National Transportation Safety Board
Aviation Accident Final Report

Location:	Biddeford, Maine	**Accident Number:**	ERA11FA233
Date & Time:	April 10, 2011, 18:05 Local	**Registration:**	N402RC
Aircraft:	Cessna 402B	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The multi-engine airplane was being repositioned to its base airport, and the pilot had requested to change the destination, but gave no reason for the destination change. Radar data indicated that the airplane entered the left downwind leg of the traffic pattern, flew at pattern attitude, and then performed a right approximate 250-degree turn to enter the final leg of the approach. During the final leg of the approach, the airplane crashed short of the runway into a house located in a residential neighborhood near the airport. According to the airplane's pilot operating handbook, the minimum multi-engine approach speed was 95 knots indicated airspeed (KIAS), and the minimum controllable airspeed was 82 KIAS. According to radar data, the airplane's groundspeed was about 69 knots with the probability of a direct crosswind.

Postaccident examination of the propellers indicated that both propellers were turning at a low power setting at impact. During a controlled test run of the right engine, a partial power loss was noted. After examination of the throttle and control assembly, two o-rings within the assembly were found to be damaged. The o-rings were replaced with comparable o-rings and the assembly was reinstalled. During the subsequent test run, the engine operated smoothly with no noted anomalies. Examination of the o-rings revealed that the damage was consistent with the o-rings being pinched between the corner of the top o-ring groove and the fuel inlet surface during installation. It is probable that the right engine had a partial loss of engine power while on final approach to the runway due to the damaged o-ring and that the pilot retarded the engine power to prevent the airplane from rolling to the right. The investigation found no mechanical malfunction of the left engine that would have prevented the airplane from maintaining the published airspeed.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot did not maintain minimum controllable airspeed while on final approach with a partial loss of power in the right engine, which resulted in a loss of control. Contributing to the accident was the partial loss of engine power in the right engine due to the improperly installed o-rings in the engine's throttle and control assembly.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	Fuel control/carburetor - Damaged/degraded

Factual Information

HISTORY OF FLIGHT

On April 10, 2011, about 1815 eastern daylight time, a Cessna 402B, N402RC, was substantially damaged when it impacted a house near Biddeford, Maine. The airline transport certificated pilot was fatally injured. The airplane was registered to My Plane, LLC, and operated under the provisions of 14 Code of Federal Regulation 91 as a positioning flight. Visual meteorological conditions prevailed and no flight plan had been filed. The airplane had departed from West Chester County Airport (HPN), White Plains, New York, about 1630.

The flight originated at Portland International Airport (PWM), Portland, Maine earlier in the day, flew to Nantucket Memorial Airport (ACK), Nantucket, Massachusetts, and acquired 115.6 gallons of 100LL aviation fuel. Then picked up a passenger, flew to HPN, where the passenger disembarked, departed and the pilot was planning to land in PWM. According to Federal Aviation Administration (FAA) Air Traffic Control transcripts, the pilot requested to change his destination to Biddeford Municipal Airport (B19), Biddeford, Maine. Radar data provided by the FAA Portland Air Traffic Control facility, revealed that the airplane overflew the south end of B19 at approximately 1,000 feet above mean sea level (msl), turned left, as if entering the left downwind leg of the airport traffic pattern. Then, approximately 2 miles from the approach end of runway 24, the airplane was observed, on radar, turning right about 250 degrees, and then a slight left turn in the direction of B19. The last radar data was recorded for the accident flight at 1804:29 and was in the vicinity of the accident location. The data indicated an altitude of 400 feet msl and a ground speed of 69 knots.

PERSONNEL INFORMATION

According to FAA records, the pilot, age 71, held an Airline Transport pilot certificate with a rating for airplane multiengine land, commercial pilot privilege for airplane single-engine land, and a certificated flight instructor with ratings for airplane single-engine land, multiengine land, and instrument airplane. His most recent FAA second-class medical certificate was issued February 4, 2011, and at the time of the examination the pilot reported 5,010 total hours of flight experience. According to a resume provided to the pilot's employer in August 2010, the pilot reported 4,735 total hours of civilian flight time as well as military navigator flight time. The resume also indicated 120 flight hours in the accident aircraft make and model. At the time of this writing no pilot logbooks had been located.

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1977 and registered to the owner on October 18, 2000. It was equipped with two Continental Motors TSIO-520 series engines. The airplane's most recent annual inspection was dated on August 21, 2010. At the time of the inspection the reported aircraft total time was 6,624.5 time in service and a Hobbs time of 4,554.1 hours. At the time of the inspection the engines had 359.0 hours since overhaul. The most recent maintenance logbook entry was March 21, 2011, and indicated a Hobbs time of 4,567.2 hours. The Hobbs meter was not located in the wreckage.

METEOROLOGICAL INFORMATION

The 1815 recorded weather observation at Sanford Regional Airport (SFM), Sanford, Maine, located approximately 16 miles to the southwest of the accident location, included wind from 150 degrees at 8 knots with gusts of 15 knots, the wind direction was variable from 100 degrees to 160 degrees, visibility 10 miles, clear skies, temperature 14 degrees C, dew point minus 2 degrees C; barometric altimeter 30.03 inches of mercury.

AIRPORT INFORMATION

The airport was equipped with a single runway oriented northeast to southwest and designated as 06/24. The runway was 3000-feet-long and 75-feet-wide, constructed of asphalt, was equipped with a 4-box visual approach slope indicator (VASI) on the left side of runway 6; however, no visual slope indicators were available to runway 24. The airport did not have an air traffic control tower. Communication was accomplished utilizing a common traffic advisory frequency; however, it was not recorded. The airport was served by two approaches to runway 6; however, runway 24 was the preferred calm wind runway.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted four trees varying in diameter from 3.2 inches to 8.75 inches and at a height of approximately 25 feet. The airplane came to rest on the roof of a single story residence that was located approximately 1,491 feet to the northeast of the runway 24 threshold. A post crash fire ensued engulfing the airplane. The left wing was thermally damaged and the outboard section of the wing was located on top of the roof. The left engine was located inside the residence. The right wing and engine were visible above the roof line. The airplane nose section, cabin, and empennage sections were thermally damaged. Portions of all flight controls were located at the accident location.

Examination of the wreckage indicated that the right main landing gear remained attached to the right wing attach point, and was in the down and locked position. The left main and nose gear were separated from the airframe and located within the residence.

The left wing's leading edge exhibited impact damage and the diameter of the damage was similar in dimensions to the diameter of the trees that were initially impacted. The left aileron was consumed by post impact fire. The fuel caps were secured and in place. The fuel tank selector handle located in the cockpit was found in the auxiliary tank position and the fuel valve located in the wing was found between the main and auxiliary tank position. The fuel strainer and filter were thermally damaged and had an area of corrosion in the bottom of the strainer approximately 30 degrees of coverage.

The right wing's aileron was separated and in the vicinity of the right wing. The right wing's outboard section approximately 2 feet inside the main fuel tank, located at the wingtip, was fractured but remained attached to the wing structure. The right main fuel tank was impact damaged near the leading edge of the tank. The right fuel tank selector handle, which was

located in the cockpit and the fuel valve located in the wing, were in the main fuel tank position. The fuel strainer was removed from the wing and contained aviation gasoline, the filter was free of debris. The fuel strainer was noted as having an area of corrosion located in the bottom of the strainer and was approximately 30 degrees of coverage and was similar in appearance as the left fuel strainer.

The wing flaps were found in the extended position and were verified by the flap motor chain position located under the cabin floor. Continuity was confirmed from the flap motor to the flap actuator. The right wing flap remained attached to the wing, the left wing flap mechanism remained attached; however, the flap skin was consumed by post impact fire.

The cockpit seats were separated and thermally damaged. Four of the five cabin seat frames remained attached to the cabin floor except for the most aft cabin seat which was located with portions of the flooring still attached to the seat feet.

Rudder continuity was confirmed from the rudder pedals to the rudder horn. The rudder counter weight was located in the wreckage in the vicinity of the empennage. Aileron continuity was confirmed from the cabin chain on the control columns to the aileron sector and then from the aileron sector to both ailerons bell cranks. The aileron sector was impact damaged in the positive direction. The aileron counter weights were located in the vicinity of the associated wing or attached to the wing. Elevator continuity was confirmed from the elevator horn to the swaged end of the cable. The right elevator counter weight remained attached; however, due to thermal damage the left counter weight could not be located.

The stall switch, located in the left wing, was removed and inspected; however, the internal mechanism was damaged and was found in the closed circuit position.

Left Engine

The engine and propeller assembly exhibited impact and thermal damage. The exhaust assembly including the turbocharger, controller, and wastegate assembly were separated from the engine and were located with the main wreckage. The wastegate actuator housing had extensive thermal damage and only the internal components were visible. The cylinders were thermal and impact damaged. The fuel system including the fuel manifold valve, fuel control, and lines had extensive thermal damage. The magnetos and ignition leads had thermal damage. The induction assembly had thermal damage. The induction elbows and air throttle assembly were not found during the inspection. The upper spark plugs were removed and had light gray to dark deposits. The cylinders were boroscoped and the combustion chambers were undamaged. The valves heads were undamaged and had normal thermal discoloration. The oil filler cap had thermal discoloration and damage. No oil was indicated on the engine oil dipstick.

Right Engine

The right engine remained partially attached with impact damage to the left aft mount leg. The engine was removed and the exhaust had impact damage. The exhaust wye-duct was torn and the left section remained attached to the impact damaged wing section. The propeller assembly

had impact damage and was removed from the engine. The oil and fuel lines remained attached. The induction assembly was crushed and the No. 6 cylinder riser separated near the cylinder attachment. The fuel manifold valve was undamaged and disassembled. The diaphragm and retaining nut were undamaged and secure. The manifold valve cavity had fuel present and the screen was free of debris. The fuel control was undamaged and the linkages moved freely by hand. The fuel control inlet screen was removed and was free of debris. Approximately 2 ounces of fuel dripped from the fuel control inlet screen port. The upper spark plugs were removed and had light gray deposits. The cylinders were boroscoped and the combustion chambers were undamaged. The valve heads were undamaged and had normal thermal discoloration. The crankshaft was rotated by hand through the upper right accessory mount drive. Gear continuity was obtained to the crankshaft propeller flange and magneto drives. Compression was obtained from each cylinder. The ignition leads were undamaged and spark was obtained from the spark plug connections. The oil filler cap was undamaged and no oil was indicated on the engine oil dipstick.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot on April 11, 2011, by the Office of Chief Medical Examiner, Augusta, Maine. The autopsy listed the cause of death as "smoke inhalation and thermal burns."

The FAA's Civil Aerospace Medical Institute performed forensic toxicology on specimens from the pilot. The report stated 12 percent carbon monoxide, no cyanide or ethanol was detected in the blood, and Quinine was detected in the blood.

ADDITIONAL INFORMATION

Engine Examination

The engines were sent to the Continental Motors facility in Mobile, Alabama manufacturers facility for examination. It was determined that the left engine exhibited thermal damage and was unable to be placed on a test stand and ran. The left engine was disassembled and no preaccident mechanical malfunctions or failures were found that would have precluded normal operation.

The right engine was examined and mounted on an engine test stand, and a test club propeller was installed. Approximately 20 minutes into the test the engine sustained a partial loss of power. Utilization of the manual primer restored engine power; however, when the primer was not used the engine would incur a partial power loss. No leaks were noted and the engine was shut down. The engine driven fuel pump was removed and placed on a test bench; the test results indicated that when compared to normal tolerance allowed by a new pump the accident airplane's pump would produce adequate to high pressure. The accident pump was reinstalled. The engine was restarted and subsequently backfired and sustained a partial loss of power. The engine was shut down and fuel was utilized from a temporary fuel tank; however, during operation the engine continued to sustain a partial power loss. The fuel screen was examined and free of contaminants. The throttle body assembly was removed and a replacement assembly was attached. The engine was started and operated smoothly at various power

settings and was subjected to several rapid accelerations and decelerations. The engine responded to the power changes smoothly and without any noticeable delay.

Right Engine Throttle and Control Assembly

The Throttle and Control Assembly was examined and no noticeable malfunctions were noted. The unit was placed on a test stand, tested, and was classified as a "failed test." The unit was disassembled revealing the four o-rings on the cam, inside the unit. The cam was determined to be a -11 and according to manufacturers guidance should have been a -8 unit. The o-rings were examined and two of the o-rings had noticeable "flat spots" around the outer circumference. The o-rings were retained and sent to the NTSB's Materials Laboratory. Four new o-rings were installed; the unit was reassembled, and reattached to the accident engine for another test run. The engine started and idled smoothly with no noticeable malfunctions, accelerated to numerous power settings, including full power, with no noticeable indication of power loss. The engine was further subjected to several decelerations and accelerations and performed smoothly without hesitations.

Propellers

The propellers were removed from the engine and shipped to McCauley Propeller Systems the manufacturers facility for examination. The examination took place on July 12, 2011 at the propeller manufacturers facility in Wichita, Kansas and Federal oversight was provided by an inspector with the FAA. The examination revealed that propeller damage was consistent with impact damage and no evidence was noted of any indications of propeller failure prior to impact. Both propellers had evidence of rotation at the time of impact and were being operated under conditions of low power. Impact signature markings indicated that both propellers were operating at or near the low pitch position at the time of impact, and the feather stop mechanisms were undamaged. Blade bending, twisting, and damage on both propellers were consistent with low power at impact.

O-Rings

The two o-rings from the right engine throttle and control assembly were sent to the NTSB's Materials Laboratory in Washington, D.C. for further examination. Both o-rings were examined utilizing a stereomicroscope. One o-ring had two semi-circular cuts; however, no material was missing from the damaged area and no mechanism was identified that could have caused the damage. The other o-ring was damaged in two areas of the outer diameter, material was missing from the damaged areas and the damage was consistent with the o-ring being pinched between the corner of the top o-ring groove and the fuel inlet surface during installation. For more information, the Materials Laboratory Report is located in the docket for this accident.

According to a right engine log book entry dated 02/16/04, several engine accessories were exchanged for remanufactured units; however, no reference to the Throttle and Control Assembly being changed was found in the logbook. According to the Authorized Certificate Release form the throttle controller unit was overhauled on 02/04/04. Based on the information from the last airframe logbook entry, the right engine Throttle and Control

Assembly had accumulated more than 372.1 flight hours.

Pilot's Operating Handbook

According to Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM), Section 4, Normal Procedures "Before Landing" checklist for the accident airplane model states in part "...Wing Flaps – Down 45° below 140 KIAS [knots indicated airspeed]... Minimum Multi-Engine Approach Speed – 95 KIAS at 6200 pounds ... Air Minimum Control Speed – 82 KIAS."

According to the POH/AFM, Section 5 "Performance" the lowest aircraft weight provided by the "Normal Landing Distance" chart was 4300 pounds and a "Speed at 50-Foot Obstacle" was 79 KIAS.

Pilots Handbook of Aeronautical Knowledge (FAA-H-8083-25)

According to the Pilots Handbook of Aeronautical Knowledge (FAA-H-8083-25), minimum control speed (Vmc) is defined as "the minimum flight speed at which a light, twin-engine airplane can be satisfactorily controlled when an engine suddenly becomes inoperative and the remaining engine is at takeoff power."

Airplane Flying Handbook (FAA-H-8083-3A)

The Airplane Flying Handbook (FAA-H-8083-3A), Chapter 12 "Transition to Multiengine Airplanes", states in part "If an engine fails below Vmc while airborne, directional control is not possible with the remaining engine producing takeoff power...the final approach should be made with power and at a speed recommended by the manufacturer...but in no case less than critical engine-out minimum control speed (Vmc)..."

History of Flight

Approach-VFR pattern final	Powerplant sys/comp malf/fail
Approach-VFR pattern final	Loss of engine power (partial)
Approach-VFR pattern final	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	71,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):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	February 4, 2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 4735 hours (Total, all aircraft), 120 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N402RC
Model/Series:	402B	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	402B1218
Landing Gear Type:	Retractable - Tricycle	**Seats:**	10
Date/Type of Last Inspection:	August 21, 2010 Annual	**Certified Max Gross Wt.:**	6300 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	6624 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	TSIO-520 SER
Registered Owner:		**Rated Power:**	300 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:	SFM	**Distance from Accident Site:**	16 Nautical Miles
Observation Time:	18:15 Local	**Direction from Accident Site:**	240°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	11°C / 2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	White Plains, NY (HPN)	**Type of Flight Plan Filed:**	None
Destination:	Biddeford, ME (B19)	**Type of Clearance:**	VFR flight following
Departure Time:	16:30 Local	**Type of Airspace:**	

Airport Information

Airport:	Biddeford Municipal Airport B19	**Runway Surface Type:**	Asphalt
Airport Elevation:	157 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:	24	**IFR Approach:**	None
Runway Length/Width:	3000 ft / 75 ft	**VFR Approach/Landing:**	Full stop;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 Fatal	**Latitude, Longitude:**	43.471942,-70.461112

Administrative Information

Investigator In Charge (IIC):	Etcher, Shawn
Additional Participating Persons:	David W Knowles; FAA/FSDO; Portland, ME Henry Soderlund; Cessna Aircraft Company; Wichita, KS Andrew Swick; Continental Motors, Inc.; Mobile, AL Danny Ball; McCauley Propeller Systems; Wichita, KS Rick Roper; Ram Aircraft LP; Waco, TX
Original Publish Date:	June 14, 2012
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=78812