug, carisoprodol. Although medical records indicated that the pilot had at one point been prescribed one opioid (oxycodone) and carisoprodol, the nearly simultaneous use of three separate opioids strongly suggests that he was misusing these substances. All of these medications are sedating and carry specific warnings against using them in combination. While the levels identified in cavity blood may be higher or lower than antemortem drug levels, the toxicology tests suggest that the pilot had 4 impairing substances in his blood at the time of the accident, and it is likely that his use of the combination of impairing medications contributed to his poor decision-making and willingness to attempt/proceed with the flight as planned.

Probable Cause and Findings

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

The pilot's decision to depart with the airplane loaded above its maximum gross weight and at or just beyond its aft center of gravity limitations, which resulted in a loss of control during the initial climb. Contributing to the accident was the pressure to complete the flight as planned, and the pilot's use of multiple impairing drugs, which degraded his decision-making.

Findings

Aircraft	Maximum weight - Capability exceeded (Cause) CG/weight distribution - Capability exceeded (Cause)
Personnel issues	Weight/balance calculations - Pilot (Cause) Aircraft control - Pilot (Cause) Decision making/judgment - Pilot (Cause) Prescription medication - Pilot (Factor)
Environmental issues	Time/schedule pressure - Decision related to condition (Factor)

Factual Information

History of Flight

Prior to flight	Aircraft loading event (Defining event)
Initial climb	Inflight upset
	Loss of control in flight
Emergency descent	Collision with terr/obj (non-CFIT)

On September 11, 2016, at 1813 Pacific daylight time, a Piper PA-28R-201T, N821ET, impacted an airport parking lot after takeoff from Reno/Tahoe International Airport (RNO), Reno, Nevada. The private pilot and two passengers were fatally injured, and the airplane was destroyed. The airplane was registered to RCS3 LLC and was being operated by the pilot under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and an instrument flight rules flight plan had been filed for the personal flight, which was destined for San Carlos Airport (SQL), San Carlos, California.

The purpose of the flight was to transport the rear-seat passenger from Nevada to California, where a series of warrants had been issued for her arrest. The front-seat passenger was a California-based bail bondsman, and the pilot was his associate. Security video footage and records provided by the fixed-base operator (FBO) at RNO indicated that the airplane arrived at the FBO about 1715. A fuel order was placed 5 minutes later, and the pilot and bail bondsman then walked to the FBO's reception area. The fueling was complete by 1725, and by 1741 the pilot had returned. He removed the chocks, leant over the wings and appeared to briefly look into both fuel tank filler necks, and then boarded the airplane. About 5 minutes later the bail bondsman arrived with the arrested passenger, who was restrained by leg chains. Although her entry into the airplane was obscured from view by the fuselage, she appeared to make multiple attempts to step up into the cabin. After about 3 minutes of maneuvering, she was onboard, followed by the bail bondsman. The engine was then started at 1753, and the airplane taxied away from the ramp at 1804.

According to witnesses, the airplane began its takeoff roll from the threshold of runway 25 and, following rotation, climbed to about 200 to 300 ft above ground level (agl) before leveling off. One witness, who was a line technician for a local FBO, was positioned on the ramp just north of runway 25 and 2,000 ft from the runway threshold. He stated that the airplane initiated its rotation abeam his position and immediately began to rock around its longitudinal axis. The nose then pitched up to a high angle and remained in that attitude as the airplane continued flying above the runway while slowly climbing. He stated that the airplane's wing-rocking movements were far more exaggerated than anything he had seen at the airport before. He then watched as the airplane began to veer to the right.

About 90 seconds after issuing the takeoff clearance, the airport tower controller, concerned that the airplane was not gaining altitude, asked the pilot if he was ok. The pilot responded, "Negative we got ah, we got a problem." Ten seconds later, the tower controller cleared the pilot to land on any runway. The pilot did not make any further transmissions. Security camera

footage revealed that the airplane continued over the runway and began to veer to the right of the runway centerline. The airplane then began a descending right turn and the right wing impacted a lamppost in an airport parking lot. The outboard section of the wing then separated and the airplane immediately rolled right, impacting parked vehicles and the ground. The airplane did not appear to be trailing smoke at any point during the flight, and video revealed that the landing gear was extended at the time of impact.

Pilot Information

Certificate:	Private	Age:	57, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	3-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 Without Waivers/Limitations	Last FAA Medical Exam:	01/12/2015
Occupational Pilot:	No	Last Flight Review or Equivalent:	12/31/2015
Flight Time:	(Estimated) 769 hours (Total, all aircraft), 216 hours (Total, this make and model), 16.2 hours (Last 90 days, all aircraft), 6.5 hours (Last 30 days, all aircraft)		

The pilot held a private pilot certificate with ratings for airplane single- and multi-engine land and instrument airplane, with a limitation of airplane multi-engine land under visual flight rules only. He held a Federal Aviation Administration (FAA) third-class medical certificate issued on January 12, 2015, with no limitations or waivers. The pilot's logbook indicated a total flight experience of about 769 hours since his first training flight in 1985 to his most recent logbook entry, dated August 23, 2016. He had accrued about 216 hours in the accident airplane since he purchased it in February 2014.

Aircraft and Owner/Operator Information

Aircraft Make:	PIPER	Registration:	N821ET
Model/Series:	PA 28R-201T 201T	Aircraft Category:	Airplane
Year of Manufacture:	1977	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	28R-7703147
Landing Gear Type:	Retractable - Tricycle	Seats:	4
Date/Type of Last Inspection:	06/09/2016, Annual	Certified Max Gross Wt.:	2900 lbs
Time Since Last Inspection:	15 Hours	Engines:	1 Reciprocating
Airframe Total Time:	4531.5 Hours as of last inspection	Engine Manufacturer:	Continental Motors
ELT:	C91A installed, activated, did not aid in locating accident	Engine Model/Series:	TSIO360-KBcFB
Registered Owner:	RCS3 LLC	Rated Power:	220 hp
Operator:	On file	Operating Certificate(s) Held:	None

The single-engine, retractable-gear airplane was registered to a corporation, of which the pilot was the sole member. The airplane was manufactured in 1977 and powered by a turbocharged, fuel-injected, Continental TSIO-360-KBcFB engine equipped with a two-blade constant-speed Hartzell propeller. The airplane was equipped with four seats and two wing-mounted fuel tanks, each of which had a capacity of 36 gallons.

The most recent annual inspection was performed on June 9, 2016. At that time, the airframe had accumulated 4,531.5 total flight hours, and the engine 1,244.21 hours since overhaul in June 2004. The most recent pitot-static, altimeter, and transponder certification was performed on March 31, 2015.

The airplane had been retrofitted with a Turboplus engine intercooler system. The flight manual supplement did not provide specific performance increase values, but rather stated, "PERFORMANCE: with the above engine and intercooler combination installed are equal to or better than the data in the FAA Flight Manual."

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	KRNO, 4400 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	0138 UTC	Direction from Accident Site:	168°
Lowest Cloud Condition:	Few / 11000 ft agl	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	14 knots / 23 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	270°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.98 inches Hg	Temperature/Dew Point:	28° C / -1° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Reno, NV (RNO)	Type of Flight Plan Filed:	IFR
Destination:	SAN CARLOS, CA (SQL)	Type of Clearance:	IFR
Departure Time:	1811 PDT	Type of Airspace:	Class C

After providing the initial takeoff clearance, the tower controller issued an advisory to the pilot indicating that the wind was from 260° at 12 knots gusting to 29 knots.

A special METAR for RNO was issued 25 minutes after the accident and included wind from 270° at 14 knots gusting to 23 knots; 10 miles visibility; few clouds at 11,000 ft; temperature 28°C; dew point -1°C; altimeter 29.98 inches of mercury. Based on these values, the calculated density altitude was about 6,900 ft.

According to the U.S. Naval Observatory, Astronomical Applications Department, the computed sunset occurred in San Carlos, California, at 1922, with civil twilight ending at 1948.

Airport Information

Airport:	RENO/TAHOE INTL (RNO)	Runway Surface Type:	Concrete
Airport Elevation:	4414 ft	Runway Surface Condition:	Dry
Runway Used:	25	IFR Approach:	None
Runway Length/Width:	6102 ft / 150 ft	VFR Approach/Landing:	None

RNO is located at an elevation of 4,145 ft mean sea level and is equipped with three grooved concrete runways. Runway 16R/34L is 11,001 ft long by 150 ft wide, and runway 16L/34R is 9,000 ft long by 150 ft wide. Runway 7/25 is 6,102 ft long by 150 ft wide on a gradient of 0.2%, and is bisected at its midpoint by runway 16/34.

The airport is located on the eastern flank of the Sierra Nevada mountain range. The route of flight to SQL would have been to the southwest and would have required traversing the range at an initial minimum en route altitude of 13,000 ft.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	2 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 Fatal	Latitude, Longitude:	39.503889, -119.776667

The airplane came to rest inverted in the parking lot on a heading about 070° magnetic about 1/2 mile north of the departure end of runway 25. All major sections of the airplane were recovered at the accident site. The left wing came to rest in the flatbed of a pickup truck, and the right wing had detached and was folded aft parallel with the tailcone. The airframe sustained crush damage through to the vertical stabilizer. A car parked just west of the main wreckage exhibited a slice in its left rear quarter panel perpendicular to the airplane's heading. The dimensions of the slice matched that of a propeller blade tip. A total of fifteen vehicles were damaged during the impact.

According to first responders, the rear seat passenger remained belted into the rear left seat when they arrived at the accident site. All four seats remained attached to the cabin floor, and all seat belts remained buckled. The front two belts and the rear left belt had been cut by first responders at the accident site to recover the occupants. The rear seats were not equipped with shoulder harnesses.

The airframe and engine were examined at both the accident site and a remote storage facility following recovery. The propeller, turbocharger, and engine components were then examined at their respective manufacturing facilities under supervision of the NTSB.

The instrument panel, along with all cockpit flight controls, sustained extensive fragmentation. The fuel selector was in the left tank detent. The gascolator had been crushed, exposing the inner surface of the bowl. The bowl was free of corrosion or blockage, and the screen was free of debris.

The flight controls and their associated cables, bellcranks, chains, pushrods, and control surfaces sustained damage consistent with impact and postaccident wreckage recovery.

The stabilator trim tab, along with its associated trim screw and control arm assembly, remained attached to the stabilator. The trim jack screw in the aft cabin displayed 12 exposed screw threads on the top side. According to Piper's documentation, zero exposed threads indicated full nose down trim, 5 threads neutral, and 16 full nose-up.

Impact damage prevented an accurate assessment of the flap position.

Engine Examination

The engine sustained impact damage, which had crushed the forward inlet manifold and breached the lower portion of the oil sump, exposing the camshaft. The propeller and hub assembly were detached at the engine crankshaft forward bearing. The fuel lines, including the fuel injector lines, sustained varying degrees of damage but were intact at their respective fittings. The turbocharger assembly was partially detached from the engine. Both magnetos displayed varying degrees of external damage and were run in a magneto test stand. Both produced spark in firing order at all output leads throughout speeds ranging between 400 and 2,700 rpm.

Cylinder No. 6 exhibited crush damage to its forward face, which had displaced the intake and exhaust rockers. The engine could be rotated smoothly via the vacuum pump accessory drive, and valves from cylinder Nos. 1 through 5 exhibited similar lift heights. Drive train continuity was confirmed through to the accessories. Thumb compression was obtained on all cylinders except No. 6. The upper and lower spark plugs for cylinder Nos. 2, 3, and 4, along with the lower spark plug for cylinder No. 6, exhibited grey deposits. The remaining plugs were coated in oil. All plugs exhibited worn out-normal signatures when compared to the Champion AV-27 Check-A-Plug chart.

The oil filter was cut open for examination. The filter element was coated in brown-colored oil and was free of debris.

Turbocharger

The turbocharger assembly was largely intact. The impeller and turbine wheel did not exhibit any signs of damage, and a radial rub mark was present on the turbine housing adjacent to the inlet consistent with blade contact. With the housing removed, the compressor and turbine wheel assembly could be rotated by hand. The turbine shaft was intact, and all internal journals and bearings were intact and wet with oil.

The pressure valve was intact and exhibited no external damage beyond a scratch on the side of its housing. The unit was tested utilizing a pressure valve test bench, with the results indicating nominal performance.

Propeller

Both propeller blades remained attached to the hub and flange, which had separated from the crankshaft. The separation point at the flange exhibited a conical 45° shear lip around its entire circumference with serrated, ratchet-like tear features around most of the crown, consistent with rotation at impact. Circumferential crack marks were present on the radial surface of the shaft adjacent to the ratchet marks.

The first blade (labeled blade 'A') exhibited leading edge gouging, chordwise scratches to its

front and aft surfaces, and an S-bend along its entire length. The outboard 16-inch-long section was separated, leaving a jagged tear pattern.

The second blade (labeled blade 'B') was intact, exhibited chordwise scoring on its forward side, and was bent about 15° aft 12 inches from the root. A 1-inch section of the tip had separated, leaving chordwise scoring and gouge marks at the area of separation.

No significant damage was observed to the hub, and the unit was disassembled. Per design, oil was present on the front side of the piston, with no signs of oil on or leakage to its aft side. An imprint was present on the preload plate of blade 'B', which corresponded to the bushing of the pitch change knob of blade 'A'. The position of the imprint corresponded to a blade 'A' pitch angle of 17.5°. Hartzell specifications call for a low pitch angle of 14.4 +/- 0.2°, and a high pitch angle of 29 +/- 1°.

Medical And Pathological Information

The Washoe County Medical Examiner's Office, Reno, Nevada, performed an autopsy of the pilot; the cause of death was multiple blunt force injuries. No significant natural disease was identified.

The FAA's Bioaeronautical Sciences Research Laboratory performed toxicology testing of specimens from the pilot. The testing identified acetaminophen, hydrocodone and its active metabolite dihydrocodeine, ibuprofen, meprobamate, morphine, nordiazepam, oxazepam, temazepam, and oxymorphone in urine. In addition, 0.04 µg/ml of diazepam, 0.111 µg/ml of its active metabolite, nordiazepam, 0.021 µg/ml of hydrocodone, and 2.243 µg/ml of meprobamate were confirmed in cavity blood.

Acetaminophen is a common analgesic often marketed with the name Tylenol and used in combination with a number of opioids. Ibuprofen is an over-the-counter analgesic often marketed with the names Advil and Motrin.

Hydrocodone is a prescription opioid available as a Schedule II controlled substance, often marketed in combination with acetaminophen as Norco, Lortab, and Vicodin. Its active metabolite, dihydrocodeine, is sold as a separate prescription opioid in other countries as a controlled substance. Hydrocodone carries this warning, "Concomitant use of opioids with benzodiazepines or other central nervous system (CNS) depressants, including alcohol, may result in profound sedation, respiratory depression, coma, and death."

Meprobamate is a prescription anxiolytic medication available as a Schedule IV controlled substance, often marketed with the name Miltown. It carries the warning, "Patients should be warned that meprobamate may impair the mental and/or physical abilities required for performance of potentially hazardous tasks such as driving or operating machinery." It is the active metabolite of carisoprodol, a prescription medication used to treat muscle pain, also a Schedule IV controlled substance, often marketed with the name Soma. It is known to be

sedating and carries the warning, "may impair the mental and/or physical abilities required for the performance of potentially hazardous tasks such as driving a motor vehicle or operating machinery. There have been post-marketing reports of motor vehicle accidents associated with the use of carisoprodol. Since the sedative effects of carisoprodol and other central nervous system depressants (e.g., alcohol, benzodiazepines, opioids, tricyclic antidepressants) may be addictive, appropriate caution should be exercised with patients who take more than one of these CNS depressants simultaneously."

Morphine is a separate opioid analgesic available as a Schedule II controlled substance in oral and IV forms; it is also the active metabolite of codeine and heroin. It carries the warning, "like all opioid analgesics, (morphine) should be used with great caution and in reduced dosage in patients who are concurrently receiving other central nervous system depressants including sedatives or hypnotics, general anesthetics, phenothiazines, other tranquilizers and alcohol because respiratory depression, hypotension and profound sedation or coma may result."

Nordiazepam is an active metabolite of diazepam, a benzodiazepine used to treat anxiety, seizures, and muscle spasms. Diazepam is available as a Schedule IV controlled substance and is often marketed with the name Valium. It carries the warning, "Patients should be advised against the simultaneous ingestion of alcohol and other CNS-depressant drugs during diazepam therapy. As is true of most CNS-acting drugs, patients receiving diazepam should be cautioned against engaging in hazardous occupations requiring complete mental alertness, such as operating machinery or driving a motor vehicle." Oxazepam and temazepam are two additional psychoactive metabolites. Each is also marketed as a separate drug, often with the names Serax and Restoril, respectively.

Oxymorphone is another opioid available by prescription as a Schedule II controlled substance, often marketed with the name Opana. It is also a metabolite of oxycodone, another Schedule II opioid, which is often marketed with the name Percocet. It carries the warning, "Concomitant use of opioids with benzodiazepines or other central nervous system (CNS) depressants, including alcohol, may result in profound sedation, respiratory depression, coma, and death."

The metabolism pathways for hydrocodone, morphine, and oxymorphone do not overlap, and as such, the toxicology findings are consistent with the pilot's use of 3 separate opioids.

According to records obtained from the pilot's primary care physician, for the period between 2013 and 2016, the pilot had episodes of back pain including pain radiating down one leg in March 2014. Treatment included opioid medication and steroid injections, and although the condition had resolved by February 2015, it recurred in May 2015. During the appointment with his primary care provider, the pilot specifically asked for "stronger" medications, and he was referred to a pain specialist. His most recent visit to the primary care provider was on December 22, 2015, and his ongoing use of oxycodone (30 mg/day) and carisoprodol (350 mg at bedtime) was documented. That visit was for a foot injury; no later visits were documented.

The pilot had reported having hay fever as well as several previous orthopedic surgeries, a tonsillectomy, gall bladder removal, and gastric bypass surgery, but reported using no medications on his most recent application for an FAA medical certificate.

Tests And Research

Sound Spectrum Study

Audio recordings from the RNO ground and tower control positions were analyzed by a specialist from the NTSB Vehicle Recorders Division to identify frequencies associated with the engine, propeller, turbocharger, and stall warning horn. The audio data consisted of an 8,000-kHz sampled monotrack.

A spectrogram was generated for the pilot's final two transmissions showing the frequency content of the sound and how it changed over time. Examination revealed that the sounds of the engine and propeller were not visible, because the recording did not capture anything below the 150-Hz frequency.

The turbocharger compressor contained 7 blades and the turbine contained 11 blades. According to representatives from Hartzell, the turbocharger shaft speed would have been about 76,900 rpm during the reported takeoff conditions, which equated to a fundamental shaft frequency of 1,282 Hz. The blade passage frequencies of the turbine and compressor were both above the upper limit of the spectrogram.

Analysis of the pilot's transmission just after the tower controller cleared him for takeoff revealed a faint tone increasing from about 2,150 Hz to 2,300 Hz. This was a potential match for the turbocharger shaft second harmonic as the throttle was increased, and corresponded to a turbocharger shaft speed increasing from 64,500 to 69,000 rpm.

One hundred eight seconds later, during a pause in the pilot's speech while he made the last transmission, a tone at about 2,500 Hz was recorded. This was also a potential match for the turbocharger shaft second harmonic, corresponding to a shaft speed of 75,000 rpm.

Electronic Devices

The airplane was equipped with an Appareo Status PRX V2, combination GPS/WAAS (wide area augmentation system) and automatic dependent surveillance-broadcast receiver. The unit contained an internal attitude and heading reference system (AHRS) and was capable of recording GPS position and AHRS information internally on a non-volatile flash memory (NVM) chip at a rate of about 5 data records per second (5 Hz).

The unit was recovered and sent to the NTSB Vehicle Recorders Division. It sustained impact damage, but NVM data was successfully extracted. The extracted data included GPS position and elevation, ground speed, ground track, heading, pitch, roll, and vertical speed.

The data revealed that the airplane taxied onto runway 25 and was aligned on a true heading of 270°. The nose pitched up to 6° as the ground roll began. Twenty-one seconds later, after travelling about 1,700 ft, the ground speed had reached 53 knots, the nose pitched up to 10°, and the vertical speed and altitude began to increase. For the next 26 seconds, a series of pitch oscillations occurred, varying between 3° nose down and 11° nose up. The ground speed remained constant, and the vertical speed varied between +275 and +700 ft per minute (fpm) as the airplane reached an altitude about 150 ft agl.

The nose then pitched up to about 15° as the airplane began a right turn to a heading of 300°. A few seconds later, it reached its highest altitude of 209 ft agl. Over the next 20 seconds, the airplane began a series of slight descents and climbs. It then began to bank to the right, reaching 45° right wing down about 15 seconds later.

The last recorded data, which occurred 1 minute 29 seconds after the takeoff roll began, indicated that the airplane was on a heading of 070°, traveling at a ground speed of 89 knots, in a 41° right bank, with a 64° nose-down attitude. The data revealed that, throughout the flight, the airplane experienced 3 to 9° roll oscillations with periods varying between 0.5 to 1 HZ.

Weight and Balance

The FBO supervisor reported that the pilot initially requested that 5 gallons of fuel be added to each tank but then changed his mind and wanted 7 gallons per tank. The supervisor informed him that the FBO waives the facility fee if 15 gallons of fuel is purchased, so the pilot elected to add 7.5 gallons to each tank. The supervisor then serviced the airplane with the agreed fuel quantity, after which the right tank was full, and the left tank level was within 1/2 to 1 inch of the filler neck.

According to the most recent aircraft weight and balance report, dated October 30, 2014, the airplane basic empty weight was 1,874.10 lbs, resulting in a total useful load of 1,025.90 lbs (maximum gross weight 2,900 lbs). The center of gravity range was between 78 and 90 inches aft of datum.

At the time of autopsy, the pilot weighed 184 lbs, the bail bondsman located in the front right seat weighed 264 lbs, and the passenger in the rear left seat weighed 278 lbs. A total of 88 lbs of cargo, including bags, engine oil and a stepladder, was recovered from the rear baggage area at the accident site.

Using the passenger and baggage weights, along with an estimated fuel load of 90% capacity (65 gallons), at the time of initial taxi, the airplane would have weighed about 3,078 lbs and its center of gravity would have been 90.36 inches aft of datum. These values were 178 lbs above the airplane's maximum gross weight and 0.36 inch aft of the center of gravity range.

The weight and balance section of the Turbo Arrow III pilot's operating handbook (POH) states the following:

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

The center of gravity range and weight chart indicated that the moment due to retracting the landing gear is + 819 inch-lbs.

Performance

According to the POH, with flaps set to 25°, the takeoff ground roll distance at maximum gross weight for the field conditions and a 10-knot headwind component would have been about 1,800 ft. The distance required to climb over a 50 ft barrier fell outside of the envelope of the performance chart, and although extrapolation indicated that the distance would have been about 2,700 ft, the POH stated that performance information derived by extrapolation should not be used for flight planning purposes.

Under the same conditions, but with flaps set to 0°, the ground distance would have been 3,250 ft, and 4,100 ft to climb over a 50 ft barrier.

With the flaps set to 0°, the gear-extended climb performance at maximum gross weight would have been 690 fpm, and the gear-retracted climb performance 850 fpm.

The handbook recommended a takeoff speed of 77 knots indicated air speed with 0° flaps, and 64 knots with 25° flaps.

Additional Information

The FBO supervisor stated that the pilot had expressed concern about the airplane's weight and stated to the supervisor that it was his understanding that the arrested passenger weighed 180 lbs. While the pilot was waiting in the lounge area, he was pacing back and forth and seemed anxious. A customer service representative who oversaw the billing for the fuel purchase recounted similar observations and stated that the pilot told her he was concerned that the airplane may be overweight.

The supervisor stated that, when the arrested passenger arrived, she appeared to be calm and in good spirits even though the chains around her waist and feet restricted her movement. He stated that she did appear to be heavier than 180 lbs.

The Nevada-based bail bondsman who delivered the passenger to the FBO stated that, while he was en route to the airport, the pilot called him and requested the weight of the arrested passenger. She replied that she was between 180 and 200 lbs. A short time later, he privately relayed to the pilot and the California-based bail bondsman that the passenger weight was closer to 250 or 260 lbs. The pilot responded that he would use 200 lbs for his weight computations and would anticipate burning off about 3 gallons of fuel during taxi, but if the passenger weighed between 250 and 260 lbs, he would need to remove about 15 gallons of fuel from the airplane.

The Nevada-based bail bondsman stated that, initially, the California-based bail bondsman was going to transport the arrested passenger by car after transferring custody at the California/Nevada border. The California-based bail bondsman and the pilot then decided they

could return to California in a more expeditious manner if they all flew back; specifically, the arrested passenger could be returned to the custody of California law enforcement that night rather than the following morning, which was a Monday and tended to be busy.

Administrative Information

Investigator In Charge (IIC):	Elliott Simpson	Report Date:	02/26/2019
Additional Participating Persons:	Lee A Oscar; Federal Aviation Administration FSDO; Reno, NV Kurt Gibson; Continental Motors; Mobile, AL Charles Little; Piper Aircraft, Inc.; Vero Beach, FL Les Doud; Hartzell Propeller / Hartzell Engine Technologies; Montgomery, AL Robert Martellotti; Piper Aircraft, Inc.; Vero Beach, FL		
Publish Date:	02/26/2019		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=93987		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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](#).