National Transportation Safety Board
Aviation Accident Final Report

Location:	Broomfield, Colorado	**Accident Number:**	CEN13FA182
Date & Time:	March 1, 2013, 15:45 Local	**Registration:**	N93AA
Aircraft:	Aero Commander 500B	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	2 Minor
Flight Conducted Under:	Part 91: General aviation - Flight test		

Analysis

The pilot stated that, during the preflight inspection of the airplane, he checked the fuel gauge, and it indicated 65 gallons. Due to the design of the fuel system, it is not possible to visually check the fuel level to confirm that the fuel gauge indication is accurate. During takeoff and as he reduced power for enroute climb, the left engine began to surge and lose power. He immediately turned left back toward the airport and contacted the control tower to advise that he was making a single-engine, straight-in approach to land. When he lowered the landing gear, the right engine began to surge and lose power. Subsequently, the pilot declared an emergency, and, realizing he had insufficient engine power and altitude to return to the airport, he retracted the landing gear and made a no-flap, gear-up landing on a nearby golf course. Postaccident application of battery power to the airplane confirmed that the fuel gauge indicated 65 gallons; however, when the airplane's fuel system was drained, only about 1/2 gallon of fuel was recovered. Thus, the engines lost power due to fuel exhaustion.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Loss of engine power due to fuel exhaustion. Contributing to the accident was the failure of the fuel gauge to indicate the actual amount of fuel on board the airplane and the design of the airplane's fuel system, which precluded a visual confirmation of the fuel level.

Findings

Aircraft	(general) - Design
Organizational issues	Adequacy of policy/proc - Operator
Aircraft	Fuel quantity sensor - Malfunction
Aircraft	Fuel - Fluid level

Factual Information

History of Flight

Initial climb	Loss of engine power (partial) (Defining event)
Emergency descent	Off-field or emergency landing

On March 1, 2013, about 1545 mountain standard time, an Aero Commander 500B, N93AA, lost power on both engines shortly after takeoff, and the pilot made a gear-up forced landing on a golf course fairway near Broomfield, Colorado. The airline transport pilot and one passenger received minor injuries. The airplane was substantially damaged. The airplane was registered to and operated by American East Airways Corporation under the provisions of 14 Code of Federal Regulations Part 91 as a test flight. Visual meteorological conditions prevailed for the local flight, which operated without a flight plan. The flight originated from Rocky Mountain Metropolitan Airport (KBJC), Broomfield, about 1540.

The pilot said that during the airplane preflight, the fuel gauge indicated 65 gallons, but the design of the fuel system precluded a visual inspection of the fuel level. The pilot said he took off on what was to be a test flight after the installation of the left engine. Shortly after reducing to climb power, the left engine began to surge and lose power. The pilot made an immediate left turn back towards the airport and contacted the control tower to advise he was making a single-engine straight-in landing approach. When he lowered the landing gear, the right engine began to surge and lose power. The pilot declared an emergency. Realizing he had insufficient engine power and altitude to return to KBJC, he retracted the landing gear and made a no-flap gear-up landing on the Omni Interlocken Golf Course.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	69,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Glider; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	December 3, 2012
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 8, 2013
Flight Time:	15000 hours (Total, all aircraft), 414 hours (Total, this make and model), 14000 hours (Pilot In Command, all aircraft), 34 hours (Last 90 days, all aircraft), 29 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

The pilot, age 69, held an airline transport pilot certificate with a multiengine land rating, and commercial privileges in airplanes single-engine land/sea and glider ratings. He was type rated in the

Boeing 737 and a Dornier Alpha Jet. He also held a flight instructor certificate with airplane single/multiengine and instrument ratings, and a ground instructor certificate with an advanced rating. His first class airman medical certificate, dated December 3, 2012, contained restrictions for corrective lenses to be worn for distant vision, and possess glasses for near and intermediate vision.

The pilot estimated he had logged more than 15,000 total flight time, of which more than 414 hours were accrued in the Aero Commander.

Aircraft and Owner/Operator Information

Aircraft Make:	Aero Commander	**Registration:**	N93AA
Model/Series:	500B	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	500B-1296-111
Landing Gear Type:	Retractable - Tricycle	**Seats:**	7
Date/Type of Last Inspection:	February 13, 2013 Annual	**Certified Max Gross Wt.:**	7000 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	10021 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-540-E1B5
Registered Owner:		**Rated Power:**	290 Horsepower
Operator:		**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Houston Air	**Operator Designator Code:**	

N93AA, serial number 500B-1296-111, was manufactured by the Aero Commander Corporation in 1964. It was powered by two Lycoming IO-540-E1B5 fuel-injected engines, rated at 290 horsepower each.

According to the aircraft's maintenance records, an annual inspection was done on February 13, 2013, at a total airframe time of 10,020.6 hours. The Hobbs meter read 586.7 hours. At that time, the left engine was replaced by an overhauled engine (serial number L-8807-48). The engine had accrued 5,391.0 total hours before overhaul. The right engine, serial number L-11118-48, had been overhauled on April 18, 2012. Total hours prior to overhaul were not given, but it had accrued 167.6 hours since overhaul.

Both propellers were Hartzell models HC-A3VK-2B. The left propeller (serial number BJ74) and the right propeller (serial number BJ252) had accrued 167.6 hours since overhaul. Total hours on the propellers were not given.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBJC,5673 ft msl	**Distance from Accident Site:**	25 Nautical Miles
Observation Time:	15:49 Local	**Direction from Accident Site:**	135°
Lowest Cloud Condition:	Scattered / 9000 ft AGL	**Visibility**	40 miles
Lowest Ceiling:	Broken / 22000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.23 inches Hg	**Temperature/Dew Point:**	7°C / -8°C
Precipitation and Obscuration:			
Departure Point:	Broomfield, CO (KBKC)	**Type of Flight Plan Filed:**	None
Destination:	Broomfield, CO (KBKC)	**Type of Clearance:**	VFR
Departure Time:	15:40 Local	**Type of Airspace:**	

Weather recorded by the KBJC AWOS (Automated Weather Observation Station) at 1549 was as follows:

Wind, calm; visibility, 40 statute miles; sky condition, 9,000 feet scattered clouds, ceiling 22,000 feet, broken clouds; temperature, 7 degrees Celsius (C.); dew point, -8 degrees C.; altimeter, 30.24 inches of mercury.

Airport Information

Airport:	Rocky Mountain Metropolitan KBJC	**Runway Surface Type:**	
Airport Elevation:	5673 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor	**Latitude, Longitude:**	39.921665,-105.135002

The fuselage structure, forward of wing attach point, was bent upwards and there was vertical deformation throughout the length of the fuselage, particularly the lower portion. The outer 3 feet of the left wing was crushed back to the spar, and the left propeller blades were bent.

Additional Information

The pilot said that when he preflighted the airplane, the fuel gauge indicated 65 gallons. Due to the design of the fuel system, it is not possible to visually check the fuel level unless all tanks are completely full. An FAA inspector applied battery power to the airplane post accident and the fuel gauges displayed 65 gallons of fuel. According to the salvage company that recovered the airplane, approximately ½-gallon of 100LL aviation gasoline was drained from the fuel system.

The following are excerpts from Section V of the Aero Commander 500B Maintenance Manual:

"Fuel is contained in five rubberized fuel bladders, two of which are located in each wing, inboard of the nacelles, and one in the center wing section above the baggage compartment. The five cells have a total capacity of 150-159 U.S. gallons and are interconnected by two-inch diameter tubes to ensure adequate fuel flow from the wing cells to the center cell. All cells are filled through the fuel fill port located on top of the right wing above the forward fuel cell.

"The fuel quantity indicating system is comprised of an indicating gage, mounted on the instrument panel… with a dial to indicate the quantity of fuel in the fuel cells. The fuel quantity gage dial is marked from E (empty) to 135 U.S. gallons. Fuel cell capacity above 135 gallons is not indicated."

Administrative Information

Investigator In Charge (IIC):	Scott, Arnold
Additional Participating Persons:	Jacky R Williams; FAA Flight Standards District Office; Denver, CO
Original Publish Date:	December 11, 2013
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=86335