Aviation Investigation Final Report

Location:	Chicago, Illinois	**Accident Number:**	CEN15FA048
Date & Time:	November 18, 2014, 02:45 Local	**Registration:**	N30MB
Aircraft:	Aero Commander 500 B	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The commercial pilot was conducting an on-demand cargo charter flight. Shortly after takeoff, the pilot informed the tower controller that he wanted to "come back and land" because he was "having trouble with the left engine." The pilot chose to fly a left traffic pattern and return for landing. No further transmissions were received from the pilot. The accident site was located about 0.50 mile southeast of the runway's displaced threshold.

GPS data revealed that, after takeoff, the airplane entered a left turn to a southeasterly course and reached a maximum GPS altitude of 959 ft (about 342 ft above ground level [agl]). The airplane then entered another left turn that appeared to continue until the final data point. The altitude associated with the final data point was 890 ft (about 273 ft agl). The final GPS data point was located about 135 ft northeast of the accident site. Based on GPS data and the prevailing surface winds, the airspeed was about 45 knots during the turn. According to the airplane flight manual, the stall speed in level flight with the wing flaps extended was 59 knots.

Postaccident examination and testing of the airframe, engines, and related components did not reveal any preimpact mechanical failures or malfunctions that would have precluded normal operation; therefore, the nature of any issue related to the left engine could not be determined. Based on the evidence, the pilot failed to maintain adequate airspeed while turning the airplane back toward the airport, which resulted in an aerodynamic stall/spin.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain airspeed while attempting to return to the airport after a reported engine problem, which resulted in an aerodynamic stall/spin.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained

Factual Information

History of Flight

Takeoff	Loss of engine power (partial)
Approach-VFR pattern base	Loss of control in flight (Defining event)
Approach-VFR pattern base	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On November 18, 2014, about 0245 central standard time, an Aero Commander 500B airplane, N30MB, impacted a residence while attempting to return for landing after takeoff from Chicago Midway Airport (MDW), Chicago, Illinois. The pilot was fatally injured. The airplane was substantially damaged. The airplane was registered to and operated by Central Airlines, Inc., dba Central Air Southwest as a 14 Code of Federal Regulations (CFR) Part 135 on-demand cargo charter flight. Night visual meteorological conditions prevailed at the time of the accident at MDW, which was operated on an instrument flight rules flight plan. The flight originated from MDW about 0238 and was destined for the Ohio State University Airport (OSU), Columbus, Ohio.

The MDW tower controller cleared the flight for takeoff from runway 31C at 0238:50 and instructed the pilot to make a right turn to a heading of 110°. At 0240:17, the pilot informed the controller that he wanted to "come back and land" because he was "having trouble with the left engine." The pilot elected to fly a left traffic pattern and return for a landing on runway 31C. At 0241:13, the controller cleared the pilot to land on runway 31C. The pilot acknowledged the clearance. No further transmissions were received from the pilot.

GPS data extracted from a handheld unit recovered from the airplane was plotted. At 0238:21, the airplane was positioned near the arrival threshold of runway 31C. Based on the GPS altitude data parameter, the airplane became airborne about 0239:39 as it was about 1,900 ft from the runway arrival threshold. The airplane ground track initially diverted to the left of the runway centerline before becoming reestablished on a track parallel to the runway, offset to the southwest of the runway centerline about 560 ft. At 0240, the airplane entered a left turn ultimately becoming established on a southeasterly course. The airplane reached a maximum GPS altitude of 959 ft (about 342 ft above ground level [agl]).

At 0241, the airplane entered a left turn about 0.45 mile south of the runway 31C arrival threshold. The left turn appeared to continue until the final data point. The final GPS data point was recorded at 0242:07, with an associated GPS altitude of 890 ft (about 273 ft agl). The average calculated groundspeed over the final 2 seconds of data was 51 knots. The accident site was located about 135 ft northeast of the final data point and 0.50 mile southeast of the runway 31C displaced threshold.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	47,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
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:**	November 12, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	November 5, 2014
Flight Time:	1339 hours (Total, all aircraft), 34 hours (Total, this make and model), 1073 hours (Pilot In Command, all aircraft), 143 hours (Last 90 days, all aircraft), 34 hours (Last 30 days, all aircraft)		

FAA records indicated that the pilot held a commercial pilot certificate with single and multi-engine land airplane and instrument airplane ratings. The certificate included type ratings for CE-500 and LR-Jet airplanes, which were limited to second-in-command (SIC) privileges only. The pilot also held a flight instructor certificate with single, multi-engine, and instrument airplane ratings. The records revealed that the pilot was not successful in his initial checkride attempts for the private pilot multi-engine and instrument ratings; the commercial pilot multi-engine rating; or the flight instructor single-engine, multi-engine, and instrument ratings. The checkrides for his private pilot single-engine, commercial pilot single-engine, CE-500 SIC, and LR-Jet SIC rating checkrides were passed on the initial attempt.

The pilot was issued a first-class airman medical certificate with a restriction for corrective lenses on November 12, 2014. On the medical certificate application, the pilot reported a total flight time of 1,374 hours, with 303 hours flown within the preceding 6 months.

The operator's training records indicated that the pilot completed the company indoctrination, general emergency, hazardous materials, aircraft systems and integration, and flight training between October 27 and November 5, 2014. He passed the airman competency/proficiency check in accordance with 14 CFR Sections 135.293, 135.297, and 135.299 on November 5, 2014. The pilot was assigned as pilot-in-command on Aero Commander 500 airplanes.

The pilot's flight duty summary noted that he was placed on flight status after passing his checkride on November 5. He had flown 26.9 hours between then and the time of the accident. The pilot was off duty from 0130 on November 15 until he reported on duty at 2030 on November 17.

Aircraft and Owner/Operator Information

Aircraft Make:	Aero Commander	**Registration:**	N30MB
Model/Series:	500 B	**Aircraft Category:**	Airplane
Year of Manufacture:	1964	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1453-160
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	October 23, 2014 AAIP	**Certified Max Gross Wt.:**	6750 lbs
Time Since Last Inspection:	56 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	26280 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C91 installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-540-E1A5
Registered Owner:	Central Airlines Inc.	**Rated Power:**	290 Horsepower
Operator:	Central Air Southwest Inc.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Central Air Southwest	**Operator Designator Code:**	ZJWA

The airplane (S/N 1453-160) was initially issued an FAA normal category, standard airworthiness certificate in June 1964. The airplane was purchased by the operator in December 1978. The airplane was maintained under an approved aircraft inspection program. According to the maintenance records, the most recent inspection, which was a phase 1 inspection of the airframe, left engine, and right engine, was completed on October 23, 2014, at a total airframe time of 26,224.7 hours.

At the time of the accident, the airframe had accumulated about 26,280 total hours. The left engine (S/N L-988-48) had accumulated about 14,134 total hours, of which about 113 hours had accumulated since overhaul. The left propeller assembly (S/N CK5153B) had accumulated about 4,902 total hours, of which about 1,000 hours had accumulated since overhaul. The right engine (S/N L-14565-48) had accumulated about 14,618 total hours, of which about 1,697 hours had accumulated since overhaul. The right propeller assembly (S/N CK5076B) had accumulated about 4,259 total hours, of which about 1,891 hours had accumulated since overhaul.

The right engine was removed on June 20, 2012. The engine was repaired with a reconditioned crankcase and new main and rod bearings on July 10, 2012. It was subsequently reinstalled on the airplane on July 17, 2012. The right propeller assembly was repaired on April 23, 2013, and returned to service.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	MDW,620 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	02:53 Local	**Direction from Accident Site:**	310°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 1900 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	13 knots / 23 knots	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	-11°C / -15°C
Precipitation and Obscuration:	Light - None - Snow		
Departure Point:	Chicago, IL (MDW)	**Type of Flight Plan Filed:**	IFR
Destination:	Ohio State Univ, OH (OSU)	**Type of Clearance:**	IFR
Departure Time:	02:38 Local	**Type of Airspace:**	Class C

Weather conditions recorded by the MDW Automated Surface Observing System, located about 0.5 mile northwest of the accident site, at 0253, were: wind from 250° at 13 knots, gusting to 23 knots; broken clouds at 1,900 ft above ground level (agl); 10 miles visibility; temperature -11° C; dew point -15° C; and altimeter 29.99 inches of mercury.

Airport Information

Airport:	Chicago Midway Intl MDW	**Runway Surface Type:**	Asphalt
Airport Elevation:	620 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	31C	**IFR Approach:**	None
Runway Length/Width:	6522 ft / 150 ft	**VFR Approach/Landing:**	Full stop;Precautionary landing;Traffic pattern

MDW is located about 9 miles southwest of the main business district and within the city limits. The airport elevation is 620 ft. It is served by two primary runways: runway 13C-31C is 6,522 ft long by 150 ft wide; runway 4R-22L is 6,445 ft long by 150 ft wide. Both runways are constructed of grooved concrete/asphalt. The airport is also configured with three additional parallel runways. Airport operations are supported by an air traffic control tower. The Chicago Terminal Radar Control facility provides air traffic control services for the surrounding airspace.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	41.77938,-87.709304(est)

The airplane impacted and came to rest within a home. The southwest corner of the home was destroyed. The left wing was located outside the home with the wing tip resting on the ground. The right wing remained attached to the fuselage and the outboard portion of the wing extended the roof of the adjacent home. The aft fuselage/empennage came to rest on the roof of the adjacent home. The homes were separated by about 10 ft. The forward fuselage and wings were oriented on magnetic heading of 030°; the aft fuselage and empennage were oriented on magnetic heading of 005°.

The fuselage nose section and cockpit area were fragmented. The center fuselage section was deformed consistent with impact forces. The fuselage structure was buckled in-line with the trailing edge of the wings. The fuselage aft of the buckled area and the empennage appeared intact. The elevator and rudder control surfaces remained attached to the horizontal and vertical stabilizers, respectively. Flight control continuity was confirmed from each control surface within the empennage/aft fuselage section.

Both wings remained attached to the fuselage. The left wing was deformed from the engine pylon outboard. The inboard portion of the wing between the fuselage and the engine pylon exhibited leading edge impact damage. The forward portion of the engine pylon structure was damaged consistent with impact forces. The engine was separated from the airframe except for the control cables, which retained the engine assembly. The engine was in position relative to the airframe at the accident site. The propeller assembly remained attached to the engine. The left main landing gear was in the extended position. The left aileron and wing flaps remained attached to the wing. The wing flaps were deflected approximately 30°. No anomalies consistent with a preimpact failure or malfunction related to the left aileron or wing flap control continuity were observed.

The right wing exhibited leading edge impact damage over the span of the wing. The outboard portion of the wing was displaced downward at the inboard side of the engine pylon. The forward portion of the engine pylon was damaged consistent with impact forces. The right engine had separated from the pylon and the right propeller had separated from the engine; both were located within the home. The right main landing gear was in the extended position. The right aileron and outboard flap section remained attached to the wing. The inboard flap section remained attached at the outboard hinge fitting. No anomalies consistent with a preimpact failure or malfunction related to the right aileron or wing flap control continuity were observed.

A fuel sample recovered from the left forward fuel cell was clean and appeared free of sediment or contamination. The sample exhibited a blue tint consistent with 100 low lead aviation fuel. The right forward fuel cell appeared to have been compromised. The fuel valves were on based on the mechanical position indicators.

The left engine exhibited damage consistent with impact forces. Internal engine and accessory section continuity was confirmed via crankshaft rotation. Compression was obtained at all cylinders. Borescope examination of the cylinders and valves did not reveal any anomalies. The ignition harness common to the left spark plugs appeared intact; the ignition harness common to the right spark plugs was damaged consistent with impact forces. The spark plug electrodes exhibited normal operating signatures. The left magneto housing was fractured with the attachment flange and rotor remaining with the engine. The remainder of the magneto was separated and not located. The right magneto remained attached and appeared intact. The right magneto produced a spark across all intact ignition harness leads when rotated. The oil pick-up screen was clean and free of debris while the pressure screen contained a small quantity of small metallic particles. The engine did not exhibit any evidence of oil starvation. The servo fuel injector, fuel distributor, fuel strainer, fuel injectors, and air inlet/engine air plenum, were unremarkable. The engine- driven fuel pump housing was fractured; however, once the end plate was removed, the input shaft rotated freely. The internal shaft and vanes were intact and undamaged. The airframe fuel filter was intact but contained a small amount of debris. The amount of debris was inconsistent with a significant loss of fuel flow to the engine.

The left propeller governor (PG) remained attached to the engine and appeared intact. The governor input and mating engine output splines were undamaged. The gasket/oil strainer was intact, and the strainer mesh was clean. The top flange of the pulley sheave exhibited wear marks consistent with contact against the un-sheaved input cable. The governor pulley rotated freely; however, the force of the torsion spring was insufficient to return the pulley to the normal stop position. (The noted anomalies are consistent with excessive tension placed on the governor cables during recovery.)

The left propeller assembly remained attached to the engine. The propeller blades remained attached to the hub. The first blade was bent aft about 90° over the span of the blade, with twisting toward low pitch. The second blade was twisted toward low pitch. The third blade was bent aft about 30° over the outboard one-third span, with twisting toward low pitch. The cylinder had separated from the hub, and the piston rod was fractured. The cylinder mounting threads had separated from the hub; however, the hub assembly appeared otherwise intact. Disassembly of the hub did not reveal any anomalies. The spring appeared undamaged. The pitch change fork appeared intact. The low pitch stop, feather stop, and start lock appeared intact and undamaged. Impression marks on the preload plates due to the fork were located consistent with the propeller blades being in the normal operating range at a low blade angle on impact.

The right engine was damaged consistent with impact forces. The propeller had separated from the engine crankshaft propeller flange. The propeller flange was intact; however, it was bent aft about 180°. Four propeller mounting holes common to the bent portion of the flange were elongated. In addition, the push-rods and shrouds common to the Nos. 5 and 6 cylinders were deformed consistent with impact damage. The engine appeared to be otherwise intact. Internal engine and accessory section continuity was confirmed via crankshaft rotation. Compression and suction was obtained at the Nos. 1 through 4 cylinders . Compression was confirmed on the Nos. 5 and 6 cylinders with the valves in the closed position. Borescope examination of all cylinders and valves did not reveal any anomalies. The ignition harness was damaged consistent with impact damage. Several spark plugs were fractured and could not be removed. The remaining spark plug electrodes exhibited normal operating signatures. The left magneto remained in position on the engine; however, the mounting bolt flanges were fractured. The right magneto remained attached to the engine; an internal distributor gear was fractured. Both magnetos

produced a spark across the intact ignition harness leads when rotated. The oil pick-up and pressure screens were clean and free of debris. The oil sump was fractured consistent with impact forces. The engine did not exhibit any evidence of oil starvation. The servo fuel injector was fractured adjacent to the inlet plenum; the input control levers were bent. The fuel distributor gasket was torn; however, the distributor was otherwise unremarkable. The fuel strainer, engine- driven fuel pump, and air inlet/engine air plenum were unremarkable. Two fuel injectors were damaged; the remaining injectors were intact. The airframe fuel filter was intact and free of debris.

The right PG remained attached to the engine and appeared intact. The governor input and mating engine output splines were undamaged. The gasket/oil strainer was intact and the strainer mesh was clean. The top flange of the pulley sheave exhibited wear marks consistent with contact against the un-sheaved input cable. The governor pulley rotated freely and returned to the normal stop position when displaced and released.

The right propeller assembly had separated from the engine. The spinner bulkhead was fractured consistent with impact forces. The propeller blades remained attached to the hub. The first blade was fractured at about two-thirds span. The blade fragment was recovered near the accident site. The second blade was fractured near the blade tip. The blade fragment was not recovered. The third blade was bent aft about 30° over the inboard one-third span. The cylinder appeared intact. Disassembly of the cylinder revealed that the spring, piston, and piston rod were intact. The hub was intact, except for one preload plate flange which was fractured. The fork appeared intact. The low pitch stop, feather stop, and start lock appeared intact and undamaged. Impression marks on the preload plates due to the fork on the first and third blades were from the top to the bottom of the normal operating range. Impression marks on the second blade preload plate were from the midrange to the feather positions. Overall, the impact marks were located consistent with the propeller blades being in the normal operating range on impact.

Medical and Pathological Information

The Cook County Medical Examiner's Office attributed the pilot's death to multiple blunt force injuries sustained in the accident. The FAA Bioaeronautical Sciences Research Laboratory performed toxicology testing of specimens from the pilot. The results were negative for all substances in the testing profile, including alcohol and carbon monoxide.

Tests and Research

Computed tomography (CT) scans of the left PG revealed that the flyweights were positioned near the top of the flyweight cavity consistent with the flyweight being dislocated from the driveshaft. The governor bearings appeared to be intact. The scans also revealed a fragment within the flyweight cavity. The scans were otherwise unremarkable.

CT scans of the right PG did not reveal any anomalies. The flyweight mechanism was located at the bottom of the flyweight cavity and the driveshaft appeared to be properly seated. The bearings appeared to be intact.

Both PGs were bench tested in accordance with the manufacturer's specifications. Before testing, the left governor housing was opened and the flyweight mechanism was reseated onto the driveshaft spline. The fragment identified by the CT scan was not observed. The housing was resealed. No other modifications were made to the component. The right propeller governor was tested as recovered.

The left PG tested within specification, except at three data points: 1) the pump capacity was 3.99 quarts per minute, which was below the minimum of 5.0 quarts per minute; 2) the feathering speed was 1,527 rpm, which was below the minimum of 1,555 rpm; and 3) the internal component leakage was 60 quarts per hour, which was above the maximum of 30 quarts per hour.

The right PG tested within specification, except at three data points: 1) the relief valve pressure was 256 pounds per square inch (psi), which was below the minimum of 260 psi; 2) the pump capacity was 4.24 quarts per minute, which was below the minimum of 5.0 quarts per minute; and 3) the internal component leakage was 60 quarts per hour, which was above the maximum of 30 quarts per hour.

The left fuel servo injector was examined and bench tested in accordance with the manufacturer's specifications. The throttle input shaft was free to rotate. The mixture input shaft was stiff, but rotated through the full range of travel. The shaft and mixture lever were bent consistent with impact forces. The component exceeded the production flow limits established by the manufacturer at each test point. A subsequent teardown examination determined that the mixture control shaft and the idle valve shaft were deformed.

Additional Information

Preflight and Flight Information

A worksheet recovered from the airplane denoted a total of six flight segments. The segments and estimated departure/arrival times were: Rickenbacker International Airport (LCK) (2120) to Burke Lakefront Airport (BKL) (2230), BKL (2300) to Willow Run Airport (YIP) (2355), and YIP (0015) to MDW (0130), MDW (0140) to Chicago Executive Airport (PWK) (0200), PWK (0230) to OSU (0400), and OSU to LCK as a "deadhead" segment.

A load manifest dated November 17, 2014, was recovered from the airplane, and it listed the pilot as the pilot-in-command. The actual departure and arrival times were denoted as LCK (2123) to BKL (2228), BKL (2318) to YIP (0008), and YIP to MDW (0137). Based on the manifest, 58 gallons of fuel were obtained before departing LCK and 40 gallons of fuel were obtained before departing YIP.

A representative of the fixed base operator at MDW stated that the pilot requested a ground power unit to assist with starting the engines before departure from MDW. The pilot requested no other services. The airplane was not fueled during the stop at MDW. The pilot reportedly informed FBO personnel that the heater in the airplane was not working properly. He subsequently got the heater working and let it run to warm the cabin.

A representative of the operator stated that the pilot was running about 45 minutes behind schedule due to a delay at BKL. As a result, the courier brought the PWK cargo to MDW for loading, eliminating the need for the MDW to PWK segment.

Airspeed Information

Approximate heading and airspeed information was extracted from the available GPS track and ground speed data. Due to the proximity to the airport, the MDW surface wind at the time of the accident was used. The data indicated that, during the initial climb and turn, the airplane maintained about 73 knots airspeed. The airplane accelerated to 97 knots during the downwind portion of the flight. The airspeed steadily decreased into the final turn. The airspeed between the final data points was approximately 45 knots. According to the airplane flight manual, the stall speed in level flight with the wing flaps extended was 59 knots (68 miles per hour).

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	Dwayne Hudson; FAA -- DuPage Flight Standards; West Chicago, IL Andrew Towner; Central Air Southwest, Inc.; Kansas City, MO Troy Helgeson; Lycoming Engines; Williamsport, PA Dan Boggs; Hartzell Propellers; Piqua, OH Peter Nielson; Precision Airmotive LLC; Arlington, WA Steve Krugler; Woodward Inc.; Rockford, IL
Original Publish Date:	May 11, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=90397