



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Port Aransas, TX	<b>Accident Number:</b>	CEN17LA136
<b>Date &amp; Time:</b>	12/05/2016, 1123 CST	<b>Registration:</b>	N75WL
<b>Aircraft:</b>	CESSNA 550	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Birdstrike	<b>Injuries:</b>	1 None
<b>Flight Conducted Under:</b>	Part 91: General Aviation - Positioning		

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## Analysis

The turbofan-powered airplane struck birds after takeoff, resulting in a total loss of power on the right engine. The commercial pilot diverted to another airport, where he landed the airplane uneventfully. Examination of the airplane revealed several locations with bird remains, including within the right engine's fan duct. Examination of the right engine showed that the fan and booster stages were missing from the engine; they were found as a unit near the departure airport. Examination of the airplane revealed substantial damage to the fuselage and right wing from the fan and booster stages.

DNA analysis of the bird remains indicated that they were from redhead ducks, which can weigh between 1.38 and 3.31 lbs each. Damage on two fan blades that were approximately opposite each other indicated that at least two birds struck the fan. Examination of the engine components revealed that all damage was consistent with overload failures resulting from the bird strikes. The engine was certified to withstand the impact of a single 4-lb bird; thus, the ingestion of multiple ducks likely exceeded the engine certification requirements. However, the subsequent engine failure was contained because the fan case and inlet were not penetrated, as designed.

## Probable Cause and Findings

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

An in-flight collision with multiple birds, which resulted in separation of the right engine's fan rotor and subsequent total loss of power of the right engine.

## Findings

Environmental issues

Animal(s)/bird(s) - Effect on equipment (Cause)

## Factual Information

On December 5, 2016, about 1123 central standard time, a Cessna 550 airplane, N75WL, experienced a loss of engine power of the right engine after striking ducks during climb-out from the Mustang Beach Airport (RAS), Port Aransas, Texas. The airplane diverted to the Corpus Christi International Airport (CRP), Corpus Christi, Texas, where an uneventful landing was made. The pilot was not injured. The right engine fan was missing and there was damage to the right side of the fuselage and the right wing forward of the engine. The aircraft was registered to and operated by DC Aviation, LLC under the provisions of Title 14 *Code of Federal Regulations* Part 91. Instrument meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan. The flight was originating from RAS and the Fort Worth Meacham International Airport (FTW), Fort Worth, Texas was the intended destination.

The airplane received substantial damage to the right engine and to the airplane's fuselage and right wing. The examination of the airplane and engines at CRP showed both of the engines were in place on the airplane with their respective inlet ducts and cowlings still in place and secure. The left engine did not have any damage, although there were two small spatters of bird remains on the lip of the inlet duct. The examination of the right engine revealed the fan and booster stages were completely missing from the front of the engine, but there were no holes in the cowling. The inside of the inlet duct was torn out at the aft end and there were circumferential scoring marks that spiraled out of the duct from back to front. The insides of the inlet duct and fan duct were coated with bird remains. The examination of the airplane revealed the left side of the nose around the cargo compartment door had a streak of bird remains. The right side of the fuselage had a cluster of holes as well as bird remains just in front of the engine and just over the wing. The right wing in front of the engine over the rear spar had an area of circumferential gouges. Several of the gouges were completely through the upper surface of the wing into the right main landing gear wheel well, although the hydraulic lines directly under the holes were not damaged.

During the examination of the airplane and engines, bird remains were collected from the inside of the right engine's fan duct. The bird remains were submitted to the Smithsonian Institute's Museum of Natural History Feather Identification Laboratory for identification. The feather lab, using DNA analysis, identified the bird as a redhead duck that is a medium-sized diving bird that can weigh between 1.38 to 3.31 pounds. The redhead duck would be indigenous to Gulf coastal waters in the winter.

The right engine was subsequently removed for further examination. The fan and booster stage rotor assembly was found by a citizen in a marsh off near RAS. The fan and booster stage were also retained for further examination.

The examination of the fan and booster stages showed that both of the disks were intact and the blades were all in place in their respective blade slots. There were 8 of the 28 fan blades that were fractured transversely across the airfoil adjacent to the blade root platform. The examination of the fracture surface on those blades showed the fractures were coarse, grainy, and had shear lips. The remaining fan blades were all fractured across the airfoil around the

area of the mid span shrouds. There was an approximate 120° arc of blades that were bent opposite the direction of rotor rotation. There were two blades, about 155° apart, that had large radius curvatures on the leading edges. The fan and booster stage assembly were subsequently subjected to metallurgical examination.

The examination of the remainder of the engine showed no evidence of an uncontainment, case rupture, or fire. The fan case was intact, although there was circumferential scoring and gouging on the interior surface and there were three distinct bulges in the case. The low-pressure compressor (LPC) drive shaft was broken into three pieces. The broken end of the aft portion of the LPC drive shaft had a heavy circumferential rub with heat check cracking and material transfer as well as resolidified metal on the inside of the shaft. The rub on the LPC drive shaft was oriented to just one side of the shaft rather than being 360° around. The No. 1 bearing housing was broken into two pieces and the No. 1 bearing housing cover was shattered into numerous small pieces. There were bird remains on the intermediate case struts. The high-pressure compressor impeller was intact, but the edges of the vanes had numerous nicks and dents with pieces of the leading edges missing. The combustor case had metal splotches on the dome and exterior of the case, but there were no bird remains in the combustor area. There was metal slag built up around the high-pressure turbine nozzles. The emergency fuel shut off valve plunger was extended indicating the valve was in the cut off position.

The JT15D-4 engine was certificated in Canada to the requirements in 14 CFR Part 33 Amendments 1 – 4 and Advisory Circulars 33-1B and 33-3. The 2,500-pound takeoff thrust JT15D-4 engine is similar in design and structure to the previously built 2,200-pound takeoff thrust JT15D-1 engine. The Canadian Department of Transport, the predecessor to Transport Canada, permitted PWC to utilize the JT15D-1 engine's large bird strike certification test for the JT15D-4 engine. During the JT15D-1 engine's large bird strike certification test, a 4-pound chicken was propelled into the engine at a speed of 495 feet per second (293 knots). The engine stopped abruptly, and five fan blades broke that then penetrated the aluminum fan case. According to the certification report, all of the shaft, rotors, and other rotating elements remained within the engine. As a result of the non-containment of the fan blades, PWC replaced the aluminum fan case with a steel fan case that was then carried over into the design of the JT15D-4 engine.

The metallurgical examination of the fractures on the LPC drive shaft showed that they were shear and ductile tensile overloads in a twisting direction that was opposite the direction of rotor rotation. The lab report suggested the fracture was consistent with the forward part of the shaft experiencing a deceleration force in relation to the turbine end of the shaft. The examination of the eight fan blades that were broken adjacent to the blade root platforms showed that the fractures were all due to ductile bending overload with no indications of fatigue.

## History of Flight

Enroute-climb to cruise	Birdstrike (Defining event) Loss of engine power (total)
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## Pilot Information

Certificate:	Commercial	Age:	73, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane Single-engine; Instrument Airplane	Toxicology Performed:	No
Medical Certification:	Class 1 With Waivers/Limitations	Last FAA Medical Exam:	05/02/2016
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:			

## Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	Registration:	N75WL
Model/Series:	550 CITATION I	Aircraft Category:	Airplane
Year of Manufacture:	1980	Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	550-0175
Landing Gear Type:	Retractable - Tricycle	Seats:	
Date/Type of Last Inspection:	Unknown	Certified Max Gross Wt.:	
Time Since Last Inspection:		Engines:	2 Turbo Fan
Airframe Total Time:		Engine Manufacturer:	P&W CANADA
ELT:		Engine Model/Series:	JT15D-4
Registered Owner:	D C AVIATION LLC	Rated Power:	2500 lbs
Operator:	D C AVIATION LLC	Operating Certificate(s) Held:	None

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	RAS	Distance from Accident Site:	
Observation Time:	1755 UTC	Direction from Accident Site:	
Lowest Cloud Condition:	Clear	Visibility	10 Miles
Lowest Ceiling:	Broken / 1200 ft agl	Visibility (RVR):	
Wind Speed/Gusts:	12 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	340°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.85 inches Hg	Temperature/Dew Point:	12° C / 11° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	PORT ARANSAS, TX (RAS)	Type of Flight Plan Filed:	IFR
Destination:	FORT WORTH, TX (FTW)	Type of Clearance:	IFR
Departure Time:	1123 CST	Type of Airspace:	Unknown

## Airport Information

Airport:	CORPUS CHRISTI INTL (CRP)	Runway Surface Type:	
Airport Elevation:	46 ft	Runway Surface Condition:	Unknown
Runway Used:	N/A	IFR Approach:	Unknown
Runway Length/Width:		VFR Approach/Landing:	Precautionary Landing

## Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 None	Latitude, Longitude:	27.811944, -97.088889

## Administrative Information

Investigator In Charge (IIC):	John M Brannen	Adopted Date:	11/15/2018
Additional Participating Persons:			
Publish Date:	11/15/2018		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	<a href="http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=94895">http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=94895</a>		

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