Aviation Investigation Factual Report

Location:	Elizabethtown, North Carolina	**Accident Number:**	ERA11LA461
Date & Time:	August 6, 2011, 17:00 Local	**Registration:**	N469CC
Aircraft:	Piper PA-46-310P	**Aircraft Damage:**	Substantial
Defining Event:	Powerplant sys/comp malf/fail	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Factual Information

HISTORY OF FLIGHT

On August 6, 2011, at 1700 Eastern Daylight Time, a PA-46-310P, N469CC, was substantially damaged during a forced landing at the Curtis L. Brown Field Airport (EYF), Elizabethtown, North Carolina. The certificated airline transport pilot and his passenger were uninjured. Visual meteorological conditions prevailed, and no flight plan was filed for the personal local flight conducted under Title 14 Code of Federal Regulations Part 91.

According to the pilot, he departed EYF after topping off the fuel tanks. While climbing through approximately 1,100 feet above mean sea level and turning from the crosswind leg of the traffic pattern to the downwind leg of the traffic pattern, the engine started making a "whining" sound. The pilot then began to "move the throttle around." The engine however did not respond. It then lost power, and the airplane began to descend. The pilot then turned towards the runway and feathered the propeller. He kept the landing gear up until "the last second" so that he would make the runway. Once he was assured that he would make it back to the runway, he put the landing gear handle in to the gear down position. The landing gear however, still had not fully extended when he touched down on the runway. The airplane then skidded on its belly down the runway and came to rest.

PERSONNEL INFORMATION

According to FAA records, the pilot held an airline transport pilot certificate with ratings for airplane single-engine land, airplane single-engine sea, airplane multi-engine land, and instrument airplane. He also held flight instructor ratings for airplane single-engine and instrument airplane. His most recent FAA second-class medical certificate was issued on March 22, 2011. He reported that he had accrued 4,930 total hours of flight experience, 326 of which were in make and model.

AIRCRAFT INFORMATION

The accident aircraft was a six-seat, single-engine, low wing, pressurized airplane of conventional metal construction. It was originally manufactured by Piper Aircraft in 1984 as a PA-46-310P.

It was equipped with retractable landing gear and was the 3rd airplane converted to a JetProp DLX when it had its original engine replaced in 1998 with a 580 shaft horsepower Pratt & Whitney Canada (PWC) PT6A-34, turbo propeller engine.

It could operate at an indicated airspeed of 260 knots at 27,000 feet above mean sea level.

According to a company pilot, the airplane had experienced 3 propeller strikes prior to the accident. The first occurred before the airplane was purchased by the company, the second occurred when the airplane was accidently taxied into a ditch, and the third occurred when the airplane was taxied over an area of uneven pavement at Lakefront Airport (NEW), New Orleans, Louisiana.

After the third propeller strike the airplane was out of service for approximately 4 months before it was repaired and placed back into service on February 28, 2011. The airplane’s most recent annual inspection was completed on March 24, 2011. At the time of the accident, the airplane had accrued 5696.3 total hours of operation.

METEOROLOGICAL INFORMATION

The reported weather at EYF at 1655, included: winds 190 degrees at 8 knots, 10 miles visibility, scattered clouds at 3,200 feet, scattered clouds at 3,800 feet, temperature 32 degrees C, dew point 23 degrees C, and an altimeter setting of 29.91 inches of mercury.

AIRPORT INFORMATION

Curtis L. Brown Field was uncontrolled and had one runway, 15/33. The runway was asphalt, and in good condition. The total length was 4,998 feet long and 75 feet wide. It was equipped with medium intensity runway edge lights and was marked with non-precision markings that were in good condition.

A 2-light precision approach path indicator was installed on the left side of runway 15. It displayed a 4.20 degree glide path.

Obstructions also existed on the approach path in the form of a 6 foot fence, 248 feet from the runway, 192 feet left of centerline, which required an 8:1 slope to clear.

WRECKAGE AND IMPACT INFORMATION

Post accident examination of the airplane by an FAA inspector revealed that the bottom of the airplane had come into contact with the runway pavement after the gear collapsed during the forced landing. Two of the four propeller blades exhibited curled tips, scrap marks, and areas where the propeller tips had holes worn through them. The nose gear tire was flat. The nose gear doors were bent, they exhibited scrape marks, and they were worn through in several areas. Several antennas mounted directly aft of the nose gear doors were also ground down. Further examination revealed that an approximate 12 by 24 inch area on the airplane's belly underneath the cabin entrance door, was also worn through to the pressure vessel structure, and the pressure vessel was substantially damaged.

Examination of the engine by the FAA also revealed no visible damage to the engine, no metal particles visible in the exhaust pipes, no visible fuel leaks, and no evidence of oil leaks. The engine was motored and the compressor turned over freely with no indication of compressor drag, blade rub, or bearing drag. Airflow and the smell of fuel was observed coming out of the exhaust pipes and turbine rotation was confirmed. Fuel was also observed to discharge from the combustion case drain and the start valve was confirmed to be closed.

TESTS AND RESEARCH

Engine Information

The PT6A-34 engine, installed in the airplane was a lightweight free turbine engine incorporating a reverse flow combustion path designed for aircraft propulsion use. It utilized two counter-rotating turbines; one driving the compressor and the other driving the propeller through a reduction gearbox. The latter turbine was “free” or independent of the compressor turbine.

It was modular in design and could be split into two major parts (the power section assembly and the gas generator assembly) for maintenance.

At the request of the NTSB the engine was removed from the airplane and shipped to PWC's St. Hubert, Quebec facility for further examination and testing.

Engine Examination

Examination of the engine, gear box housing, installed accessories, exhaust duct, and power turbine revealed no evidence of preimpact failures or malfunctions. The propeller shaft was intact and could be rotated freely by hand along with the power turbine rotor and the exposed accessory drives. The exhaust duct, and power turbine blades, also displayed no evidence of distress.

Examination of the gas generator case and accessory gearbox also revealed no evidence of any preimpact failures or malfunctions. The housing and installed accessories displayed no evidence of distress. The gas generator rotor turned freely, along with the accessory gearbox. The compressor 1st stage, compressor turbine guide vane ring, compressor turbine shroud, compressor turbine, accessory gearbox housing, and installed accessories also displayed no evidence of distress. Additionally, the accessory gearing rotated smoothly with the gas generator case rotor, along with all of the exposed accessory drives.

Examination of the fuel control unit manual override revealed the presence of an unapproved field modification. The fuel control unit manual override input lever was found to have been lockwired so that the travel was restricted from the stowed (idle) position to approximately 1/4 inch from the maximum (full rated power) stop set screw which would have rendered the engine unable to produce full rated power when using the manual fuel override. The input lever airframe input connection was also modified and was roughly countersunk from its as delivered configuration. The set screw lockwire lead seal, was in place and undisturbed.

Examination of the pneumatic lines also revealed anomalies. The compressor discharge air (P3) line was continuous from the gas generator case fitting to the fuel control input fitting however; the gas generator case fitting bolts were not lockwired. The power turbine control (Py) line propeller governor fitting lockwire was also found to be fractured at the loop through the "B" nut lockwire hole and the nut was found to be backed off approximately 1/3 to 1/2 turn, and the line could be moved by hand. Macroscopic inspection of the fracture showed features characteristic of overload fracture in tension and torsion at the location of a pre-existing nick. The fracture displayed no indications of fatigue or other progressive fracture mechanism. The forward fire seal fitting lockwire was also found to be overstressed and showed nicks where it looped through the "B" nut lockwire hole. The remaining lockwire and connections were intact.

Engine Functional Test

An engine functional test was conducted in a dynamometer test cell in accordance with PWC Overhaul Manual P/N 3021243 Section 72-00-00 "Engine Testing" procedures.

During the initial start, the gas generator speed (Ng) and fuel flow (Wf) stabilized at minimum fuel flow values. The engine however, displayed no response to power lever movement. The engine was then shut down and the Py line propeller governor "B" nut fitting was tightened. The engine was then restarted, and it accelerated normally to ground idle. All engine handling checks, acceleration to full power, feathering, bleed valve closing check, and manual override functional checks were normal.

To confirm fuel control bellows integrity the engine was then run at 34,000 RPM Ng for 10 minutes with negligible degradation of Ng RPM.

From idle power, the Py line propeller governor "B" nut fitting was then loosened to determine the point at which the Ng speed would fall to sub-idle. It was determined that loosening the fitting approximately 1/3 turn would bleed sufficient Py pressure for the Ng to fall to sub-idle.

Engine History

After the propeller strike that occurred at NEW, the engine was removed and disassembled and the power section and compressor sections were sent out for inspection and overhaul. After the overhaul, the engine was then shipped back to NEW for reinstallation. The mechanic who had been doing the work however, had left the company and another mechanic had to reinstall it on the airplane along with the propeller. However, the engine still needed to be rigged correctly, so another mechanic was then brought in by the airplane owner to complete the maintenance. This mechanic then rigged the beta system and fuel controller with technical assistance from Rocket Engineering.

According to maintenance records, the engine had accrued 2,679.9 hours of operation and

2,680 cycles.

On October 8, 2010, at 2678 total hours the power section was overhauled for the propeller strike by Dallas Airmotive, Dallas, Texas under sales order RPR21175.

On 14 December 2010, in conjunction with the power section overhaul, a hot section inspection was performed by East Texas HSI, Tyler, Texas.

On February 18, 2011 the engine was returned to service by Liberty Aviation LLC, Dickson, Tennessee.

The origin of the pre-existing nick, the travel limiting lockwire, and the countersinking of the input lever could not be determined.

FAA Advisory Circular (AC) 43.13-1B

According to AC 43.13-1B, Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair; the word "safetying" is a term universally used in the aircraft industry.

Briefly, safetying is defined as: "Securing by various means any nut, bolt, turnbuckle etc., on the aircraft so that vibration will not cause it to loosen during operation." These practices are not a means of obtaining or maintaining torque, rather a safety device to prevent the disengagement of screws, nuts, bolts, snap rings, oil caps, drain cocks, valves, and parts.

Three basic methods are used in safetying; safety-wire (either soft brass or steel), cotter pins, and self-locking nuts. Retainer washers and pal nuts are also sometimes used.

There are many combinations of safety wiring with certain basic rules common to all applications. These rules state in part that;

1. Safety wire must never be overstressed. Safety wire will break under vibrations if twisted too tightly. Safety wire must be pulled taut when being twisted, and maintain a light tension when secured.

2. Safety wire must not be nicked, kinked, or mutilated.

3. Excessive twisting of the wire will weaken the wire.

Manual Fuel Override

All PT6A engines intended for single-engine aircraft are equipped with a manual override function installed on the fuel control unit.

According to PWC, the manual override function was intended to be used to modulate engine power to allow a pilot to continue flight to the nearest airport in the event of malfunction in the fuel control pneumatic system which resulted in one of the following conditions:

1. Uncommanded power roll back and inability to recover with the Power Lever Assembly (PLA).

2. No response to PLA movement, when starting from or around idle.

3. PLA becomes stuck at or around idle.

In the JetProp DLX, The manual override was connected to a manual fuel override switch labeled "Man Override" located on the throttle quadrant. The Manual Fuel Override switch would manually through a motor drive, override all of the automatic fuel control features and act directly on the fuel valve to directly modulate the fuel flow to the engine.

The pilot advised the NTSB during a post accident interview however, that he did not attempt to use the manual override switch when the engine lost power.

Review of the JetProp DLX Pilot's Operating Handbook (POH), also revealed that the conditions stated by PWC for use of the manual override function were not listed in the POH and that use of the manual override switch was only referenced in the emergency procedures in the section on "Engine Roughness" under the subtitle "Engine Surges", where the POH advised that the most likely cause of engine surges is a fuel control malfunction, and that a fuel control malfunction could result in the engine rolling back to idle.

The POH also advised that if the surges were minor, to land as soon as practical and if the surges became excessive or engine goes to idle to actuate the manual control switch.

FAA Advisory Circular (AC) 20-29B

In 1972 the FAA released AC 20-29B, Use of Aircraft Fuel Icing Additives, to provide information on the use of anti-icing additives as an acceptable means of compliance with FAA regulations that require assurance of continuous fuel flow under conditions where ice may occur in turbine aircraft fuel systems. It stated in part that:

1. Although rigorous precautions are taken to ensure that fuel being pumped into an aircraft contains as little water as possible, an aircraft fuel containing no water is impossibility. This is due primarily to the affinity that hydrocarbon fuels have for water. Even if fuels are prepared, handled, and used without even contacting liquid water, the fuels will contain water picked up from the air. The extent of such pickup is largely a function of the humidity of the air drawn into the fuel tank to equalize the pressure resulting from changes in tank temperature.

2. The affinity that fuel has for water varies with its composition and temperature. The saturation level for a jet fuel in parts per million by volume is approximately equivalent to the

temperature in degrees F.; that is, a jet fuel at 50 degrees F. may contain approximately 50 parts per million of dissolved water. When the fuel is cooled, that water which is above the saturation level is rejected as discrete water in minute particles. Until this water can coalesce and migrate to the bottom of the tank, it will be carried in the fuel. At temperatures below the freezing point, these minute particles may be supercooled and will be deposited out only when they strike a solid obstruction and freeze.

3. The small differences in the specific gravity of water and jet fuel (1.0, 0.77, and 0.83, respectively, for water, JP-4 and kerosene) complicate the task of removing the discrete water dispersed in the fuel. While this water will in time settle out of the fuel, the particle size is so small that filters and water separators cannot be depended upon for its complete removal. Experience has shown that jet fuels may contain up to 70 parts per million of dispersed water.

4. An aircraft after a long flight at high altitudes will have tank surfaces and fuel that are colder that the air that is drawn into the tank during descent. When moisture-laden air enters the tank space, condensation may occur in the tank. Due to the higher viscosity of cold fuel, this water will not settle out as readily and will be carried as dispersed water for a longer period of time. Under these conditions, the dispersed water in the fuel may reach 100 parts per million.

For these reasons, some aircraft utilize fuel heating systems to melt any ice that forms at altitude, while other aircraft require the use of a Fuel System Icing Inhibitor (FSII).

Nevertheless, when asked about the use of FSII, the pilot of the accident airplane advised that he was unsure if they had been using any. Review of the POH also revealed no reference for the use of FSII, and that the airplane was not equipped with fuel heaters. Fuel samples taken by the FAA from the wing tanks, header tank, and engine case drain of the accident airplane also revealed that they contained water and contaminates.

ADDITIONAL INFORMATION

In order to improve safety, the supplemental type certificate holder made the following changes:

1. Clarified and described in more detail the use of the manual override system in the JetProp POH.

2. Added a requirement for the use of anti-icing additives to the POH.

3. Added a requirement for placards requiring the use of anti-icing additives at each fuel filler port.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	31,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; 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 single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	March 22, 2011
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	January 10, 2011
Flight Time:	4930 hours (Total, all aircraft), 326 hours (Total, this make and model), 3067 hours (Pilot In Command, all aircraft), 65 hours (Last 90 days, all aircraft), 25 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N469CC
Model/Series:	PA-46-310P	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	46-8408049
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	March 24, 2011 Annual	**Certified Max Gross Wt.:**	4300 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo prop
Airframe Total Time:	5696 Hrs at time of accident	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Installed, not activated	**Engine Model/Series:**	PT6A-34
Registered Owner:	MARKING AVIATION LLC	**Rated Power:**	500 Horsepower
Operator:	MARKING AVIATION LLC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	EYF,132 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	16:55 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 3200 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.9 inches Hg	**Temperature/Dew Point:**	32°C / 23°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Elizabethtown, NC (EYF)	**Type of Flight Plan Filed:**	None
Destination:	Elizabethtown, NC (EYF)	**Type of Clearance:**	None
Departure Time:	17:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Curtis L. Brown Field Airport EYF	**Runway Surface Type:**	Asphalt
Airport Elevation:	132 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	15	**IFR Approach:**	None
Runway Length/Width:	4998 ft / 75 ft	**VFR Approach/Landing:**	Forced landing;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	34.601943,-78.579444(est)

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Anthony Congelosi; FAA/FSDO; Greensboro, NC Marc Hamilton; TSBC; Montreal, Canada Thomas Berthe; Pratt & Whitney Canada; Longueuil, Canada Robert Martellotti; Piper Aircraft Inc.; Vero Beach, FL
Report Date:	October 19, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=81527