National Transportation Safety Board
Aviation Accident Final Report

Location:	Philadelphia, Mississippi	**Accident Number:**	ERA12FA146
Date & Time:	January 16, 2012, 12:42 Local	**Registration:**	N700PS
Aircraft:	Aerostar Aircraft Corporation PA-60-601P	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

On the day of the accident, a mechanic taxied the airplane onto the runway and performed a full power check of both engines, exercised both propellers, and checked each magneto drop with no discrepancies reported. Following the engine run, the mechanic taxied the airplane to the fuel ramp where the fuselage fuel tank was filled; after fueling, the fuselage tank had 41.5 gallons of usable fuel. The mechanic then taxied the airplane to the ramp where the engines were secured and the fuel selector switches were placed to the off position. The mechanic reported that, at that time, the left fuel tank had 4 to 5 gallons of fuel, while the right fuel tank had about 2 to 3 gallons of fuel; the unusable fuel amount for each wing tank is 3 gallons.

The pilot taxied the airplane to the approach end of runway 18 and was heard to apply takeoff power. A pilot-rated witness noted that, at the point of rotation, the airplane pitched up fairly quickly to about 20 degrees and rolled left to about 10 to 15 degrees of bank. The airplane continued rolling left to an inverted position and impacted the ground in a 40 degree nose-low attitude. A postcrash fire consumed most of the cockpit, cabin, both wings, and aft fuselage, including the vertical stabilizer, rudder, and fuselage fuel tank.

Postaccident inspection of the flight controls, which were extensively damaged by impact and fire, revealed no evidence of preimpact failure or malfunction. Although the flap actuators were noted to be asymmetrically extended and no witness marks were noted to confirm the flap position, a restrictor is located at each cylinder's downline port by design to prevent a rapid asymmetric condition. Therefore, it is likely that the flap actuators changed positions following impact and loss of hydraulic system pressure and did not contribute to the left roll that preceded the accident.

Examination of the engines and propellers revealed no evidence of preimpact failure or malfunction that would have precluded normal operation. Postaccident examination of the fuselage fuel sump revealed the left fuel selector was in the crossfeed position, while the right fuel selector was likely positioned to the on position. (The as-found positions of the fuel selector knobs were unreliable due to postaccident damage.) The starting engines checklist indicates that the pilot is to move both fuel selectors from the on position to the crossfeed position, and back to the on position while listening for valve actuation/movement. The before takeoff checklist indicates that the pilot is to verify that the selectors are in the on position.

Although the left engine servo fuel injector did not meet flow tests during the postaccident investigation, this was attributed to postaccident heat damage. Calculations to determine engine rpm based on ground scars revealed that the left engine was operating just above idle, and the right engine was operating about 1,315 rpm, which is consistent with a left engine loss of power and the pilot reducing power on the right engine during the in-flight loss of control. Examination of both propellers determined that neither was feathered at impact.

Although the as-found position of the left fuel selector knob could be considered unreliable because of impact damage during the accident sequence, given that right wing fuel tank had no usable fuel, it is unlikely that the experienced pilot would have moved the left fuel selector to the crossfeed position in response to the engine power loss. It is more likely that the pilot failed to return the left fuel selector to the on position during the starting engines checklist and also failed to verify its position during the before takeoff checklist; thus, the left engine was being fed only from the right fuel tank, which had very little fuel. There was likely enough fuel in the right tank and lines for the pilot to taxi and takeoff before the left engine failed, causing the airplane to turn to the left, from which the pilot did not recover.

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 directional control during takeoff following loss of power to the left engine due to fuel starvation. Contributing to the loss of control was the pilot's failure to feather the left propeller following the loss of left engine power.

Findings

Aircraft	Engine out control - Not attained/maintained
Aircraft	Propeller feather/reversing - Not used/operated
Aircraft	Fuel - Fluid management
Personnel issues	Aircraft control - Pilot
Personnel issues	Use of equip/system - Pilot

Factual Information

HISTORY OF FLIGHT

On January 16, 2012, about 1242 central standard time, an Aerostar Aircraft Corporation PA-60-601P, N700PS, registered to M & H Ventures LLC, experienced a loss of directional control during the initial takeoff and crashed in an open field near Philadelphia Municipal Airport (MPE), Philadelphia, Mississippi. Visual meteorological conditions prevailed at the time and no flight plan was filed for the 14 Code of Federal Regulations (CFR) Part 91 personal flight from MPE to Key Field Airport, Meridian, Mississippi. The airplane sustained substantial damage due to impact and a postcrash fire. The airline transport pilot, the sole occupant, was fatally injured. The flight was originating at the time of the accident.

A witness in an airplane waiting short of the runway for the accident pilot to depart watched the takeoff roll from runway 18 and reported the accident airplane became airborne just before the intersection of the ramp and runway. After becoming airborne, the witness noted the airplane immediately, “got squirrelly” and went to the left. The witness stated he taxied onto the runway and back taxied to the approach end of runway 18, where he initiated his takeoff roll; the wind at the time was from 160 degrees at 15 knots with gusts to 20 knots. After becoming airborne, he noted the airplane had crashed and reported the event on the airport UNICOM frequency.

Another witness saw the airplane while it was airborne and noted it rolled left and “it looked like the wind caught the wing.” The witness reported the airplane rolled onto its left side and pitched nose down impacting the ground.

Still another witness who was located northeast of the accident site reported hearing the airplane begin the takeoff roll. The witness walked outside the building and noticed the airplane, “…veering to the left like it was turning out…” then noticed the airplane rolling onto its left side and pitching nose down impacting the ground.

PERSONNEL INFORMATION

The pilot, age 48, held an airline transport pilot certificate with airplane multi-engine land rating, and also a commercial pilot certificate with airplane single engine land rating. At the airline transport level he was type rated in several transport category airplanes. He held a first class medical certificate with no limitations issued on July 27, 2011. On the application for his last medical certificate he listed having a total time of 6,200 hours.

In December 2011, the pilot undertook initial ground and flight training in the airplane. The training was conducted by a pilot who had 16,000 hours in Piper Aerostar airplanes.

The ground instruction consisted of 24 hours over the course of three full days, and the flight instruction consisted of 2.0 hours dual flight in the accident airplane, which occurred on December 15, 2011. The ground school consisted of systems instruction, while the flight training consisted of stalls, pitch and power demonstration, climbs, turns, flap demonstration,

air velocity minimum control (VMCa), engine failures after takeoff, in the traffic pattern, and on final approach. Twelve takeoff's and landings with and without flaps were performed, and go-arounds and aborted takeoff's were also performed. The notes section of the flight review checklist indicates "Great Job-."

AIRCRAFT INFORMATION

The airplane was manufactured in 1977 by Ted Smith Aerostar Corporation, as model PA-60-601P, and was designated serial number 61P-0427-157. It was certificated in the normal category and originally equipped with two turbocharger equipped Lycoming IO-540-S1A5 engines rated at 290 brake horsepower at 2,575 rpm, automatic controlled turbochargers installed in accordance with (IAW) supplemental type certificate (STC) SE60WE, and Hartzell constant speed full manual feathering HC-C3YR-2UF propellers with FC8468-8R propeller blades.

In December 1996, the airplane was modified by supplemental type certificate (STC) SA1658NM which removed the original engines and installed 350 horsepower Lycoming TIO-540-U2A engines; the same make and model propellers remained installed. The airplane type certificate holder reported that as a result of the engine change, flight testing confirmed there was no change to the airplane's original Vmca, which is 97 miles-per-hour indicated airspeed.

The airplane's fuel supply system in each wing consists of integral wet wing tanks located outboard of the engine nacelle. Each tank has a total capacity of 65 gallons, of which 62 gallons are considered usable. The airplane also has a bladder-type fuselage fuel tank located between the rear cabin bulkhead and the forward bulkhead of the baggage compartment, which has a total capacity of 43.5 gallons, of which 41.5 gallons are considered usable. An annunciator light labeled "LOW FUEL" installed in a group in the annunciator panel in the glare shield by design illuminates continuously when 12 gallons fuel remain in the fuselage tank. The light will remain on as fuel is depleted from the fuselage tank until it is serviced above 12 gallons. The airplane was not equipped with a crossfeed annunciator light when the airplane was manufactured and the maintenance records do not reflect a crossfeed annunciator light was installed after manufacture in accordance with Kit 764-493.

A multiple sump assembly installed below the fuselage fuel tank has a "center sump" which is the low point for the fuselage tank, and two wing sumps which are the low points for each wing tank. Each sump can be drained by depressing its respective drain valve located on the lower aft side of the fuselage just aft of the wing. Fuel from the left and right wings are supplied via lines and hoses to each respective wing sump through a flapper check valve installed on each respective wing sump. Flapper check valves are also installed on each side of the fuselage fuel sump; the check valves prevent back-flow of fuel from one tank to another. Fuel from the fuselage tank flows through flapper check valves into each respective wing fuel sump, then to the each respective engine through valves, hoses, auxiliary fuel pumps, servo fuel injector, flow divider, injector lines, and fuel injector nozzles.

Four electrically operated valves are installed on the fuel sump assembly, and are controlled from two fuel selector switches (one for each engine) mounted on the instrument panel. Each valve on the fuel sump assembly has two positions (open or closed) and the switches have three

detent positions (off, on, and crossfeed). The left switch is mounted on the pilot's lower panel, while the right switch is mounted on the co-pilot's lower panel. For example, when either fuel selector is in the on position, fuel is supplied from its respective wing tank if fuel is available and also from the fuselage tank. With either fuel selector positioned to the crossfeed position, fuel is supplied to the engine from only the opposite wing tank and not the fuselage tank. If both fuel selectors are positioned to crossfeed at the same time, no fuel will be consumed from the fuselage tank; the left engine will only be supplied fuel from the right wing and the right engine will only be supplied fuel from the left wing.

The FAA Approved Airplane Flight Manual indicates that the crossfeed position is only to be used in level coordinated flight only, and double crossfeed is prohibited except in emergency when the "LOW FUEL" warning light on the annunciator panel is illuminated.

Review of the maintenance records that begin with an entry dated July 18, 1977, associated with an entry related to a production test flight, to the last entry dated January 16, 2012, revealed no entry indicating removal or replacement of either fuel selector switch, or fuel selector knob.

Further review of the maintenance records revealed the airplane was last inspected in accordance with an annual inspection on December 27, 2011. The logbook entry indicates the airplane total time at that time was 2,856.9 hours. The mechanic who signed off the repairs and approved the airplane for return to service indicated that during the annual inspection, calibration of the fuel quantity system was performed. The airplane had accumulated approximately 22 hours since the inspection at the time of the accident. The maintenance records also reflect an entry on the day of the accident indicating in part that the left engine servo fuel injector was reinstalled after being sent for "bench check and repair." The entry also indicates that after installation of the servo fuel injector, the mechanic rigged and leak checked it. Additionally, the mechanic also removed and cleaned the fuel injector nozzles, and adjusted the idle speed and idle mixture settings.

The mechanic who signed off the installation of the left servo fuel injector reported that he determined that a full power, high speed taxi should be performed to verify that the left engine would meet all full power parameters. On the day of the accident about 0905, or about 3 hours 37 minutes before the accident, he performed a walk-around inspection then started both engines using the airplane's checklist. At the time, he reported that the left wing fuel tank had 4 to 5 gallons fuel, the right tank had 2 to 3 gallons fuel, and the center tank had 18 gallons of fuel. He taxied the airplane to the turn-around for runway 18, then performed a preflight run-up. He cycled the propellers at 1,500 rpm, then performed a magneto check at 2,000 rpm noting a drop of 75 rpm when checking each magneto separately. He further reported that all engine parameters were in the "normal operating range." He taxied into position, held the brakes and applied 30 inches manifold pressure, then released the brakes and smoothly increased power to 42 inches manifold pressure. He noted that the rpm was 2,500 and the fuel flow was 38 gallons-per-hour. He then reduced power and taxied to the ramp where he allowed the engines to cool for 4 minutes, then secured the engines. He then examined the engine nacelles for oil or fuel leaks, but did not report seeing any. Realizing the airplane needed fuel, he restarted the engines, taxied to the fuel pump, where a lineman filled the center fuel tank adding 22 gallons 100 low lead (100LL). He restarted the engines, taxied to his hangar, shut

down the engines, and moved each fuel selector switch to the off position. He then towed the airplane inside the hangar.

The mechanic further stated that the accident pilot and another individual arrived at the airport about 1025, and then both departed the airport briefly. They returned to the airport, and he discussed the maintenance that was performed, and began installing a new mount on the pilot's yoke for a Garmin 696 portable global positioning system (GPS) receiver. The mechanic towed the airplane to the ramp, and returned the tug to the hangar. He then went back to the airplane and met the pilot while he was performing his preflight inspection. The mechanic noted that the aileron trim was neutral, and he checked the fuel sump drains while being watched by the accident pilot. The mechanic left the airport before the accident flight departed and did not witness the accident.

The last entry in the airframe logbook was dated January 16, 2011; the sign off should have been January 16, 2012. The entry indicated that the airplane total time was approximately 2,879 hours.

METEOROLOGICAL INFORMATION

A surface observation weather report taken at Philadelphia Municipal Airport at 1245, or approximately 3 minutes after the accident indicates the wind was from 180 degrees at 14 knots with gusts to 20 knots. The visibility was 10 miles, and scattered clouds existed at 2,400 feet and 6,500 feet, while a ceiling of broken clouds existed at 9,000 feet. The temperature was 19 degrees Celsius, but the dew point reading was missing, and the altimeter setting was 30.24 inches of Mercury.

COMMUNICATIONS

According to the pilot of an airplane waiting to depart after the accident pilot departed, the accident pilot announced his takeoff from runway 18 on the common traffic advisory frequency (CTAF); the accident pilot did not make any distress call on the CTAF after becoming airborne.

AIRPORT INFORMATION

The Philadelphia Municipal Airport is a publically-owned airport which has one asphalt runway designated 18/36. The runway is 5,001 feet in length and 75 feet in width.

FLIGHT RECORDERS

The airplane was not equipped, nor was it required to be equipped, with a cockpit voice recorder (CVR) or flight data recorder (FDR). However, the airplane was equipped with components that are capable of recording and retaining non-volatile memory associated with flight, or fuel load. The components that have non-volatile memory, or are capable of retaining data consist of a Garmin GTN 750, Garmin 696 portable global positioning system (GPS) receiver, and a Shadin fuel flow indicator.

The Garmin GTN 750 records only data consisting of last frequencies, stored flight plans, and

user settings, while the Garmin 696 GPS was downloaded but there was no track log recorded for the accident flight; it is a pilot/owner selectable option to enable or disable the recordings. The Shadin fuel flow gauge was downloaded indicated 41.4 gallons fuel remaining, 2.3 gallons of fuel used, and a full fuel load as being 165.5 gallons. Details of component analysis are available in the NTSB public docket for this accident.

WRECKAGE AND IMPACT INFORMATION

The airplane crashed in an open field; the main wreckage was located at 32 degrees 47 minutes 38.2 seconds North latitude and 089 degrees 07 minutes 25.0 seconds West longitude, or approximately 930 feet east of runway 18/36 centerline and at a point abeam runway 18/36, about 523 feet from the departure end of runway 18.

Examination of the accident site revealed craters associated with the leading edge of the left wing, both engines, and the top portion of the fuselage. The ground scar attributed to the left wing was oriented on a magnetic heading of 154 degrees magnetic, while the ground scar attributed to the top portion of the fuselage was oriented on a magnetic heading of 128 degrees. An energy path of dirt and debris was oriented on a magnetic heading of 120 degrees. Windscreen pieces were noted in the ground scar crater attributed to the upper portion of the fuselage, while the ground scar attributed to be from the leading edge of the left wing that extended several inches below the surface was at an angle of 40 degrees from the surrounding surface terrain. The upper portion of the clam shell door was partially embedded in the ground on the right side of the ground scar from the upper fuselage with the word “Aerostar” visible and oriented upright but nearly 180 degrees from the energy path orientation. Two parallel oriented ground scars attributed to the left and right propeller blades were noted. The distance between the two attributed from the left propeller measured 37 inches, while the distance between the two attributed from the right propeller measured 21.5 inches.

The front fuselage and right wing came to rest on a magnetic heading of 160 degrees magnetic. Extensive postaccident fire damage was noted to the cockpit, cabin, both wings, and empennage. The grass south of the main wreckage was also burned. Both engines remained attached to the wings and the propellers remained attached to the engines. All components necessary to sustain flight remained attached or were found in close proximity to the main wreckage. Examination of the flight controls for roll, pitch, and yaw revealed no evidence of preimpact failure or malfunction. The left flap actuator was extended approximately 3.375 inches while the right flap actuator was extended approximately 5.625 inches; both flap actuators were retained for further examination.

Examination of the cockpit revealed the left throttle, left propeller, and both mixture controls were full forward, while the right throttle was about ½ knob width less than full forward, and the right propeller control was about 1 knob width less than full forward. Both magneto switches were in the both position. The elevator trim indicator was off scale nose low, the rudder trim indicator was off scale nose left, and the flap indicator was off scale past full down. The flap selector was in the down position, while the landing gear selector handle was in the up position. The hour meter indicated 540.4. The 5 housings of the annunciator lights were separated from the attach point of the glare shield; the annunciator housings were retained for further examination. A Garmin 696 portable GPS receiver was tightly clamped to within 1 inch

of the pilot's yoke by a steel band clamp; the GPS receiver was retained for further examination. The left fuel pressure was off scale low, while the right fuel pressure was in the green arc near the upper red line limit. The cabin door pin of the lower door was near the green mark. Examination of the fuel pressure gauge revealed the left needle was indicating approximately 31 psi or just below the lower red line limit, while the right was indicating approximately 35 PSI or just above the lower red line limit.

Examination of the pilot's instrument panel revealed the left fuel selector knob part number (P/N) MS91528-1K4B, was separated and was not located. The remaining portion of the aluminum knob which had a matching flat remained secured to the switch shaft key. The flat of the knob and switch shaft key remained aligned and were parallel to the "OFF" marking on the instrument panel. Further inspection of the back portion of the switch revealed several wires were separated from it, and the switch back was broken.

Examination of the co-pilot's instrument panel revealed the right fuel selector knob P/N MS91528-1K4B was in the off position as first viewed. The portion of the knob in the area of the set screws was broken. Following removal of the knob, the remaining portion of the aluminum knob which had a matching flat remained secured to the switch shaft key. The flat of the knob and switch shaft key remained aligned and were parallel to the "OFF" marking on the instrument panel. The switch moved freely when the remaining portion of knob was moved by hand. Further examination of the right fuel selector knob revealed evidence of 2 holes associated with set screws. Proper placement of the knob correlated with the shaft and set screws revealed it was in the crossfeed position.

Examination of the fuel sump assembly revealed it exhibited extensive heat damage. The position indicator for the No. 1 valve was in the closed position, while the position indicators for the Nos. 3 and 4 valves were in the open positions. The No. 2 valve was destroyed by fire; therefore, the position could not be determined.

Examination of the left and right engines was performed by a representative of the engine manufacturer with Safety Board oversight. The examination of the left engine revealed crankshaft, camshaft, and valve train continuity. Suction and compression was noted in each cylinder during hand rotation of the crankshaft. The magnetos remained installed and noted to produce spark at all towers during rotation of each magneto using an electrical drill motor. Inspection of the air induction system revealed no obstructions. Inspection of the turbocharger components revealed no evidence of preimpact failure or malfunction. Slight heat damage was noted to the lower aft area of the engine; the servo fuel injector cover exhibited evidence of light heat damage. The propeller, propeller governor, servo fuel injector, flow divider, and engine-driven fuel pump were retained for further examination.

Examination of the right engine revealed crankshaft, camshaft, and valve train continuity. Suction and compression was noted in each cylinder during hand rotation of the crankshaft. The magnetos remained installed and noted to produce spark at all towers during rotation of each magneto using an electrical drill motor. Inspection of the air induction system revealed no obstructions. Inspection of the turbocharger components revealed no evidence of preimpact failure or malfunction. The propeller, propeller governor, servo fuel injector, flow divider, and engine-driven fuel pump were retained for further examination.

Examination of the left propeller revealed all blades were in the low pitch position. One propeller blade was loose in the propeller hub, which appeared to be intact with no evident impact damage. Cycling of the pitch change mechanism was not attempted and the air valve retained an air charge. The propeller faying flange, cylinder, piston, piston change rod, fork, spring and spring guides, feather stop, and start lock were unremarkable. The low pitch stop had an impression mark. None of the preload plates installed on the butt end of each propeller blade had impact marks; therefore, the position of the propeller blades at the moment of impact could not be determined. However, the propeller blades were not feathered at the moment of impact. Examination of the propeller blades revealed the No. 1 blade as marked was bent aft about 20 degrees at mid-blade; no blade twist or leading edge damage was noted. The No. 2 propeller blade was bent forward approximately 20 degrees at mid-blade; no blade twist or leading edge damage was noted, but rotational scoring was noted in the paint on the cambered side of the blade. The No. 3 propeller blade was bent aft approximately 20 degrees at mid-blade; no blade twist or leading edge damage was noted, but rotational scoring was noted in the paint on the cambered side of the blade. The pitch change knob of the No. 1 blade was fractured, while the pitch change knobs of the Nos. 2 and 3 blades were not fractured. No discrepancies were noted that would preclude normal operation; all damage noted was attributed to impact damage.

Examination of the right propeller revealed all blades were in the low pitch position. Cycling of the pitch change mechanism was not possible and the air valve was fractured and did not retain an air charge. The cylinder exhibited light gouges on the forward end due to contact by the spinner. The propeller faying flange, piston, spring, spring guides, feather stop, and start lock were unremarkable. The pitch change rod was bent, and the fork was cocked on the bent pitch change rod. The low pitch stop had an impression mark. The preload plate of the No. 1 propeller blade as marked exhibited an impact mark caused by fork contact at a low pitch position. The impact mark equated to a 2 degree blade angle. The No. 2 propeller blade had an impact mark on the preload plate at a low pitch position, while the No. 3 propeller blade had an impact mark on the preload plate of the caused by fork contact at a low pitch position. The impact mark equated to a 6 degree blade angle. Examination of the propeller blades revealed the No. 1 blade exhibited a 30 degree large radius aft bend at mid-blade, and the leading edge was twisted towards low pitch. Paint abrasion and rotational scoring was noted on the leading edge and cambered side of the blade; the pitch change knob was fractured. The No. 2 propeller blade exhibited a 20 degree large radius aft bend at mid-blade, and the leading edge was twisted towards low pitch. Paint abrasion and rotational scoring was noted on the leading edge and cambered side of the blade; the pitch change knob was fractured. The No. 3 propeller blade was bent mildly aft at mid-blade, and the pitch change knob was bent. No discrepancies were noted that would preclude normal operation; all damage noted was attributed to impact damage.

MEDICAL AND PATHOLOGICAL INFORMATION

A postmortem examination of the pilot was performed by the Mississippi State Medical Examiner's Office, Jackson, Mississippi. The cause of death was listed as "multiple blunt traumatic injuries due to air craft crash, N700PS."

Forensic toxicology was performed on specimens of the pilot by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The toxicology report stated the specimens were unsuitable for carbon monoxide analysis, but the results were negative for cyanide, volatiles, and the drug screen.

TEST AND RESEARCH

As previously reported, the position indicators at the fuselage fuel sump were examined and the position indicator for the No. 1 valve was in the closed position, while the position indicators for the Nos. 3 and 4 shutoff valves were in the open positions. The No. 2 valve was destroyed by fire; therefore, the position could not be determined.

Per the airplane maintenance manual, the Nos. 1 and 3 valves are associated with the left engine, and the Nos. 2 and 4 valves are associated with the right engine. The as-found positions of the Nos. 1 and 3 valves at the fuel sump assembly equates to the left fuel selector being in the crossfeed position, or fuel to the left engine being supplied from the right fuel tank. Although the position of the No. 2 shutoff valve could not be determined, the maintenance manual also indicates that the only scenario in which the No. 4 shutoff valve would be in the open position (as viewed post accident), is when the right fuel selector is in the on position.

The airplane was fueled on the day of the accident at 0935. According to the individual who fueled the airplane, a total of 22.0 gallons of 100 low lead (100LL) fuel were added to the center fuel tank.

The pilot of an airplane (N252HM) fueled from the same source reported he did not notice any contamination in his fuel tanks as a result of the 10 gallons of 100LL fuel added to each wing fuel tank of his airplane. He also reported he did not experience any engine discrepancies related to fuel during his subsequent 1.0 hour flight after fueling.

Postaccident, a sample of fuel from the facility that fueled the airplane was submitted for analysis to Interek Caleb Brett, located in Romeoville, Illinois. The test results indicate that the submitted specimen meets the requirement of ASTM International (ASTM), ASTM D910 Aviation Gasoline specifications. A copy of the report is contained in the NTSB public docket for this case.

Bench testing of the left and right propeller governors was performed at a Federal Aviation Administration (FAA) certified repair station. Bench testing of the left and right propeller governors revealed no evidence of preimpact failure or malfunction.

Bench testing and examination of both servo fuel injectors (servo) and flow dividers was performed at a FAA certified repair station. The left servo was placed on a test bench as received, and was noted to flow 160 pounds-per-hour (PPH) at test points 1, 3, and 4. Specification at test points 1, 3, and 4 are 52.0 to 84.0 PPH, 84.0 to 96.0, and 212.0 to 237.0 PPH, respectively. Following bench testing, the servo was disassembled which revealed the regulator seat was loose in the body and was not sitting correctly. The seat assembly was removed and noted to be deformed when compared with an exemplar seat. An exemplar seat was installed and the unit was re-assembled then placed on the test bench. At test point 1, the

unit flowed 1.0 PPH higher than specification, at test point 3 the unit flowed 3.0 PPH greater than specification, and at test point 4 the unit flowed within specification. Testing of the automatic mixture control (AMC) was performed and it tested satisfactory. Bench testing of the right servo revealed it flowed within limits at test points 1 and 4, however, the unit flowed 11 PPH higher than specification at test point 4. Testing of the AMC was performed and it tested satisfactory. Bench testing of the left and right flow dividers revealed both tested satisfactory. Disassembly inspection of each flow divider after flow testing revealed no discrepancies with the diaphragm, or spring. Each flow divider had a 2.0 PSI spring installed.

A representative of the servo fuel injector manufacturer was contacted to review the findings of the left fuel servo test results (160 PPH at test points 1, 3, and 4), and also the finding of the distortion of the seat assembly. The representative reported in his experience he has seen distortion of the seat in cases where there was a postcrash fire. The representative also indicated that the material of the seat melts just above 300 degrees. He stated that the as-found flow result of 160 PPH at test point 1 would have resulted in an excessively rich mixture that most likely would not sustain combustion, and the reduced fuel flow at test point 4 would have resulted in a lean mixture when attempting to obtain full power.

Bench testing of the left and right engine-driven fuel pumps was performed at a FAA certified repair station. At 2,575 rpm and 38 PSI (test standard), the left and right engine-driven fuel pumps flowed 47.8 and 46.35 gallons-per-hour (GPH), respectively. The specified fuel flow at that rpm and PSI setting is a minimum of 42.0 GPH. The left engine-driven fuel pump passed the 600 RPM test, while the right engine-driven fuel pump did not pass the 600 RPM test. Disassembly of the right engine-driven fuel pump revealed the valve poppet had a worn spot, which is why it failed the 600 RPM test.

According to the FAA Approved Airplane Flight Manual, the starting engines checklist indicates that both fuel selectors are to be moved to the on, crossfeed, then back to the on positions, with wording indicating to listen for actuation/movement of valve actuation. The before takeoff checklist indicates to verify that the fuel selectors are in the on position, and the "LOW FUEL" warning light is out.

As previously reported, at the beginning of the flight, the fuselage fuel tank was full, and the left wing fuel tank had 4 to 5 gallons fuel, while the right wing fuel tank had 2 to 3 gallons of fuel. The airplane flight manual indicates that the unusable fuel amount for each wing fuel tank is 3 gallons.

Examination of the left and right flap actuators, and also the five annunciator housings was performed by the NTSB Materials Laboratory located in Washington, D.C. The flap actuators were submitted in an attempt to determine each actuator position prior to impact, while the annunciator housings were submitted for filament testing and examination in an effort to determine whether any of the bulbs were illuminated at impact. The examination of the flap actuators revealed both exhibited signs of exposure to fire and thermal damage. No witness marks were noted; therefore, the pre-fire flap actuator position could not be determined. Each of the five annunciators housed two annunciator lights that were made up of two bulbs each, for a total of four bulbs per fixture. The annunciator lights bulb filaments for REQ OXY (oxygen required per altitude switch, GEAR (throttle below 20 inches manifold pressure and

gear in the up position), A/P INT (autopilot interrupt when using control wheel steering with autopilot on), LOW FUEL (when fuel quantity in the fuselage tank falls below 12 gallons), HTR FAIL (heater overheat circuit breaker is off), AUX HYD (auxiliary hydraulic pump is pumping, DE-ICE (when boots are inflating), R ALT and L ALT (alternators are off line). No bulb filament stretching was noted for both bulbs of the gear, low fuel, auxiliary hydraulic, de-ice, right alternator, or left alternator. Stretching was noted to both bulb filaments for regulator oxygen, while stretching was noted to one bulb filament of autopilot interrupt and heater fail.

Calculations to determine left and right engine rpm at impact were performed using the measured distance for the left and right propeller blades (37 inches and 21.5 inches), respectively. The calculations took into account the estimated groundspeed of 70 knots, which is the VMCa speed of 84 knots minus the headwind component of 14 knots. The formula is to multiply the groundspeed by 1212, and divide that amount by the distance in inches between the propeller slash marks multiplied by the number of propeller blades. Using that formula, the calculations revealed that the left engine rpm was approximately 764, while the right engine rpm was approximately 1,315.

A search of the FAA Service Difficulty Reports for the P/N of the fuel selector switch (980223-001) and P/N of the knob (MS91528-1K4B) revealed no records.

The flight manual supplement indicates that following engine failure during takeoff with insufficient runway remaining, the propellers and throttles are to be advanced to high rpm and to 42 inches manifold pressure, then place the landing gear up, and flaps up. The next step indicates to verify inoperative engine, followed by feathering of the propeller. The next step is to maintain 100 knots calibrated airspeed (CAS) for obstacle clearance, then after obstacle clearance establish best rate of climb speed of 117 knots CAS. The airplane is then to be trimmed, and the suspect engine secured.

The Aerostar Model 601P FAA Approved Airplane Flight Manual indicates that with respect to the flaps, flow control valves are installed in the flap system to provide equal fluid flow to the left and right flap actuators thereby ensuring symmetrical flap extension and retraction. A restrictor is also located at each cylinder's downline port to prevent a rapid asymmetric condition from occurring should the downline rupture when the flaps are extended.

History of Flight

Initial climb	Fuel starvation
Initial climb	Loss of engine power (partial)
Initial climb	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

Pilot Information

Certificate:	Airline transport; Commercial; Flight engineer	**Age:**	48,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	July 27, 2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 15, 2011
Flight Time:	6200 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Aerostar Aircraft Corporation	**Registration:**	N700PS
Model/Series:	PA-60-601P	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	61P-0427-157
Landing Gear Type:	Retractable - Tricycle	**Seats:**	5
Date/Type of Last Inspection:	December 27, 2011 Annual	**Certified Max Gross Wt.:**	6315 lbs
Time Since Last Inspection:	22 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	2857 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	Installed	**Engine Model/Series:**	TIO-540-U2A
Registered Owner:		**Rated Power:**	350 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MPE,458 ft msl	**Distance from Accident Site:**	
Observation Time:	12:45 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 2400 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 9000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / 20 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.23 inches Hg	**Temperature/Dew Point:**	19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Philadelphia, MS (MPE)	**Type of Flight Plan Filed:**	None
Destination:	Meridian, MS (MPE)	**Type of Clearance:**	None
Departure Time:	12:42 Local	**Type of Airspace:**	

Airport Information

Airport:	Philadelphia Municipal Airport MPE	**Runway Surface Type:**	Asphalt
Airport Elevation:	458 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:	18	**IFR Approach:**	None
Runway Length/Width:	5001 ft / 75 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	32.793888,-89.123611

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Harold E Aycock; FAA/FSDO; Jackson, MS James M Childers; Textron Lycoming; Williamsport, PA Thomas McCreary; Hartzell Propeller; Piqua, OH
Original Publish Date:	May 30, 2013
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=82684