



National Transportation Safety Board Aviation Accident Final Report

Location:	Alpine, TX	Accident Number:	CEN17LA254
Date & Time:	07/03/2017, 1815 CDT	Registration:	N9714B
Aircraft:	CESSNA 208B	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	1 Minor
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

While on climbout on a cargo flight, the pilot heard a loud bang, followed by a squealing noise; the engine immediately lost power. The pilot accomplished a forced landing to a field, during which both wings were damaged after contacting power poles.

Examination of the engine revealed the compressor turbine (CT) blades had fractured. Material analysis of the CT blades confirmed operational overtemperature conditions had occurred during previous flights, and significant creep in the microstructure of the blades indicated an imminent cracking probability in all the CT blades. During the last borescope inspection about 3 months before the accident, a crack in a CT blade that could be seen in a video recording of the inspection was not observed by the technician who conducted the inspection. It is likely that this CT blade failed due to creep and the undetected crack.

The engine's compressor turbine vane ring had features different from an original equipment manufacturer part, including cooling air ducts that were a different size; however, the investigation was not able to determine if cooling air performance was compromised. The CT vane axial positioning, which was staggered, likely increased vibrational loads on the CT blades; however, the investigation was not able to determine if this contributed to the CT blade longevity and crack initiation.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

Fracture of a compressor turbine (CT) blade due to operational overtemperatures and the failure of a maintenance technician to detect an existing crack in the CT blade during the last engine inspection.

Findings

Aircraft	Turbine section - Capability exceeded (Cause) Turbine section - Failure (Cause)
Personnel issues	Scheduled/routine inspection - Maintenance personnel (Cause)
Environmental issues	Pole - Contributed to outcome

Factual Information

On July 3, 2017, about 1815 central daylight time, a Cessna 208B airplane, N9714B, was substantially damaged during a forced landing near Alpine, Texas. The commercial pilot, who was the sole occupant, sustained minor injuries. The airplane was registered to and operated by Martinaire Aviation LLC under the provisions of Title 14 *Code of Federal Regulations* Part 135 as a cargo flight. Day visual meteorological conditions prevailed for the instrument rules (IFR) flight, which departed about 1812 from Alpine-Casparis Municipal Airport (E38), Alpine, Texas, with an intended destination of Maverick County Memorial International Airport (5T9), Eagle Pass, Texas.

While climbing through about 500 ft agl, the pilot heard a loud bang, followed by a squealing noise and an immediate loss of engine power. The pilot released back pressure on the controls and pulled the propeller control to feather. During the forced landing, the both wings were damaged due to impact with power poles and the airplane came to rest in a field.

A preliminary engine examination conducted at the salvage facility revealed distress to the compressor and power turbine blades. The left ignition lead was not connected with the ignition plug, and the pin on the left plug exhibited oxidation that was not evident on the pin on the right plug. The power control and reversing linkage was in place and secure.

The engine was removed from the airframe and transported to Pratt & Whitney Canada (PWC) facilities for examination. The power turbine blades were all present, but fractured, with varying lengths of blade span remaining. The power turbine wheel was sent to the PWC laboratory; no evidence of fatigue was found.

The power turbine vane ring (PTVR) was battered in various locations, with 11 thumbnail sized fractures at the leading and trailing edges. Additionally, there was one through hole, about 0.10 inches in diameter, near the trailing edge. The PTVR was not an original equipment manufacturer (OEM) part.

The compressor turbine (CT) shroud had four locations with deep impact marks, consistent with a blade release. The remaining surfaces of the CT shrouds were heavily battered, consistent with contact against smaller fragments.

The compressor turbine vane ring (CTVR) was part number 3029051 and the serial number was unreadable. An additional identification number, 13-769 0531R13 was vibro-peened on the part. Operator records were insufficient to ascertain the origin of the CTVR.

The CTVR did not conform to an OEM part, with vane cooling air exit slots that differed in shape and size. The investigation was not able to determine if cooling air performance was compromised.

The CTVR vane sealing plates welding differed from an OEM part and the axial locations of the vane trailing edge, which should all be on the same plane, were staggered. A variation of the axial stagger of the compressor turbine vanes would induce a flow variation to the CT blades,

thereby increasing their vibrational amplitude. The investigation was not able to determine if this variation would affect CT blade longevity. The CTVR could not be tested due to damage.

The CT blades were all present, but fractured, at varying heights. Material analysis of the CT blades confirmed the existence of operational overtemperature conditions. Significant creep in the micro-structure of the blades that was observed indicated an imminent cracking probability. Creep is the tendency of a solid material to deform permanently under the influence of long-term mechanical stress that are still below the yield strength of the material and is more severe in materials that are subjected to heat for long periods.

The most recent borescope inspection of the CT blades occurred on April 12, 2017, with no defects reported. According to a video recording of this inspection, one CT blade was cracked. The technician who conducted the inspection stated that he was focused on the tip clearance of the blades and did not notice the crack.

The operator was approved by the Federal Aviation Administration for an 8000-hour time between engine overhaul. Raw trend monitoring data was manually collected by the operator's pilots during cruise and this trend data was monitored by Camp EHM, who advised the operator of engine health and maintenance. Camp EHM did not report any trend changes since the last inspection interval that was significant enough to alert the operator. Although trend monitoring has occasionally been able to detect a CT rotor in which all the blades have significant creep, it cannot detect cracks in a single blade. Also, manual trend monitoring does not capture engine temperature exceedances.

History of Flight

Initial climb	Loss of engine power (total) (Defining event)
Landing	Off-field or emergency landing Hard landing

Pilot Information

Certificate:	Flight Instructor; Commercial	Age:	56, Male
Airplane Rating(s):	Multi-engine Land; Single-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	Toxicology Performed:	No
Medical Certification:	Class 2 With Waivers/Limitations	Last FAA Medical Exam:	07/25/2016
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	04/18/2017
Flight Time:	5290 hours (Total, all aircraft), 1040 hours (Total, this make and model), 4965 hours (Pilot In Command, all aircraft), 128 hours (Last 90 days, all aircraft), 57 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	Registration:	N9714B
Model/Series:	208B	Aircraft Category:	Airplane
Year of Manufacture:	1989	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	208B0153
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	04/12/2017, AAIP	Certified Max Gross Wt.:	7449 lbs
Time Since Last Inspection:	94 Hours	Engines:	1 Turbo Prop
Airframe Total Time:	94 Hours as of last inspection	Engine Manufacturer:	P&W
ELT:	C91 installed, activated, did not aid in locating accident	Engine Model/Series:	PT6A-114A
Registered Owner:	MARTINAIRE AVIATION LLC	Rated Power:	675 hp
Operator:	MARTINAIRE AVIATION LLC	Operating Certificate(s) Held:	On-demand Air Taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	KE38, 4513 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	1735 CDT	Direction from Accident Site:	228°
Lowest Cloud Condition:	Thin Broken / 9500 ft agl	Visibility	10 Miles
Lowest Ceiling:	Broken / 9500 ft agl	Visibility (RVR):	
Wind Speed/Gusts:	9 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	320°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.26 inches Hg	Temperature/Dew Point:	20° C / 16° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	ALPINE, TX (E38)	Type of Flight Plan Filed:	IFR
Destination:	EAGLE PASS, TX (5T9)	Type of Clearance:	IFR
Departure Time:	1812 CDT	Type of Airspace:	Class E

Airport Information

Airport:	ALPINE-CASPARIS MUNI (E38)	Runway Surface Type:	N/A
Airport Elevation:	4514 ft	Runway Surface Condition:	Rough
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced Landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	In-Flight
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Minor	Latitude, Longitude:	30.393056, -103.670278 (est)

Administrative Information

Investigator In Charge (IIC):	Michael J Folkerts	Report Date:	06/03/2020
Additional Participating Persons:	Corey Wehmeyer; Flight Standards District Office; Lubbock, TX Patrick Jemison; Martinaire Aviation LLC; Addison, TX Earl Chapman; Transportation Safety Board of Canada; Ottawa, ON		
Publish Date:	06/03/2020		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=95490		

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