Aviation Investigation Final Report

Location:	LaGrange, Georgia	**Accident Number:**	ERA10LA357
Date & Time:	July 11, 2010, 09:15 Local	**Registration:**	N405RW
Aircraft:	Beech 58	**Aircraft Damage:**	Substantial
Defining Event:	Explosion (non-impact)	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane had just been fueled by the lineman at the fixed-base operator (FBO), who secured the fuel caps after the service. During the climb after takeoff, the right-wing fuel cap came off of the wing, remaining attached only by the chain. An estimated 11 gallons of fuel was siphoned from the wing before the pilot returned to the airport and taxied back to the FBO. The pilot secured the cap and conducted a visual inspection of the right wing, before attempting to start the engine again. The right engine backfired, followed by a loud bang and whoosh sound; flames then rose from the right wing. A postaccident examination of the right wing revealed that the internal blast was a result of the backfire igniting fuel vapors that remained after the siphoning. The blast caused the upper wing skin to expand and separate from the retaining rivets. A soot trail originated at the exhaust pipes and traveled in an aft direction to the trailing edge of the wing.

Examination of the fuel cap revealed that the outer o-ring was dry and cracked, a washer was missing, the cap leaked under pressure, and that the force required to secure the cap exceeded the manufacturer's specification. The airplane's maintenance records did not indicate the last time the fuel cap was overhauled. Fuel cap maintenance is permissible by a Federal Aviation Administration (FAA) certified airframe mechanic or by an FAA-approved overhaul facility. While the cap's manufacturer has standards on the required forces to secure the fuel cap lock tab and a leak testing process, the airplane's maintenance manual does not mention either.

As a result of separate investigations, the airplane's manufacturer has included in applicable airplanes' maintenance manuals the following verbiage: "Note: Inspect the fuel filler cap outer o-ring for flexibility, splits cracks or distortion. If the o-ring is damaged in any way replace or

overhaul the fuel cap.”

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot not allowing sufficient time for fuel spill vapors to dissipate before starting the engine. Contributing to the accident was the inadequate maintenance of the fuel cap.

Findings

Personnel issues	Incorrect action performance - Pilot
Aircraft	Fuel storage - Incorrect service/maintenance
Organizational issues	Document/info production - Manufacturer

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Initial climb	Sys/Comp malf/fail (non-power)
Initial climb	Fuel related
Standing-engine(s) start-up	Explosion (non-impact) (Defining event)
Standing-engine(s) start-up	Fire/smoke (non-impact)

On July 11, 2010, at about 0915 eastern daylight time, a Beechcraft, BE-58, N405RW, owned and operated by private individuals, sustained substantial damage during a right engine start at the LaGrange-Callaway Airport (LGC), Lagrange, Georgia. The pilot was not injured. Visual meteorological conditions prevailed for the Title 14 Code of Federal Regulations Part 91, personal flight.

The pilot stated that the lineman filled both wings to full capacity and secured both fuel caps. His preflight visually showed both caps in place. Following the takeoff from runway 31, at approximately 700 feet above the ground, the fuel cap on the right wing released from the opening and remained attached to the airplane by the retaining chain. Fuel was observed coming from the opening. The pilot initiated a return to LGC. With no traffic and no wind at the time, he landed on runway 13 and returned to the ramp. At the ramp, both engines were shut down as he met the lineman. He exited the airplane, secured the right fuel cap and visually observed that the upper and lower wing had no sign of fuel spillage. The lineman stated he observed the pilot re-secured the fuel cap on the right wing after his return and declined a top off of the right wing fuel tank. About 10 minutes from the time the airplane returned, the pilot boarded the aircraft and started the left engine then proceeded to start the right engine. The engine backfired on startup and a loud bang and whoosh sound was heard; flames rose from the right wing. The pilot continued cranking the engine and completed the emergency procedure for an engine fire during start. The propeller wash extinguished the flames quickly except for a small flame at the aileron linkage area, which the lineman extinguished with a fire extinguisher. The pilot shut down the engines and exited the aircraft.

The airplane was examined by a Federal Aviation Administration (FAA) inspector and a representative from the airplane's manufacturer. An estimated 11 gallons of fuel vented from the wing filler neck during the air turn back. Examination of the right wing revealed the blast was internal causing the upper wing skin to expand and separate from the retaining rivets. A soot trail originated at the exhaust pipes and traveled in an aft direction to the trailing edge of the wing. The wing exhibited upper and lower skin panel bulging and upper skin panel wrinkling. The majority of the damage was centered in the area around the aileron bell crank box structure. Several rivets separated and damaged the wing rib area. The aileron exhibited a bulged out area with soot near the outboard aileron hinge. The airplane's fuel boost pumps

were operated and no leaks were noted at the time. The left fuel cap was removed and it appeared to work properly. The right fuel cap was removed and it did not operate properly The locking tab could be lowered without the fuel cap being attached to the filler opening. The lanyard retaining clip was installed backwards.

In addition the wing examination revealed that the right wing navigational light power wire was rubbing on a lightning hole and the landing light wires were chafing on the edge of a lighting hole. The right wing fuel vent lines were not secured with a clamp. Three inspection panels were observed with small amounts of fuel residue on the outside of the panels.

The right wing's fuel cap was tested and examined at a FAA certified overhaul facility with National Transportation Safety Board oversight. The outer o-ring was dry and cracked. The fuel cap leaked under pressure and exceeded the cap's manufacture's specification for the force required to close and secure the right fuel cap lock tab. The force to release (unlock) the fuel cap tab was below the cap's manufacture's specification. When the right fuel cap was disassembled a washer was missing. The fuel cap was reassembled with all the required parts and properly adjusted. The cap's manufacturer specified forces to secure and unlock the tab were obtained at reexamination and the fuel cap did not leak during the second pressure test.

The 1978 Beechcraft Baron 58 last annual inspection, reported by the pilot, was on July 7, 2009, the airplane had a total time of 3,139 hours. A review of the airplane's maintenance records by the FAA did not reveal the last time the right fuel cap underwent maintenance or was overhauled.

The fuel cap maintenance can be accomplished by a FAA certified airframe mechanic or by a FAA approved overhaul facility. The investigation discovered that the airplane manufacturers maintenance manual does not provide the forces required to open and close for the accident part number fuel cap. The cap's manufacturer calls for specific required forces to open and close the fuel cap lock tab during the overhaul process. In addition, the overhaul process requires a pressure leak check on the cap; the airplane's manufacturer maintenance manual does not.

The airplane's manufacturer and the fuel cap manufacturer have recognized that the fuel cap replacement is treated as an on condition basis, though no specific condition is typically given. As a result of separate investigations, the airplane manufacturer believes it is appropriate to add instructions for the fuel cap to be overhauled or replace on the condition of outer o-ring needing to be replaced. The airplane manufacturer has included, to applicable airplane's maintenance manuals the following verbiage: "Note: Inspect the fuel filler cap outer o-ring for flexibility, splits cracks or distortion. If the o-ring is damaged in any way replace or overhaul the fuel cap".

The airplane's manufacturer published a Safety Communiqué, No 298, dated October 2008, advising the operators and maintenance personnel of the importance for proper interior wing inspection of those areas of concern such as those found during the wing examination. On

December 2010, the airplane's manufacturer issued Safety Communiqué, N.298 - Revision 1, adding additional areas of concerns discovered during this investigation. The FAA published Special Airworthiness Information Bulletin (SAIB) CE-11-28, dated April 8, 2011, addressing the areas of concern as noted in the mentioned Safety Communiqués.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	67,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:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 27, 2009
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 21, 2009
Flight Time:	30510 hours (Total, all aircraft), 215 hours (Total, this make and model), 18000 hours (Pilot In Command, all aircraft), 27 hours (Last 90 days, all aircraft), 12 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N405RW
Model/Series:	58 TC	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	TH325
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	July 20, 2009 Annual	**Certified Max Gross Wt.:**	5400 lbs
Time Since Last Inspection:	100 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	3139 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	C91A installed, not activated	**Engine Model/Series:**	IO-520-C
Registered Owner:	On file	**Rated Power:**	285 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LGC,693 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	09:15 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	27°C / 29°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	LaGrange, GA (LGC)	**Type of Flight Plan Filed:**	None
Destination:	Savannah, GA (SAV)	**Type of Clearance:**	None
Departure Time:	09:15 Local	**Type of Airspace:**	

Airport Information

Airport:	LaGrange-Callaway LGC	**Runway Surface Type:**	
Airport Elevation:	693 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 None	**Latitude, Longitude:**	33.008609,-85.072502(est)

Administrative Information

Investigator In Charge (IIC):	Obregon, Jose
Additional Participating Persons:	Rick Hoy; FAA/FSDO; Atlanta, GA Mike Gibbons; Hawker Beechcraft Corporation; Wichita, KS
Original Publish Date:	April 20, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=76609