Cessna Aircraft Company
Aircraft Incident/Accident Final Report

Cessna
A Textron Company

Aircraft and Incident/Accident Information			
Year: 1983	Model: P210N	Serial number: P21000825	Registration: N210LE
Location: Deerfield, MA		Date: 09-23-11	Time: 1620 EDT

Aircraft Owner	Aircraft Operator
Silent H. Ltd. [redacted] Wilmington, DE 19810-4902	Lawrence Edward Hrablook [redacted] Grapevine, TX 76051-7126

Report Information		
Air Safety Investigator, Sr.: Peter J. Basile	Report #: 11-CRUK	Report Date: 01-25-12
Signature: [redacted]	NTSB Report #: ERA11LA502	NTSB Party Status: Yes

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Incident/Accident Summary and Investigation Synopsis

The aircraft departed Barnes Municipal Airport (KBAF), Westfield/Springfield, MA, at approximately 1539 EDT. The intended destination was Hancock County-Bar Harbor Airport (KBHB), Bar Harbor, ME. Immediately after takeoff, the pilot reported the landing gear warning horn activated and then stopped; he told ATC that they would continue the flight. Approximately 5 minutes after takeoff the JPI recorded a drop in battery voltage and the pilot stated he had a total electrical failure. Radar data shows the pilot made a series of 360° turns and several altitude changes. The pilot stated that he saw a clearing in the clouds and elected to make an emergency off airport landing in a field due to the electrical failure. He stated the engine continued to run the entire flight. The aircraft struck an approximately 50-foot tall tree next to State Highway 5 and impacted the ground in a wooded area. The restrained pilot and one passenger sustained serious back injuries. There was no fire damage.

This investigator examined the aircraft on-site, at a wreckage facility in Biddeford, ME, and attended the engine examination in Mobile, AL. Examination of the electrical system revealed the following: The aft mounted alternator was part number C611503-0103 (it should be part number C611503-0104). The front alternator battery wire was chaffed on the insulation near the connector and on the cylinder #6 baffling. The ship battery measured 18.15 volts at the time of the examination. The non-Cessna dual alternator restart battery pack located under seat #1, contained 6 C-Size batteries (1.5 volts in each cell) and measured 5.46 volts at the time of the examination. Electrical wiring continuity was established for all alternator and battery wires except the wire from the Alternator Low Voltage circuit breaker to the warning lights. An after-market warning light panel had been installed in the right side of the instrument panel. All five of the light bulbs were removed and each filament was observed fractured; the fractured was consistent with a cold filament.

The Western Skyways overhauled engine contained ECi "IO-520" high compression pistons which are approximately 0.082" taller than the applicable low compression piston. CMI installed a new low compression piston on the #6 piston rod and a new CMI cylinder was installed in the #6 position. The engine operated normally at low RPM, but would not produce more than approximately 2,000 RPM.

5. Aircraft Information

Airframe		
First Delivery Date: 10-30-84	Date Purchased by Current Owner: 08-13-04	
Last Annual Inspection: Date: 08-11-11	Hours: 2,964.8	Hours Since Inspection: 34.3
Total Aircraft Hours at Occurrence: 2,999.1	Previous Accident History: No	
Last Pitot-Static Check: 06-09-09	Flight Manual on Board: No	Aircraft Logbooks on Board: No
Major Components		
Engine: Make: Continental	Model: TSIO-520-AF (3)	S/N: 525102
Propeller: Make: McCauley	Model: D3A34C402	Hub S/N: 831285
Engine TTSN: 2,073.9	Engine TSMO: 347.6	Propeller TTSN: 2,999.1

Remarks:

According to the FAA registration paperwork, the aircraft was originally registered as N4851A, before it was changed to N427BF, and then to N210LE. A search of aircraft accident, incident, and service difficulty reports databases revealed the following: On 01-15-87, an FAA service difficulty report was recorded for N4851A. The engine exhibited severe roughness and backfiring on the left magneto check. The investigation revealed the rotor finger on the distributor gear was loose and swinging out into the distributor contacts causing severe retardation of the ignition. There was no damage history for N427BF, and there was no damage history for N210LE prior to this accident.

A review of airworthiness and FAA form 337 records indicated the following modifications:

- 09-20-96 Installed United Instrument Altimeter and Ameri-King Blind Encoder
- 09-24-96 Brackett Air Filter STC SA71GL
- 08-26-99 O&N Aircraft Modifications low fuel warning system and baggage compartment fuel tank and transfer system STC SA00606NY and SA532NE.
- 06-23-00 Installed WX-500 Stormscope antenna and Garmin GNS 530 GPS.
- 08-15-02 Installed TurboGAMIjectors STC SE09289SC.
- 02-21-03 Found GMA 340 and Rosen Product Development Inc Sun Visors installed.
- 04-14-03 Installed Precise Flight speed brakes SA2602NM
- 10-26-04 Installed a JPI EDM-800-6C SA2586NM, Shadin Microflo-L SA639GL, fuel flow transducer SE444GL.
- 10-19-04 Installed PS Engineering PAV-80 In-flight Entertainment system SA02707AT, Garmin SL30 Nav/Com, GTX-330 Mode S transponder, Bendix King KN64 DME, Mid-Continent MD-200-306 Nav Indicator, and Avionics Innovations Sirius Satellite Receiver.
- 05-13-05 Installed S-TEC system 60 2-axis autopilot per STC SA6045SW-D
- 08-23-05 Installed RMD Aircraft Lighting Inc wing tip lights with landing lights SA3685NM.
- 01-19-06 Installed Lopresti Boom Beam landing/taxi lamp kit SA02279AT
- 03-17-06 Installed RMD Aircraft Lighting High Intensity discharge wingtip lights SA01107SE
- 01-11-07 Installed Garmin GMX-200 Multi function display SA01692SE and GDL 69A Data Link receiver with XM radio SA01487SE.
- 08-27-07 Installed Garmin GNS530W (WAAS) SA01933LA.

6. Investigation Information

On 09-26-11, the FAA and this investigator examined the aircraft at the accident site. On 10-25-11, an NTSB investigator, two FAA representatives, a Continental Motors investigator, a Cessna Electrical Engineer, and this investigator examined the aircraft at the Ryan Aircraft Salvage facility in Biddeford, ME. On 01-18-12 through 01-20-12, an FAA representative, Continental Motors representatives, and this investigator examined the engine at Continental Motors, Inc. in Mobile, AL.

Airframe

Impact Sequence and Airframe Structure

The right horizontal stabilizer/elevator, both wing tips, and the outboard left wing and aileron were located near the beginning of the approximately 150-foot long wreckage path. Both wings sustained tree impact damage and were partially separated and bent aft. The cabin remained intact.

Airframe Systems

Flight Control Systems		
Flight Control Cable Continuity		
Ailerons: See below	Elevators: See below	Rudder: Established
Aileron tab: Not Applicable	Elevator tab: See below	Rudder tab: Not Applicable
Flap and Trim Positions		
Flap Actuator: ~1.3" = ~20-25°	Flap Indicator: ~10-20 degrees	Flap Switch: Up
Elevator Trim: Actuator: Undt		Indicator: Between Neutral and Full Nose Down
Rudder Trim: Actuator: Undt		Indicator: Undetermined

Remarks:

Partial control cable continuity was established due to impact damage. The elevator cables were continuous from the control column to the aft bell crank; the down spring was in place. The elevator trim cables were continuous to the aft tail cone; the elevator trim tab actuator was unreliable due to damage. The left aileron cable exhibited tension overload signatures near the left wing root. The majority of the aileron carry through cable remained attached to the left aileron bell crank and exhibited tension overload signatures near the right wing root. The right aileron cable exhibited tension overload signatures near the right wing root.

Airframe Fuel System		
Fuel Strainer Screen: Undetermined		
Main Fuel Tank Gauges: Left: Empty		Right: Empty
Fuel Selector Handle: Both	Fuel Selector Valve: Undt	Fuel Boost Pump: Off
Firewall Fuel Shutoff: Open		

Remarks:

According to the FAA, the aircraft was fueled with 57 gallons of 100LL prior to departing KBAF. According to the pilot, the aircraft had approximately 75 gallons of fuel on board at the time of the accident.

Landing Gear System			
Gear Position:	Nose: Undetermined	Left: Undetermined	Right: Undetermined
Actuator Position:	Nose: Undetermined	Left: Undetermined	Right: Undetermined
Landing Gear Cockpit Switch: Extended			

Environmental System	
Cabin Heater: Off	Air Conditioner: Off
Cabin Vent: On	Defrost Control: Off

Pressurization System	
Cabin VSI: 0	Cabin Altitude: Undt
Differential Pressure: 0	Source Selector Knob: Undt
Safety Valve: Undt	Dump Valve: Open

Icing System			
Certified Into Known Icing? Yes		De-Icing Boots Installed? Yes	
Pitot Heat: Off		Stall Heat: Off	
De-Ice: Surface: Off	Propeller: Not Applicable	Windshield: Not Applicable	
Anti-Ice: Surface: Not Applicable	Propeller: Off	Windshield: Off	

ELT			
Installed? Yes	Manufacturer: Dorne & Margolin	Model: DM ELT 8.1	Type: AF
Serial Number: 1909	Battery Due Date: 09-12	Armed: Yes	Activated: No

Remarks:
The nose landing gear remained attached to the aircraft and was observed bent aft. The left main landing gear was bent aft and remained approximately halfway in the wheel well. The right main landing gear was bent aft, but remained out of the wheel well. The right wheel and tire assembly was separated from the strut.

According to the pilot, his wife attempted to manually extend the landing gear with the hand pump.

According to the FAA, the landing gear warning horn could be heard on the ATC tower recording. The audio recording captured an intermittent tone consistent with the landing gear warning horn.

Examination of the landing gear warning horn micro switch located on the lower right firewall revealed the cam did not contact the switch in the full throttle or idle position.

Instrument Panel

Navigation Instruments					
Analog Primary Instruments			Autopilot Type: S-Tec		
Suction Gage: 0		Magnetic Compass: ~070		Clock: Undt	
	Left Side	Right Side		Left Side	Right Side
Airspeed:	0		Turn Coordinator (Airplane):	Level	
Attitude (Pitch):	~5-10 Up		Turn Coordinator (Ball):	Left	
Attitude (Roll):	~15 Left		Heading Indicator:	187	
Altimeter:	240		Heading "Bug":	050	
Altimeter Setting:	30.07		Vertical Speed Indicator:	100 Up	

Communication and Navigation Radios							
Radio	Switch	Active Frequency	Stand-By Frequency	Radio	Switch	Active Frequency	Stand-By Frequency
COM #1	Undt	Digi	Digi	COM #2	Undt	Digi	Digi
NAV #1	Undt	Digi	Digi	NAV #2	Undt	Digi	Digi
OBS #1	Undt			OBS #2	Undt		
Transponder: Mode: Digi			Active Code: Digi			Standby Code: Digi	

Electrical Switch Positions			
Master Battery: On	Master Alternator: On	Avionics #1: On	Inverter #1: N/A
Stand-By Battery: N/A	Alternator 2: On	Avionics #2: Undt	Inverter #2: N/A

Lighting Switch Positions		
Navigation Lights: On	Rotating Beacon(s): On	Landing Light(s): On
Taxi Light(s): Off	Strobe Light(s): On	Instrument Lights: Undt
Wing Ice Light: Off		

Ignition Switch Position	
Key Switch: Both	

Remarks:

The aircraft was equipped with a dual alternator electrical system. The forward mounted alternator (#2) remained attached to the engine mounts. The propeller was separated from the crankshaft and the #2 alternator drive belt was found just forward of the wreckage. The #2 alternator belt was intact and had one minor cut in the rubber consistent with impact damage. The aft mounted alternator (#1) remained attached to the accessory section mounts and the drive belt was intact.

A multi-meter indicated 11.91 volts when the leads were applied to the terminals of the 24-volt battery at the accident site.

No circuit breakers were observed out or "popped" at the accident site.

7. Powerplant Description

Engine Instruments							
Hour Meter:	00983.6	Tach RPM:	0	Tach Hours:	2,999.1	Manifold Press:	~28 inHg
Oil Press:	0	Oil Temp:	0	TIT:	Undt	CHT:	Undt
Fuel Press:	Undt	Fuel Flow:	0	Ammeter:	0		

Engine Control Positions					
	Cockpit	Engine		Cockpit	Engine
Throttle:	~Full	Undt	Cowl Flaps:	Open	Undt
Mixture:	Rich	Undt	Alternate Air:	Undt	Undt
Propeller:	Aft - Low RPM	Undt	Primer:	N/A	

Engine Condition			
Engine Attached to Airframe:	Yes	Propeller Attached to Engine:	No
Engine Compression:	See Below	Valve Train Continuity:	See Below
Vacuum Pump Drive Shaft:	Undetermined		

Engine Fuel System Condition			
Fuel Pump Drive Shaft:	See Below	Fuel Control Inlet Screen:	See Below
Fuel Distribution Valve Screen:	See Below	Fuel Injectors:	See Below

Magneto Condition			
Left Magneto Attached:	Yes	Right Magneto Attached:	Yes
Left Magneto Spark:	See Below	Right Magneto Spark:	See Below

Spark Plug Condition (per Champion Check-A-Plug Card)						
	1	2	3	4	5	6
Top	Normal	Normal	Normal	Normal	Normal	Normal
Bottom						

Remarks:
The engine was not examined on-site by the FAA or this investigator. On 10-25-11, a Continental Motors investigator examined the engine in Biddeford, ME. The cylinder #6 rocker box cover had an approximately 2 inch hole protruding from the intake valve. When the rocker box was removed, the intake valve spring and valve stem were found loose. The valve was fractured near the head. The #6 cylinder was inspected with a borescope and the valve head was observed inside with impact damage. The #6 piston sustained intake valve impact damage and had a hole in it.

The throttle lever appeared full forward. It was out approximately 0.5"; full forward was approximately 0.3". The mixture lever was full forward. The propeller lever was out approximately 1.4"; full out is approximately 1.6".

Propeller
The propeller attachment bolt threads were stripped and the propeller was lying on the ground under the lower cowling. Two blades were visible and appeared straight; the leading edges were smooth and the cambered surfaces had no scratches.

8. Research & Testing

A JPI-800 was removed from the instrument panel and sent to the NTSB laboratory for analysis. The data recovered from the unit indicated an increase in RPM to approximately takeoff power at about 1540 EDT. At that time the battery voltage was approximately 27 volts. Approximately one minute later, the battery voltage dropped to approximately 24 volts. From 1541 EDT to approximately 1546 EDT the battery voltage continued to decline. At approximately 1546:24, the battery voltage declined to approximately 10 volts and the JPI stopped recording.

Inspection of the aircraft revealed the aft mounted alternator (#1) was part number C611503-0103, S/N A4070102 (also referred to as 9910591-2 in the Cessna Engineering Specification Drawing). According to the Cessna Illustrated Parts Catalog (IPC), the aft mounted alternator should be part number C611503-0104 (also referred to as 9910591-3 in the Cessna Engineering Specification Control Drawing). According to the engineering drawing, the -0103 alternator is made from the -0104 alternator by indexing the front of the case 120 degrees clockwise. By installing the -0103 in place of the -0104, the aft mounted alternator was improperly indexed. This caused the alternator poles to be in the incorrect location and the associated wiring to be incorrectly routed; however, there was no chaffing observed on the installed wires.

Inspection of the aircraft revealed the front mounted alternator (#2) was part number C611503-0103, S/N A002114. According to the Cessna IPC, the front mounted alternator should be part number C611503-0103. The front alternator was installed correctly; however, chaffing of the battery wire insulation was observed near the connector and on the cylinder #6 baffling. The insulation was not penetrated and there was no evidence of arcing.

The ship battery measured 18.15 volts at the time of the examination. The dual alternator restart battery pack located under seat #1, contained 6 C-Size batteries (1.5 volts in each cell). It measured 5.46 volts at the time of the examination. The battery pack was a non-Cessna part.

A 25-volt power supply, provided by the FAA, was used to test the alternator field circuits. The emergency alternator field restart battery pack was disconnected and the power supply was connected to the wires. The #1 alternator measured 24.6 volts at the field while the #2 alternator measured 23.4 volts at the field. Electrical wiring continuity was established for all alternator and battery wires except the wire from the Alternator Low Voltage circuit breaker to the warning lights: Alternator #1 Off, Alternator #2 Off, and Low Voltage. An after-market warning light panel had been installed in the right side of the instrument panel. The warning lights were labeled: De-ice, Alt 1, Alt 2, Low Volt, and Cabin Alt. All five of the light bulbs were removed and each filament was observed fractured.

The forward mounted alternator control unit (ACU), part number C611007-101; serial number 0641, controls the aft mounted #1 alternator. The aft mounted ACU, part number C611007-101; serial number 0084176, controls the forward mounted #2 alternator. The ACU's and the alternators were removed for additional testing and analysis. The alternators and ACU's had not been tested at the time this report was written.

On 01-18-12 through 01-20-12, an FAA representative, Continental Motors representatives, and this investigator examined the engine at Continental Motors, Inc. in Mobile, AL. According to maintenance records, the engine was overhauled on 07-21-09 by Western Skyways. At that time, ECi cylinder assemblies were installed on the engine. At the exam, the #6 cylinder rocker box cover was observed damaged. The rocker box cover was removed and the intake valve springs, valve retainers, and valve guide were found loose. The #6 cylinder was removed. The fractured intake valve head was found in

the cylinder. The inside of the cylinder head exhibited impact damage. The #6 piston also exhibited impact damage and a hole was observed in the top of the piston. On the side of the ECi piston the engine "type" identification on the piston skirt coating was "IO-520." Note: the TSIO-520 (accident engine) is a low compression engine and requires a low compression piston while the IO-520 is a high compression engine and requires a high compression piston. The difference in the pistons is that the top of the high compression piston has a beveled head which makes it "taller." According to the CMI piston drawings, the dimension of a high compression piston (incorrect for this accident engine) from the center of the piston pin to the top of the piston should be 1.917/1.921 inches. While the dimension of a low compression piston (correct piston for the accident engine) from the center of the piston pin to the top of the piston should be 1.835/1.839 inches. Therefore, the incorrect piston was 0.082 inches "taller."

The #4 cylinder was removed to check the piston. The piston was also labeled "IO-520." The #4 cylinder was reinstalled. A new CMI low compression piston was installed on the #6 piston rod and a new CMI cylinder was installed in the #6 position. The magnetos were reinstalled and timed to the engine. The engine was transported to the test cell and operated normally at low RPM. When power was increased, the engine would not produce more than approximately 2,000 RPM.