National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA15FA353	**09/12/2015 1625 EDT**	**Regis# N139RT**	**Oneida, TN**	**Apt: Scott Muni SCX**
Acft Mk/Mdl AERO VODOCHODY L39-C		**Acft SN 332505**	**Acft Dmg: DESTROYED**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl IVCHENKO AI-25TL		**Acft TT 1550**	**Fatal 1 Ser Inj 0**	**Flt Conducted Under: FAR 091**
Opr Name: STANLEY JAY GORDON, JR.		**Opr dba:**		**Aircraft Fire: GRD**
				AW Cert: SPE

Summary
The pilot of the single-engine, high-performance, jet airplane was scheduled to be the final performer at an air show. Several witnesses who observed the airplane take off reported that the airplane seemed "slow" during climbout. A witness located near the end of the departure runway stated that the airplane did not appear to be climbing as quickly as other jet-powered airplanes he had previously observed. This witness reported that the airplane made a right turn and pitched -up to gain altitude, and then the engine lost power. The airplane subsequently descended nose first and impacted trees and terrain about 2 miles west of the airport. The wreckage was severely fragmented, scattered along a 325-ft debris path, and partially consumed by a postimpact fire.

Examination of the airframe and engine did not reveal evidence of any preimpact mechanical malfunctions. Although bending of fan blades opposite the direction of rotation indicated that the engine was rotating at the time of impact, imprints of fan blade tips on the shrouds with no circumferential rub marks indicated that the engine had little rotational energy and was operating at low power. Extensive damage to the fuel control unit precluded a functional test for any anomalies that could have resulted in or contributed to a loss of engine power.

Although one toxicology laboratory identified ethanol in the pilot's muscle tissue, a second laboratory did not, indicating that the ethanol was from postmortem production and did not play a role in the accident. In addition, metoprolol and diphenhydramine were identified in the pilot's muscle and brain tissue. Metoprolol, a medication for hypertension, is not impairing. Diphenhydramine is a significantly impairing sedating antihistamine; however, without a blood level, no determination could be made as to whether the pilot was impaired by the effects of diphenhydramine at the time of the accident.

Cause Narrative
THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's failure to maintain airplane control following a partial loss of engine power during initial climb. The reason for the partial loss of engine power could not be determined due to extensive postimpact damage.

Events
1. Initial climb - Loss of engine power (partial)
2. Emergency descent - Loss of control in flight
3. Emergency descent - Collision with terr/obj (non-CFIT)
4. Post-impact - Fire/smoke (post-impact)

Findings - Cause/Factor
1. Personnel issues-Task performance-Use of equip/info-Aircraft control-Pilot - C
2. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-(general)-Not attained/maintained - C
3. Not determined-Not determined-(general)-(general)-Unknown/Not determined - C

Narrative
HISTORY OF FLIGHT

On September 12, 2015, about 1625 eastern daylight time, an Aero Vodochody L-39C Albatros, N139RT, was destroyed when it impacted terrain shortly after takeoff from Scott Municipal Airport (SCX), Oneida, Tennessee. The airline transport pilot was fatally injured. The airplane was registered to Float Dancer, Inc., and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the local airshow performance flight.

According to witnesses, the pilot flew the airplane to SCX the day before the accident to perform in the Wings Over Big South Fork airshow that was being held on the day of the accident. Witnesses reported that the pilot was scheduled to be the final performer in the airshow.

A friend of the pilot, who had flown the airplane about 1 week before the accident and assisted the pilot on the day of the accident, reported that he removed the safety pins for the front cockpit ejection seat, filled the airplane's smoke system oil tank, and observed the pilot perform a full power engine check and smoke system check before the takeoff from runway 23. He further stated that the takeoff "appeared normal in all respects." As the airplane began to climb, he diverted his attention to the spectators, and when he looked back for the airplane, he could not locate it. Moments later he observed a rising column of smoke.

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
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The airboss, who cleared the airplane for takeoff, reported no distress calls or abnormal communications from the pilot before the accident. Several witnesses reported that a "puff of smoke" exited the airplane's exhaust before the airplane's taxi to the runway and that the airplane seemed "slow" during climbout. A witness located near the departure end of the runway stated that the airplane did not appear to be climbing as quickly as other jet-powered airplanes he had previously observed. He further stated that the airplane made a right turn and pitched up to gain altitude, and "the engine failed." The airplane subsequently entered a "sliding turn" and descended nose first toward the ground.

PERSONNEL INFORMATION

The pilot, age 61, held an airline transport pilot certificate with ratings for airplane single- and multiengine land. He also held type ratings for Cessna CE-525- and CE-525S-series airplanes and had private pilot privileges in single-engine sea airplanes.

The pilot's personal flight logs were not located. He reported 6,000 hours of total flight experience, with 40 hours accumulated during the previous 6 months, on his most recent Federal Aviation Administration (FAA) medical examination, which was conducted on December 23, 2014, and resulted in the issuance of a limited second-class/full third-class special issuance medical certificate. A flight instructor reported that the pilot satisfactorily completed a flight review and pilot proficiency check in the airplane on April 16, 2015.

AIRCRAFT INFORMATION

The single-engine, two-seat, high-performance airplane was manufactured in Czechoslovakia as a basic and advanced military jet trainer. It was equipped with an Ivchenko AI-25TL turbofan engine, which had a takeoff thrust rating of 3,792 pounds.

According to FAA airworthiness records, the airplane was manufactured in 1983 and purchased by the pilot on October 7, 1999. It was issued an FAA experimental special airworthiness certificate in the exhibition category on October 23, 1999.

The airplane was maintained under an FAA-approved maintenance program. Review of maintenance records revealed that the airplane's most recent condition inspection was performed on April 2, 2015. The pilot's friend reported that the airplane had been flown about 13 to 15 times and had accumulated about 15 to 18 hours of flight time since the condition inspection.
At that time, the airplane had been operated for about 1,550 total hours and about 325 hours since it was purchased by the pilot. The engine, which was new when it was installed on March 27, 2001, had been operated for about 325 hours. The airplane was not flown between October 25, 1999, and the date the that new engine was installed.

METEOROLOGICAL INFORMATION

At 1635, the weather conditions reported at Campbell County Airport (JAU), which was located about 24 nautical miles east-southeast from the accident site, included wind from 310ø at 5 knots, visibility 10 statute miles, clear sky, a temperature of 23øC, a dew point of 4øC, and an altimeter setting of 29.85 inches of mercury.

WRECKAGE INFORMATION

The airplane impacted trees about 2 miles west of the departure end of runway 23 in the Big South Fork National River and Recreation Area. The airplane was severely fragmented and partially consumed by a postimpact fire. A debris path began around a group of about 75-ft-tall broken trees and continued on a magnetic heading of about 120ø for about 325 ft over sloped, uneven terrain to the engine.

Portions of all major parts of the airframe, which included all the flight controls, were identified in the debris path. The fuselage and both wings were fragmented, and the empennage was separated. The vertical stabilizer and rudder were separated from the empennage. The rudder trim tab was separated from the rudder. The left and right elevators remained attached to the horizontal stabilizer; however, the horizontal stabilizer and both elevators displayed crushing damage and tearing consistent with tree and ground impacts. The left aileron remained attached to the outboard portion of the left wing, and the right aileron was separated. Both wing tip fuel tanks were separated. The postimpact condition of the airframe precluded confirmation of flight control continuity.

The airplane was equipped with ejection seats. One ejection seat rocket motor was found discharged, and one parachute was located in the debris path; however, its respective envelope was not inflated.

The engine was impact and fire damaged. It was complete from the inlet case's front flange to the exhaust duct's rear flange. Visual examination of the last stage turbine assembly did not reveal any damage consistent with an internal catastrophic failure. The gearbox was missing from the engine. A small section of the gearbox housing, which included three internal spur gears with no apparent teeth damage, was recovered among the airplane debris.

Additional examination of the engine after it was recovered from the accident site revealed that all the fan ducts were in place, except for an area on the top of the engine between the intermediate case and the rear fan duct that was partially burned away. There was no forward-to-aft linearity of the soot and burn patterns, consistent with a postimpact fire. All of the 1st, 2nd, and 3rd stage fan blades were in place in their respective disks. Five 1st stage fan blades were separated up to 2 inches above their blade root platforms, and the remaining fan blades were bent in the midspan area opposite the direction of rotation. None of the 1st stage fan blades had any soft body or hard body impact damage. The 3rd stage fan blade shroud contained imprints of the 3rd stage fan blades, with no circumferential rub marks.

The fuel control throttle pointer indicated 30 (0-110 scale), and the high-pressure compressor variable stator vane indicator was at 17 (0-30 scale). The fuel control unit remained attached to the engine but sustained both impact and thermal damage.

MEDICAL AND PATHOLOGICAL INFORMATION

The Knox County Regional Forensic Center, Knoxville, Tennessee, performed an autopsy on the pilot. According to the autopsy report, the cause of death was "multiple blunt force injuries following airplane crash."

Review of the pilot's medical history revealed that he had a history of hypertension, high cholesterol, and severe coronary artery disease, which required surgery in 1997. He reported all those diagnoses to the FAA, as well as the use of several medications, including atorvastatin and atenolol.

Toxicological testing performed by NMS Labs on specimens from the pilot at the request of the medical examiner identified 0.064 gm/dl of ethanol and caffeine in muscle tissue. Ethanol is an intoxicant commonly found in beer, wine, and liquor that acts as a central nervous system depressant. Ethanol may also be produced in body tissues by microbial activity after death.

Toxicology testing performed on specimens from the pilot by the FAA Bioaeronautical Science Research Laboratory, Oklahoma City, Oklahoma, was limited by the lack of available blood, urine, or vitreous for testing. No ethanol was identified in muscle; however, diphenhydramine and metoprolol were detected in muscle and brain tissue. Metoprolol is a beta-blocking agent similar to atenolol that is used to treat high blood pressure and reduce the risk of recurrent heart attacks. Diphenhydramine is a sedating antihistamine used to treat allergy symptoms and as a sleep aid.

Accident Rpt# ERA17FA279 08/16/2017 620 CDT	Regis# N6082B	Philipp, MS	Apt: N/a	
Acft Mk/Mdl AIR TRACTOR AT502-B	Acft SN 502B-0274	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim	Prob Caus: Pending
Eng Mk/Mdl PRATT & WHITNEY PT6A-34	Acft TT 11409	Fatal 1 Ser Inj 0	Flt Conducted Under: FAR 137	
Opr Name: MIDWAY-AIR	Opr dba:		Aircraft Fire: NONE	
			AW Cert: SPR	

Events

1. Maneuvering-low-alt flying - VFR encounter with IMC

Narrative

On August 16, 2017, about 0620 central daylight time, an Air Tractor AT-502B, N6082B, was substantially damaged when it impacted wooded terrain near Philipp, Mississippi. The commercial pilot was fatally injured. The airplane was operated by Midway Air Service as an aerial application flight conducted under the provisions of 14 Code of Federal Regulations Part 137. Instrument meteorological conditions prevailed and no flight plan was filed for the planned local flight that departed from a private airstrip in Minter City, Mississippi, about 0610.

According to the operator, the airplane was supposed to spray a cornfield located about 5 miles southeast of the airstrip. When the airplane did not return, a search was initiated and the wreckage was located in wooded terrain about 3 miles southeast of the airstrip at 0930.

An approximate 50-foot debris path was observed oriented about a magnetic course of 130ø. The debris path began with freshly cut tree branches at a descending angle and ended with the main wreckage, which was also oriented about 130ø magnetic. The main wreckage came to rest upright and a strong odor of fuel was present at the accident site. An impression of the left wing leading edge was observed in the ground near the left wing, consistent with a nose-down vertical descent. Both wings were partially separated from the airframe. The flaps and ailerons remained attached to both wings and both wings exhibited crushing damage to the leading edges.

The vertical stabilizer and rudder remained attached while the horizontal stabilizer and elevator were partially separated. Rudder control continuity was confirmed from the rudder through cables to the rudder pedals in the cockpit. Elevator control continuity was confirmed from the elevator through push-pull tubes to the cockpit area, where the push-pull tubes separated consistent with impact. Aileron control continuity was confirmed from both ailerons to their respective wing root, where the push-pull tubes separated consistent with impact. The elevator trim was connected by push-pull tubes and found in the full nose-down position; however, the preimpact position of the elevator trim could not be determined.

The cockpit was partially crushed and the four-point restraint system remained intact, with the exception of the right shoulder harness, which separated consistent with overload. The power lever and propeller control were found in the full forward position and the fuel valve was in the on position. Measurement of the flap actuator corresponded to a flaps retracted position. The altimeter indicated a negative number and 30.00 was displayed in the Kollsman window.

The propeller hub separated from the engine, but all three blades remained attached to the hub. One blade was bent aft with its tip separated and exhibited leading edge gouging and chordwise scratching. Another blade exhibited s-bending and the third blade was bent aft. The propeller shaft exhibited a torsional separation. Partial teardown and examination of the engine revealed that the power turbine and compressor turbine exhibited rotational scoring consistent with contact from the power turbine vane and baffle. The first stage compressor blades exhibited tip rollover and some of the blades were also bent opposite the direction of rotation. Fuel was recovered from the fuel filter and fuel line to the flow divider. The fuel was consistent in odor to Jet A and absent of visible contamination.

The pilot, held a commercial pilot certificate with a rating for airplane single-engine land. He did not possess an instrument rating. His most recent Federal Aviation Administration (FAA) second-class medical certificate was issued on March 30, 2017. At that time, he reported a total flight experience of 1,800 hours.

The single-seat, low-wing, fixed tailwheel airplane was manufactured in 1994 and issued an FAA restricted category airworthiness certificate. It was powered by a Pratt and Whitney PT6A-34, 783-shaft horsepower engine, equipped with a three-blade Hartzell propeller. Its most recent annual inspection was completed on March 30, 2017. At that time, the airframe and engine had accumulated 11,409 hours since new. The airplane had flown an additional 288.6 hours from the time of the annual inspection, until the accident.

Greenwood-Leflore Airport (GWO), Greenwood, Mississippi was located about 18 miles southeast of the accident site. The recorded weather at GWO, at 0641, was: wind from 210ø at 5 knots, visibility 6 statute miles in mist; overcast ceiling at 400 ft; temperature 24ø C; dew point 23ø C, altimeter 30.02 inches of mercury.

A GPS unit was recovered from the wreckage and retained for further examination.

Accident Rpt# ANC17CA041 **08/03/2017 1300 AKS** **Regis# N351SH** **Delta Junction, AK** **Apt: N/a**

Acft Mk/Mdl AIRBUS AS350-B3 **Acft SN 4598** **Acft Dmg: SUBSTANTIAL** **Rpt Status: Factual** **Prob Caus: Pending**

Eng Mk/Mdl SAFRAN HELICOPTER ENGINES ARRIEL **Acft TT 3824** **Fatal 0** **Ser Inj 0** **Flt Conducted Under: FAR 135**

Opr Name: SOLOY HELICOPTERS, LLC **Opr dba: SOLOY HELICOPTERS, LLC** **Aircraft Fire: NONE**

AW Cert: STN

Events

2. Landing - Collision during takeoff/land

Narrative

The helicopter pilot reported that he was transporting a passenger to a remote drilling site, where a tracked drilling unit was stationed. He reported that he landed into the wind, which necessitated descending over bordering trees into the drilling site. The helicopter touched down on the dirt, and upon lowering the collective, he reported he heard a "bang" and the helicopter slowly started to "pick up a ground wobble." The pilot shutdown the helicopter and both occupants exited without further incident.

A postaccident inspection revealed that the blue and red main rotor blades sustained substantial damage from impacting a black 1.5-inch steel frame attached to the tracked drilling unit, which is used to mount a canvas weather shelter for the drilling crews. The pilot reported that the steel frame was not visible to him from above as he was descending into the drilling site. The pilot further reported that multiple landings have been made to the drilling site in the past 3 months, and that with the previous landings he landed further past the tracked drilling unit and the steel frame was always behind the helicopter.

The pilot reported that there were no preimpact mechanical failures or malfunctions with the airframe or engine that would have precluded normal operation.

The Federal Aviation Administration Helicopter Flying Handbook (FAA-H-8083-21A, 2012) discusses high and low reconnaissance procedures and states in part:

The purpose of conducting a high reconnaissance is to determine direction and speed of the wind, a touchdown point, suitability of the landing area, approach and departure axes, and obstacles for both the approach and departure.

A low reconnaissance is accomplished during the approach to the landing area. When flying the approach, verify what was observed in the high reconnaissance, and check for anything new that may have been missed at a higher altitude, such as wires and their supporting structures (poles, towers, etc.), slopes, and small crevices.

Accident Rpt# WPR15LA177 06/01/2015 1948 MST	Regis# N73AW	Dewey, AZ	Apt: N/a	
Acft Mk/Mdl BELL 206 L4-L4	Acft SN 52115	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual	Prob Caus: Pending
Eng Mk/Mdl ALLISON/ROLLS ROYCE 250-C30P	Acft TT 4092	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091	
Opr Name: AIRWEST HELICOPTERS	Opr dba:		Aircraft Fire: NONE	
			AW Cert: STN	

Events

1. Enroute-cruise - Loss of engine power (total)

Narrative

On June 1, 2015, about 1948 mountain standard time, a Bell 206 L-4, N73AW, sustained substantial damage during an emergency landing following a loss of engine power, near Dewey, Arizona. The commercial pilot, the sole occupant of the helicopter, was not injured. The helicopter was registered to Air Medical Services LLC and operated by Airwest Helicopters as a Title 14 Code of Federal Regulations Part 91 ferry flight. Visual meteorological conditions prevailed and a company visual flight rules, company flight plan, was filed. The cross country flight, departed Valle Airport (40G), Grand Canyon, Arizona about 1905 with a planned destination of Glendale Municipal Airport (GEU), Glendale, Arizona.

The operator reported that several weeks prior to the accident, the helicopter's engine chip detector caution light momentary illuminated during a routine maintenance engine run. The engine was shut down and the magnetic chip detectors (MCDs) were examined. A small amount of debris, that was determined to be within the manufacturer's limits, was observed. The MCDs were cleaned and re-installed and then a 30-minute engine run was conducted. Afterward, no further debris was found and the helicopter was returned to service. During a subsequent flight, a couple of weeks later, the engine chip detector caution light momentary illuminated. The helicopter landed and the MCDs were once again inspected, and a small flake and metallic paste on the lower MCD was observed. The oil system was drained, flushed, changed, and a new filter was installed. A 30-minute ground engine run was accomplished, and the MCDs were inspected afterwards and free of debris. The helicopter was then flown about 30 minutes, to a location where an oil sample could be drawn from the original oil removed. The oil sample was sent out for analysis and the helicopter was not operated for about 2 weeks, while awaiting results. The oil analysis was received, and the operator was satisfied with the result of no metal detected, and attempted to ferry the helicopter back to its home base.

During the flight, the pilot reported observing a momentary illumination of a caution light that he could not identify, prior to it extinguishing. About 10 minutes later, the engine chip detector caution light briefly illuminated, while the helicopter was in cruise flight, about 750 ft above ground level. The pilot elected to make a precautionary landing and initiated a descent. During the descent, the engine chip detector light illuminated again and shortly thereafter, was followed by a loud bang. Immediately, the engine lost power and an emergency autorotation landing was accomplished. During the landing sequence, the main rotor blades struck the tail boom and resulted in substantial damage.

Postaccident examination of the helicopter, revealed control continuity with the cockpit controls to the engine and flight controls. Besides the tail boom damage, the remainder of the fuselage was relatively intact. Initial visual examination of the engine revealed no obvious damage. The inlet, exhaust section, and turbine blades, were clear of obstructions and observed to be undamaged. The engine was removed to facilitate an examination. The compressor could not be rotated by hand but the power turbine could be rotated by hand, with resistance. The magnetic chip detectors were removed and observed to have accumulated ferrous debris. The engine was shipped to Rolls-Royce for further examination.

The engine was examined and disassembled under the supervision of the National Transportation Safety Board, investigator-in-charge, at the Rolls-Royce facility near Indianapolis, Indiana. The compressor module was separated from the accessory gearbox by removing the compressor discharge tubes and the Compressor Turbine Drive Shaft (CT shaft). Thermal damage and cooked oil was observed on the CT shaft. The turbine module was removed for examination. On the first and second stages of the turbine, thermal and blade tip damage was observed. All the bearings were examined and were unremarkable, except for the No. 2 bearing.

The aft end of the compressor module revealed damage to the No. 2 bearing. The No. 2 bearing was fractured and exhibited thermal damage. Examination of the No. 2 bearing oil delivery tube revealed it was properly installed with no obvious blockage of the oil jets. The tube was removed and x-rayed for internal contamination of the oil passages with negative results. Further, the tube was flow checked and verified to flow oil at the specified rate.

The accessory gearbox was disassembled and observed to be intact and functional. Metal debris was observed throughout the gearbox. The oil pump screen, oil delivery tubes and engine mounted oil filter had minor contamination but no obstructions to flow.

A detailed examination of the No. 2 bearing revealed that its composition was consistent with the manufacture material types required. The bearing separator was fractured completely through both rails, at the forward and aft sides, of the bearing. All 10 of the ball bearings were retained in the separator, however half of them exhibited damage consistent with smearing and material transfer between the raceway and balls.

The No. 2 bearing is the primary means of support of the compressor impellor. Failure of the No. 2 bearing will allow the impellor to migrate forward, where it will eventually contact the compressor shroud. According to the manufacturer, only minor contact between the impeller and shroud is acceptable, however, examination of the compressor impellor revealed that the shroud and its vanes had considerable rubbing damage.

Accident Rpt# GAA17CA355	**06/21/2017 840 PDT**	**Regis# N6180A**	**Williams, CA**	**Apt: N/a**
Acft Mk/Mdl BELL UH1B		**Acft SN 62-1994**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl LYCOMING T-53-13B		**Acft TT 15178**	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 137**
Opr Name: JONES AVIATION INC		**Opr dba:**		**Aircraft Fire: NONE**
				AW Cert: SPR

Summary

The helicopter pilot reported that, while maneuvering at a low altitude during an agricultural application flight, he "forgot to duck" for some nearby transmission wires. The tail rotor struck the transmission wires, and the helicopter impacted terrain.

The helicopter sustained substantial damage to the tailboom.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's failure to maintain clearance from transmission wires while maneuvering at a low altitude during an agricultural application flight.

Events

1. Maneuvering-low-alt flying - Miscellaneous/other

Findings - Cause/Factor

1. Personnel issues-Psychological-Attention/monitoring-Monitoring environment-Pilot - C
2. Environmental issues-Physical environment-Object/animal/substance-Wire-Effect on operation - C
3. Personnel issues-Action/decision-Action-Lack of action-Pilot

Narrative

The helicopter pilot reported that, while maneuvering at a low altitude during an aerial application flight, he "forgot to duck" for some nearby transmission wires. The tail rotor struck the transmission wires and the helicopter impacted terrain.

The helicopter sustained substantial damage to the tailboom.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN14LA430 08/09/2014 734 CDT	**Regis# N943LR**	**San Antonio, TX**	**Apt: San Antonio Intl SAT**	
Acft Mk/Mdl BOMBARDIER CL600 2D24 - 900	**Acft SN 15068**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual**	**Prob Caus: Pending**
Eng Mk/Mdl GENERAL ELECTRIC CF34-8C5	**Acft TT 12283**	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 121**	
Opr Name: MESA AIRLINES INC	**Opr dba: AMERICAN EAGLE**		**Aircraft Fire: NONE**	
			AW Cert: STT	

Summary

During pushback from the gate, the tug positioned the airplane on the taxiway. Before disconnecting, the tug reversed and the airplaneÿrolled forward while still attached to the tug. As the airplane rolled past the tug, theÿtug impactedÿthe left side of the fuselage. The tow bar pin was found sheared, but it could not be determined if the pin failed before or during the tow operation. Further, the operator did not have an immediate means of communicating with the flight crew the need to apply the brakes while the tug was still attached.

The tug operator's postaccident urine test was positive for marijuana, which indicated prior use. However, it could not be determined whether the tug operator was impaired by the effects of marijuana at the time of the event.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: Failure of the tow bar shear pin, which resulted in the tug operator's loss of control of the airplane during pushback operations. Contributing to the accident was the tug operator's inability to communicate to the flight crew to apply the airplane's brakes.

Events

1. Pushback/towing - Ground collision

Findings - Cause/Factor

1. Personnel issues-Task performance-Use of equip/info-Use of equip/system-Ground crew - C
2. Personnel issues-Task performance-Communication (personnel)-Lack of communication-Ground crew - F

Narrative

On August 9, 2014, about 0735 central daylight time (CDT), a Bombardier CL600 airplane, N943LR, collided with a tug during pushback from the gate at San Antonio International Airport (SAT) San Antonio, Texas. The airplane sustained substantial damage to the fuselage structure and internal damage to nose landing gear. The airplane was registered to and operated by Mesa Airlines Inc. as US Airways flight 2763. The four flight crewmembers and passengers on-board were not injured. Visual meteorological conditions prevailed at the time of the accident and the flight operated on a instrument flight rules flight plan. The scheduled, domestic passenger flight was operated under the provisions of 14 Code of Federal Regulations Part 121. The flight was destined for Phoenix Sky Harbor International Airport (PHX), Phoenix, Arizona.

The first officer reported the tug driver did not have an operable headset and the pushback was initiated using hand signals. The airplane was positioned on the ramp at a 90-degree angle to the gate. The tug driver stated after turning the airplane onto the taxiway he "reversed back," pulling the airplane forward. The tug stopped perpendicular to the left nose of the airplane, but the airplane continued to roll forward while still attached to the tow bar. The airplane rolled into the tug impacting the left side of the fuselage.

Examination revealed the tow bar shear pin had failed, but the investigation could not determine if the shear pin failed prior to or during the pushback process.

In accordance with company policies and procedures, a postaccident drug test of the tug driver was administered about 9 hours after the accident, which was positive for marijuana. According to 49 CFR Part 40 Section 40.87, the initial test cut off is 50 ng/ml, but a positive marijuana test can be reported if the confirmatory test identifies 15 ng/ml or more of marijuana metabolite (tetrahydrocannabinol carboxylic acid, or THC-COOH) in urine. According to the NTSB Medical Officer, about 30% of THC is eventually excreted in urine, primarily as THC-COOH. However, its presence in urine only indicates prior THC exposure. After smoking marijuana, it can take as long as four hours for THC-COOH to appear in the urine at concentrations above the initial reporting cut off of 50 ng/ml. Positive urine test results generally indicate use within hours to a few days; however, the detection window can be significantly longer following chronic, heavy use.

Accident Rpt# GAA17CA191	03/11/2017 830 HST	Regis# N865MA	Kalaupapa, HI	Apt: Kalaupapa LUP
Acft Mk/Mdl CESSNA 208		Acft SN 208B0996	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl P&W PT6A SER			Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 135
Opr Name: SCHUMAN AVIATION CO. LTD		Opr dba: MAKANA KAI AIR		Aircraft Fire: NONE
				AW Cert: STC

Events

2. Approach-VFR go-around - Loss of control in flight

Narrative

The pilot of the commuter airplane reported that she was going to establish an approach and landing to runway 05 at an airport with a single runway and no taxiways. While on a seven-mile final, she communicated with the pilot of an airplane that was on short final for the same airport. The pilot that was on short final reported that he would report when he was clear of the runway, and he did. The commuter pilot acknowledged the other pilot's clear of runway transmission, and initiated the approach.

As the pilot descended through 150 feet above ground level, she noticed that the airplane that she had communicated with was not clear of the runway. The airplane on the ground was near the runway 23 numbers with the propeller turning, facing toward her landing airplane. She aborted the landing but the airplane did not climb. The airplane impacted the runway hard and bounced. She reported that when the airplane touched down after the bounce, she "applied left rudder pedal to steer the aircraft off the runway and out of the way of the other aircraft's possible flight path." The airplane exited the left side of the runway and ground-looped to the left. The airplane sustained substantial damage to the right side of the fuselage and the right wing.

After the ground-loop, the pilot of the airplane near the runway 23 numbers attempted to takeoff. He was contacted via radio transmission by the airport manager and vehemently told that the runway was closed until further notice.

Examination of the accident airplane by Federal Aviation Administration, Aviation Safety Inspectors, determined that there were no preimpact mechanical anomalies that would have prevented normal flight operation.

Accident Rpt# ANC16LA012 01/02/2016 1205 AKS	Regis# N540ME	Anaktuvuk Pass, AK	Apt: Anaktuvuk Pass AKP
Acft Mk/Mdl CESSNA 208B	Acft SN 208B-0540	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl P&W CANADA PT6A-6 SERIES	Acft TT 19555	Fatal 0 Ser Inj 5	Flt Conducted Under: FAR 135
Opr Name: WRIGHT AIR SERVICE INC	Opr dba:		Aircraft Fire: NONE
			AW Cert: STN

Summary

The airline transport pilot was conducting a scheduled passenger flight in an area of remote, snow-covered, mountainous terrain with seven passengers on board. The pilot reported that, after receiving a weather briefing, he chose to conduct the flight under visual flight rules (VFR). While en route about 10,000 ft mean sea level (msl), the visibility began "getting fuzzy." The pilot then descended the airplane to 2,500 ft msl (500 ft above ground level) to fly along a river. When the airplane was about 10 miles southwest of the airport, he climbed the airplane to about 3,000 ft msl in order to conduct a straight-in approach to the runway. He added that the visibility was again a little "fuzzy" due to snow and clouds, and that he never saw the airport. The pilot also noted that the flat light conditions limited his ability to determine his distance from the surrounding mountainous, snow-covered terrain. Shortly after climbing to 3,000 ft msl,ÿthe airplane collided with the rising terrain about 6 miles southwest of the airport. Another pilot, who had just departed from the airport, confirmed that flat light and low-visibility conditions existed in the area at the time of the accident. Further, camera images of the weather conditions recorded at the airport showed that, although conditions were marginal VFR at the surface at the time of the accident, there was mountain obscuration and reduced visibility due to light snow and clouds along the accident flight path and that the worst conditions were located along and near the higher terrain.

The pilot reported no preimpact mechanical malfunctions or failures with the airplane that would have precluded normal operation. It is likely that that the pilot encountered flat light and low-visibility conditions as he neared the airport at 3,000 ft msl while operating under VFR and that he did not see the rising, snow-covered mountainous terrain and subsequently failed to maintain clearance from it.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's continued flight into deteriorating, flat light weather conditions, which resulted in impact with mountainous, snow-covered terrain.

Events

1. Enroute - Controlled flight into terr/obj (CFIT)

Findings - Cause/Factor

1. Personnel issues-Action/decision-Info processing/decision-Decision making/judgment-Pilot - C
2. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-Heading/course-Not attained/maintained - C
3. Environmental issues-Conditions/weather/phenomena-Light condition-Flat light-Effect on personnel - C
4. Environmental issues-Conditions/weather/phenomena-Light condition-Flat light-Decision related to condition - C

Narrative

HISTORY OF FLIGHT

On January 2, 2016, about 1205 Alaska standard time, a single-engine, turbine-powered Cessna 208B airplane, N540ME, impacted mountainous, snow-covered terrain about 6 miles southwest of Anaktuvuk Pass Airport, Anaktuvuk Pass, Alaska. The airline transport pilot and four passengers sustained serious injuries, and three passengers sustained minor injuries. The airplane sustained substantial damage. The airplane was being operated by Wright Air Service, Inc., Fairbanks, Alaska, as a 14 Code of Federal Regulations Part 135 visual flight rules (VFR) scheduled commuter flight. Visual meteorological conditions (VMC) existed at the Anaktuvuk Pass Airport at the time of the accident, and company flight-following procedures were in effect. The flight departed from Fairbanks International Airport, Fairbanks, Alaska, about 1030 destined for Anaktuvuk Pass. The area between Fairbanks and Anaktuvuk Pass consists of remote, steep mountainous terrain, which is snow-covered in January.

Following the accident, the pilot stated that, after receiving a weather briefing in the morning from the Federal Aviation Administration (FAA) Flight Service Center, he chose to conduct the flight under VFR. He reported that, while en route to Anaktuvuk Pass about 10,000 ft mean sea level (msl), the visibility began "getting fuzzy" as he flew over the Caribou Hills. He then descended to 2,500 ft msl (or 500 ft above ground level) to fly along the John River. When the airplane was about 10 miles southwest of Anaktuvuk Pass, he climbed to about 3,000 ft msl to be at the published airport traffic pattern altitude while maintaining a flight track on the east side of the river valley to conduct a straight-in approach to runway 2. He added that the visibility was again a little "fuzzy"; that there was snow, white walls, and white clouds; and that he never saw the airport. The pilot noted that the flat light conditions limited his ability to determine his distance from the surrounding snow-covered, mountainous terrain. Shortly after climbing to 3,000 ft msl, the airplane collided with the rising snow-covered terrain about 6 miles southwest of the Anaktuvuk Pass Airport. The pilot stated that he did not remember any ground proximity warning system alerts before the collision. In a subsequent written statement, the pilot reported no preimpact mechanical failures or malfunctions with the airframe or engine that would have precluded normal operation.

The airplane's Spidertracks flight tracking system transmitted flight tracking data every 2 minutes. A review of the data revealed that the airplane's last reported location was along the east side of the John River valley at an altitude of 2,560 ft msl on a ground track of about 48ø.

Immediately following the accident, a passenger used a cell phone to call for rescue from Anaktuvuk Pass residents. About 20 minutes later, rescue personnel located the airplane and began extricating passengers from the wreckage and transporting them via snow machine to Anaktuvuk Pass for medical attention.

PERSONNEL INFORMATION

The pilot, age 57, held an airline transport pilot certificate with airplane single-engine land and multiengine land ratings. The pilot was issued a first-class airman medical certificate on October 1, 2015 with the limitation that he must have available glasses for near vision.

The accident pilot completed CFIT avoidance training on May 26, 2015. On November 21, 2015 the pilot successfully completed an airman competency and proficiency check in accordance with 14 CFR 135.293 and 135.297 which included CFIT avoidance.

AIRCRAFT INFORMATION

The accident airplane, a Cessna 208B, N540ME, was manufactured in 1996. At the time of the last inspection on December 9, 2015, the airplane had logged a total time in service of 19,555.4 flight hours.

The airplane was equipped with a Pratt & Whitney Canada PT6A-114A, 675 shaft horse power turbine engine. The engine had a total time in service of 8,915.4 hours, of which 3,542.4 hours were since the last overhaul.

The airplane was equipped with a Terrain Awareness Warning System (TAWS). The pilot did not recall inhibiting the system, which required navigation through several data pages within the GPS unit. The airplane was not equipped with a remote inhibit switch and due to system design and a lack of non-volatile memory, the status of the system could not be determined post-accident.

METEOROLOGICAL INFORMATION

The closest weather reporting facility was Anaktuvuk Pass Airport, located about 6 miles northeast of the accident site. At 1156, a METAR was reporting, in part, wind from 170ø at 5 knots; sky condition, broken clouds at 4,400 ft, overcast at 5,000 ft; visibility 6 statute miles; temperature 19øF, dew point 12øF; and altimeter setting 29.03 inches of mercury.

The FAA maintained weather cameras at Anaktuvuk Pass, which recorded images to the northeast, southeast, south, and southwest; the site elevation was 2,171 ft msl. A review of the recorded images revealed deteriorating weather conditions about the time of the accident. The south-facing camera showed that, between 1152 and 1212, the visibility was less than 2 miles, that ceiling conditions were below 4,100 ft msl, and that snow was falling. Weather conditions improved slightly by 1222 with visibility greater than 2 miles but less than 4 miles and a broken cloud ceiling. Overall, the camera images showed that, although conditions were marginal VFR at the surface at the time of the accident, there was mountain obscuration and reduced visibility due to light snow and clouds along the accident flightpath and that the worst conditions existed along and near the higher terrain at the time of the accident. The pilot reported that he did not check the FAA weather cameras before departure because it was dark at Anaktuvuk Pass at the time of departure.

Another pilot who had just departed from Anaktuvuk Pass reported that he contacted the accident pilot as he was approaching the airport and stated that the weather was "pretty much as advertised." The other pilot added that he had encountered flat light conditions after departing Anaktuvuk Pass, which was "compounded by low visibility," and that, to remain in VMC, he had to turn toward the north side of the valley and initiate a climb. The pilot stated that he perceived that the flat light and low-visibility conditions were highly localized.

FLIGHT RECORDERS

The accident airplane was not equipped, nor was it required to be equipped with, a cockpit voice recorder or a flight data recorder.

WRECKAGE AND IMPACT INFORMATION

On January 3, two FAA aviation safety inspectors traveled to Anaktuvuk Pass and reached the accident site that morning. The inspectors reported that the main wreckage was in an open area of snow-covered tundra at an elevation of about 2,500 ft msl. The top of the ridge where the airplane impacted was at an elevation of about 3,000 ft msl. From the initial point of impact, the airplane slid downhill about 300 ft and then came to rest in an upright position. The FAA inspectors reported finding a 1/2-inch layer of ice on the nonprotected, leading edge surfaces of the tail structure and outside air temperature probe. However, no ice was present on the areas protected by the inflatable deice boots.

The airplane wreckage was further examined by the NTSB IIC, two Textron Aviation air safety investigators, and a representative from the operator. The examination revealed that the airplane had sustained substantial damage to the fuselage, wings, and empennage. Flight control primary and secondary cable continuities were established from the cockpit controls to the respective flight control bell cranks and trim surface actuators. The flight control surfaces remained attached to the airplane except for the left aileron, which was separated outboard of the inboard hinge. The left aileron control rod was separated. The separated left aileron was observed during the initial on-scene examination, but due to recent snowfall, the remaining portion of aileron was not recovered with the airplane wreckage. The pitch trim actuator extensions were altered at the accident site to facilitate recovery. The aileron trim actuator was found in the "neutral" position. The flap actuator screw jack extension indicated that the flaps were retracted. The engine had separated from the firewall at the attachment points. Rotational scarring at the propeller hub attachment points were consistent with the engine operating at the time of impact.

The examination revealed no preimpact mechanical malfunctions or anomalies with the airplane or engine that would have precluded normal operation.

MEDICAL AND PATHOLOGICAL INFORMATION

The FAA's Civil Aerospace Medical Institute performed toxicological testing on specimens from the pilot on February 12, 2016 which was negative for ethanol and drugs.

ADDITIONAL INFORMATION

Medallion Foundation

According to the Medallion Foundation Shield Program website, the purpose of the Shield Program was to create and maintain a higher level of safety through the use of system safety and safety management system principles. An applicant needed to earn a "star" in each of the following categories to earn a shield:

- Controlled flight into terrain (CFIT) avoidance
- Operational control
- Maintenance and ground service
- Safety
- Internal evaluation

To earn a star, an applicant organization had to complete specific training classes, produce a required manual, and undergo an external audit to determine if the company had incorporated the information into its corporate culture. Following the initial audit, annual independent audits were to be conducted.

According to the Medallion website, the benefits of being a Shield carrier "include reduced insurance rates, cross promotional marketing of Shield carriers and recognition by DOD [Department of Defense], OGP [Oil and Gas Producers] and the FAA as an operator who incorporates higher standards of safety than required by regulations."

At the time of the accident, Wright Air Service was the holder of a CFIT avoidance "star."

Flat Light Conditions

In the FAA publication titled, "Flying in Flat Light and White Out Conditions," flat light is defined as an optical illusion that causes pilots to lose their depth perception and contrast in vision. It states that flat light can completely obscure features of the terrain, creating an inability to distinguish distances and closure rates.

Accident Rpt# GAA17CA490	08/04/2017 1400 PDT	Regis# N9829B	Mulino, OR	Apt: Mulino State 4S9
Acft Mk/Mdl CESSNA 208B-B		Acft SN 208B0116	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
			Fatal 0 Ser Inj 0	Flt Conducted Under: FAR PUBU
Opr Name: KAPOWSIN AIR SPORTS LTD		Opr dba:		Aircraft Fire: NONE

Accident Rpt# CEN16LA052	**11/02/2015 1925 CST**	**Regis# N732MD**	**Chicago, IL**	**Apt: Chicago O'hare International ORD**
Acft Mk/Mdl CESSNA 208B-B		**Acft SN 208B1083**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl P&W PT6A SER		**Acft TT 16329**	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 135**
Opr Name: MULTI-AERO INC		**Opr dba: AIR CHOICE ONE**		**Aircraft Fire: NONE**
				AW Cert: STN

Summary
After landing in night visual meteorological conditions, the commuter flight proceeded to taxi to the ramp. Upon coming to a service road perpendicular to the taxiway, a vehicle moved directly across the airplane's taxi path. The flight crew immediately applied brakes to stop. While braking, the airplane's tail rocked aft and struck the ground. The flight crew contacted ground control to inform them about the vehicle incident and resumed taxi to the ramp, and the driver of the vehicle radioed the tower, informing themÿthat he had cut off an aircraft. An inspection of the airplane by the operator revealed structural damage toÿthe aft pressure bulkhead resulting from the tail strike.

Cause Narrative
THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The failure of the driver of the service vehicle to yield to the taxiing airplane, which resulted in a near-collision and tail strike.

Events
1. Taxi-from runway - Abrupt maneuver

Findings - Cause/Factor
1. Personnel issues-Action/decision-Action-Incorrect action performance-Ground crew - C
2. Environmental issues-Conditions/weather/phenomena-Light condition-Dark-Not specified

Narrative
On November 2, 2015, about 1925 central standard time, a Cessna 208 Caravan, N732MD, registered to Multi-Aero Inc., of Sarasota, Florida, and doing business as Air Choice One of St. Louis, Missouri, was substantially damaged during taxi after braking to avoid a ground vehicle at the Chicago O'Hare International Airport (ORD). The pilot, co-pilot, and seven passengers were not injured. Night visual meteorological conditions prevailed. The flight was being operated as a commuter passenger flight under the provisions of Federal Code of Regulations Part 135. The flight had originated from Ironwood, Michigan (IWD), and ORD was its final destination.

After landing on Runway 27 at ORD, the flight crew proceeded to taxi to the ramp via Taxiway R. Upon coming to a service road perpendicular to the taxiway, a vehicle moved directly across their taxi path. The flight crew immediately applied brakes to stop. While braking, the airplane's tail section stuck the ground before stabilizing back to a normal stance on the landing gear. The flight crew contacted ground control to inform them about the vehicle incident and resumed taxi to the ramp.

According to a report by the FAA inspector who responded to the accident scene, the driver of the service vehicle (OPS 11) had radioed the tower on frequency 120.75. The driver stated that he just cut off an aircraft on taxiway R. A few minutes later, the driver radioed on frequency 129.9 and reported that he was sorry. Both the pilot-in-command, and the first officer reported that they were cut off by the service vehicle and stopped the aircraft immediately to avoid collision.

A special fight permit was issued by the FAA to ferry the aircraft from ORD to the company repair facility in St. Louis, Missouri, to accomplish repairs. As reported on NTSB Form 6120, an inspection of the airplane by the operator revealed structural damage to the aft pressure bulkhead.

Accident Rpt# GAA17CA404 **07/11/2017 1510 PDT**	**Regis# N357PJ**	**King Vale, CA**	**Apt: N/a**	
Acft Mk/Mdl EUROCOPTER AS 350-B3	**Acft SN 3608**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual**	**Prob Caus: Pending**
Eng Mk/Mdl SAFRAN (TURBOMECA) 2B	**Acft TT 1937**	**Fatal 0** **Ser Inj 0**	**Flt Conducted Under: FAR 091**	
Opr Name: PJ HELICOPTERS, INC	**Opr dba:**		**Aircraft Fire: GRD**	
			AW Cert: STN	

Events

2. Landing - Loss of control in flight

Narrative

The pilot of the helicopter reported that, during the landing on the unimproved dirt parking lot, dust started to kick up, and he transitioned to looking through the "chin bubble" for a visual point of reference. When the helicopter was about 5 to 6ft. above the ground, the pilot felt a sudden impact, followed by subsequent impacts from the two additional rotor blades impacting what later was found to be a tree. The helicopter "violently" fell to the ground and rolled onto its left side.

The helicopter sustained substantial damage to the fuselage and main rotor system.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

Accident Rpt# GAA17CA344 05/25/2017 1630 MST Regis# N153GC Peach Springs, AZ Apt: Grand Canyon West 1G4

Acft Mk/Mdl EUROCOPTER EC130-B4 Acft SN 7074 Acft Dmg: SUBSTANTIAL Rpt Status: Factual Prob Caus: Pending

Eng Mk/Mdl TURBOMECA ARRIEL 2B1 Fatal 0 Ser Inj 0 Flt Conducted Under: FAR 091

Opr Name: PAPILLON AIRWAYS INC. Opr dba: PAPILLON GRAND CANYON HELICOPTERS Aircraft Fire: NONE

AW Cert: STN

Summary

The pilot of the helicopter reported that, after fueling the helicopter with the engine running, the ground crewman opened the front passenger door on the opposite side from the pilot. Upon unlatching the door, the ground crewman released the door, and it was blown open. The door separated from the door strut and struck the main rotor, damaging the blades.

The helicopter sustained substantial damage to the main rotor blades.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The ground crewman's failure to hold onto the passenger door while the main rotor was still rotating, which resulted in the door separating from the helicopter and damaging the main rotor.

Events

1. After landing - Miscellaneous/other

Findings - Cause/Factor

1. Personnel issues-Action/decision-Action-Lack of action-Ground crew - C
2. Aircraft-Aircraft structures-Doors-Passenger/crew doors-Capability exceeded

Narrative

The pilot of the helicopter reported that, after fueling the helicopter with the engine running, the ground crewman opened the front passenger door on the opposite side from the pilot. Upon unlatching the door, the ground crewman released the door, and it was blown open. The door separated from the door strut, and struck the main rotor damaging the blades.

The helicopter sustained substantial damage to the main rotor blades.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

Accident Rpt# WPR17LA186 **08/22/2017 1618 PDT** **Regis# N338AX** **Pacific Ocean, PO** **Apt: N/a**

Acft Mk/Mdl HAWKER SIDDELEY HUNTER MK.58-NO **Acft SN 41H-697452** **Acft Dmg: DESTROYED** **Rpt Status: Prelim** **Prob Caus: Pending**

Fatal 0 **Ser Inj 1** **Flt Conducted Under: FAR PUBU**

Opr Name: AIRBORNE TACTICAL ADVANTAGE **Opr dba:** **Aircraft Fire: NONE**

AW Cert: SPE

Events

1. Enroute-cruise - Miscellaneous/other

Narrative

On August 22, 2017, about 1618 Pacific daylight time, a Hawker Hunter MK-58, N338AX, was substantially damaged when it impacted open ocean during an exercise with a United States Navy fighter jet. The airline transport pilot received serious injuries. The airplane was registered to Hunter Aviation International, Inc. and operated by Airborne Tactical Advantage (ATAC) under contract with the U.S. Navy as a public aircraft. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the local flight that departed Point Mugu Naval Air Station, Ontario, California at 1517.

According to the pilot's wingman, he was one nautical mile behind the accident airplane during an adversarial exercise with a military fighter jet. The military airplane was about 1,000 feet abeam the accident airplane's port side when it suddenly turned right and crossed in front of the accident airplane's flight path. The pilot of the accident airplane subsequently entered a 60 degree right turn and pitched up to follow the military fighter, but the airplane entered a rapid left bank angle, which was immediately followed by a nose low pitch attitude. He then observed the airplane roll wings level and then immediately roll into a 60 degree right turn again followed by a rapid left bank angle. The airplane's repeated the same sequence at least one more time before it entered a 40-degree nose down pitch attitude and the pilot ejected. In his recount, the witness reported that the airplane appeared to depart controlled flight about 15 seconds after the military airplane crossed in front of the accident airplane.

Accident Rpt# ERA14LA361 07/26/2014 1545 EDT	Regis# N107HA	Wadesboro, NC	Apt: N/a	
Acft Mk/Mdl HILLER UH 12E	Acft SN HA3007	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual	Prob Caus: Pending
Eng Mk/Mdl ALLISON 250-C20B	Acft TT 11884	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 137	
Opr Name: SUMMIT HELICOPTERS INC	Opr dba:		Aircraft Fire: NONE	
			AW Cert: SPR	

Summary

The airline transport pilot was conducting an aerial application flight in the helicopter. About 75 ft above ground level, the pilot heard three engine compressor stalls, which were followed by a partial loss of engine power. During the ensuing forced landing to a nearby road, the helicopter rolled over into a drainage ditch and came to rest on its right side.

Examination of the engine revealed that the accessory gearbox No. 2 bearing had degraded and fractured. The bearing displayed evidence of heat damage associated with its degradation. The cage of the bearing revealed fatigue fractures with multiple origins, indicative of relatively high-stress concentrations to the bearing. The cage fractures were likely secondary failures following the initial degradation of the bearing. The bearing balls were black in appearance. In addition, they were undersized when compared to engineering drawing requirements and displayed signatures consistent with material loss, likely from wear.

Considering that the engine had accumulated only about 92 hours since the gearbox was installed following an overhaul, it was possible that the bearings experienced an abnormal load. The cause of the abnormal load could have been due to installation error, an alignment issue from a previous hard landing that was noted in the gearbox maintenance records, or from insufficient lubrication within the gearbox assembly. However, the investigation could not determine which of these factors, if any, caused the failure of the No. 2 bearing and resulted in the partial loss of engine power.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: A partial loss of engine power due to the failure of the No. 2 engine accessory gearbox bearing for reasons that could not be determined based on the available information.

Events

1. Maneuvering-low-alt flying - Loss of engine power (partial)
2. Autorotation - Collision with terr/obj (non-CFIT)

Findings - Cause/Factor

1. Aircraft-Aircraft power plant-Engine (turbine/turboprop)-Accessory drives-Failure - C
2. Not determined-Not determined-(general)-(general)-Unknown/Not determined - C

Narrative

HISTORY OF FLIGHT

On July 26, 2014, about 1545 eastern daylight time, a Hiller UH-12E, N107HA, was substantially damaged when it impacted terrain near Wadesboro, North Carolina. The airline transport pilot was not injured. Day visual meteorological conditions prevailed and no flight plan had been filed. The local aerial application flight originated at a temporary staging location about 1540. The flight was conducted under the provisions of 14 Code of Federal Regulations Part 137.

According to the pilot, while applying the agriculture product about 75 feet above ground level, he heard three engine compressor stalls, which was followed by a partial loss of engine power. During a forced landing to a nearby road the helicopter rolled over into a drainage ditch and came to rest on its right side, which resulted in substantial damage to the fuselage, tailboom, main rotor blades, and tail rotor blades

PERSONNEL INFORMATION

According Federal Aviation Administration (FAA) records, the pilot held an airline transport pilot certificate with ratings for airplane multiengine land and helicopter, a commercial pilot certificate with ratings for airplane single-engine land and instrument helicopter, and a flight instructor certificate for helicopter and instrument helicopter. He held an FAA second-class medical certificate, which was issued on April 9, 2014. The pilot reported 9,604 hours of total flight experience, of which 5,800 total hours were in rotorcraft and 1,210 hours were in the accident helicopter make and model.

AIRCRAFT INFORMATION

The helicopter was issued a standard airworthiness certificate on June 7, 1974. The most recent 100-hour inspection was conducted on June 18, 2014; at the time of the inspection the helicopter had approximately 11,884 total hours in service. The helicopter was powered by an Allison 250-C20B turboshaft engine, manufactured on April 11, 1980. The engine had been operated for 7,566.6 total hours at the time of the accident.

A review of the maintenance records revealed that the engine was converted from a 250-B17C engine to a 250-C20B engine in September of 1993. At the time of the conversion the engine had 1,381.4 total hours in service. An entry located in the gearbox assembly service record dated October 30, 2007, stated "repair after hard landing." The gearbox repair was completed on November 8, 2008, and no other entries were located revealing any time in service between the repair and when the gearbox was installed on the accident engine. The compressor, gearbox, and turbine assemblies were installed on the accident engine on December 16, 2013, and the engine was subsequently installed on the accident helicopter the next day.

At the time of installation on the accident helicopter, the engine had accrued 7,474.4 total hours in service and the compressor had 5,651.9 total hours in service and 0 hours since overhaul. On May 30, 2014, the gearbox was removed from the accident helicopter with a maintenance record entry that indicated it was "making metal." The entry further stated that the "bearings on N2 tach/gov spur gear shaft going bad." The manner in which the assemblies and the engine were stored prior to installation on the accident helicopter could not be determined.

METEOROLOGICAL INFORMATION

The 1553 recorded weather observation at Monroe Airport (EQY), Monroe, North Carolina, located about 22 nautical miles northwest of the accident location, included wind from 210ø at 6 knots, 10 statute miles of visibility, scattered clouds at 4,200 ft above ground level, temperature 31ø C, dew point 21ø C, and an altimeter setting of 29.99 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

According to photograph provided by an FAA inspector that responded to the accident location, the helicopter came to rest on its right side in a ditch. The ditch was located along a roadway that was perpendicular to the field that the pilot was spraying. The tailboom exhibited damage consistent with being severed by the main rotor blades, the skids were impacted separated, and the windscreen was damaged.

TEST AND RESEARCH

Engine Disassembly

On October 7, 2014, the engine was examined by an NTSB investigator at the engine manufacturer's facility. All fittings were found secured and in place, with the associated torque stripe showing no evidence of rotation. Compressed air was utilized and an air leak was observed at the B-nut on the Pc line; however, according to the engine manufacturer, the leak would not have precluded normal operation of the engine. The compressor was separated and the shims were counted and measured. The measurement was the same as the vibropeened number at the respective case points. Following case separation to facilitate further examination, the N1 rotated but had both tactile and audible resistance noted. N2 rotated smoothly with no resistance noted.

The accessory gearbox was disassembled; the bearings and transfer tube were all labeled as PMA (Part Manufacturer Approval) parts. The No. 2 bearing was examined in place and upon removal the inner race separated and three ball bearings were located outside of the race. The No. 2 bearing and associated hardware was sent to the NTSB Materials Laboratory for further examination. [Further information pertaining to the engine disassembly and examination can be found in the "Engine Examination Report" located in the public docket for this accident.]

NTSB Materials Laboratory Examination of the No. 2 bearing

The No. 2 bearing was examined by NTSB Materials Laboratory personnel. The components of the bearing exhibited discoloration consistent with heat damage and the bearing cage was fractured in multiple locations consistent with fatigue fracture features. The outer diameter of the outer race exhibited fretting damage and coked oil spray patterns. The inner race half, on the compressor-side of the bearing, was uniformly tinted black and was darker in color than the other race half and the outer race revealed circumferential sliding contact marks. The bearing balls were black in appearance. In addition, they were undersized when compared to engineering drawing requirements and displayed signatures consistent with material loss.

Accident Rpt# WPR17LA075 02/22/2017 1325 LCL	**Regis# N805LA**	**Unknown, PO**	**Apt: N/a**	
Acft Mk/Mdl HUGHES 369A-NO SERIES	**Acft SN 101355**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual**	**Prob Caus: Pending**
Eng Mk/Mdl ALLISON 250-C10D	**Acft TT 7375**	**Fatal 0 Ser Inj 2**	**Flt Conducted Under: FAR 091**	
Opr Name: JIMS AIR REPAIR	**Opr dba:**		**Aircraft Fire: NONE**	

Events

1. Prior to flight - Fuel contamination

Narrative

HISTORY OF FLIGHT

On February 22, 2017, about 1325 local time, a Hughes (McDonnell-Douglas/Boeing) model 369A helicopter, N805LA, was substantially damaged during an autorotation to the Pacific Ocean, in international waters near Guam. The commercial pilot was seriously injured, and the aerial observer's injuries were reported as "minor." The aerial observation flight was operated by Jim's Air Repair, which was owned by an individual who owned multiple helicopter operations, the largest of which was Hansen Helicopters. The flight was conducted under the provisions of 14 Code of Federal Regulations Part 91, during daylight visual meteorological conditions.

A written accident report was completed and submitted to the NTSB by a representative of Hansen Helicopters. According to that report, the flight was a fish-spotting mission that was operating from a Japanese fishing boat. The report stated that the helicopter had been airborne about 30 minutes, cruising about 1,000 ft above the ocean, when the pilot noticed that a "Generator Light" was illuminated. The report then stated that, in response to the light, the pilot applied friction to the collective control in order to free one hand to reset a switch, and that concurrently, the pilot "felt the helicopter drop suddenly." The pilot noticed that the main rotor rpm was "at the bottom of the green" arc on the cockpit instrumentation. He initiated an autorotation but the helicopter struck the water in what a Hansen representative termed a "hard landing." The main rotor blades severed the tail boom, but the helicopter remained upright and afloat, supported by its utility floats.

The wreckage was recovered to the fishing boat, and subsequently transported to a Hansen Helicopters facility on Guam. On March 13, 2017, representatives from the Federal Aviation Administration (FAA), Boeing, and Rolls Royce examined the wreckage at the Hansen facility.

PERSONNEL INFORMATION

The pilot was a US citizen who held FAA Commercial and Flight Instructor certificates. The filed report indicated that the pilot had about 2,936 total hours of flight experience, all of which were in helicopters, and 1,350 hours of which were in the accident helicopter make and model. The pilot's most recent flight review was completed in July 2015, and his most recent FAA second-class medical certificate was issued in January 2016. The medical certificate status reverted to third-class status after 12 months, and per FAA regulations, the pilot could not exercise his commercial privileges for compensation.

NTSB attempts to interview the pilot were unsuccessful; he was still hospitalized and could not be reached telephonically. FAA attempts to interview the pilot in person on March 13 were also unsuccessful; he refused to speak to the FAA without counsel, but was unable or unwilling to provide the name of, or any other contact information for, his counsel. Two days later, the pilot was transferred by air ambulance to the Philippines for surgery related to his accident injuries. The pilot made no subsequent contact with the NTSB.

The observer was a Japanese citizen, and according to a representative of Hansen Helicopters, he had no pilot experience. The observer was evacuated to Japan shortly after the accident, and no NTSB attempts were made to interview him.

AIRCRAFT INFORMATION

The helicopter, an OH-6A (Manufacturer's Model 369A, SN 101355) was delivered new to the US Army on February 24, 1970 as US Army SN 69-15985. Hughes Tool Company (HTC), Aircraft Division was the original manufacturer of the helicopter. HTC underwent several ownership (and name) changes subsequent to the production of this helicopter.

FAA registration and airworthiness documentation indicated that the helicopter was powered by a Rolls-Royce (Allison) C250 series turboshaft engine. FAA records indicated that the helicopter was first registered to Jim's Air Repair in August 2009. Jim's Air Repair is based in the country of Vanuatu.

Hansen-provided information stated that the airframe had 7,374.8 total hours of service, that the engine had 2,702.4 total hours of service, and that the engine had accumulated 393.7 hours in service since its most recent overhaul.

METEOROLOGICAL INFORMATION

The Hansen-provided accident report stated that the weather at the time of the event included winds from 350 degrees at 5 knots, visibility 20 miles, clear skies, temperature 26ø C, and daylight conditions.

WRECKAGE AND IMPACT INFORMATION

Airframe

The investigation team's first contact with the helicopter was about 3 weeks after the accident. The helicopter was examined inside a Hansen Helicopters building, where it was reported to have been stored since shortly after the accident. It was upright, resting on the left utility float, fuselage lower structure, and the right forward and aft struts. The right utility float had been removed from the helicopter during recovery. The four fuselage attach points for the landing gear struts/dampers were severely damaged, with torn skins and fractured structure.

The fuselage sustained extensive impact damage, with the left side more damaged than the right side. The tailboom was separated into at least two sections. According to the Hansen Helicopters report, one portion of the tail boom assembly that was severed by the main rotor blades during the ocean impact was lost at sea. The recovered section was fracture-separated from the fuselage near fuselage station (FS) 197.78, and extended to approximately FS 258.0. The recovered section showed evidence of main rotor blade contact. The tailboom aft of FS 258.0, including the vertical and horizontal stabilizers, tail rotor transmission, and the tail rotor system, was not recovered from the ocean.

The canopy windscreens and overhead transparencies, doors, and doorframe structures were all damaged from impact. The cockpit instrument panel and center console assembly, and its associated components, showed little damage. Two hour meters were located in the helicopter. One displayed a reading of 937.8 hours, and the other one displayed a reading of 1,245.9 hours. Hansen personnel did not provide any information regarding the functions of these two hour meters.

Both the left and right cockpit seat pans were significantly deformed downward, and their box structures were crushed. The seat restraint systems were intact and functional.

The helicopter was equipped with single pilot, left hand controls. Cyclic and collective control system continuity was confirmed. The cyclic stick balance was consistent with the trim actuators being neutral. Anti-torque control continuity was confirmed from the pilot's pedals to the fractured tail rotor control rod at the tailboom separation point.

The main rotor system hub assembly and components, strap assemblies, pitch housings, feather bearings, and pitch change links were relatively undamaged. The rotor system exhibited hub damage that was consistent with excessive blade lead/lag excursions and high flapping angles. All four main rotor blades were unbroken, with varying degrees of bends and skin damage. The damage to the main rotor system components was consistent with low rotor rpm, power-off, main rotor blade strikes.

Drivetrain continuity was established from the engine, through the main transmission, to the main rotor. Rotation of the main rotor hub by hand resulted in rotation of both the engine-to-transmission drive shaft and the tail rotor driveshaft. The over-running clutch assembly was functional. The transmission cooler blower assembly appeared undamaged. The main transmission appeared undamaged. One transmission magnetic chip plug had a small amount of unidentified paste-like material on it, and the other chip plug was clean.

The tail rotor driveshaft separation locations matched the locations of the tailboom separations. The shaft fracture signatures were consistent with lower-than-flight-normal rpm.

Engine

The engine is a two-spool design. In the direction of airflow, the first spool is referred to as "N1," and includes all 7 compressor stages and the first 2 turbine stages. The N1 turbine section, which drives the compressor, is also referred to as the "gas generator" turbine. The second spool includes the last two turbine stages and the mechanical accommodations to drive the rotor system. This section is also referred to as the "N2" or "power turbine" section.

The engine mounting structure was properly secured and generally intact. All engine mounts exhibited deformation consistent with a hard landing. Inspection of the engine exterior revealed no evidence of fire or uncontained failure. The N1 section was able to rotate freely, and had no indications of foreign object damage or housing rubbing. The N2 section showed no visible damage. Its rotation was stiff, but this appeared consistent with saltwater corrosion damage to the accessory gearbox, and not with impact damage.

All fuel, lubrication, and pneumatic lines, and their associated fittings, were found to be at least finger tight. No evidence of oil leakage was observed in the engine bay or surrounding area. The helicopter was positioned at an angle which precluded an accurate oil level determination, and no indications of oil underfill were noted.

No obstruction of the intake was noted, and no evidence of any mechanical failures or deficiencies that would have prevented normal engine operation was observed.

Fuel System

No information regarding the fuel on board, either at the time of departure or at the time of the accident, was provided to the investigation. No fuel was observed in the fuel tank during the examination. The fuel pump power wire was not wrapped around the start pump fuel line, as it was required to be; this condition can result in an erroneous fuel quantity indication. In addition, the in-tank quantity sensor exhibited visible corrosion.

A vacuum check of the engine fuel system indicated that there was a slow leak within the fuel system. During the check, systematic isolation of components traced the leak to a line that connected the fuel pump to the fuel control. The B-nut on the fuel pump side of this line was found to be excessively tight, and was the most likely leak source. However, visual examination of the B-nut ferrule did not reveal any obvious cracks or damage, and the exact source of the vacuum leak was not determined. According to the Rolls-Royce representative, the leak rate was insufficient to result in an engine power loss.

The fuel spray nozzle (FSN) appeared normal. The FSN filter screen exhibited contamination similar to that found in the fuel pump filter. A borescope examination revealed no evidence of foreign object damage or operational thermal damage to the gas generator turbine blades or nozzle vanes.

Significant evidence of water contamination was observed in the helicopter's fuel storage and delivery system, including all filters. The fuel cell cover was opened and water, with no evidence of fuel, was found inside the cell. Potential water entry points included the fuel vent system, a deficient fuel-cap seal, or tank damage. The investigation considered the possibility that damage, including torn/ripped structure around the fuel cell, might have compromised the fuel cell. However, no evidence of fuel leakage was observed, and no visible holes or tears were noted in the fuel bladder.

The contents drained from the fuel pump filter bowl contained significant amounts of entrained particulates, and a liquid suspected to be water. Water-detecting paste confirmed the presence of water. The filter bowl in the housing of the engine-driven fuel pump was opened and examined. The filter exhibited significant contamination of unknown particulate matter, a paste-like substance, and what appeared to be plant material.

With low or zero fuel pressure, such as when the engine is not operating, the fuel supply line from the fuel pump filter to the FSN is normally closed at both ends by spring-loaded check valves. These check valves trap the fluid immediately prior to its introduction into the FSN and combustion chamber. The fluid from that line was drained and examined. That fluid was observed to be about 30% water.

The fuel system architecture precluded introduction of water into either the fuel pump or the FSN fuel line unless the engine was operating.

Maintenance Records

Hansen personnel reported that a mechanic was stationed on the fishing boat with the helicopter, but they provided only his name to the investigation. They did not state whether he was a certificated mechanic, and did not provide any mechanic certificate or qualifications information for him. In addition, Hansen reported that the mechanic was sent home to the Philippines after the accident. The investigation did not attempt to contact the mechanic.

The Hansen Director of Maintenance (DOM) provided the investigation with a binder that he represented as being the helicopter maintenance records. The binder included a mix of flight records, status reports, and copies of FAA 337 forms. Exclusive of the 337 forms, none of the contents conformed to the FAA maintenance entry requirements. The records contained multiple internal service time and/or component number discrepancies. According to the FAA inspector, cursory comparisons of the 337 forms with the records on file with the FAA in Oklahoma City revealed numerous discrepancies.

The most recent recorded 100 hour/Annual, 300 hour, or 600 hour inspection was completed and signed off by the Hansen Helicopters DOM on 5/7/16. On that inspection entry, the airframe time was listed as 6,891.1 hours, and the "Hobbs time" was listed as 544.1 hours. The inspection entry stated "Next inspection due is a 100 hour at 6991.1" [hours]. However, despite the fact that all available information indicated that the helicopter has accumulated nearly 400 hours since that inspection, no additional FAA-compliant inspection entries were observed for dates subsequent to 5/17/16.

ORGANIZATIONAL AND MANAGEMENT INFORMATION

Ownership and Control

The accident report filed by Hansen Helicopters stated that the form had been completed by the pilot, and that "Jim's Air Repair" was the operator of the helicopter. A Hansen representative stated that two organizations were "affiliated companies," but did not provide any additional details at that time. In an email dated March 14, 2017, the representative stated that "Hansen Helicopters provides employment recruiting, training and logistical support for Jims Air Repair." In that same email, the Hansen representative also stated that the pilot was "working under a contractor's agreement with Jim's Air Repair out of Vanuatu."

Hansen Helicopters' primary facilities were in the US state of Georgia, and on Guam, a US territory. NTSB requests for documentation regarding the operational arrangements between Hansen Helicopters, Jim's Air Repair, the pilot, the maintenance providers, and the Japanese fishing boat were not satisfied; therefore the investigation was unable to independently determine which personnel and companies exercised the actual operational and maintenance control of the helicopter.

Injury Reporting Accuracy

The Hansen-filed written accident report to the NTSB indicated that the two persons on board sustained minor injuries, and Hansen never advised the NTSB of any changes to that status. About 13 days after the accident, the NTSB was advised via a third party that both the pilot and the observer had been hospitalized since the accident, as a result of injuries incurred in the accident. The NTSB was further advised by this third party that the observer had already been transferred to Japan, and that the pilot was scheduled to be transported to the Philippines for surgery for injuries sustained in the accident. The investigation was able to confirm that the pilot was seriously injured, but was unable to confirm the level or nature of the observer's injuries.

ADDITIONAL INFORMATION

Fuel Contamination Source

After the damaged helicopter was delivered to Guam by the fishing boat, the boat departed without examination by either Hansen Helicopters personnel or any investigation-related personnel. Therefore, the specifics of the boat's storage and dispensing system for the helicopter fuel, or the equipment and procedures related to prevention and detection of fuel contamination, were not able to be determined. Thus, the investigation was unable to determine the fishing boat's potential as the source of the water contamination of the fuel.

Additionally, because the investigation was unable to interview the pilot, the specifics of his activities and procedures, including preflight inspection, regarding the prevention or detection of fuel contamination, were not able to be determined. Although the evidence was consistent with the water being present in the helicopter fuel system prior to the flight, the investigation was unable to determine when or how the water entered the fuel system, or why the pilot failed to detect the water in the fuel.

Helicopter Fuel System Information

The helicopter was equipped with two fuel cells that were interconnected. The two fuel cells were of the conventional bladder type, and were located under the cabin floor in separate compartments. The helicopter was equipped with a single fuel filler neck and cap, located on the right side of the helicopter, aft of the cabin door.

The fuel cell sump drain was in the left fuel cell. There was one drain valve located on the lower fuselage in this sump area. It was spring-loaded to the closed position, and depressed (pushed in) to open. In addition, the helicopter was equipped with a drain valve that installed on the fuel line elbow assembly that was attached to the engine firewall.

Other Helicopter Systems and Flight Procedures

Helicopter electrical power was provided by a 24 volt battery, and a 28 volt starter-generator that was gear-driven by the engine. Generator output was controlled by a voltage regulator. The helicopter was equipped with a visual and aural caution/warning alerting system, part of which was an array of discrete, dedicated lights across the top of the instrument console. That alerting system was unable to be activated or tested during the examination due to a lack of electrical power on the helicopter.

One of those discrete annunciator lights was the "GEN OUT" light. According to the helicopter manufacturer's information, the dedicated "GEN OUT" annunciator light in the caution/warning array will illuminate when the generator "is not powering the electrical bus." A loss of engine power would result in such a condition and GEN OUT alert, among others. According to the helicopter manufacturer's guidance in the Rotorcraft Flight Manual (RFM), in the event of a generator failure, the pilot is to "Turn generator switch off" and "Reduce electrical load to 16 amperes or less, if possible."

The helicopter was equipped with N1, N2, and [Main] Rotor rpm gauges, also referred to as "tachometers." The N2 and Rotor rpm indications were presented on a single instrument, with two concentric scales and two indicating needles, one for each parameter. The scales were calibrated and positioned so that during normal operation, the N2 and Rotor rpm needles will be aligned with one another.

The tachometers were marked with green arcs and red radial lines to respectively denote normal operating range and minimum and maximum rpm values. The N2 scale was from 0 to 120%, and occupied an arc of about 290ø. The N2 lower and upper rpm values were 100% and 103% respectively, and therefore occupied an arc of about 8ø.

Engine power loss in this model helicopter will typically initially manifest itself with left yaw, decreases in engine and rotor rpm, and a change in noise level. Subsequent manifestations will include airspeed and altitude losses. To assist pilot detection of an engine failure, some helicopters of this model were equipped with an "Engine Out" alerting system. The system included a dedicated "ENG OUT" annunciator light, augmented by an aural warning horn. The generator switch must be ON to enable the Engine Out warning. N1 decrease below 55% will trigger these ENG OUT alert annunciations.

The accident helicopter was equipped with the ENG OUT annunciator light. However, the investigation was unable to determine the presence or condition of any of the other components of the Engine Out alerting system, or the pre- or post-accident functionality of that system, if in fact it was installed and intact.

The RFM procedures for an engine failure when operating more than 420 ft above the surface specified that the pilot should "enter normal autorotation by lower[ing the] collective pitch full down" and then selecting an appropriate landing spot and airspeed. The RFM also stated that an engine restart can be attempted at the pilot's "discretion."

For engine failures at altitudes below 420 ft, the RFM specified lowering of the collective to maintain minimum rotor rpm, and stated that the "amount and duration of collective reduction depends upon the height above the ground at which the engine failure occurs."

The pilot did not provide any indication that he was alerted to or noticed an engine power loss until after he became involved in addressing the generator problem, and the investigation was unable to question the pilot on his observations or actions.

Accident Rpt# GAA17CA146 03/12/2017 1700 PDT	**Regis# N675TH**	**Julian, CA**	**Apt: N/a**
Acft Mk/Mdl KAMAN AEROSPACE CORP K 1200-NO	**Acft SN A94-0025**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl HONEYWELL T5317-A1	**Acft TT 9821**	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 091**
Opr Name: TIMBERLINE HELICOPTERS INC	**Opr dba:**		**Aircraft Fire: NONE**
			AW Cert: STN

Events

1. Takeoff - Part(s) separation from AC

Narrative

The pilot of the helicopter reported that he had landed and was going to reposition to another company landing zone after dropping of his crew chief. The pilot opened the engine cowling to allow the engine to cool before restart. However, the pilot did not perform a thru flight walk around and climbed in to the cockpit and took off. About sixty seconds after departure, he felt a large thump throughout the airframe and landed as soon as practicable. Upon shutdown and inspection, he noticed that the engine cowling had departed the helicopter and struck the right two main rotor blades and the vertical stabilizer. Substantial damage was sustained to the right main rotor blades and the vertical stabilizer.

The pilot reported that there were no preaccident mechanical malfunctions or failures with the airplane that would have precluded normal operation.

In the recommendations section of the National Transportation Safety Board Pilot Aircraft Accident Report, the pilot specified that the company has issued a policy that prohibits opening the engine cowling for the sole purpose of allowing the engine to cool. Additionally, the policy directed a pre-takeoff helicopter inspection to be completed by a qualified technician.

Incident Rpt# CEN17IA319 **08/11/2017 1330 EDT**	**Regis# N113RC**	**Greenwood, MS**	**Apt: N/a**	
Acft Mk/Mdl PIPER PA 31T	**Acft SN 31T-7520009**	**Acft Dmg: MINOR**	**Rpt Status: Prelim**	**Prob Caus: Pending**
Eng Mk/Mdl U/A CANADA PT6A-27-28		**Fatal 0** **Ser Inj 0**	**Flt Conducted Under: FAR 091**	
Opr Name:	**Opr dba:**		**Aircraft Fire: NONE**	
			AW Cert: STN	

Events

3. Approach-VFR go-around - Flight control sys malf/fail

Narrative

On August 11, 2017, about 1330 eastern daylight time, a Piper PA 31T airplane, N113RC, experienced multiple systems anomalies while en route near Greenwood, Mississippi. The private pilot was not injured. The airplane sustained minor damage. The personal flight was conducted under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no Federal Aviation Administration (FAA) flight plan had been filed for the flight. The flight had departed Greenwood-Leflore Airport (GWO), Greenwood, Mississippi, about 1130.

According to initial statements from the pilot, while en route at 6,000 feet the landing gear horn sounded and the pilot was unable to silence the horn. The pilot elected to return to GWO for a precautionary landing, at which time the autopilot engaged. The pilot spent several hours trying to disengage the autopilot including conversations with pilots on the ground and a pilot from Piper Aircraft. Eventually the pilot was able to redirect the airplane to GWO with variable thrust from the engines and he landed the airplane without further incident. The airplane has been retained for an investigation.

an airsafety.com e-product

Prepared From Official Records of the NTSB By:

Air Data Research

9865 Tower View, Helotes, Texas 78023

210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# ERA14LA424 09/05/2014 1410 EDT	Regis# N900KN	Caribbean Sea, CB UN	Apt: N/a	
Acft Mk/Mdl SOCATA TBM 700	Acft SN 1003	Acft Dmg: DESTROYED	Rpt Status: Factual	Prob Caus: Pending
Eng Mk/Mdl P&W CANADA PT6A-66D	Acft TT 97	Fatal 2 Ser Inj 0	Flt Conducted Under: FAR 091	
Opr Name: NEW 51LG LLC	Opr dba:		Aircraft Fire: NONE	
			AW Cert: STN	

Events

1. Enroute-cruise - Pressure/environ sys malf/fail

Narrative

HISTORY OF FLIGHT

On September 5, 2014, about 1410 eastern daylight time (EDT), a Daher-Socata TBM700 (marketed as a TBM900 model), N900KN, was destroyed when it impacted open water in the Caribbean Sea near the northeast coast of Jamaica. The commercial pilot and the passenger were fatally injured. An instrument flight rules flight plan was filed for the cross-county flight that originated from Greater Rochester International Airport (ROC), Rochester, New York, at 0826 and was destined for Naples Municipal Airport (APF), Naples, Florida. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91.

The pilot used a fixed based operator (FBO) at ROC, his home airport, to hangar the airplane. On the day of the accident, FBO personnel towed the airplane to the ramp in advance of the pilot's arrival. The pilot arrived at the airport before the passenger, who was his wife, and briefly spoke with two of the FBO employees, who described his demeanor as relaxed. Once his wife arrived, they loaded their bags and then boarded the airplane. An FBO employee pulled the chocks and marshalled the airplane off the FBO ramp.

Surveillance video retrieved from the ROC airport showed that the airplane departed at 0826. According to recorded Federal Aviation Administration (FAA) air traffic control (ATC) information, a controller instructed the pilot to climb to 9,000 ft mean sea level (msl) and fly direct to a waypoint on the pilot's flight plan. Several minutes later, the controller instructed the pilot to climb to Flight Level (FL) 280, and the pilot complied. The flight proceeded without incident for about 45 minutes.

About 0912, ATC lost communications with the airplane for a few minutes. The airplane was operating in Cleveland Center's airspace at FL280 when the pilot was instructed to contact the controller of the next sector; however, he did not acknowledge the handoff or attempt to contact the handoff controller on the provided frequency. The controllers made multiple attempts to contact the pilot, but the pilot did not respond until about 4 minutes 30 seconds after the controller's initial handoff instruction. The pilot reported to the controller that "ah something happened I don't know what happened to you but we're back." The controller subsequently issued a new frequency, which the pilot acknowledged.

About 0917, the passenger contacted the new sector as previously instructed. The sector controller instructed the flight to contact Washington Center and provided a new frequency. The passenger acknowledged the instruction and checked in with the controller at Washington Center. All further radio communications from the airplane were made by the pilot.

At 1003:11, the pilot checked in with an Atlanta Center controller as instructed and confirmed that the flight was level at FL280. About 1 minute later, the pilot radioed "nine hundred kilo november we need to descend ah down to about one eight zero we ah have an indication that's not correct in the plane." The controller cleared the flight to FL250, and the pilot acknowledged, "two five zero and we need to get lower nine hundred kilo november." The controller asked whether the pilot was declaring an emergency, and at 1004:50, the pilot replied, "ah not yet but we'll let you know;" radar data indicated that the airplane had started to descend from FL280 and was at FL277 when this transmission occurred. The controller instructed the flight to turn left 30ø, and at 1005:02, the pilot acknowledged, "thirty left nine hundred kilo November." The pilot's speech during this period did not display any anomalies.

About 1005, the controller contacted another ATC facility to coordinate the airplane's clearance to a lower altitude. Although the pilot had not declared an emergency and had not specified the nature of his problem, the second facility agreed to redirect another airplane after the controller reported that the pilot had "a pressurization issue." By 1006, the controller had coordinated efforts to descend the airplane to FL200 and then to FL180.

At 1006:35, while the airplane was at FL250, the controller cleared the flight to descend and maintain FL200. After receiving no acknowledgement, the controller repeated his instruction at 1006:43, and the pilot quickly acknowledged, "two zero zero nine hundred kilo november." A continuation of the carrier signal on the audio recording indicated that the airplane transmit switch remained keyed (activated) for about 4 seconds after the pilot concluded his statement. Radar data showed that the airplane remained at FL250 instead of descending as cleared by ATC and acknowledged by the pilot.

At 1007:17, the controller cleared the flight direct to the Taylor VOR. No verbal response from the flight occurred, but the audio recording contained about 2 seconds of carrier signal, indicating that the airplane's radio transmit switch was keyed. The controller repeated his clearance, and at 1007:36, the pilot immediately responded, "direct taylor nine hundred kilo november." Radar data shows the airplane did not alter its course toward the Taylor VOR.

At 1008:10, the controller asked the flight to confirm that it had received the descent clearance to FL200. At 1008:15, the pilot replied, "two zero zero kilo November." Review of the audio recording indicated that the pilot's voice was faint during this transmission.

At 1008:40, the controller stated, "November zero kilo November descend and maintain flight level two zero zero and you are cleared direct taylor." The pilot responded immediately with, "direct kilo November nine hundred kilo November." Review of the audio recording indicated that the faintness in the pilot's voice associated with the previous call was gone. Subsequently, the controller made numerous attempts to contact the pilot, but no further radio transmissions (either verbal or carrier signal) from the flight were received.

About 1039, two Air National Guard (ANG) F-16s from McEntire Joint National Guard Base (MMT), Eastover, South Carolina, were vectored to intercept N900KN about 40 miles southeast of MMT. Minutes later, the F-16s intercepted the airplane on a 165ø magnetic heading at FL250 and 175 knots indicated airspeed. One of the ANG pilots made several radio calls to the accident airplane but did not receive a response. The F-16s completed a visual inspection of the airplane, which did not reveal any visible damage to the airplane or an accumulation of ice; however, there was a small line of condensation noted along the bottom of the right cockpit window. The engine was running, and the anti-collision lights were operating normally. According to a statement from one of the ANG pilots, he observed two occupants in the cockpit. The left seat was occupied by a male seated with his back straight, while the right seat occupant's torso and head were slouched against the fuselage aft of the right cockpit window. The ANG pilot also observed headsets on both occupants and noted that the left seat occupant's boom mic was pointed straight up. About 1 hour 20 minutes after the airplane was first intercepted, the left seat occupant's head slumped forward, which enabled the ANG pilots to see his chest rising and falling. Neither occupant was wearing an oxygen mask.

Two F-15s from Homestead Air Reserve Base (HST), Homestead, Florida, relieved the F-16s about 70 miles east of Daytona Beach, Florida about 1 hour after the initial intercept. According to one of the F-15 pilots, the airplane maintained the same heading, airspeed, and altitude as noted by the F-16 intercept from MMT. According to one of the F-15 pilot's statement, he did not observe any signs of smoke or fluids coming from the engine, which continued to function normally. The exterior lights and instrument panel were illuminated; however, the distance between the airplanes prevented the intercept pilots from reading the indications on the glass panel display. According to one of the F-15 pilots, the intercept group disengaged from the airplane before the flight reached Cuba.

The intercept from HST captured several digital camera photographs of the airplane that were forwarded to the NTSB. Review of the photographs confirmed that neither occupant was wearing an oxygen mask. Magnification of the photographs showed that the bottom corners of the emergency exit door on the right side of the cabin appeared to be recessed into the fuselage frame. A postaccident demonstration by the manufacturer revealed that the airplane's emergency exit door protruded out from the fuselage frame when the airplane was pressurized.

According to a review of FAA radar data, about 1409, the airplane entered a high rate of descent from FL250. The last radar target was recorded over open water about 10,000 ft msl, about 20 nautical miles north of Port Antonio, Jamaica.

Search aircraft and watercraft from the Jamaican Defense Authority and the United States Coast Guard observed an oil slick and small pieces of debris scattered over 1/4 mile near the last radar target. The airplane was subsequently located by an autonomous underwater vehicle and recovered by a salvage effort about 4 months after the accident.

PERSONNEL INFORMATION

Pilot

The pilot, age 68, held a commercial pilot certificate with ratings for airplane single-engine land and instrument airplane. His most recent FAA third-class medical certificate was issued on August 6, 2013, with the limitation "must wear glasses for distant [vision], [and] have glasses for near vision." A pilot data information sheet provided by SIMCOM Aviation Training showed that, at the time of his most recent training, which took place 1 week before the accident, the pilot reported a total of 7,100 flight hours with 240 hours within the preceding 12 months. The pilot's personal logbook(s) were not located after the accident. According to a friend of the pilot, the pilot had a high altitude endorsement, but he may not have received any training experience in an altitude chamber.

Before he purchased the accident airplane, the pilot had owned two other Daher-Socata TBM700 airplanes, a TBM700 "A" model (N51HT) and a TBM850 "Legacy" model (N51LG). According to a service center, the pilot purchased the A model in 1994 and accumulated about 2,700 flight hours in the airplane. He subsequently purchased the TBM850 model without a G1000 avionics suite, which he flew for about 1,250 hours before buying the accident airplane in April 2014.

The pilot's insurance policy authorized only the pilot and one other person to act as pilot in command of the accident airplane. Maintenance records indicated that the airplane was flown about 52 hours between the time the pilot purchased it and June 20, 2014. Data retrieved from a public flight tracking service showed that the airplane had accumulated about 50 additional flight hours between June 20, 2014, and the date of the accident. A cross-check of the flight tracking service's data with the FBO's departure/arrival log validated each flight with the exception of two arrivals. Thus, the maintenance records and flight tracking service data indicated that the airplane had been flown about 102 hours since the pilot acquired it.

The pilot completed a 5-day training course on the TBM900 at SIMCOM Aviation Training Center, Orlando, Florida on August 29, 2014, to satisfy an insurance policy requirement. According to a representative of SIMCOM, the course duration would have been about 8 hours per day for the first 3 days and about 6 hours per day for the remaining 2 days. The representative stated that the course's ground training addressed the technical aspects of the TBM900's airframe, engine, and avionics and included a review of the environmental system. The course's simulator training included environmental system inspections, failures, the controls for smoke or fume elimination, and emergency descent procedures. Proper oxygen mask donning procedures were also demonstrated and discussed. The pilot's instructor at SIMCOM stated that he instructs students to don their oxygen masks before troubleshooting any pressurization problems. The instructor further stated that he likely spent 45 minutes on pressurization system training in the classroom and another 45 minutes in the simulator. The airplane manufacturer reported that, at the time of the accident, SIMCOM had the only simulator that could present crew alerting system (CAS) messages related to the TBM900 pressurization system.

The pilot attended the course with a friend who was the other named pilot on the airplane's insurance policy, frequently accompanied him during personal flights, and commonly shared crewmember duties. According to the friend, who attended the first 3 days of the 5-day course, the pilot used a Garmin G1000 simulator program on his personal computer to familiarize himself with the system in advance of the SIMCOM course as this was his first airplane with a full glass cockpit display.

The pilot and his friend completed numerous flights together, including twelve flights in the accident airplane. He stated that the pilot was "religious" about adjusting the cabin altitude in flight; in the TBM850, the pilot would normally enter a climb and adjust cabin altitude simultaneously. During flights in the TBM900, he observed the pilot monitor cabin altitude by placing his finger on the multi-function display to verify cabin altitude during each instrument scan.

According to the pilot's friend, the pilot completed an "external walk around" inspection of the airplane before each flight. During inspections, the pilot's friend observed him physically open the door to the oxygen bottle and verify that the oxygen cylinder's valve was on. The pilot further used a gauge in the cockpit to confirm the flow of oxygen after he turned the cockpit oxygen switch on and tested the oxygen masks.

Family and friends indicated that the pilot was in excellent health. He was an occasional cigar smoker, took one medication for cholesterol, rarely consumed alcohol, and exercised regularly. The family did not report any unusual behaviors with the pilot or his wife in the 72 hours before the accident. A friend of the pilot stated that the pilot appeared to be in "excellent health and spirits" when he met with him the day before the accident.

Pilot-Rated Passenger

The pilot-rated passenger, age 68, held a private pilot certificate with a rating for airplane single-engine land. She reported a total flight experience of 410 hours on her latest third-class medical certificate application, dated July 1, 1992. The pilot-rated passenger's personal logbook(s) were not located after the accident.

AIRCRAFT INFORMATION

According to FAA records, the Daher-Socata TBM900 model, serial number 1003, was manufactured in 2014 and powered by a single Pratt and Whitney PT6A-66D turbo-prop engine. A standard airworthiness certificate was issued on March 6, 2014, and the airplane was subsequently registered to the pilot on April 8, 2014.

In March 2014, the factory-new airplane was delivered from the manufacturer's facility in France to an airplane sales and service company in Connecticut with a total of 37.6 flight hours. The service center completed several flights in the airplane before the pilot took possession of it in April 2014, at a total time of 44.3 flight hours. The first in-service inspection prescribed by the manufacturer was performed on June 20, 2014, at which time, the airplane and engine had accrued an additional 52 flight hours.

Airplane Fuel Performance

A report furnished by the FBO indicated that the airplane was last serviced with 177 gallons of fuel on August 29, 2014. According to the manufacturer's performance calculations, the airplane would have consumed about 23 gallons of fuel in 20 minutes during its climb to cruise altitude (FL280). After reaching FL280, the airplane then flew for about 5 hours 25 minutes. Based on the manufacturer's computation, this corresponds to a mean fuel flow of about 49 gallons per hour, which is consistent with normal cruise flight fuel performance.

Bleed Air and Cabin Pressurization System

The pilot's operating handbook (POH) states that the global air system is composed of three main subsystems: the engine bleed air system, the environmental control system, and the cabin pressure control system. These three subsystems are managed by a single-channel digital global air system controller (GASC) that receives the information from the sensors in the subsystems and from the cockpit displays and controls and issues the proper commands to the subsystem actuators and indication or warning elements. Specifically, the GASC controls the cabin pressure by modulating the amount of air dispelled from the cabin through the outflow valve. According to the POH, when the BLEED switch is set to AUTO, a ground fan cools down engine bleed air through the main heat exchanger, and the outflow valve (OFV) remains in the full open position until takeoff. After departure, the airplane's GASC controls the aperture of the OFV to reach its computed cabin altitude and rate of change.

Cabin Pressurization Control Panel

The airplane's maintenance manual shows that, once pressurized bleed air passes ports from the engine case, the BLEED switch enables GASC control of the opening of the flow control shut-off valve (FCSOV) and other components. When the BLEED switch is set to AUTO, the pilot controls cabin pressure by the PRES MODE (pressurization mode) switch through one of two modes, AUTO and MAX DIFF. In AUTO mode, the cabin altitude will remain below 10,000 ft msl, and the cabin differential pressure will not exceed 6.2 psi. In MAX DIFF mode, the system will maintain a cabin pressure of 0 ft when the airplane's altitude is below 13,500 ft msl. When the airplane climbs above 13,500 ft msl, the cabin altitude will not exceed 10,000 ft msl or a differential pressure of 6.0 psi. The system can be reset or turned off by setting the BLEED switch to OFF/RST (off/reset). A blocking device between the AUTO and OFF/RST positions prevents the pilot from inadvertently turning the switch to the OFF/RST position.

According to the normal procedures section of the POH, the pilot sets the BLEED switch to the OFF/RST position before starting the engine. After engine start, the pilot sets the BLEED switch to AUTO once the ammeter display is less than 100 amperes. The pilot also sets the A/C and PRES MODE switches to AUTO and adjusts the cabin temperature as necessary. After the adjustments have been made, the checklist does not call for the pilot to check the pressurization system until cruise altitude is reached.

Engine Bleed Air System

Bleed air is supplied to the pressurization system by the engine bleed air system, which is comprised of two engine bleed air ports: the P2.5 port, a lower pressure port, and the P3 port, a higher pressure port. A non-return valve (NRV) is fitted at the outlet of the P2.5 port, and an intermediate pressure port sensor (IPPS) is housed between the engine P2.5 port and the NRV. The P3 port contains a solenoid-activated shutoff valve (SOV) installed at the outlet of the P3 port. The SOV is normally sprung-closed and requires the solenoid to open. An overheat thermal switch (OTSW) is fitted beyond the junction of the P2.5 NRV and P3 SOV and before the bleed air reaches the FCSOV.

The GASC electronic module is designed to maintain a cabin altitude of less than 10,000 ft msl regardless of the pressurization mode setting. For most operations, the P2.5 bleed air supply is sufficient to pressurize the cabin until the airplane reaches a cruise flight altitude where it can operate with a reduced throttle setting. Should the air pressure measured by the IPPS decrease below 9.5 psig, the GASC programming laws will then automatically command the SOV to the open position, thus allowing higher pressure bleed air flow from the P3 line into the pressurization system. The increase in pressure from the P3 line will close the NRV, which isolates the P2.5 port. The GASC will command the SOV to the closed position once the P2.5 pressure returns to a value above 14.5 psig, which resumes the supply of bleed air from the P2.5 port to the pressurization system.

OTSW Design and Function

The OTSW is a stainless steel tube with a 3-pin threaded connector at one end and a switch module at the opposing end, which contains a bimetallic disc that controls the position of an open-closed electric switch. The switch is threaded into a pneumatic bleed tube upstream of the FCSOV, so that the flow of air from the P2.5 or P3 ports will pass the OTSW. The switch module is flush with the inner wall of the tube. As the module heats to 315ø C +/- 5ø C, the bimetallic disc will change from a concave to a convex shape. A pin is pushed by the disc during the shape transition to move the contacts to the open position. As the switch cools to 295ø C +/- 5ø C, the disc is designed to revert to its concave shape, thereby closing the contacts.

Pressurization System Overheat Protection

A function of the GASC programming is to protect the cabin in the event of a bleed air overheat or engine fire. According to the pressurization system manufacturer, when the OTSW detects a temperature of 315ø C, the contacts will open, which removes the electrical power that holds the spring-loaded SOV open. This causes the SOV in the P3 tube to close so that the P2.5 port becomes the primary source of bleed air for the cabin.

The GASC indirectly determines if the OTSW contacts are open or closed by measuring voltage in a parallel circuit. When the GASC detects an open OTSW state, a BLEED_OVHT fault code is recorded in the GASC non-volatile memory (NVM), accompanied by the activation of a 30-second timer. Should the temperature drop below 295ø C within 30 seconds, the OTSW will close, and the SOV will be re-energized, which returns the system to P3 mode.

If the OTSW contact state is still detected as open after the 30 seconds have elapsed, BLEED TEMP and BLEED OFF indications will be annunciated on the CAS, and the GASC will close the FCSOV, which discontinues the flow of bleed air into the cabin. This prompts an illumination of the cockpit master caution warning annunciator light and an aural alarm. In addition, the GASC will record a BLEED_TEMP fault code in the GASC NVM.

Loss of Engine Bleed Air Input to Cabin

Reduced engine bleed air supply to the environmental control system will cause a decrease in cabin pressure that will then cause the GASC to command the OFV to close. Without a bleed air supply to maintain selected cabin pressure, the cabin altitude will continue to increase until it equalizes with the ambient altitude. The rate of cabin depressurization depends upon the difference between the cabin and atmospheric pressures and upon the cabin leakage rate. Cabin leakage is normal and unavoidable, but the rate is limited to a maximum value specified in the airplane maintenance manual. A PC_COMP_OOR fault code will be recorded in the GASC NVM when the cabin pressure is detected to be out of range (below -3,550 ft or above 15,960 ft msl).

Leak Rate Chart

The airplane manufacturer developed and published "leak rate charts" to determine the overall pressure integrity of the airplane, both during manufacture and in service operation. The airplane was equipped with an additional door located on the left side of the cockpit referenced by the airplane manufacturer as a "pilot door." The manufacturer published two separate cabin leak rate charts: one for airplanes equipped with a pilot door and one for those without a pilot door. Each chart contains a line plotted as differential pressure versus time. The line represents the threshold (minimum allowable) time for the cabin pressure to decrease from one differential pressure value to another; that time is inversely proportional to the cabin leak rate. Thus, bleed-down times faster than those defined by the line indicate unacceptably high cabin leak rates, which must be corrected to render the airplane airworthy.

Review of the chart for airplanes equipped with a pilot door indicated that, at 28,000 ft, once pressurized air ceased to be supplied, the cabin pressure would bleed down to the ambient atmospheric pressure in about 4 minutes. The chart presumes that the cabin integrity is in compliance with the manufacturer's standards and that the OFV closes completely once pressurized air ceases to be supplied.

Emergency Oxygen System

The airplane's emergency oxygen system is intended to provide oxygen to the flight crew and passengers in the event of a loss of cabin pressurization. Oxygen is stored under high pressure in a single cylinder mounted outside the airplane's pressure vessel and inside the right wing root fairing. The cylinder holds the equivalent of 50.3 cubic ft of oxygen at sea level pressure.

The flight crew emergency oxygen system is comprised of two oxygen masks with smoke goggles and is manually controlled by a normally-closed OXYGEN switch-operated valve that must be turned ON in order for the system to supply oxygen to the masks. The BEFORE STARTING ENGINE procedure contains a step that calls for the pilot to turn the OXYGEN switch to the ON position. As long as the valve mounted on the physical oxygen cylinder is opened during the relevant PREFLIGHT INSPECTION procedure and the OXYGEN switch is in the ON position, both flight crewmembers will receive oxygen as they breathe if their oxygen masks have been donned.

The flight crew masks are secured in stowage cups located behind the cockpit seats, and each mask is equipped with a microphone, a three-position selector, and a button labeled PRESS TO TEST. To don a cockpit oxygen mask, the occupant must reach behind the opposite seat, remove the mask from its stowage cup, depress two vanes on the mask to inflate the harness, and then place it over their nose and mouth. The remaining oxygen quantity is transmitted by an electrical analog signal output and displayed to the flight crew on the Garmin GDU 1500 multi-function display (MFD). Once the mask is in use, the occupant can enable the mask microphone through the MICRO/MASK switch, which is normally set to MICRO via a switch guard.

The normal checklists in the POH specified the following numbered steps regarding the emergency oxygen system:

PREFLIGHT INSPECTION Procedure

13 - Rear R.H. karman [wing root fairing]

- Oxygen cylinder - Open

- Oxygen quantity - Checked

14 - Oxygen pressure - Checked

BEFORE STARTING ENGINE Procedure

10 - MICRO/MASK micro inverter - MICRO

42 - Pilot's OXYGEN switch - ON

43 - Front oxygen masks - Checked

Press push button "PRESS TO TEST": the blinker shall turn red momentarily, then turns transparent.

AFTER STARTING ENGINE Procedure:

4 - Oxygen supply - Available for the planned flight (see tables of paragraph "IN-FLIGHT AVAILABLE OXYGEN QUANTITY" in Chapter 4.4 and Chapter 7.10 for a FAR 135 type operation)

Oxygen Cylinder Maintenance

According to the airplane's maintenance records, a hydrostatic test was last performed in January 2013, and the airplane's oxygen cylinder was last refilled on March 28, 2014. An entry in the airplane logbook showed that the oxygen cylinder was last checked for security, corrosion, distortion, and attachment during the airplane's first inspection in June 2014. A representative of the airplane's service center stated that, at the first inspection, they would have added oxygen and recorded the work in the airplane's logbook if the service quantity was below full.

Emergency Procedures

According to the POH, the Emergency Descent procedures are as follows:

MAXIMUM RATE DESCENT

1 - Throttle - Flight IDLE

2 - OXYGEN - USE if necessary

3 - DESCENT - from - 10ø to - 20ø

Procedure in smooth air

6 - Speed 266 KIAS

Procedure in rough air or in case of structure problem

10 - Maintain IAS = kts

The POH also includes an Emergency Descent procedure for a Maximum Range Descent using the following procedures:

MAXIMUM RANGE DESCENT

1 - Throttle - CUT OFF

2 - Flaps - UP

3 - Landing gear control - UP

4 - SPEED IAS - 120 KIAS

5 - Oxygen - USE if necessary (Check oxygen duration before reaching 12,000 ft and check flow to passengers)

In the event of an anomaly, the avionics system will present warning messages in two different areas of the instrument panel; the CAS box in the MFD and lights labeled as "Master Caution" (red colored) and "Master Warning" (amber colored) located in the upper left corner of the panel between the left seat occupant's primary flight display and the glareshield. When a message appears in the CAS annunciator box, it is accompanied by the illumination of the master light that coincides with the colored CAS message and an aural tone to capture the pilot's attention. A red CAS message will be accompanied by a flashing red "Master Caution" indicator, which requires immediate action from the pilot. An amber CAS message will be accompanied by a fixed amber "Master Caution" indicator, which requires pilot action as soon as practical. The pilot must depress the corresponding red or amber light to terminate the warning tone.

The 656-page POH includes a 96-page emergency procedures section and a separate 98-page normal procedures section. Four separate pressurization system procedures are included in the emergency section, each of which corresponds to a color-coded CAS message. BLEED TEMP, CABIN DIFF PRESS, and CABIN ALTITUDE appear in red-colored text and BLEED OFF appears in amber-colored text.

A red BLEED TEMP CAS message, accompanied by both master and aural warnings, indicates an overheat of the bleed air system, which can lead to a termination of bleed air into the cabin and an amber warning and a BLEED OFF CAS message, also accompanied by both a master caution and aural warning. In the event of a "BLEED TEMP" indication, the pilot is instructed to do the following:

1 - If possible - REDUCE POWER

2 - HOT AIR FLOW distributor - turn to the right

3 - CONTROL selector - COCKPIT

4 - TEMP/øC selector - MINI

5 - BLEED switch - OFF/RST

6 - As soon as warning BLEED TEMP off, set BLEED switch to AUTO

When the BLEED OFF amber CAS message indication appears, the pilot is instructed to:

1 - CHECK BLEED switch position and - CORRECT

2 - If possible, reduce power

FLY THE AIRPLANE

3 - BLEED switch - OFF/RST (Reset)

4 - BLEED switch - AUTO

5 - If warning BLEED OFF displayed:

6 - Limit flight altitude to maintain cabin altitude < 10,000 feet

7 - If necessary (no oxygen available) - EMERGENCY DESCENT

8 - Continue flight

A red CABIN ALTITUDE CAS message accompanied by a master and aural warning will appear when the cabin altitude exceeds 10,000 ft ñ 500 ft. The POH instructs the pilot to complete the following procedure in the event of this indication:

1 - Pressurization indicator - CHECK

If cabin altitude is greater than 10,000 feet ñ 500 feet:

2 - OXYGEN - USE, if necessary

FLY THE AIRPLANE

3 - BLEED switch - CHECK AUTO

4 - DUMP switch - CHECK UNDER GUARD

5 - EMERGENCY RAM AIR control knob - CHECK PUSHED

6 - Limit flight altitude to maintain cabin altitude < 10,000 feet

7 - If necessary - EMERGENCY DESCENT

A CABIN DIFF PRESS message will appear if the cabin pressure differential is over 6.4 psi ñ 0.2 psi. The POH instructs the pilot to complete the following procedure in the event of this indication:

1 - Pressurization indicator - CHECK

If pressure change is greater than 6.4 PSI ñ 0.2 PSI:

2 - BLEED switch - OFF/RST

3 - Oxygen - Use, if necessary

METEOROLOGICAL INFORMATION

According to an NTSB weather study, the winds aloft at the airplane's cruising altitudes of FL280 and FL250 were from about 270ø at 15 knots and 140ø at 4 knots, respectively. The study found that the flight encountered some convective activity along the South Carolina coast, about 30 minutes after the pilot's final transmission to ATC.

WRECKAGE AND IMPACT INFORMATION

According to radar data, the airplane impacted the water at more than 300 knots and separated into small fragments. The wreckage was located by an underwater search vehicle, which revealed a 984-foot-long debris field, at a depth of about 10,000 ft. The debris field included the engine and several sections of the fuselage. Fuselage and engine components of the wreckage were recovered about 4 months after the accident and transported to Panama City, Florida, where NTSB and airplane manufacturer personnel identified and sorted the recovered components.

Among the components recovered by the investigative team were the FCSOV, the GASC, the SOV, and the Garmin G1000 primary flight display and its SD flash memory card. These items were packaged in sealed containers with distilled water to hinder corrosion before all of the recovered wreckage was transported to a secure facility in Maryland for further examination.

MEDICAL AND PATHOLOGICAL INFORMATION

A forensic examination was performed on the recovered occupant remains by the District Fourteen Medical Examiner, Panama City, Florida. The forensic report confirmed the identity of the occupants through an osteological examination.

According to a laboratory technician at the FAA Bioaeronautical Sciences Research Laboratory, a hypoxia clinical study could not be completed due to a lack of physical specimens.

TESTS AND RESEARCH

Sound Spectrum Study

An NTSB sound spectrum study showed that the pilot's microphone release time following each statement increased significantly about 2 minutes 30 seconds after he initially reported the "abnormal" indication to ATC. Further, a spectrograph of the radioed call sign revealed that the pilot began slurring his speech about 3 minutes after his initial report of the problem to ATC.

Non-Piloted Airplane Behavior

According to the airplane manufacturer, once the engine shuts down due to fuel starvation, the airplane will decelerate and increase its angle of attack as the autopilot continues to attempt to maintain altitude until the airplane stalls and the autopilot disengages.

OFV Examination

The OFV modulates the discharge airflow to control the cabin pressure and is controlled by the GASC through a torque motor. During ground operations, the OFV is normally in the full open position. When the airplane is airborne, the GASC controls the aperture of the OFV to reach the target cabin altitude at an optimized control rate. The OFV and safety valve (SFV) are equipped with overpressure and negative relief safety valves that are controlled by independent pneumatic modules that override the GASC control; these are intended to prevent excessive differential pressure values. The pressurization system manufacturer stated that the OFV and SFV are designed to close within 1 second in response to a cessation of bleed airflow into the cabin. The OFV will remain closed unless negative differential pressure is encountered during a descent.

The accident airplane's OFV was recovered from the ocean; it remained attached to the aft pressure bulkhead and was not damaged by impact. Saltwater immersion damage and accumulated organic ocean material prevented testing of the torque motor. Scars at the contact interface indicated that the valve was shut at impact.

SFV Examination

According to the manufacturer's reference materials, the SFV ensures negative pressure relief and prevents cabin overpressure. The SFV is designed to open when the cabin altitude is greater than the outside pressure.

The accident airplane's SFV was recovered from the ocean; it remained attached to the aft pressure bulkhead, but the valve body was fractured at each of the six aluminum braces, and the center body was broken. The valve body could not be manipulated by hand due to damage and accumulated oceanic material, which precluded testing the unit in the manufacturer's air chamber. Multiple functional tests of the subcomponents were completed at the pressurization system manufacturer's facility, including leak tests of the manometric chamber overpressure relief valve, servo chamber, and cabin pressure valve. The SFV tests did not reveal any anomalies, and the component examination indicated that the valve was open about 13 mm at the time of impact.

GASC NVM Data and Garmin G1000 primary flight display SD Flash Memory Card

According to the pressurization system manufacturer, the GASC NVM stores fault codes in its memory, which are overwritten after each take-off. The fault codes are recorded in the sequence in which they occur without time stamps.

Both the recovered GASC unit and primary flight display SD card were submitted to the NTSB Recorders laboratory for possible data download. The SD card was successfully read but did not contain any accident-related data.

The GASC was severely damaged by impact forces. The internal NVM data was extracted using laboratory hardware and software provided by the manufacturer of the pressurization system. The data showed multiple CAS message fault codes that were generated by the GASC during the flight, in the following sequence: ECS_HEATING FAULT, BLEED_TEMP, BLEED_OVHT, and PC_COMP_OOR.

FCSOV Examination

Examination of the recovered FCSOV revealed that the unit was in the closed position and sealed by oceanic deposits. The valve was subsequently disassembled at the pressurization system manufacturer's facility in Toulouse, France. Further examination of the unit's witness marks and actuator components confirmed that it was in a closed position at impact.

BLEED and PRES MODE Switch Examinations

The recovered BLEED and PRES MODE switches were both found in the AUTO position. The locking gate of each switch displayed an imprint on its AUTO position, and the OFF/RST side of each switch did not display any deformation or imprints, consistent with the switches being in the AUTO position at impact.

OTSW Examination

The OTSW was recovered from the wreckage and subsequently tested at the manufacturer's facility in Redmond, Washington. After an electrical resistance test, the switch was inserted into a mounting rack alongside an exemplar switch and placed in a static oven that was slowly heated to 336ø C. The exemplar unit's contacts opened after 2 minutes 47 seconds. At 3 minutes 25 seconds, the switch burst open with a loud noise and sufficient force to bend the mounting rack, which precluded further testing as the welded area of the switch had split open. Disassembly revealed that the switch had been filled with sea water, which had turned to steam and pressurized the switch until it burst. The dielectric and insulation tests were not performed as a result of this damage.

The top of the switch module was covered in a black residue typical of corrosion and exhibited extensive surface pitting. The larger pits were near the wire terminals and proximal to different types of metal. A microscope examination revealed no evidence of heat or molten globules, but confirmed the presence of flaking, consistent with salt water corrosion. The switch module was subsequently tested inside the static oven after the wires were intentionally separated from the welds at the switch module terminals. Similar to the previous test, the unit was slowly heated until the switch contacts opened, which occurred at 326.8ø C. The switch is designed to open at 315ø +/- 5øC and close at 295øC +/- 5øC.

Disassembly of the switch module revealed the presence of brown deposits and extensive rust on the interior surfaces of the module wall that were the result of long-term saltwater immersion. The sleeve that held the bimetallic thermal disc in place was rusted over. A subsequent examination of the switch contacts at the manufacturer's facility showed evidence of electrical wear and material transfer pitting on the contact surfaces. An evaluation was completed by the Air Force Research Laboratory (AFRL) Materials Integrity Branch. The AFRL reported that the wear and pitting were consistent with arc erosion. The evaluation also stated that the damage was typical for a used switch and not considered excessive.

Examination of OTSWs from Other Airplanes

According to records supplied by the airplane manufacturer, at least 18 OTSWs had been replaced between 2008 and October 2015, including 3 that were replaced after the accident. At least 12 of the records included statements from pilots or mechanics that the cabin had depressurized in flight.

The three OTSWs that were replaced after this accident were examined and tested at the switch manufacturer's facility. The examinations revealed small amounts of contact wear, which was consistent with having been in service. Two of the three switches passed functional testing, and it was later determined that the third switch had been improperly field tested. The contacts of this unit were not burned, welded, or otherwise abnormal.

The OTSW manufacturer provided contacts from two test switches that had accumulated 100,000 resistive load cycles. The wear area of the contacts from one of the test switches exhibited a wider area of material transfer between the contacts and a pit depth similar to the accident switch contacts. For additional details, please refer to the Systems Group Chairman Factual Report in the NTSB public docket.

Oxygen Switch Examination

The airplane's oxygen cylinder and flight crew masks were not recovered. An examination of the cockpit OXYGEN switch revealed that it was in the OFF position, which would have prevented the flow of oxygen to the oxygen masks. A subsequent microscopic inspection of the toggle switch base did not show any indication that the switch was in a different position at impact.

Hypoxia

The FAA's Aeronautical Information Manual (Section 8-1-2) states that "the effects of hypoxia are usually quite difficult to recognize, especially when they occur gradually."

FAA Advisory Circular (AC) 61-107B (Aircraft Operations at Altitudes Above 25,000 Feet Mean Sea Level or Mach Numbers Greater Than .75) states that altitude hypoxia is caused by "an insufficient partial pressure of oxygen in the inhaled air resulting from reduced oxygen pressure in the atmosphere at altitude. Altitude hypoxia poses the greatest potential physiological hazard to a flightcrew member when at altitude. Supplemental oxygen will combat hypoxic hypoxia within seconds. Check your oxygen systems periodically to ensure an adequate supply of oxygen and that the system is functioning properly. Perform this check frequently with increasing altitude. If supplemental oxygen is not available, initiate an emergency descent to an altitude below 10,000 ft MSL."

AC 61-107B includes the following warning concerning altitude hypoxia:

"If hypoxia is suspected, immediately don oxygen mask and breathe 100 percent oxygen slowly. Descend to a safe altitude. If supplemental oxygen is not available, initiate an emergency descent to an altitude below 10,000 ft MSL. If symptoms persist, land as soon as possible."

AC 61-107B also describes the concept of "time of useful consciousness" (TUC) or "effective performance time" (EPT) as follows:

"This is the period of time from interruption of the oxygen supply, or exposure to an oxygen-poor environment, to the time when an individual is no longer capable of taking proper corrective and protective action. The faster the rate of ascent, the worse the impairment and the faster it happens. TUC also decreases with increasing altitude. Figure 2-3, Times of Useful Consciousness versus Altitude, shows the trend in TUC as a function of altitude. However, slow decompression is as dangerous as or more dangerous than a rapid decompression. By its nature, a rapid decompression commands attention. In contrast, a slow decompression may go unnoticed and the resultant hypoxia may be unrecognized by the pilot."

AC61-107B includes the following warning concerning TUC:

"The TUC does not mean the onset of unconsciousness. Impaired performance may be immediate. Prompt use of 100 percent oxygen is critical."

Figure 2-3 in AC 61-107B indicates that the TUC/EPT for a slow decompression at 28,000 ft is 2.5 to 3 minutes, and at 25,000 ft it is 3 to 5 minutes. The table notes that "the times provided are averages only and based on an individual at rest. Physical activity at altitude, fatigue, self-imposed stress, and individual variation will make the times vary."

According to The Principles of Clinical Medicine for Space Flight, the "EPT tables were designed with data largely derived from young healthy military aviators seated at rest in altitude chambers." The accident pilot was typical of a more mature population of business owners and non-professional pilots that are required to hold a high altitude endorsement to act as pilot-in-command of an airplane that has a service ceiling or maximum operating altitude above 25,000 ft msl as prescribed by 14 CFR Part 61.31(g)(1). The regulation does not require the endorsement candidate to experience a simulated sudden depressurization in an altitude chamber.

ADDITIONAL INFORMATION

Airplane Manufacturer Service Bulletin SB70-226

About 14 months after the accident, in November 2015, the airplane manufacturer issued a service bulletin to address the reports of BLEED OFF CAS messages and the associated shutdowns of the airplane's pressurization system. The service bulletin implements a GASC software revision to maximize bleed availability through a wiring adjustment that causes the FCSOV to remain open and continue the flow of bleed air into the cabin after the OTSW contact state is detected as OPEN. The service bulletin results in the cabin losing heat without depressurizing, and the pilot will continue to receive the visual CAS warning message and aural warning alarm.

POH Revision

Following the accident, the airplane manufacturer revised some of the emergency checklists in the POH for the TBM930 model (the model of the TBM700 currently in production) to make "Use Oxygen Mask" the first checklist item in the "relevant emergency procedures." The manufacturer plans, in 2017, to make similar revisions to the checklists in the operating handbooks of prior models.

Accident Rpt# ANC17LA046 08/16/2017 1800 AKD Regis# N32LF Talkeetna, AK Apt: Stephan Lake Lodge AK61
Acft Mk/Mdl THRUSH S2R-800 Acft SN 5089R Acft Dmg: SUBSTANTIAL Rpt Status: Prelim Prob Caus: Pending
Eng Mk/Mdl HONEYWELL AERSOPACE Fatal 0 Ser Inj 0 Flt Conducted Under: FAR 091
Opr Name: GLENN AIR, INC. Opr dba: GLENN AIR, INC. Aircraft Fire: NONE
AW Cert: SPR

Events

1. Landing-flare/touchdown - Sys/Comp malf/fail (non-power)

Narrative

On August 16, 2017, about 1800 Alaska daylight time, a turbine-powered Thrush (formerly Rockwell International) S2R-800 airplane, N32LF, lost control and impacted terrain while landing at the Stephan Lake Lodge Airport, Talkeetna, Alaska about 46 miles northeast of Talkeetna. The commercial pilot sustained no injury, and the airplane sustained substantial damage. The airplane was registered to, and operated by, Glenn Air, Inc., Palmer, Alaska, as a visual flight rules flight under the provisions of 14 Code of Federal Regulations (CFR) Part 91. Visual meteorological conditions prevailed at the time of the accident, and company flight following procedures were in effect. The flight originated from the Willow Airport, Willow, Alaska about 1730.

The pilot reported that the purpose of the flight was to transport bulk fuel to the Stephan Lake Lodge Airport. Upon taking off from the Willow Airport, the pilot reported he heard a "wack" noise emit from the rear of the airplane which he attributed to a rock impacting a flap. After an uneventful flight, the pilot proceeded to land into the wind to runway 18 at the Stephan Lake Lodge Airport. Upon touchdown on the dirt and gravel runway, the tail of the airplane came down, and the pilot reported he heard a "loud bang." He reported the tailwheel assembly "went clear" to the ground and he had no rudder authority. The pilot attempted to control the airplane, he maintained a straight path for about 600 feet, and the plane departed the runway to the right going about 25 miles per hour. The airplane came to rest after impacting a ditch running parallel to the runway. A postaccident inspection by the pilot revealed that a bolt in the front tail spring attachment assembly failed.

The airplane sustained substantial damage to the left wing and the empennage.

The wreckage was recovered and transported to a secure facility for future examination of the airframe.