Aviation Investigation Final Report

Location:	Ranger, Texas	**Accident Number:**	DFW08FA031
Date & Time:	November 15, 2007, 15:00 Local	**Registration:**	N55307
Aircraft:	Piper PA-28R-200	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

While on an instructional cross-country flight in visual meteorological conditions, the airplane experienced an in-flight breakup during an aerobatic maneuver. Five maneuvers of interest were identified in the radar data for the accident flight. During the last maneuver the airplane's airspeed exceeded 134 knots calibrated airspeed (KCAS). According to the airplane's type certificate data sheet, the airplane's maximum maneuvering speed was 116 KCAS. Fellow flight instructors revealed that the accident flight instructor had reported performing "rolls" and/or "snap rolls" in the past while in the flight school's airplanes. In addition, one primary flight student reported that the accident flight instructor had demonstrated "rolls" and "spins" to him during flight lessons. No preimpact mechanical deficiencies with the airplane were noted, and all fracture surfaces were consistent with overload separations.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's intentional performance of aerobatic maneuvers that exceeded the design limits of the airplane structure.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE

Findings

1. (C) DESIGN STRESS LIMITS OF AIRCRAFT - EXCEEDED - PILOT IN COMMAND(CFI)
2. (C) IN-FLIGHT PLANNING/DECISION - IMPROPER - PILOT IN COMMAND(CFI)

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CRUISE

Findings
3. AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
4. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On November 15, 2007, approximately 1500 central standard time (CST), a single-engine Piper PA-28R-200 airplane, N55307, was destroyed during an in-flight break up and subsequent impact with terrain, near Ranger, Texas. The flight instructor, foreign-certificated private pilot, and one passenger were fatally injured. The airplane was registered to and operated by Skymates Inc., of Arlington, Texas. The 132-nautical mile cross country flight departed Arlington Municipal Airport (GKY), Arlington, Texas, about 1348 and was destined for the Abilene Regional Airport (ABI) near Abilene, Texas. Visual meteorological conditions prevailed and a visual flight rules flight plan was filed for the 14 Code of Federal Regulations Part 91 instructional flight.

Although no witnesses reported seeing the events leading up to the in-flight break up, two witnesses reported hearing the airplane and observing falling debris.

One individual, located approximately 2 miles north of the accident site, was standing by his truck when he heard what he described as three "engine stalls" with several seconds spacing. The engine went silent after the third engine "stall" which was followed by an "unusual" sound. The sound drew his attention to the airplane and through binoculars he observed the airplane "wobbling" and descending in a slight nose down attitude with a slow clockwise rotation.

Another witness, located approximately 1 mile south of the accident site, was working in a barn when he heard "whirling sounds" as if an airplane was "circling" or "spinning." These sounds were followed by a "loud bang." When he walked out from the barn, he observed pieces of the airplane falling to the ground.

Five "maneuvers" of interest were identified in the radar data for the accident flight. In 4 of the 5 maneuvers, the airplane pitched nose down for 1,000 to 1,200 feet of altitude and increased airspeed from about 80 to 120 knots calibrated airspeed (KCAS.) In three of the maneuvers, the airplane then regains 300 to 400 feet of altitude and decelerates back to about 90 KCAS.

The first "maneuver" begins when the airplane pitches over at 12,300 feet mean sea level (MSL) and descends to approximately 11,100 feet msl. It then pitches up and climbs to 11,500 feet msl where it momentarily levels off.

The second "maneuver" starts when the airplane pitches over at 11,500 feet msl and descends to 10,500 feet msl. It then ascends to 10,850 feet msl, momentarily levels off, and then climbs to 11,000 feet msl.

For the third "maneuver" the airplane pitches over at 11,000 feet msl and descends to about 9,950 feet msl. It then pitches up and climbs to 10,250 feet msl before leveling off.

During the fourth "maneuver" the airplane climbs to 11,400 feet msl where it again pitches down and descends to 11,100 msl before a pull up is initiated and the airplane climbs to 13,000 msl feet and levels off.

For the last "maneuver" the airplane climbs to 11,800 feet msl and pitches nose down. The airspeed exceeds 134 KCAS before starting to decrease. It was around this time that the aircraft disappeared from radar.

PERSONNEL INFORMATION

The instructor pilot held a certified flight instructor certificate with ratings for airplane single-engine land, multi-engine land, and instrument airplane. His last Federal Aviation Administration (FAA) first-class medical was issued on February 27, 2007, with no limitations.

A review of the flight instructor's records indicated that he had received his private pilot certificate on January 22, 2004, with a total logged time of 56 hours. His next recorded flight was on February 28, 2007. The pilot received his temporary airman certificate for airplane single-engine land, multi-engine land, and instrument airplane on July 18, 2007. Two days later, July 20, 2007, he received his temporary airman certificate for flight instructor, airplane single-engine land, multi-engine land, and instrument airplane. He completed his "New Flight Instructor Training" at Skymates Inc., on July 25, 2007.

An examination of the flight instructor's logbook indicated an estimated total flight time of 595 hours; of which 37 hours were in this make and model of airplane. He logged approximately 307 hours in the last 90 days and 60 in the last 30 days.

The foreign-certificated private pilot's logbook indicated an estimated total flight time of 119 hours; of which 1 hour was in this make and model of airplane. He logged 64 hours in the last 90 days and 34 in the last 30 days.

AIRCRAFT INFORMATION

The 1973-model Piper PA-28R-200, serial number 28R-7335213, was a low wing, semi-monocoque airplane, with retractable landing gear, and was configured for four occupants. The airplane was powered by a direct drive, air-cooled, horizontally opposed, fuel injected, normally aspirated four-cylinder engine. The engine was a Lycoming IO-360-C1C, serial number L-10313-51A, rated at 200 horsepower at 2,700 rpm, and was driving a two-bladed constant speed Hartzell propeller.

According to the airplane's Type Certificate Data Sheet (TSDS), the airplane's maximum maneuvering speed was 116 KCAS. Maximum structural cruising speed was 148 KCAS.

According to the airframe logbook, the airplane's most recent annual inspection was completed on October 1, 2007, with an airframe total time of 7,260.5 hours.

The engine logbook revealed that the engine had been inspected in accordance with an annual inspection on October 1, 2007. At the time of this inspection, the engine had accumulated approximately 2,245.6 hours since its last major overhaul and a total time of 7,360.5 hours.

METEOROLOGICAL INFORMATION

At 1453, an automated weather station located at Mineral Wells, Texas, approximately 34 miles northeast from the accident site, reported winds from 350 degrees at 8 knots, visibility 10 statute miles, skies clear, temperature 61 degrees Fahrenheit, dew point 12 degrees Fahrenheit, and barometric pressure of 30.40 inches of Mercury.

WRECKAGE AND IMPACT INFORMATION

On site documentation of the wreckage was conducted by investigators from the National Transportation Safety Board, Federal Aviation Administration, and representatives from The New Piper Aircraft Company, and Lycoming Engines.

The wreckage was located on hilly terrain, amongst scrub oak, and cacti. The debris field was scattered over an area approximately one mile long by one half mile wide. The airplane was broken into six major sections. These sections consisted of the fuselage cabin area, the cabin roof, the aft fuselage with the attached empennage, the outboard section of the left wing, the outboard section of the right wing, and the instrument panel forward. All major components of the airplane were accounted for with the exception of a section of the right aileron; however the fracture surfaces associated with this aileron exhibited overload failures.

The main wreckage consisted of the cabin area with all four seats, the inboard section of both wings, and the aft fuselage extending aft to, but not including the tail section.

About 115 inches of the inboard left wing was intact and attached to the fuselage. There was no obvious deformation evident on the left wing. The front spar was fractured about 115 inches outboard of the fuselage and the rear spar was fractured about 113 inches outboard of the fuselage. The left flap remained attached to the left wing in the retracted position and exhibited some minor upward deformation with paint flaked off at the trailing edge. The upper and lower skin and forward and rear spars were deformed downward at the break. Two prop slashes were evident in the upper skin at the break. The aileron was recovered separate from the wing. The inboard aileron hinge remained attached to the rear spar. There was a hole in the upper skin where the landing gear pushed through. The left main gear was found extended about 45-degrees. The left fuel tank was found to contain approximately four inches of a blue liquid consistent with 100LL fuel.

The outboard section of the left wing was located about 1,838 feet south from the main wreckage. This section exhibited deformation consistent with separation in a downward direction including buckling damage to the lower skin. There were 4 prop slashes evident in the upper and lower skin adjacent to the break. The outboard aileron hinge remained attached to the rear spar. There was impact damage to the outboard trailing edge of the left wing.

About 90 inches of the right wing remained attached to the fuselage. This section was deformed upwards along it length. The forward spar was fractured about 90 inches outboard of the fuselage at the production splice joint, was deformed forward beginning about 26 inches outboard of the fuselage, and was twisted in a leading edge up direction along its length. The rear spar was fractured about 84 inches outboard of the fuselage, deformed upwards and forward along its length and twisted leading edge up along its length. The wing was flattened due to the twisting of the spars. The damage at the spar fractures was consistent with separation of the outboard wing in an upward direction. There was a hole in the upper skin where the landing gear had pushed through. The right flap remained attached by the inboard mount to the wing and was extensively damaged. The pre impact flap position could not be determined. The right main gear was found extended approximately 45 degrees and bent forward. The right main fuel tank had been compromised and did not contain fuel.

The outboard section of the right wing was located 2,588 feet south from the main wreckage. This section of wing exhibited 45 degree buckling in the upper skin stringer bays adjacent to the fracture and the upper skin was curled upwards at the break. The spar fractures were consistent with failure in an upwards direction. The inboard 20 inches of right aileron was recovered separated from the wing while the rest was not recovered. The inboard hinge remained attached to a section of rear spar. The outboard aileron hinge was still attached to the rear spar and counterweight.

The front section of the fuselage separated at the production splice immediately forward of the front seats and was located about 650 feet southeast from the main wreckage. There was no directional evidence at the separation point. This section came to rest inverted, on a heading of 25-degrees, and exhibited heavy thermal damage associated with a post crash fire. This section consisted of the windshield window frames, the cabin door both control yokes, the instrument panel, engine and accessories, the nose landing gear and the propeller.

The cabin door remained attached to the fuselage via both forward hinges. The upper half of the door was found separated but next to the lower door half. Both parts exhibited heavy thermal damage.

The fuselage was intact from below the forward seats to the area just forward of the empennage. The aft fuselage was twisted in a clockwise direction at the empennage separation point. The cabin roof was found about 1,860 feet southeast of the main wreckage. The roof had separated from the cabin area and did not show any impact or wing slap evidence.

The aft fuselage, with attached empennage, was located about 1,073 feet south from the main wreckage. The empennage remained essentially intact with the exception of the outboard right horizontal stabilizer. The outboard left horizontal stabilizer was deformed upwards and the damage to the separated outboard right horizontal stabilizer was consistent with separation in an upward direction. There were 45 degree buckling creases in the upper and lower skin of the horizontal stabilizer. The vertical stabilizer was deformed to the left with respect to the horizontal stabilizer (as looking forward). The left side of the vertical stabilizer was bulged outward. The stabilator with trim tab and the vertical stabilizer with rudder were all found attached via their respective hinges.

There was no evidence of any pre-existing cracks in any of the structure examined. In addition, there was no significant corrosion present in the wreckage. All fracture surfaces were consistent with overload separations.

The engine sustained impact and fire damage. The engine could not be rotated by hand due to impact damage. All cylinders were inspected using a lighted borescope. No pre-impact anomalies were noted. Three holes were drilled into the crankcase at the top right side to allow a visual inspection of the rotating assembly. Crankshaft, camshaft, and valve train continuity were established.

The exhaust system, intake system, accessory housing, oil sump, and fuel system were destroyed during impact. The magnetos and ignition harness were thermally damaged and could not be tested. All observed spark plugs displayed a mid-service life, and a color consistent with normal combustion, when compared to the Champion Spark Plug Wear Guide P/N AV-27.

The propeller remained attached to the engine. One blade extended into the ground along its entire length. The other blade extended out of the ground and was twisted towards the feathered position. The spinner remained partially attached and did not exhibit rotation scoring.

The engine examination did not reveal any pre-impact anomalies that would have prevented it from producing power.

MEDICAL AND PATHOLOGICAL INFORMATION

The Office of the Medical Examiner of Tarrant County, located in Tarrant County, Texas, performed an autopsy on the flight instructor and foreign-certificated private pilot on November 16, 2007. The cause of death for both pilots was listed as "massive blunt force trauma of head, chest, abdomen, pelvis, and extremities due to light aircraft crash."

TESTS AND RESEARCH

The Investigator-In-Charge (IIC) conducted interviews at Skymates Inc. following the accident.

The first flight instructor reported that she had flown with the accident flight instructor in the past and felt completely safe with his flying abilities. The instructor continued that the flight instructor would occasionally do spins with his students; however, she felt it was unnecessary because it was not required for their stage of training.

The student who was riding in the back seat of the airplane at the time of the accident was her student. Since English was not his primary language, and he was having trouble with aircraft communications, she suggested that he ride along on the accident flight to observe the radio communications.

Before the accident flight, the instructor and the accident flight instructor had lunch together. The instructor reported that she asked the accident flight instructor to "not do any funny stuff" with her student on board. She didn't want him to learn any "bad habits." The instructor further reported that she had heard, before the accident, that the accident flight instructor had done a "barrel roll" in one of the flight school's airplane's.

According to a second flight instructor, the accident flight instructor was the best pilot he had ever flown with. This instructor recalled a conversation where the accident flight instructor revealed that he had performed a "snap roll" in a couple of flight school's airplanes. According to the instructor, he had expressed his displeasure to the accident flight instructor about his performing "snap rolls." The instructor reported that he had not heard anything further about the accident flight instructor performing this maneuver and assumed he had stopped.

When the IIC asked the instructor to describe how this maneuver was done, he responded with the following: The airplane is nosed over until 140 knots is reached. The pilot then pitches up until about 10 to 15 degrees above the horizon. The pilot then applies left rudder and aileron.

The second fight instructor further reported that the accident flight had been intended to be a time builder for the foreign-certificated pilot and that to the best of his knowledge there was no other flight training planned.

According to a primary flight student, the accident flight instructor had demonstrated a "barrel roll" and "spins" to him in a Cessna 172SP once or twice. The student described that to do a roll they would pitch the airplane's nose down until they reached 140 knots. At that point they would "pitch up and then turn." The student continued that the roll was "smooth" and "not violent." The student further reported that the accident flight instructor was a very good pilot.

The IIC received an email, dated November 7, 2007, that the rear seat passenger had sent to friends in Italy. Two translations of sections from the email are listed below:

"However,...yesterday I flew as passenger with an megalomaniac instructor ... I heard the radio communications while in flight and they are so amazing/incredible... Unfortunately, there are two air traffic controllers, whom one look[s] like he is dying when talking on the radio, the other

talks in code...

Well, speaking of the megalomaniac instructor,...yesterday during the flight he took control and did two spin turns...without any warning...it looked like I was thrown out of the aircraft since I did not fasten the seat belt...we were not going to do acrobatics...well,...it was so amusing though..."

"...yesterday with a MEGALOMANIAC instructor I went up as a passenger to listen to the radio communications that are something to make you hallucinate. Unfortunately there are two air traffic controllers of which, when one speaks, he seems to be dying and the other speaks in code...

Well I was telling you about the megalomaniac...yesterday while we were going jolly good he takes over the controls and does 2 corkscrews...just like that without saying anything...I almost flew out of the airplane because I was wearing my seatbelt loose...after all we were not supposed to do acrobatics...Well...but it was a lot of fun..."

A review of the flight school records reveled that accident flight instructor had instructed the rear seat passenger for 1.1 hours on November 7, 2007; however, investigators were unable to determine, for certain, which flight instructor the email was referring to.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	29,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	February 1, 2007
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 1, 2007
Flight Time:	595 hours (Total, all aircraft), 37 hours (Total, this make and model), 555 hours (Pilot In Command, all aircraft), 307 hours (Last 90 days, all aircraft), 60 hours (Last 30 days, all aircraft)		

Student pilot Information

Certificate:	Foreign; Private	**Age:**	19,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Unknown	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 12, 2007
Flight Time:	119 hours (Total, all aircraft), 1 hours (Total, this make and model), 90 hours (Pilot In Command, all aircraft), 64 hours (Last 90 days, all aircraft), 34 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N55307
Model/Series:	PA-28R-200	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	28R-7335213
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 1, 2007 Annual	**Certified Max Gross Wt.:**	2600 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	7260.5 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-360 SER
Registered Owner:	SKYMATES INC	**Rated Power:**	200 Horsepower
Operator:	SKYMATES INC	**Operating Certificate(s) Held:**	None
Operator Does Business As:	Skymates Inc	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MWL,974 ft msl	**Distance from Accident Site:**	34 Nautical Miles
Observation Time:	14:53 Local	**Direction from Accident Site:**	51°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.39 inches Hg	**Temperature/Dew Point:**	16°C / -11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Arlington, TX (GKY)	**Type of Flight Plan Filed:**	VFR
Destination:	Abilene, TX (ABI)	**Type of Clearance:**	VFR
Departure Time:	13:48 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	32.476943,-98.519996

Administrative Information

Investigator In Charge (IIC):	LeBaron, Timothy
Additional Participating Persons:	Gary L Weeks; Federal Aviation Administration; Fort Worth, TX Michael C McClure; Piper Aircraft Inc.; Prosper, TX John Butler; Lycoming Engines; Arlington, TX
Original Publish Date:	May 6, 2009
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=67086

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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.