

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA16LA322	09/23/2016 1215 EDT	Regis# N139AJ	Norfolk, VA	Apt: Hampton Roads Executive PVG
Acft Mk/Mdl AERO VODOCHODY L 39-ZO		Acft SN 330214	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl IVCHENKO AL-25SERIES		Acft TT 3017	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: WARBIRDS LLC		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPE

Events

1. Approach-VFR pattern final - Flight control sys malff/fail
2. Landing-landing roll - Collision during takeoff/land

Narrative

On September 23, 2016, at 1215 eastern daylight time, an Aero Vodochody L39, N139AJ, was substantially damaged after it impacted trees during a runway excursion while landing at Hampton Roads Executive Airport (PVG), Norfolk, Virginia. The private pilot was not injured. Visual meteorological conditions prevailed, and no flight plan had been filed for the personal flight that was operated under the provisions of 14 Code of Federal Regulations Part 91.

According to the pilot, the airplane was on final approach to runway 28, about 100 ft above ground level and 60 ft from the runway threshold, when there was an "uncommanded" retraction of the flaps. He adjusted the pitch of the airplane and advanced the throttle in order to compensate for the flap retraction. The airplane touched down on the paved surface of the runway, the pilot applied the brakes, and then he applied the emergency brake. As the airplane began to veer toward the side of the runway, the pilot released the emergency brake, and continued to apply the brakes utilizing the brake pedals. The pilot stated that the "normal" braking action was insufficient to keep the airplane from over-running the runway. The airplane continued off the departure end of the runway, struck trees, and came to rest about 1,050 feet from the end of runway 28, which was a 5,350-ft-long runway.

An examination of the runway revealed that skid marks from the airplane began around 1,000 ft prior to the departure end of the runway and continued into the area where the airplane came to rest.

According to Federal Aviation Administration (FAA) records, the airplane was issued an experimental exhibition airworthiness certificate on December 12, 2007. It was powered by a Ivchenko, AI-25TL engine. According to the pilot, the most recent condition inspection was performed on September 1, 2016, at an airframe total time of 3,016.9 total hours. According to the emergency checklist located in the airplane, it was equipped with an emergency flap extension system. The pilot did not mention using the emergency flap extension system during the accident sequence.

An examination of the flap system, under the oversight of an FAA inspector, revealed that there were no disconnects or abnormalities in the flap mechanical actuation system besides the impact damage, which prevented a test of the flap system. The flap actuator was intact and no evidence of hydraulic leakage was noted. The emergency flap extension handle located to the right of the pilot's seat was moved without anomaly.

A review of the accident airplane's flight manual revealed, under the conditions that existed at the time of the accident, that the landing ground roll distance was approximately 2,000 feet, and was based on the circumstances of idle engine power, full flaps, and the speedbrakes retracted.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN16LA208	06/06/2016 1316 CDT	Regis# N10325	Ropesville, TX	Apt: N/a
Acft Mk/Mdl AIR TRACTOR AT-502		Acft SN 502-0078	Acft Dmg: DESTROYED	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl P&W CANADA PT6A-60A			Fatal 0 Ser Inj 1	Flt Conducted Under: FAR 137
Opr Name: T-C AERIAL LLC		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPR

Events

1. Maneuvering-low-alt flying - Loss of control in flight
4. Maneuvering-low-alt flying - Loss of control in flight

Narrative

On June 6, 2016, at 1316 central daylight time, an Air Tractor Inc. AT-502, N10325, impacted terrain during an aerial application of a field near Ropesville, Texas. The airplane was destroyed. The pilot received serious injuries. The airplane was operated by T-C Aerial LLC under the provisions of 14 Code of Federal Regulations Part 137 as an aerial application flight that was not operating on a flight plan. Visual meteorological conditions prevailed at the time of the accident.

The pilot stated that during a "routine" aerial application, he circled the field to be sprayed to locate obstacles. He sprayed the field from north to south and made passes from east to west. During the third pass when the airplane exited the field to west to return for an eastward pass, he felt the airplane shake at the apex of the turn. He said that he "corrected for the shake/stall," and the shaking quit for a moment. He then felt the right wing "take a hard dip." The airplane entered a right roll and impacted the ground.

The pilot stated that there was no mechanical malfunction/failure of the airplane.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA17LA286	08/21/2017 1830 CDT	Regis# N247LA	Shaw, MS	Apt: Tapley Airport 1MS0
Acft Mk/Mdl AIR TRACTOR INC AT 402A		Acft SN 402A-1247	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
Eng Mk/Mdl PRATT & WHITNEY CANADA PT6A-31	Acft TT 2679	Fatal 0	Ser Inj 0	Flt Conducted Under: FAR 137
Opr Name: BOAIR INC	Opr dba:			Aircraft Fire: NONE
				AW Cert: SPR

Events

1. Takeoff - Runway excursion

Narrative

On August 21, 2017, about 1830 central daylight time, an Air Tractor AT-402A, N247LA, was substantially damaged when it impacted terrain during takeoff from Tapley Airport (1MS0), Shaw, Mississippi. The commercial pilot was not injured. The airplane was operated by Boair Inc. as an aerial application flight conducted under the provisions of 14 Code of Federal Regulations Part 137. Visual meteorological conditions prevailed, and no flight plan was filed for the local flight.

According to the pilot, after taxiing to, and lining up on runway 27 at 1MS0 with a full load of herbicide onboard, he applied power for takeoff. He noticed that the engine was at maximum torque and maximum rpm. When the airplane reached the end of the paved portion of the runway, he could "feel that the airplane did not want to fly." He then lowered the wing flaps and "pushed the throttle to the stop," but the airplane was still not flying. As he approached the end of the runway, he dumped the load of herbicide that was in the hopper tank. Then as he left the runway, the left wing "went down" and the right wing "went up," and the main landing gear separated from the airplane as the airplane crossed a drainage ditch. The airplane then slid, spun around, and came to rest in a bean field.

The pilot also advised that before this flight, he had been flying all day, and had previously taken two loads of the same mixture and quantity in the hopper tank with no indication of any problems.

Cursory examination of the airplane by a Federal Aviation Administration (FAA), inspector, revealed that the airplane was substantially damaged. The aft fuselage was bent and torn almost in half, the main landing gear had separated from its mounting position, the tail wheel was damaged, and the right and left wings were bent and twisted.

According to Federal Aviation Administration (FAA) records and pilot records, the pilot held a commercial pilot certificate with a rating for airplane single-engine land. His most recent FAA second-class medical certificate was issued on November 16, 2016. He reported that he had accrued 5,400 total hours of flight experience, 3,850 of which was in the accident airplane make and model.

According to FAA airworthiness and maintenance records, the airplane was manufactured in 2012. Its most recent annual inspection was completed on March 1, 2017. At the time of the accident, the airplane had accrued 2,679 total hours of operation.

The reported weather at Cleveland Municipal Airport (RNV), located 10 nautical miles north of the accident site, at 1835, included: wind 280ø at 4 knots, 10 miles visibility, scattered clouds at 4,800 ft., temperature 33ø C, dew point 24ø degrees C, and an altimeter setting of 30.04 inches of mercury.

The wreckage was retained by the NTSB for further examination.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# GAA17CA360	06/22/2017 1600	Regis# N700LA	Portales, NM	Apt: N/a
Acft Mk/Mdl AIR TRACTOR INC AT 502-B		Acft SN 502B-0700	Acft Dmg: DESTROYED	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl P&W CANADA PT6A-34AG		Acft TT 6435	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 137
Opr Name: KING AG AVIATION INC.		Opr dba:		Aircraft Fire: GRD
				AW Cert: SPR

Summary

The pilot reported that, during an agricultural application flight and while maneuvering at the destination field in a left turn, he realized that the airplane was not going to be able to climb over transmission lines in his flightpath. He added that he lowered the nose to fly under the transmission lines, but the "airspeed was still too low," and the airplane impacted an embankment, slid across the ground for about 100 ft, and nosed over.

The airplane was destroyed by the impact and a postcrash fire.

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

An automated weather observation station 10 nautical miles north of the accident reported, about 5 minutes before the accident, calm wind, temperature 102°F (39°C), dewpoint 43°F (6°C), and barometric setting of 29.77 inches of mercury. The calculated density altitude was 8,200 ft.

According to the Federal Aviation Administration Koch Chart, considering the surrounding temperature and field elevation, the airplane would have likely experienced a 65% decrease in the normal climb rate.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's decision to fly the airplane under transmission lines while maneuvering at low altitude in high-density altitude conditions, which resulted in subsequent collision with terrain.

Events

1. Maneuvering-low-alt flying - Other weather encounter
2. Maneuvering-low-alt flying - Abrupt maneuver
3. Maneuvering-low-alt flying - Loss of control in flight
4. Maneuvering-low-alt flying - Collision with terr/obj (non-CFIT)

Findings - Cause/Factor

1. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-Altitude-Not attained/maintained - C
2. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-Heading/course-Incorrect use/operation - C
3. Personnel issues-Task performance-Use of equip/info-Aircraft control-Pilot - C
4. Personnel issues-Action/decision-Info processing/decision-Decision making/judgment-Pilot - C
5. Environmental issues-Physical environment-Object/animal/substance-Wire-Effect on operation - C
6. Environmental issues-Conditions/weather/phenomena-Temp/humidity/pressure-High density altitude-Effect on operation

Narrative

The pilot reported that, during an aerial application flight while maneuvering at the destination field in a left turn, he realized that the airplane was not going to be able to climb over transmission lines in his flight path. He added that he lowered the nose to fly under the transmission lines, but the "airspeed was still too low" and the airplane impacted an embankment, slid across the ground for about 100 ft., and nosed over.

The airplane was destroyed by the impact and a post-crash fire.

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

An automated weather observation station, 10 nautical miles north of the accident, about 5 minutes before the accident, reported the wind as calm, temperature 102°F (39°C), dewpoint 43°F (6°C), and barometric setting of 29.77" Hg. The calculated density altitude was 8,200 ft.

According to the Federal Aviation Administration Koch Chart, when considering the surrounding temperature and field elevation, the airplane would have likely experienced a 65% decrease in the normal climb rate.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN18LA019	10/24/2017 820 CDT	Regis# N502G	Olton, TX	Apt: N/a
Acft Mk/Mdl AIR TRACTOR INC AT 502B		Acft SN 502B-0591	Acft Dmg: DESTROYED	Rpt Status: Prelim Prob Caus: Pending
Eng Mk/Mdl PRATT&WHITNEY CANADA PT6A-34AG			Fatal 0 Ser Inj 1	Flt Conducted Under: FAR 137
Opr Name: KING AG AVIATION INC		Opr dba:		Aircraft Fire: GRD
				AW Cert: SPR

Events

1. Maneuvering - Aerodynamic stall/spin
-

Narrative

On October 24, 2017, about 0820 central daylight time, an Air Tractor AT-502B airplane, N502G, impacted a field about 5 miles west of Olton, Texas. The pilot sustained serious injuries and the airplane was destroyed by a postimpact fire. The airplane was registered to G B Aerial Applications Inc., and operated by King Ag Aviation Inc., under the provisions of 14 Code of Federal Regulations Part 137 as an aerial application flight. Visual meteorological conditions prevailed at the time of the accident and no flight plan had been filed. The local flight had departed Fairview Field Airport (XA05), Sudan, Texas.

The airplane's owner stated that the airplane was being utilized by another operator, King Ag Aviation, who was the pilot's employer.

Local law enforcement stated that multiple witnesses observed the accident sequence. The witnesses reported that the airplane was flying north over highway 70 and made a left turn towards west. During the left turn the airplane descended, impacted a field and burst into flames. The pilot exited the airplane and was transported via helicopter to a hospital in Lubbock, Texas.

The responding Federal Aviation Administration (FAA) inspector reported that the airplane came to rest facing south and was mostly consumed by a postimpact fire (figure 1). The engine was buried in the mud and only one propeller blade was visible.

The wreckage was retained for further examination.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# GAA17CA244	04/24/2017 1225 CDT	Regis# N899CZ	Waukesha, WI	Apt: Waukesha County UES
Acft Mk/Mdl BEECH 99-A		Acft SN U-96	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl PRATT & WHITNEY PT6A-28		Acft TT 30823	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: FREIGHT RUNNERS EXPRESS INC		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Summary

The pilot flying the airplane reported that, during an instrument flight rules instructional flight, the airplane was established on a very high frequency omnidirectional range approach. The pilot reported that, during the approach, he observed a large bird dive into the airplane's nose section. The pilot recalled that there was no time to react between the initial observation and impact. He terminated the training flight and landed the airplane as soon as practical and without further incident. The airplane sustained substantial damage to the fuselage frame.

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

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: An in-flight collision with a bird during the approach.

Events

1. Enroute - Birdstrike

Findings - Cause/Factor

1. Environmental issues-Physical environment-Object/animal/substance-Animal(s)/bird(s)-Ability to respond/compensate - C

Narrative

The pilot in command (PIC) of the airplane reported that during an instrument flight rules instructional flight, the airplane was established on a very high frequency omnidirectional range approach. The PIC reported that during the approach he observed a large bird that dove into the nose section of the airplane. The PIC recalled that there wasn't any reaction time between the initial observation and impact. He terminated the training flight and landed the airplane as soon as practical and without further incident. The airplane sustained substantial damage to the fuselage frame.

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

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# GAA17CA495	08/20/2017 1230 PDT	Regis# N6259C	Minden, NV	Apt: Minden-tahoe MEV
Acft Mk/Mdl BELL 206-B		Acft SN 703	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ROLLS ROYCE 250-C20B		Acft TT 22237	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: HELICOPTER PARTS INTERNATIONAL INC		Opr dba:		Aircraft Fire: NONE AW Cert: STN

Events

1. Landing - Loss of tail rotor effectiveness
-

Narrative

The pilot of the helicopter reported that, during landing, the helicopter "encountered LTE [loss of tail rotor effectiveness]". He added that he maneuvered the helicopter to an open field adjacent to the intended helipad and the tail rotor impacted a barbed wire fence.

The helicopter sustained substantial damage to the empennage.

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

Federal Aviation Administration's Helicopter Flying Handbook, FAA-H-8083-21A, contains a section titled "Loss of Tail Rotor Effectiveness (LTE)" which states:

Loss of tail rotor effectiveness (LTE) or an unanticipated yaw is defined as an uncommanded, rapid yaw towards the advancing blade which does not subside of its own accord. It can result in the loss of the aircraft if left unchecked. It is very important for pilots to understand that LTE is caused by an aerodynamic interaction between the main rotor and tail rotor and not caused from a mechanical failure. Some helicopter types are more likely to encounter LTE due to the normal certification thrust produced by having a tail rotor that, although meeting certification standards, is not always able to produce the additional thrust demanded by the pilot.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# GAA17CA218	04/06/2017 1035 PDT	Regis# N206SA	La Verne, CA	Apt: Brackett Field POC
Acft Mk/Mdl BELL 206-B		Acft SN 1013	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ROLLS ROYCE 250-C20		Acft TT 8482	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: HAVASU HELI FLIGHTS, LLC		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Summary

The flight instructor in the helicopter reported that he was providing hovering autorotation training to a private pilot. The flight instructor reported that he rolled off the throttle to initiate the maneuver, and the private pilot "raised the collective too soon which resulted in the aircraft climbing." The rotor inertia decayed, and a main rotor blade struck the tailboom after the helicopter struck the ground. The helicopter sustained substantial damage to the tail rotor drive shaft. The pilot reported that there were no preaccident mechanical malfunctions or failures 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 early increased application of the collective during a simulated hovering autorotation, which resulted in a loss of rotor rpm and subsequent main rotor blade strike of the tailboom.

Events

1. Autorotation - Abrupt maneuver
2. Autorotation - Attempted remediation/recovery
3. Autorotation - Hard landing

Findings - Cause/Factor

1. Aircraft-Aircraft propeller/rotor-Rotorcraft flight control-Main rotor control-Incorrect use/operation - C
2. Personnel issues-Task performance-Use of equip/info-Use of equip/system-Pilot - C
3. Personnel issues-Action/decision-Action-Incorrect action sequence-Pilot - C

Narrative

The flight instructor in the helicopter reported that he was providing hovering autorotation training to a private pilot. The flight instructor reported that he rolled off the throttle to initiate the maneuver and the private pilot, "raised the collective too soon which resulted in the aircraft climbing." The rotor inertia decayed and a main rotor blade struck the tailboom after the helicopter struck the ground. The helicopter sustained substantial damage to the tail rotor drive shaft.

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

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN18LA020	10/24/2017 1540 CDT	Regis# N60EA	Groom, TX		
Acft Mk/Mdl BELL 206B		Acft SN 2068	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim	Prob Caus: Pending
Eng Mk/Mdl ROLLS-ROYC 250-C20			Fatal 0	Ser Inj 0	Flt Conducted Under: FAR 137
Opr Name: MICHAEL FRIEMEL		Opr dba:		Aircraft Fire: NONE	
				AW Cert: SPR	

Events

1. Approach-VFR pattern base - Loss of engine power (total)
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Narrative

On October 24, 2017, about 1540 central daylight time, a Bell 206B helicopter, N60EA, sustained substantial damage during a forced landing after a total loss of engine power while on approach to a private landing zone near Groom, Texas. The pilot was not injured. The helicopter was owned by the Plains Aerial Leasing, Inc. and operated by the pilot as a 14 Code of Federal Regulation Part 137 agricultural aerial application flight. Visual meteorological conditions existed near the accident site at the time of the flight, and a flight plan had not been filed. The flight departed about 1510 on a local aerial application flight.

At 1530, the surface weather observation at the Perry Lefors Field Airport (PPA), Pampa, Texas, located about 25 miles to the northeast of the accident site, was; wind 340 degrees at 18 kts, gusting to 27 kts; visibility 10 miles; skies clear; temperature 18 degrees C; dew point -7 degrees C; altimeter 30.40 inches of mercury.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# WPR16LA020	11/02/2015 1424 PST	Regis# N22743	Dallas, OR	Apt: N/a
Acft Mk/Mdl BELL 206B-B		Acft SN 3624	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ROLLS ROYCE 250-C20B		Acft TT 18443	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 133
Opr Name: APPLEBEE AVIATION INC		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

1. Maneuvering-low-alt flying - Loss of engine power (partial)

Narrative

On November 2, 2015, about 1424 Pacific standard time, a Bell 206B, N22743, was substantially damaged during an autorotation landing following a partial loss of engine power near Dallas, Oregon. The helicopter was registered to and operated by Applebee Aviation under the provisions of 14 Code of Federal Regulations Part 133. The commercial pilot, sole occupant of the helicopter, sustained minor injuries. Visual meteorological conditions prevailed, and no flight plan was filed for the external load flight. The local flight originated from a staging area about 15 minutes prior to the accident.

The pilot reported that prior to the accident flight, the helicopter was refueled with 30 gallons of Jet-A fuel. The pilot departed from a staging area and began lifting Christmas trees from a field to a nearby loading zone. The pilot stated that after about 5 or 10 loads, he released a load of trees in the loading zone and shortly after, it seemed like the engine went to a reduced power setting at an altitude of about 50 feet above ground level. He further stated that he heard an abnormal noise originate from the helicopter as the helicopter began to spin to the right along with an illumination of a low rotor RPM light. The pilot jettisoned the external load line and rolled the throttle towards a closed position in order to counteract the yawing motion, with no response noted. The pilot initiated an autorotation and during the landing sequence, the helicopter impacted a tree. Subsequently, the helicopter came to rest upright in a nose high position. The pilot further stated that after the helicopter came to rest, he noted that the engine was at a "very slow idle" and he had to shut off the engine.

Postaccident examination of the helicopter by a Federal Aviation Administration inspector revealed that the tailboom forward of the tailrotor gearbox was twisted about 90°. The helicopter was recovered to a secure location for further examination.

On December 2, 2015, the recovered helicopter was examined at the facilities of AvTech Inc., Auburn, Washington, by the National Transportation Safety Board (NTSB) investigator-in-charge and representatives from Rolls Royce and Bell Helicopters. The examination revealed that the skids were removed to facilitate wreckage transport. Flight control continuity was established throughout the airframe to the main rotor head and aft to the tailrotor. An area of impact damage was observed just forward of the tailrotor gearbox. Continuity of the engine controls was established from the cockpit controls to the engine. The airframe fuel filter was removed. The filter element was dark, almost black in color. The fuel removed was dark in color (charcoal looking). Debris was observed within the fuel filter bowl. Samples of the debris and fuel were retained. Power was applied to the helicopter, and the fuel boost pumps were turned on. Fuel expelled out of the engine supply fuel lines. A sample was taken, and the fuel appeared to be fairly clear in color with no debris noted. Visual inspection of the fuel tanks revealed that about 10 to 20 gallons of fuel was present.

The engine was visually intact and all fuel and air lines appeared to be secure. N1 and N2 rotated freely and continuity was established throughout the engine to the gearbox. The engine fuel filter was removed from its housing, and a fuel sample was collected. The fuel was dark in color and contained an unknown sediment inside. The filter was dark in color. The fuel from the fuel nozzle supply line was captured and was found clear in color.

The engine was removed and subsequently shipped to Rolls Royce for further inspection. Fuel samples were retained and sent for subsequent testing.

On April 6, 2016, the engine was further examined at the facilities of Rolls Royce, Indianapolis, Indiana. The engine was placed on an engine stand, and visually examined. Compressed air was applied to the port where the PC Line connects to the compressor scroll. Air was found leaking from the PC line that connects to the fuel control unit. The engine was subsequently installed in an engine test cell and run for about 90 minutes throughout various power settings. During a governor droop test, when the load was removed from the engine to test the governor's ability to maintain RPM, N2 RPM increased to the limit for the test cell. Throughout the engine run, the engine produced rated power at cruise flight and takeoff power settings.

The power turbine governor and fuel control unit were removed and subsequently examined at the facilities of Honeywell, Inc., South Bend, Indiana, under the supervision of an NTSB investigator. The investigator reported that the bench tests of the power turbine governor revealed the unit was "sluggish" however, would not result in a loss of engine power. The fuel control unit was placed on a test bench and functioned normally.

The fuel sample from the fuel filter housing from the accident helicopter was submitted to a third-party laboratory for analysis. There was a small amount of unknown debris visible in the sample. Three tests, including Freezing Point; Flashpoint and Distillation were performed on the fuel sample. All tests were found to be within specification for Jet A fuel. The debris was retained and sent to the NTSB Materials Laboratory for further examination. The testing results for the debris found higher elemental levels of calcium (Ca), copper (Cu), iron (Fe), magnesium (Mg), nickel (Ni), potassium (K), silver (Ag) and zinc (Zn). The source of the debris could not be determined.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN17FA100	02/06/2017 1909 CST	Regis# N978RH	Galveston, TX	Apt: N/a
Acft Mk/Mdl BELL 206B-III		Acft SN 4075	Acft Dmg: DESTROYED	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ALLISON (ROLLS-ROYCE) 250-C20J		Acft TT 15287	Fatal 1 Ser Inj 0	Flt Conducted Under: FAR 135
Opr Name: REPUBLIC HELICOPTERS, INC.		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

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

Narrative

HISTORY OF FLIGHT

On February 6, 2017, at 1906 central standard time, a Bell 206B-III, N978RH, impacted the waters of West Bay near Galveston, Texas. One passenger was fatally injured. The pilot and a second passenger were seriously injured. The helicopter was destroyed. The helicopter was registered to and operated by Republic Helicopters, Santa Fe, Texas, under the provisions of 14 Code of Federal Regulations (CFR) Part 135 as a non-scheduled domestic passenger flight. Instrument meteorological conditions (IMC) prevailed at the time of the accident. Company flight following was being utilized. The flight originated from the oil tanker Eagle Vancouver, anchored in Galveston Bay, at 1837, and was en route to Republic's Helicopters, Inc., Heliport (2TE1), Santa Fe, Texas.

According to the operator, this was the helicopter's third flight of the day. It departed 2TE1 at 1404 and flew to the Eagle Vancouver, landing at 1457. The pilot shut down and the two passengers, both employees of Societe Generale Surveillance (SGS), disembarked and began their work on the tanker. The helicopter had originally been scheduled to depart at 1600 but was delayed. The helicopter finally took off at 1837. Official sunset was at 1802. It was scheduled to arrive at 2TE1 at 1910. The last radio communication Republic Helicopters Operations had with the helicopter was at 1906 when the pilot reported, "I have the lights of the shore."

The helicopter was equipped with a GPS SkyRouter fast tracking system that reports the helicopter's position every 2 minutes. The last data point received from the GPS SkyRouter system was at 1906, when the helicopter was about 0.27 miles from the Galveston Island coastline at 494 feet and 127 mph. Republic Helicopters An "Inactive" signal was received from the Blue Sky GPS by Republic Helicopters Operations 10 minutes after this last contact, or 1916, and the U.S. Coast Guard was alerted. Based on time and distance from the last data point to the accident location with an approximate helicopter speed of 120 mph, the time of the accident was computed to be 1909.

On February 22, 2017, at 1100, two Federal Aviation Administration inspectors from the Houston Flight Standards District Office interviewed the pilot at the University of Texas Medical Branch in Galveston. Also present was Republic's Director of Safety and the pilot's wife. The pilot confirmed there had been a delay in departure, but when they did depart, the weather was "good." He said he had more than 6 miles' visibility and he could see the moon above and the water below. He contacted Republic Operations, established his flight plan, received a weather update and got the current altimeter setting. His en route altitude was between 700 and 800 feet. He said that as he approached Galveston Island State Park, he had visual reference with the lights from Galveston and lights off the water. The next thing he remembered was being in the water.

he didn't. They had to throw the line again. When they got me to the deck, I just flopped down on the deck. I was so cold. I just don't understand why it took so long for someone to rescue us."

The accident site was at N29°14.39' W94°59.44' -- 4.3 miles from the last Blue Sky data point at an azimuth of 326.95° and 8 miles, or 283° from Scholes International Airport (KGLS), Galveston. It was 6.96 miles on a heading of 325.73° from 2TE1. The accident site was in an area with little or no ground lights.

PERSONNEL INFORMATION

The 30-year-old pilot held an airline transport pilot certificate with a rotorcraft-helicopter rating, and private pilot privileges with airplane single-engine land and instrument ratings. He was hired by Republic Helicopters on March 31, 2015. His first-class airman medical certificate, dated March 16, 2016, contained no waivers, limitations, or restrictions.

According to Republic Helicopters records, as of September 7, 2016, the pilot had logged a total of 1,702 flight hours, of which 1,552 hours were in rotorcraft, 1,452 hours were in the Bell 206, and another 600 hours in Bell models 222, 230, and 430. He had also logged 220 hours were under simulated instrument

National Transportation Safety Board - Aircraft Accident/Incident Database

conditions, and 4 hours were in actual instrument conditions. He had also logged 150 hours in single-engine airplanes. No night flying time was noted in any category. His last FAA and company proficiency check was accomplished on March 1, 2016, in the Bell 206.

AIRCRAFT INFORMATION

N978RH, serial number 4075, a model 206B-III, was manufactured by the Bell Helicopter Corporation in 1989. It was powered by an Allison (now Rolls-Royce) 250-C20J turboshaft engine, serial number CAE 270491, rated at 450 shaft horsepower.

The last airframe annual inspection was performed on August 31, 2016, at 15,138.9 total hours. At the time of the accident, the airframe had accrued 15,287.2 total hours. The transponder and pitot-static system were IFR-certified on September 30, 2016 (FAR 91.413 and 91.411). At the last 100-hour inspection, the engine had accumulated 13,645.4 total hours and 24,394 cycles. The last compressor and turbine overhauls were accomplished at 11,872.8 and 13,118.3 hours, respectively.

METEOROLOGICAL INFORMATION

According to Meteorology Group Chairman's Factual Report, AIRMET (Airmen's Meteorological Information) Sierra was issued at 1445 CST, well before the accident flight departure time, and valid at the accident time for the accident site. The AIRMET forecast IFR conditions due to mist developing between 1500 and 1800 CST. The Area Forecast (FA) issued at 1345 CST and valid at the accident time and departure time forecasted a broken ceiling at 2,000 feet with tops at 5,000 feet. The KGLS Terminal Aerodrome Forecast (TAF), valid at the time of the accident, was issued at 1906 CST and was valid for a 23-hour period beginning at 1900 CST. It forecasted the wind to be from 150ø at 10 knots, 5 statute miles visibility, mist, and an overcast ceiling at 400 feet agl. The KGLS TAF valid before the departure time was issued at 1726 CST and was valid for a 24-hour period beginning at 1800 CST. It forecasted the wind to be from 150ø at 14 knots, 6 statute miles visibility, haze, and scattered clouds at 1,000 feet agl. The 1726 CST KGLS TAF forecast did not forecast L (low) IFR conditions until 2000 CST.

The report noted the phase of the moon was "Waxing Gibbous with 78% of the Moon's visible disk illuminated. The moonlight would have likely been visible above the cloud tops. Below 3,000 feet near the accident site at the accident time would have been instrument meteorological conditions with no moonlight visible."

WRECKAGE AND IMPACT INFORMATION

The helicopter was recovered from West Bay on February 8, 2017, by T&T Marine Salvage, Inc, and was examined at their facilities at Teichman Point, Galveston, on February 8 and 9, 2017. T&T Marine Salvage reported the water depth at the accident site was approximately 7 to 8 feet, and all recovered wreckage was found in a radius of 80 to 100 feet.

Damage was consistent with a relatively level water impact. The fuselage was separated into several sections. The cabin and cockpit area was extensively damaged. The main rotor had departed the helicopter. There was evidence of mast bumping. The mast fracture was consistent with the rotating main rotor blades striking the water. Three main rotor blades strikes to the fuselage were noted. Both main rotor blades bore impact damage, with one blade missing two-thirds of its span to the tip. The other main rotor blades had an intact spar, but the spar was bent forward -- consistent with sudden stoppage. Transmission continuity was observed. The last two tail rotor driveshaft segments on the tail boom were missing and evidence indicated that the driveshaft was struck by a main rotor blade at impact. The tail rotor gearbox rotated freely. The helicopter was equipped with STC (supplemental type certificate) Van Horn tail rotor blades. They turned freely, and the hub and blades were relatively intact. Free T/R pitch change was present through the T/R hub. The flight controls exhibited much damage in the cockpit and vertical tunnel areas. No pre-impact anomalies were observed in any airframe systems.

Examination of the instrument panel revealed the following: altimeter, 900 feet; Kollsman window, 29.92 inches of mercury; heading indicator, 220ø; Hobbs meter, 4,143.8. Examination of the annunciator panel revealed no stretching of any of the bulb filaments. Examination of the position lights revealed no filament stretching of the red or white lights. The green light and landing lights were destroyed.

MEDICAL AND PATHOLOGICAL INFORMATION

The pilot and right rear seat passenger were both seriously injured and were found by the U.S. Coast Guard approximately one hour after the accident, clinging to a section of fuselage. The pilot had sustained stomach and intestinal trauma, several lumbar fractures, and abrasions on his shoulders, consistent with rubbing of the shoulder harness. The left front seat passenger was fatally injured and was found about 100 meters from the wreckage.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA15LA140 03/01/2015 1615 EST Regis# N600NP Marco Island, FL Apt: Marco Island Airport MKY
Acft Mk/Mdl BOMBARDIER CANADAIR CL600-2A12-601Acft SN 3002 Acft Dmg: SUBSTANTIAL Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl GE CF34-3A Acft TT 15771 Fatal 0 Ser Inj 1 Flt Conducted Under: FAR 091
Opr Name: SIX HUNDRED NP LLC Opr dba: Aircraft Fire: NONE
AW Cert: STT

Events

1. Landing-landing roll - Miscellaneous/other
3. Landing-landing roll - Runway excursion

Narrative

HISTORY OF FLIGHT

On March 1, 2015, about 1615 eastern standard time, a Bombardier Canadair CL-600-2A12 airplane, N600NP, experienced a landing overrun and subsequent collapse of the nose landing gear at Marco Island Airport (MKY), Marco Island, Florida. The two pilots, one flight attendant, and four passengers were not injured; one passenger sustained serious injuries; and one passenger sustained minor injuries. The airplane was substantially damaged. The airplane was being operated as a 14 Code of Federal Regulations (CFR) Part 91 executive/corporate flight. An instrument flight rules flight plan was filed, and visual meteorological conditions prevailed at MKY about the time of the accident. The flight originated about 1554 from Florida Keys Marathon Airport (MTH), Marathon, Florida.

Earlier on the day of the accident, the pilot-in-command (PIC) and second-in-command (SIC) landed the airplane on a 5,008-ft-long, asphalt-grooved runway at MTH. After touchdown with the flaps fully extended, the ground spoilers and thrust reversers were deployed, and normal braking occurred. The flight crewmembers reported no discrepancies pertaining to the normal brake system, antiskid system, thrust reversers, or ground spoilers.

The PIC, who was seated in the left seat, stated that, after takeoff from MTH, they proceeded to MKY and obtained information from the automated weather observing station (AWOS), which indicated the wind was from 250ø at 5 knots. Before the approach, the pilots reviewed the speeds and landing distance; the calculated required landing distance assuming a Vref of 133 knots was 3,166 ft for a dry runway and 4,166 ft for a wet runway; runway 17 was 5,000 ft long. About 10 miles south of MKY, they had the runway in sight and then requested and were approved for a visual approach from Fort Myers Approach Control. The airplane then entered the downwind leg of the airport traffic pattern from the south while slowing; the flaps were extended to 20ø. The PIC noted that there was rain about 2 to 3 miles east of MKY but that the runway appeared to be dry. Because of the rain, the PIC chose to fly the traffic pattern closer to the runway (0.5 mile) on the downwind leg, which he extended 1 mile to avoid the rain. When the airplane was abeam the approach end of runway 17, the SIC extended the landing gear and the flaps to 30ø. The pilots then performed the Landing checklist and the antiskid test, which was normal. The PIC then armed the thrust reversers and made a "teardrop turn" to the final approach leg of the airport traffic pattern. The airplane owner, who was pilot-rated and seated in the cabin, recalled a greater bank angle on the turn from downwind to final.

During the approach, the flaps were extended to 45ø, and while flying Vref plus 10 knots, the airplane encountered a couple of wind gusts. The SIC checked the AWOS again, but the wind information was the same. The flight did not encounter rain during the approach, and at 50 ft above ground level (agl), the automated callout occurred. The PIC maintained a normal glidepath at Vref plus 4 or 5 knots at the runway threshold, at which point, he placed the thrust levers in the "idle" position. The owner later reported that, while over the runway, it felt like they were floating slightly longer than normal.

The PIC reported that the touchdown was "firm" occurring between 300 and 500 ft beyond the "aiming point marking." After touchdown, he tried to extend the ground spoilers without success. He later attributed that to the complex process requiring the lever to be pulled up then moved rearward through an integral gate. When the nose landing gear (NLG) contacted the runway, he applied forward control yoke pressure and brake pressure but felt no deceleration. He indicated that he also attempted to deploy the thrust reversers but did not believe they deployed and did not see any thrust reverser deploy lights. He further stated that each piggyback lever never unlocked and that he could not get the levers into the reverse position. The owner later reported that he heard what he thought was a "tire go" during the landing roll, that he felt "heavy braking," and that he became concerned when he did not feel or hear the thrust reversers deploy.

The PIC added that he applied "moderate" brake pressure but did not feel any deceleration, which the SIC characterized the landing roll as similar to skidding on ice. The PIC informed the SIC there was no braking energy, released the brakes, turned off the antiskid, and then "re-applied the brakes pressing hard." The SIC also reported he too applied the brakes because he felt no deceleration. The PIC reported he did not feel any deceleration and again tried to deploy the

National Transportation Safety Board - Aircraft Accident/Incident Database

thrust reversers without success. He maintained the runway centerline using the nosewheel steering and began modulating the brakes. However, the airplane did not slow as expected. After the PIC realized that he was not going to be able to stop the airplane on the runway and because there was water beyond the runway end, he intentionally veered the airplane to the right. The SIC reported the airplane departed the runway travelling about 35 knots, and rolled about 250 ft into sand. The airplane owner, who had stood up to go to the cabin entry door when it became clear to him that the airplane was not going to stop on the runway, was bounced against the sidewall between the Nos. 1 and 2 seats on the airplane's left side and sustained serious injuries.

The PIC ordered an emergency evacuation and secured the engines. At that time, the piggyback levers were still up; he then pushed them down, pulled the firewall shutoff valves, and secured the auxiliary power unit. The passengers exited the airplane, and power was secured. Shortly after, airport personnel arrived and rendered assistance. Subsequently, a passenger occupying the cockpit jumpseat complained of back pain and was taken to a hospital for treatment. The PIC later confirmed that he used nosewheel steering to maintain the runway centerline, and that, during the landing roll, he did not detect any abnormal issues with the nosewheel steering.

The SIC later reported that there was no antiskid or weight-on-wheels (WOW) annunciations or failed lights and no warnings from the enhanced ground proximity warning system (EGPWS). He indicated that he and the PIC did not discuss whether to go-around because the problem became evident when the airplane was too far down the runway.

PERSONNEL INFORMATION

PIC

The PIC held a Federal Aviation Administration (FAA) airline transport pilot certificate with a multiengine airplane rating and type ratings in several aircraft, including the CL-600. He also held a commercial pilot certificate with an airplane single-engine land rating and a flight instructor certificate with airplane single-engine, airplane multiengine, and instrument airplane ratings. He was issued a first-class medical certificate on January 15, 2015, with the limitation that he "must wear corrective lenses," which he was wearing at the time of the accident.

The PIC's total flight time was 8,988 hours, 840 hours of which were in the accident airplane make and model, 625 hours of which were as PIC in the accident airplane. In the 90 days before the accident, his total flight time was 65 hours, 25 hours of which were as PIC and 40 hours of which were as SIC.

He obtained his initial type rating in the CL-600 in March 2011 from CAE SimuLite (CAE), Fort Worth, Texas. His last 14 CFR 135.297 check was performed in a Level D simulator at CAE on February 3, 2015, and his last 14 CFR 135.293 check in a CL600 was performed at CAE in August 2014.

The operator hired the PIC in February 2009 as a captain. After obtaining his PIC type rating in the CL-600 in March 2011, he flew a rotation of different aircraft for 2 years. From May 2013 to the accident date, he only flew the CL-600.

SIC

The SIC held an FAA airline transport pilot certificate with an airplane multiengine land rating and type ratings in several aircraft, including the CL-600. He also held a commercial pilot certificate with an airplane single-engine land rating.

The SIC estimated that his total flight time was more than 17,000 hours, about 1,500 hours of which were in the accident airplane make and model and 10 hours of which were in the 90 days before the accident. He obtained his type rating in the CL600 in December 2008 from CAE, and his last 14 CFR 61.58 check in the CL600 was performed at CAE in June 2014.

The operator hired the SIC in 2007 as the chief pilot. He had flown with the captain for years. In July 2014, he took a Director of Operations position for another company but continued to be a contract pilot for the operator.

AIRCRAFT INFORMATION

The airplane, serial number (S/N) 3002, was manufactured in 1983 by Canadair Ltd. A Certificate for Airworthiness for Export was issued on September 9, 1983, and 20 days later, the FAA issued a transport-category Standard Airworthiness Certificate. The airplane was powered by two General Electric CF34-3A

engines.

The airplane was equipped with steer-by-wire nosewheel system, which was controlled by an electronic control module that operated a hydraulic steering control valve (SCV) in response to the commands via either the handwheel and/or rudder pedals. The SCV controlled an actuator, which through a rack-and-pinion arrangement, rotated a steering cuff. The steering cuff in turn rotated the nosewheels through torque links (or scissors). The steering system was normally switched on continuously during flight and was enabled only when the aircraft was on the ground with WOW input. With no WOW input, the NLG was free castoring.

The airplane was equipped with a normal brake system, and each four-wheel brake system provided one-quarter of the total stopping force in the four-tire set (Nos. 1 and 2 on the left main landing gear [MLG] and Nos. 3 and 4 on the right MLG). Each pilot had a left and right brake pedal, which were mechanically linked at the brake control assembly located beneath the cockpit floor. The brake control assembly contained two brake control valves (BCV) that manipulated hydraulic valves via mechanical inputs. Each of the four BCVs regulated the amount of hydraulic pressure provided to each of the four-wheel brake systems through the antiskid braking system and hydraulic fuses. There were two BCV assemblies installed in the nose hydraulics compartment as a part of the brake control mechanism assembly. The upper BCV controlled the inboard brakes, and hydraulic pressure was supplied by the No. 3 hydraulic system; the lower BCV controlled the outboard brakes, and hydraulic pressure was supplied by the No. 2 hydraulic system. The BCVs were considered on-condition components.

The airplane was equipped with an antiskid braking system that consisted of a skid control unit and two dual antiskid control valves and wheel speed sensors (WSS) located in the axle of each main wheel. The system independently controlled the braking of each main wheel by automatically varying the hydraulic pressure output of each dual BCV before these outputs reached the brakes. WSSs were considered on-condition components. An arming switch on the antiskid panel controlled power to the antiskid valves from the 28-volt direct current main bus via the inboard and outboard antiskid relays and the parking brake microswitch. Therefore, the system cannot be armed when the parking brake is on (parking brake shutoff valve closed). When the parking brake is applied, the INBD FAIL and OUTBD FAIL antiskid warning lights illuminated.

The antiskid system had the following features: (1) modulated skid protection of each wheel via the primary antiskid circuits; (2) locked-wheel protection, which provided a pressure dump signal in the event of a deep skid or failure of a wheel to spin up at touchdown and a coarse backup circuit in the event of a primary antiskid circuit failure; (3) pretouchdown protection which, via input from the WOW circuitry, dumped all the wheels' brake pressure while the airplane was still airborne, but the protection was overridden as soon as the wheels have spun up to allow normal skid-controlled braking; (4) built-in test equipment to provide a check of virtually all the system circuits, both on the ground (before takeoff) and in the air (before landing); and (5) spin-up relays to inhibit thrust reverser deployment until after touchdown.

The airplane was equipped with ground spoilers that were controlled electrically via a control unit located in the underfloor avionics bay, which received electrical signals from the ground spoilers on/off/test switch, spoiler control lever, landing gear control unit, antiskid control unit, and throttle levers. Upon receiving all required signals concurrently, the spoiler control unit transmitted a signal to energize the solenoid valves of a manifold assembly located in each MLG wheel well, which, in turn, directed hydraulic pressure to the extend port of each ground spoiler actuator to extend the spoilers. The ground spoilers are armed for deployment at touchdown by setting the ground spoilers switch to the "on" position and moving the spoiler control lever to the "extend" position. The lever must be pulled up, then moved rearward through an integral gate to achieve the required position. In addition to the lever selection, the throttle levers must be set at idle and the aircraft weight must be on the landing gear (and/or wheels spin-up) before the ground spoilers can deploy.

The airplane was equipped with thrust reversers that redirected engine fan air flow forward over the nose cowl assembly. Thrust reverser selection and control are accomplished primarily by a throttle-quadrant-mounted thrust lever for each engine. Each lever is held in the stow position by a thrust reverser lever stop, which is released by lifting the stop release latch. A deploy switch for each thrust reverser was mounted in the throttle quadrant and was operated by moving the appropriate thrust reverser lever to the "deploy" position.

The airplane was maintained in accordance with the manufacturer's maintenance steering group (MSG) 3 program since January 30, 2009, which consisted of hours- or months-interval inspections of systems or components. Review of the program revealed no requirement to periodically perform an operational test of the antiskid system; however, it contained a general zonal visual inspection every 120 months of the lower internal left nose compartment, which contained the upper and lower BCVs. The zonal inspection did not require inspection of either the upper or lower BCVs input rods extension lengths. The last inspection of that zone was completed on January 18, 2013, at an airframe total time of 15,155.5 hours and 9,303 cycles.

Review of the maintenance records revealed that the airplane's last 800-hour inspection was completed on January 14, 2015, at an airplane total time of

National Transportation Safety Board - Aircraft Accident/Incident Database

15,737.0 hours and 9,684 cycles. The 800-hour inspection included an operational test of the nosewheel steering electronic control module and the landing gear control unit.

A review of the Aircraft Reporting Form (used by flight crewmembers to report discrepancies) for the 90 days before the accident revealed no discrepancies regarding the brakes, antiskid system, ground spoilers, or thrust reversers.

According to the current status document provided by the operator, there was no record that the upper BCV or No. 1 WSS had been removed, replaced, or repaired since the airplane was manufactured. Maintenance record entries indicated that the No. 1 tire, part number (P/N) 256K43-3, S/N 33097507, was installed on November 10, 2014, at an airframe total time of 15,699.7 hours and 9,657 cycles. At the time of the accident, the airplane had a total time of 15,771.2 and 9,705 cycles.

METEOROLOGICAL INFORMATION

The MKY AWOS reported about the time of the accident wind from 250° at 8 knots, visibility 10 statute miles, few clouds at 9,000 ft, temperature 27°C, dewpoint 20°C, and altimeter setting 30.22 inches of mercury.

The Weather Surveillance Radar 0.5°-elevation scan depicted the conditions from between 3,740 and 10,990 ft over the accident site. The scan images for 1611 and 1626, which were 4 minutes before and 11 minutes after the accident, respectively, depicted an area of echoes with maximum intensities from 45 to 50 dBZ immediately east of MKY. Plotting of the approach path to MKY onto the weather images showed that the airplane flew under the leading edge of the echoes as it entered the traffic pattern turning onto final approach. The main area of the echoes began to move over the accident site about 7 minutes after the accident with echoes of 35 to 40 dBZ, which are associated with moderate-to-heavy rain. No strong outflows or divergent signatures with the area of echoes were noted, indicating that no strong winds, gust fronts, or microbursts were associated with the echoes. Additionally, no lightning was detected, indicating that the strong echoes were only associated with rain showers and not thunderstorms during the period.

No pilot reports were made in the area surrounding the accident time nor were any Convective SIGMETs, Severe Weather Forecast Alerts, or Center Weather Advisories issued along the accident route.

Airport security cameras captured portions of the approach, landing, landing roll, and accident sequence. A review of the footage revealed that it began raining about 10 minutes after the accident.

AIRPORT INFORMATION

MKY was a public airport with a single, grooved asphalt runway, 17/35, which was 5,000 ft long by 100 ft wide and reported to be in "fair condition." Left traffic was specified for runway 17, which was a slight upsloping runway.

FLIGHT RECORDERS

The airplane was equipped with an L-3 Communications/Fairchild A100A Cockpit Voice Recorder (CVR); it was not equipped nor was it required to be equipped with a flight data recorder. Audio was extracted from the CVR normally and without difficulty; however, the accident flight was not recorded. Further examination of the CVR revealed that the drive mechanism's mylar belt was broken.

According to the CVR manufacturer, the broken drive belt rendered the unit incapable of recording and would not have passed the operational test required by the flight crewmembers before flight and by maintenance personnel every 800 hours. Maintenance records revealed that maintenance personnel's last operational check of the CVR occurred on January 14, 2015, about 34 hours before the accident.

The airplane was also equipped with a Honeywell Mark VII EGPWS. Examination of the unit revealed that the terrain inhibit was not active, and there were no warnings associated with the accident flight. The landing record occurred when the flight was about 800 ft before the runway threshold, which, according to the EGPWS manufacturer, occurred when the radio altimeter indicated the airplane passed below 50 ft and the landing gear were down.

WRECKAGE AND IMPACT INFORMATION

The airplane reportedly came to rest about 250 ft past the departure end of runway 17. Examination of the runway revealed that the first identified skid mark associated with the No. 1 tire was about 2,094 ft from the approach end of the runway. Alternating light and dark skid marks with rain grooves and gaps continued for about 780 ft, at which point a dark skid mark continued for about 128 ft. At the end of the dark skid mark from the No. 1 main tire, or about 3,002 ft from the approach end of the runway, the skid mark was distorted. Along the dark skid mark associated with the No. 1 tire, minor skid marks from the No. 2 tire were noted. Dark skid marks from the Nos. 3 and 4 tires were noted 3 ft right of the runway centerline beginning just beyond the heavy skid mark from the No. 1 main tire, or about 2,900 ft from the approach end of the runway. The skid marks made on the runway by the Nos. 3 and 4 tires changed direction multiple times, which continued to the end of the runway. At the departure end of the runway, a rubber transfer skid mark associated with the NLG tire was noted inboard of the skid mark from the No. 3 tire.

Beyond the departure end of the runway, marks from all landing gear tires were noted; however, the mark from the NLG stopped about 81 ft 10 inches before the resting position of the left MLG, which was consistent with the collapse of the NLG.

Examination of the airplane revealed a hole in the lower portion of a bulkhead, a tear in the skin and frame from the right NLG trunnion attachment, a buckle in the right NLG wall, and displacement of the left NLG wall. The NLG was separated from its attachment point but remained partially attached by two flexible hydraulic hoses. The P62 and P63 connections associated with the WOW harness in the NLG area were tightly secured.

The NLG WOW harness, NLG steering harness, and hydraulic lines were disconnected due to partial separation of the NLG. The WOW harness was properly secured to the NLG, and the WOW sensors were tightly secured and safety wired. Although the gap of the NLG WOW sensors was not measured before the WOW harness was removed, according to the mechanic who removed it, the gap appeared normal. Further, a review of a picture provided by Bombardier revealed some overlap of one WOW sensor, although the strut was not compressed. The left and right NLG tires were within 2 and 1 pound per square inch (psi) of the specified limit, and the NLG strut pressure was within limits. The No. 3 system hydraulic return lines in the NLG wheel well, which were damaged, were removed, and the lines were capped.

Examination of the left wing revealed that the wing tip fairing was crushed upward. The inboard flap fairing of the inboard flap was damaged by the left MLG door, and the outboard flap fairing of the outboard flap was damaged. The thrust reverser was fully stowed. There was no observed damage to the right wing, vertical stabilizer, horizontal stabilizer, or engines; the right thrust reverser was also fully stowed.

Examination of the cockpit revealed that the nosewheel steering switch was in the "arm" position and that the ground spoiler and the antiskid switches were in the "off" position. The thrust levers were in the "cutoff" position, and the thrust reverser levers were stowed.

With electrical power applied, the WOW annunciator illuminated, and both thrust reverser switches "arm" lights illuminated. The Nos. 1, 2, and 3 quantity indicators were in the green arc range. With momentary activation of the Nos. 1, 2, and 3 hydraulic systems, the pressure in each increased to 3,000 psi, and the quantity in each indicated 60, 40, and 50%, respectively. The brake inboard and outboard pressures indicated 3,000 psi due to momentary activation of the Nos. 2 and 3 system hydraulic pumps.

Examination of the left MLG revealed that the Nos. 1 and 2 tires remained on the wheel assembly but that the No. 1 tire was on the inboard wheel half. The No. 1 tire showed evidence of flat spotting and a rupture tear, whereas the No. 2 tire pressure was within limits, but the tire was worn. The gaps of both WOW switches were within limits, and both were properly secured and safety wired. With about 1,300 lbs of fuel onboard and the airplane fully resting on the MLG, the forward end of the inboard and outboard WOW switches was flush with the forward end of the target. No defects were noted in the WOW wiring harness in the MLG area. Both WSSs were properly installed; however, the No. 1 WSS coupling subassembly, P/N 6002286, was fractured near the base. The No. 1 WSS and tire assembly were retained for further examination.

Examination of the right MLG revealed that the Nos. 3 and 4 tires and wheel halves exhibited flat spotting. The gaps of both WOW switches were within limits, and both were properly secured and safety wired. With about 1,300 lbs of fuel onboard and the airplane fully resting on the MLG, the forward end of the inboard and outboard WOW switches was 3/4 overlapped with the forward end of the target. No defects were noted in the WOW wiring harness in the MLG area. The Nos. 3 and 4 WSSs externally appeared normal, but the No. 3 WSS back shell was completely unscrewed. There was no damage to the threads.

To facilitate operational testing, the NLG WOW electrical harness was spliced back into the airplane's wiring harness, and hydraulic lines in the NLG area were capped. The airplane was configured to allow for testing without the engines operating and was then simulated being in the air. It was configured per the

National Transportation Safety Board - Aircraft Accident/Incident Database

Approach checklist used by the flight crewmembers, which consisted of the following conditions: a) all hydraulic B pumps on, b) nosewheel steering switch armed, c) ground spoilers switch on, d) thrust reverser switches armed, and e) flaps extended 45°. Under these conditions, the antiskid was armed and tested satisfactorily, which included wheel spin-up. In the same configuration, the airplane was then simulated being on the ground with both thrust levers at idle; the ground spoilers were manually deployed 10 times satisfactorily; no discrepancies were noted.

While the airplane was simulated being on the ground, one engine was operated at a time only to idle thrust and with each thrust reverser armed, each thrust reverser solenoid on the throttle quadrant released, and each thrust reverser was deployed three times followed by a slight increase in power. Safety concerns prevented full reverse thrust application. No discrepancies were noted with either thrust reverser.

Operational testing of the brakes revealed extensive leakage from the damaged Nos. 3 and 4 brakes, which precluded further testing; they were removed for further examination, and exemplar brakes were installed. Subsequent testing revealed normal pressures at the No. 1 (left outboard), No. 3 (right inboard), and No. 4 (right outboard) brakes (between 1,850 and 2,000 pounds per square inch, gauge [psig]); however, only 150 psig was noted at the No. 2 (left inboard) brake. The issue was associated with the upper BCV. The No. 2 brake line was repositioned to the No. 3 position at the BCV, and normal pressure was noted at the No. 2 brake. The BCV assembly was retained for further examination.

Operational testing of the antiskid system was conducted at 2,000 rpm, which approximately correlated to the airplane's reported touchdown speed. Because of damage to the No. 1 WSS, no in-situ testing was performed. The Nos. 3 and 4 positions tested satisfactorily. Because the No. 1 WSS was not tested, the No. 3 WSS, which tested satisfactorily, was installed to the No. 1 wheel position and tested satisfactorily. Because of reduced brake pressure at the No. 2 brake, the No. 2 WSS was installed to the No. 3 wheel position and tested satisfactorily.

MEDICAL AND PATHOLOGICAL INFORMATION

Following the accident, the PIC, SIC, and flight attendant submitted specimens for testing. The testing results for all of them were negative for drugs of abuse; testing for alcohol was not performed.

TESTS AND RESEARCH

Additional Examinations

Examination of the No. 1 tire revealed that it exhibited flat spots through the tread and a cross-shaped tear through the inner-most plies, consistent with sudden depressurization due to the rupture of the inner bladder. Detailed examination of the tire revealed no evidence of operation at low-pressure, preexisting damage, or manufacturing defects. The tire also had a tear/cut that extended to a hole at the edge of the flat-spotted area. A sharp-edged circular hole slightly more than 1/4-inch in diameter was found at the end of the cross-shaped tear. The wheel flange was found to have about the same lateral distance from center, straightness of cut/tear toward cross-shaped damage, parallel nature of the cut/tear with the wheel flange, and approximate diameter of the hole. No evidence of blue tinted rubber or reverted rubber on the interior, exterior, or in the bead areas nor of bead movement or damage was found. The interior liner exhibited no evidence of operation at low-pressure or with the sidewall collapsed. The flat-spotted and torn areas revealed the internal construction of the tire, and no design or construction anomalies were noted in these areas. The plies were straight and parallel in orientation. No loss of adhesion was found between the plies or between the tread construction and loss of tread. No evidence of repair-related damage was found.

Examination of the Nos. 3 and 4 brakes and No. 1 WSS was performed at the manufacturer's facility. Damage to both brake assemblies precluded operational testing; however, visual examination revealed no evidence of preimpact failure or malfunction.

Operational testing of the No. 1 WSS revealed that, even without the coupler installed (it was removed for National Transportation Safety Board [NTSB] metallurgical examination), it produced a constant sinusoidal wave. The WSS manufacturer reported that, since 2010, 57 sensors had been returned but that no coupling failures had been reported. Metallurgical examination of the No. 1 WSS coupler revealed hackles and rib markings on the injection-molded polymer, consistent with overstress fracture. A shrinkage void was noted on the fracture surface. The fracture initiated in bending overstress at the corner with very small radii and reinitiated at the void.

Visual examination of the upper BCV at the manufacturer's facility revealed that the input pushrod for the No. 2 (left inboard) brake was displaced inward compared to the input pushrod for the No. 3 (right inboard) brake and was not in contact with the roller of its associated input linkage; no visible damage to the

unit was noted. The upper BCV was placed on a test bench for operational testing, which confirmed the low pressure at the No. 2 (left inboard brake). Disassembly of the upper BCV revealed that the left power brake spring was fractured. Examination of the fractured spring by the NTSB Materials Laboratory revealed generally rounded and equiaxed-shaped dimple rupture features, consistent with tensile overstress, with little to no shear or torsional component. The spring composition and microstructure were consistent with the prescribed material.

Previous BCV Failures

The current BCV manufacturer reported to the NTSB that in the 385 BCVs that they repaired or overhauled between July 1992 and October 2016, excluding the accident unit, there was 1 other identified spring failure, and about 11%, or 43 units, had relaxed springs. The manufacturer did not report this information to the FAA through the service difficulty reporting (SDR) system. At the suggestion of the NTSB postaccident, the BCV manufacturer's Repair Station and Quality Control Manual were updated regarding SDR submissions.

A review of FAA SDRs concerning brakes and BCVs with the accident BCV P/N revealed no reports describing asymmetric braking or failure or malfunction of a BCV.

Bombardier reported that, since October 2003, excluding the accident airplane, operators of Challenger 600/601/3A/3R airplanes reported 142 instances in which the BCVs were removed from the airplane for various reasons (scheduled, unscheduled, etc.). In most of the 142 reports, the operator provided Bombardier with a description of the issue or reason for removal. Four of the reports noted asymmetric braking; three of these BCVs were sent to Tactair, the current manufacturer; however, all three of these BCVs had been modified without inbound evaluation; therefore, the reason for the reported asymmetric braking could not be determined.

Airplane Performance Study

The NTSB conducted a performance study using ASR-11 radar from Southwest Florida International Airport and from a tethered aerostat radar station located about 80 nautical miles from the accident site. According to the study, based on EGPWS altitude and location and shifting of radar data to align with the runway centerline, the final descent angle was 2.6°. The calculated groundspeed based on radar returns indicated that the airplane did not touch down faster than recommended. The study also indicated that, based on the security camera footage, the airplane touched down just past the 1,000 ft mark, which corroborated the flight crewmembers' statements.

Landing and Stopping Distance Information

The airplane flight manual (AFM) did not contain nor was it required to contain landing distance increases if one brake became inoperative.

The airplane manufacturer conducted stopping distance calculations based on the airplane's reported weight, weather conditions, calculated and PIC-reported Vref speed, flap extension, and estimated touchdown point and included nonuse of the ground spoilers and thrust reversers, operational antiskid and steering systems, and braking delay. The calculations showed that, with all four brakes functional, the airplane would stop on the runway with 959 ft of runway remaining. Calculations assuming the same parameters with loss of one brake per side (symmetric half braking), the airplane would have required 690 ft of additional runway; under the same conditions but with thrust reversers used, the airplane would have required 27 ft of additional runway. The calculations could not be conducted to determine the effect of the loss of two brakes on the same side (asymmetric half braking).

Brake Certification

A representative from the airplane manufacturer reported that, during certification of the brake system, the failure of the BCV power brake spring was considered acceptably low and would be evident to pilots within five landings of the failure. The airplane manufacturer representative also indicated that, during certification, the loss of two brakes on the same side was considered to be extremely remote and a low-risk condition. Failure of either the upper or lower BCV is not annunciated to the flight crewmembers.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# DCA14CA147	08/10/2014 605 EDT	Regis# N815EX	Harrisburg, PA	Apt: Harrisburg Intl MDT
Acft Mk/Mdl DEHAVILLAND DHC 8 102-103		Acft SN 321	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
			Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 121
Opr Name: PIEDMONT AIRLINES INC		Opr dba: US AIRWAYS EXPRESS		Aircraft Fire: NONE

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA15LA322	08/21/2015 1420 EDT	Regis# N120EA	Danbury, CT	Apt: Danbury Muni DXR
Acft Mk/Mdl ECLIPSE AVIATION CORP EA500-NO		Acft SN 000199	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl P&W CANADA PW610F-A		Acft TT 858	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: UF EQUIPMENT LLC		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

1. Landing-landing roll - Runway excursion
2. Landing-landing roll - Runway excursion

Narrative

HISTORY OF FLIGHT

On August 21, 2015, about 1420 eastern daylight time, an Eclipse Aviation Corporation EA500, N120EA, sustained substantial damage during a runway overrun while landing at Danbury Municipal Airport (DXR), Danbury, Connecticut. The airline transport pilot and two passengers sustained minor injuries. Day visual meteorological conditions prevailed and an instrument flight rules flight plan had been filed for the personal flight. The flight was conducted under the provisions of 14 Code of Federal Regulations Part 91. The flight originated from Wittman Regional Airport (OSH), Oshkosh, Wisconsin, about 1220.

According to the pilot, the approach to runway 26 "required a steeper than normal approach," because of trees near the runway. The airplane touched down near the displaced threshold and he applied the brakes to decelerate; however, the "first pedal push was soft," which was "not unusual." Then, he continued "pumping the brakes" and considered a go-around; however, the remaining runway was too short. The pilot continued to "pump" the brakes, about six times; however, he did not think the brakes were operating. The airplane continued off the end of the runway, impacted a berm, and came to rest upright approximately 200 feet beyond the end of the runway.

According to an air traffic controller who witnessed the accident, the airplane touched down approximately 100 feet past the "D" taxiway intersection with the runway, which would have resulted in about 2,800 feet of runway remaining.

During the accident sequence, the right main landing gear punctured the underside of the right wing, which resulted in substantial damage. In addition, the nose landing gear separated from the airplane.

AIRPLANE INFORMATION

According to Federal Aviation Administration (FAA) records, the airplane was issued an airworthiness certificate on May 29, 2008, and was registered to a corporation. It was equipped with two Pratt & Whitney Canada W610F-A series, turbo fan engines that were each capable of producing 950 pounds of thrust. According to the pilot, the most recent annual inspection was performed on May 26, 2015. At the time of the accident, the airplane had accumulated 858.1 total hours.

According to the airplane flight manual, the braking system was "mechanically actuated and hydraulically operated. Braking was provided by hydraulically operated single disc brakes on each main gear. When pressure is applied to the toe brakes, hydraulic pressure is applied to the corresponding main gear brake."

The brake fluid reservoir was located outside the forward pressure bulkhead. "An optical sensor triggers a BRAKE FLUID LOW advisory message when the brake fluid is low."

The airplane manufacturer released a mandatory modification bulletin (MB 500-32-003) on April 3, 2015, pertaining to the Anti-lock Braking System (ABS) Pressure Switch and Harness Route. The reason for the bulletin was to improve the harness routing and ABS installation. According to the pilot, the maintenance described in the modification bulletin had not been performed on the airplane, however, it was scheduled for a later date.

PERSONNEL INFORMATION

According to the pilot, he held an airline transport pilot certificate with a rating for airplane multiengine land and a private pilot certificate with ratings for airplane

National Transportation Safety Board - Aircraft Accident/Incident Database

single-engine land and sea. In addition, he held a type rating for the EA-500S, which included the accident airplane model. The pilot was issued an FAA third-class medical certificate on March 27, 2015. He reported 7,846 hours of total flight experience, of which 1,111 hours were in the same make and model as the accident airplane, and 3.7 hours were accumulated during the 30 days that preceded the accident. In an interview, the pilot stated that the six previous landings he performed with the airplane were on runways that were over 6,000 feet long.

METEOROLOGICAL INFORMATION

At 1425, the recorded weather at DXR included wind from 350ø at 6 knots, a few clouds at 6,000 feet above ground level, clear skies, 10 statute miles visibility, temperature 28ø C, dew point 16ø C, and an altimeter setting of 30.04 inches of mercury.

AIRPORT INFORMATION

Danbury Municipal Airport was located 3 miles southwest of Danbury, Connecticut, at an elevation of 456 feet above mean sea level (msl). It had two intersecting runways, which were designated 8/26 and 17/35. Runway 8/26 was 4,422 feet by 150 feet and runway 17/35 was 3,135 feet by 100 feet. In addition, runway 26 had a displaced threshold of 734 feet. At the time of the accident, the airport had an operating air traffic control tower, that operated between the hours of 0700 and 2200 daily.

TESTS AND RESEARCH

Examination of the airplane by a representative from the manufacturer under the supervision of an FAA inspector noted that brake pressure was obtained on both sets of brake pedals when they were depressed. There was no bleed down or reduction in pedal firmness when the brakes were pumped several times. Both antilock brake system drive adapters were connected, and the wheel speed sensors rotated freely. In addition, the hydraulic reservoir was "full," and there were no leaks noted throughout the brake system, including the reservoir, brake lines, or around the brake assembly. No anomalies were noted during the examination of the brake system. Furthermore, in his written statement, the pilot did not report any crew alerting system messages or any alerts involving the brake system.

The Eclipse Aviation Diagnostic Storage Unit (DSU) was sent to the NTSB recorders laboratory for data download. A review of the data revealed that several parameters were recorded during the accident flight. In addition, the data revealed several sets of data from previous flights.

ADDITIONAL INFORMATION

Performance Study

A review of the DSU data revealed that the ground speed recorded at the weight on wheels (WOW) transition on the accident flight was the highest of the flights reviewed. Utilizing ground speed data, the time between WOW transition through 50 knots, the accident flight had the largest deceleration calculated from the available data, which was 2.2 knots per second (kts/s). The data for previous downloaded flights revealed a deceleration rate that averaged 0.7 kts/s. Although the airplane's calculated reference speed for the weight at the time of the accident was 89 knots, the airplane's touchdown speed was 91 knots on the accident flight. However, the touchdown speed on the accident flight was 12 to 18 knots faster than the reviewed prior landings. In addition, integration of the airplane's recorded ground speed indicated that it touched down 1,280 feet from the threshold of Runway 26 and traveled 2,600 feet before coming to a stop, which was about 200 feet beyond the runway.

Landing Distance Data

According to the downloaded DSU data and the performance section of the airplane flight manual, under the conditions that existed at the time of the accident, the estimated landing distance required was approximately 3,063 feet when crossing the runway threshold at 50 feet above ground level. According to the recorded data, the airplane touched down 1,280 feet beyond the threshold of runway 26, which left 2,408 feet of the runway remaining since the displaced threshold was at 734 feet of the 4,422 foot runway.

Emergency Procedures

National Transportation Safety Board - Aircraft Accident/Incident Database

According to the Airplane Flight Manual, Section 3 Emergency Procedures, the Brakes Ineffective or Pulling to One Side procedure was to be used when the braking "with ABS becomes ineffective or causes the aircraft to pull to one side." The procedure included:

1. Maintain directional control using rudder and steering.
2. Brakes - Release.
3. ALL INTERRUPT - PRESS and HOLD
4. Reapply Brake (Pump Brakes as required) - Stop Normally

In an interview with a manufacturer representative, the pilot stated that he was not aware of that procedure until after the accident. In addition, he stated that he "was not trained" on the use of the ALL INTERRUPT button, which disabled the anti-skid brake system functions and restored normal braking, when the brakes were ineffective.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA17LA126	02/21/2017 1015 AST	Regis# N413LP	San Juan, PR	Apt: Fernando Luis Ribas Dominicci TJIG
Acft Mk/Mdl EUROCOPTER AS 350-B3		Acft SN 3228	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl TURBOMECA ARRIEL 2B		Acft TT 1846	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: PEDRO FELICIANO		Opr dba:		Aircraft Fire: IFLT
				AW Cert: STN

Events

1. Autorotation - Fire/smoke (non-impact)
2. Autorotation - Fire/smoke (non-impact)

Narrative

On February 21, 2017, about 1015 Atlantic standard time, an Airbus Helicopters (Eurocopter) AS 350 B3, N413LP, operated by the commercial pilot, was substantially damaged during a practice autorotation at Fernando Luis Ribas Dominicci Airport (TJIG), San Juan, Puerto Rico. The flight instructor and commercial pilot were not injured. The instructional flight was conducted under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the flight that originated from TJIG about 0900.

According to the flight instructor's written statement, he was the pilot-in-command for the flight and the commercial pilot/owner of the helicopter was practicing autorotations. During recovery from the last 180° autorotation, the flight instructor noticed that the engine rpm continued to increase and exceeded limitations, followed by a vibration in the helicopter. He then immediately landed on a grass area near a runway. After the landing, a mechanic told him that the helicopter's engine was on fire. The flight instructor completed the engine fire procedure and exited the helicopter.

According to the commercial pilot's written statement, he had completed several training maneuvers and autorotations uneventfully. The flight instructor then asked if he could perform an autorotation and the commercial pilot agreed. During the flare at the end of the autorotation, the commercial pilot heard the engine overrev, followed by an Nr (rotor speed) aural warning, followed by a fire warning light illumination on the instrument panel. After landing, the commercial pilot exited the helicopter with a fire extinguisher and attempted to extinguish an engine fire.

Review of airport security video revealed that the helicopter was descending to a grass area adjacent to the runway. About 30 feet above ground level, smoke began emitting from the helicopter and it climbed out of the video frame. It then descended back into the video frame and landed on the grass while smoke continued to emit from the helicopter.

Examination of the helicopter by a Federal Aviation Administration inspector revealed that the fire resulted in damage to the engine deck support structure and a portion of the tail rotor drive shaft. A vehicle and engine multifunction display (VEMD), digital engine control unit (DECU), hydromechanical unit (HMU), and assembly valve were retained for examination and data download at the manufacturers' facilities under the supervision of the Bureau d'Enquetes et d'Analyses (BEA) in France. Examination and testing of the HMU and assembly valve did not reveal any anomalies that would have precluded normal engine operation.

Review of data downloaded from the VEMD and DECU revealed that during the accident flight, the first failure recorded by both computers was an NG/N1 failure, respectively. The failure was recorded at 1 hour, 13 minutes, 18 seconds (1:13:18) into the 1-hour, 14-minute flight by the VEMD and 1:13:27 by the DECU. The recorded failure indicated that the gas generator rotation speed (N1) reached an out of limit value. At that time, the fuel regulation was in mixed mode as the collective twist grip throttle control was out of the "flight" detent and the pilot was manually controlling the throttle. A second failure was recorded 2 seconds later, which indicated that the free turbine rotation speed (N2) reached an out of limit value. The failure was triggered by the maximum recorded value of 545 rpm, which equated to an Nr of 140%.

According to a representative from the engine manufacturer, the engine's freewheeling turbine was designed for its turbine blades to separate at 150% turbine speed. The design was to prevent the turbine disc from separating at a turbine speed of 170%. During his examination of the engine, the representative observed evidence consistent with the turbine blades separating, resulting in an engine fire.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# WPR15LA257	09/03/2015 1752 UTC	Regis# N9068F	Manra Island, PO KR	Apt: N/a
Acft Mk/Mdl HUGHES 369HS-HS		Acft SN 210293S	Acft Dmg: DESTROYED	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ALLISON 250-C18C		Acft TT 6871	Fatal 1 Ser Inj 1	Flt Conducted Under: FAR 091
Opr Name: WHIRLWIDE HELICOPTERS INC		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPR

Summary

According to an operator representative, the commercial pilot and passenger/spotter were conducting fish-spotting duties. The operator reported that, about 16 minutes after the helicopter departed from the fishing vessel, the fishing vessel's radio operator reported losing contact with the helicopter. Vessel personnel then located the helicopter upside down in the water and initiated rescue operations.

The passenger reported that "the helicopter went wrong in the air and started rolling over and fell into the water." The pilot was fatally injured as his personal life vest, which was equipped to self-inflate upon submerging in water, interfered with his ability to evacuate the helicopter as it rolled over. The passenger evacuated the helicopter and was rescued shortly after. He reported that he saw that the pilot's life vest had inflated inside the helicopter and that the pilot was struggling to exit and then stopped moving. After the passenger was transported to a hospital, he was not available for further questioning. The pilot's personal life vest, which was equipped to self-inflate when submerged in water, likely prevented him from evacuating the helicopter as it rolled over. After the accident, the operator advised its pilots not to use this type of life vest and to use the company-issued flotation life vests.

The helicopter subsequently sank and was not recovered. The reason for the flight upset and descent loss of helicopter control could not be determined.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: A The loss of helicopter control for reasons that could not be determined as because the helicopter sank in the ocean water and was not recovered.

Events

1. Maneuvering - Low altitude operation/event
2. Landing - Ditching

Findings - Cause/Factor

1. Not determined-Not determined-(general)-(general)-Unknown/Not determined - C
2. Aircraft-Aircraft systems-Equipment/furnishings-Life jacket-Not specified

Narrative

HISTORY OF FLIGHT

On September 3, 2015, at 1752 Coordinated Universal Time (UTC), a Hughes 369HS helicopter, N9068F, was destroyed following a forced landing into the Pacific Ocean about 300 nautical miles east of Manra Island, Republic of Kiribati. The El Salvador certificated helicopter pilot was fatally injured, the passenger sustained serious injuries. The helicopter was operated by Whirlwide Helicopters Inc., of Port Vila, Vanuatu. The local aerial observation flight was conducted under the provisions of 14 Code of Federal Regulations (CFR) Part 91, when the accident occurred. Visual meteorological conditions prevailed, and no flight plan had been filed for the flight, which originated from a tuna fishing vessel 35 minutes prior to the accident.

In a written report to the NTSB, a representative from the operator stated that the pilot and passenger/spotter were conducting fish spotting duties when the accident occurred. He reported that the helicopter descended and impacted the water and rolled upside-down. The spotter was able to exit the helicopter when he observed that the pilot's life vest had deployed while inside the helicopter and the pilot was struggling to exit. He saw the pilot stop moving, but due to his injuries was unable to assist him.

A nearby fishing vessel was able to recover the pilot and the passenger but the helicopter sank and was not recovered.

Shortly after being rescued, the passenger, a Vietnamese national, reported to the fish master that "the helicopter went wrong in the air and started rolling over and fell into the water." After the passenger was transported to a hospital in Majuro, Marshall Islands, he was not available for further questioning.

The operator reported that the flight crews are issued life vests, but that some pilots preferred to use their own vests. The accident pilot had acquired his own vest which was equipped with an auto-inflation activation system which would activate anytime the vest was submerged underwater.

National Transportation Safety Board - Aircraft Accident/Incident Database

PERSONNEL INFORMATION

The pilot held a commercial helicopter pilot certificate issued by the Republic of El Salvador on May 20, 2004, and a first-class airman medical certificate issued on November 6, 2014, with the limitations that the pilot must wear corrective lenses. The pilot's logbook was not recovered for examination. The operator reported the pilot had 5,350 total flight hours with 355 hours in make and model. No personal flight records were located for the pilot.

The pilot did not hold a pilot certificate issued by the United States Federal Aviation Administration, which is required to operate a US registered aircraft while in international airspace.

MEDICAL AND PATHOLOGICAL INFORMATION

The pilot's body was transported to Majuro for further processing. The investigation was unable to obtain any results of any testing or examination of the pilot. The mechanism of his injuries, detailed postmortem information was not available.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# WPR16FA064	02/05/2016 1157 MST	Regis# N551JP	Maricopa, AZ	Apt: N/a
Acft Mk/Mdl NORTH AMERICAN F51-D		Acft SN 44-85634	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl PACKARD ROLLS ROYCE V 1650-7			Fatal 2 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: JEFFREY PINO		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPL

Events

1. Maneuvering-aerobatics - Aerodynamic stall/spin

Narrative

HISTORY OF FLIGHT

On February 5, 2016, about 1157 mountain standard time, a North American F-51D, N551JP, sustained substantial damage when it impacted terrain about 6 miles southwest of Maricopa, Arizona. The commercial pilot and the pilot-rated passenger were fatally injured. The airplane was registered to and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan had been filed. The local personal flight departed Stellar Airpark, Chandler, Arizona, earlier that morning, at an unknown time.

Several witnesses, located between about 1/2 to 1 mile from the accident site, reported observing the airplane performing acrobatic-type maneuvers. One witness, described the maneuver as a "regular loop." The witness stated that, during the last half of the maneuver, the airplane never pulled up. He estimated the height of the airplane to be about 2,500 ft above ground level, at the top of the maneuver, and said that the airplane may have rotated during the dive. Several other witnesses reported seeing the airplane descending in a nose-down spiral until it impacted the ground. Further, all of the witnesses that commented on the airplane's engine, stated that they heard the engine running during the nose down spiraling descent. Some of the witnesses described the engine sounding like it was going from full power to a lower power setting.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with airplane multi-engine land and single-engine land, rotorcraft-helicopter, and instrument airplane and helicopter ratings. He also held a flight instructor certificate with airplane single-engine and helicopter ratings. The pilot was issued a third-class airman medical certificate on March 10, 2015, with the limitation that it was not valid for any class after March 31, 2016. The pilot reported on his most recent medical certificate application that he had accumulated 6,700 total flight hours, and had flown 105 hours in the last 6 months.

AIRCRAFT INFORMATION

The dual-seat, low-wing, retractable gear, tail wheel airplane, serial number 44-85634, was manufactured in 1944. The airplane was a type of American fighter used during World War II. A review of the maintenance logbooks revealed that the last annual inspection was accomplished on August 10, 2015, at an airplane hour meter time of 1,882 hours. The engine was given a 100 hour conditional check on August 10, 2015, at an hour meter time of 1,882 hours and 2.4 hours since overhaul.

The airplane's current weight and balance form could not be located and the investigation was unable to determine the weight and balance condition at the time of the accident.

METEOROLOGICAL INFORMATION

A review of recorded data from the Casa Grande Municipal Airport, Casa Grande, Arizona, automated weather observation station, located about 21 miles east of the accident site, revealed that at 1155 conditions were wind from 010ø at 6 knots, visibility 10 statute miles, clear sky, temperature 15ø C, dew point -7ø C, and an altimeter setting of 30.36 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site by the National Transportation Safety Board (NTSB) investigator-in-charge revealed that the airplane impacted terrain at an elevation of about 1,274 ft. All major components of the airplane were contained within the main wreckage site. Wreckage debris of mostly broken canopy

National Transportation Safety Board - Aircraft Accident/Incident Database

pieces and small metal fragments was scattered about 150 ft in front of the main wreckage. The first identified point of contact was a large area of disturbed dirt, about 4 ft by 3 ft in size and 6 inches deep, located about 5 ft aft of the wreckage. The airplane was partially buried in dirt, and two of the four propellers blades were completely buried in the dirt. The two propellers blades that were visible, had about 1/3 of their blades in the ground.

The airplane came to rest perpendicular to the edge of a road and partially buried in a crater. Across the road, an area of light vegetation of about 25 ft by 150 ft was scorched by the post-impact fire. A majority of the fuselage structure and wings were consumed by fire. The power lines located adjacent to the main wreckage were not damaged.

The fuselage came to rest upright on a heading of about 180° magnetic. The wings remained partially attached to the main fuselage. The empennage was partially attached to the main fuselage.

Flight control continuity was established from the individual flight controls to the center portion of the cabin.

The wings sustained thermal damage, and leading-edge compression damage was observed on both wings. The left aileron was attached at all its respective mounts. The left aileron's trim tab was located behind the main wreckage. The left flap was separated but located near its normal position, in the main wreckage. The right aileron was attached at all its respective mounts and sustained thermal damage. The right flap and portions of the right aileron trim tab were separated and were located near the main wreckage.

The empennage was crushed and sustained thermal damage. The vertical stabilizer was attached to all its respective attachment points, and its leading edge was crushed aft throughout its entire vertical span. The rudder was separated, and portions of it were located on top of the engine and on the right wing. The horizontal stabilizers and right elevator remained attached to all their respective attachment points. The left elevator was separated but located near its normal position behind the left horizontal stabilizer. The damage sustained to the left elevator was consistent with impact damage. Both elevator trim tabs were intact and remained attached at all their respective attach points.

The instrument control panel and cabin area were mostly consumed by the post-impact fire. The mounts to a video recording system were found in the wreckage but the recording devices were located, at a later date, in the airplane's hanger. Following the on scene examination, the airplane wreckage was recovered to a secure facility for further examination.

MEDICAL AND PATHOLOGICAL INFORMATION

The Pima County, Office of Medical Examiner, conducted an autopsy on the pilot. The medical examiner determined that the cause of death was "multiple blunt force injuries."

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing on the pilot. Testing was negative for carbon monoxide, cyanide, volatiles, and tested-for drugs. Ethanol was detected in the muscle and liver. Ethanol is primarily a central nervous system depressant commonly found in beer, wine, and liquor. After ingestion and absorption, ethanol is quickly distributed uniformly throughout the body's tissues and fluids. Ethanol is also produced after death by microbial activity.

Review of the pilot's FAA medical records found that they included multiple cardiology evaluations performed as part of special issue requirements because of the pilot's history of an arrhythmia and stroke. The pilot suffered a cardioembolic stroke in March 2012, because of a blood clot that resulted from atrial fibrillation. The atrial fibrillation was successfully ablated in June 2012. At the time of his last FAA medical exam, he reported using rivaroxaban, a blood thinner use to decrease the risk of clots commonly marked as Xarelto.

The most recent cardiology evaluation in the pilot's FAA records, dated February 2015, found no evidence of recurrent atrial fibrillation and no significant cardiovascular abnormalities. Additionally, the pilot's FAA records included multiple neurological evaluations, the most recent of which was from August 2013, which found no significant motor or cognitive impairment.

The pilot's cardiology records from his treating cardiologist for the period from January 2014 to February 2016, were also reviewed. The most recent visit was dated February 5, 2016, the day of the accident. The visit was to follow up on the pilot's annual Holter monitor study (a 24-hour ambulatory electrocardiogram [EKG]). The physician documented that the pilot had done very well in the past year and had not sustained palpitations to indicate atrial fibrillation. The

National Transportation Safety Board - Aircraft Accident/Incident Database

examination documented a normal cardiovascular examination and a normal EKG. The 24-hour monitor showed no evidence of atrial fibrillation. The cardiologist stated that from a cardiovascular standpoint, the pilot was fit for a third-class medical certificate.

TESTS AND RESEARCH

Engine and Airframe Examination

On April 11 and 12, 2016, at the facilities of Air Transport, in Phoenix, Arizona, the airframe and engine were examined.

A majority of the fuselage was extremely fragmented. Some remains of the airplane's instruments and engine controls were located in the recovered wreckage. The airspeed indicator displayed about 530 miles per hour. The left and right wing leading edges, exhibited compression, aft to the wing spar, throughout their entire span.

The forward and aft control stick assembly was located. The forward control stick remained attached; however, it was separated into multiple sections. The aft control stick was bent forward near the base and aft near the upper portion of the stick. The forward and aft control sticks were removed and sent to the NTSB Materials Laboratory for further examination. The examination revealed that both control sticks exhibited ductile overload fractures, and no corrosion or cracks were present.

The engine was mostly intact. Visual continuity of the crankshaft, connecting rods, and pistons was established throughout the entire engine. One of the four propeller blades had separated. The separated blade exhibited "S" bending signatures, leading edge gouges, and chordwise scratches. Two of the attached blades were slightly bent and exhibited leading edge damage and chordwise striations. The other attached blade exhibited slight bending and chordwise striations.

Examination of the airframe and engine revealed no pre-impact anomalies that would have precluded normal operation of the airplane.

A performance study was conducted by the NTSB Office of Research and Engineering. The study used airport surveillance radar to determine the accident airplane's ground track, altitude, and speed. The radar data used in the study began at 1154:59 when the airplane was northwest of Maricopa, Arizona. The airplane climbed from an initial altitude of 5,400 ft to 6,100 ft mean sea level (msl), and, at 1156:45, it descended to 5,700 ft msl. The airplane's airspeeds were calculated and revealed that, during this portion of the flight, airspeed was increasing from 180 kts to 250 kts. The descent and airspeed increase were consistent with maneuvering to enter a climbing acrobatic-type maneuver. The study determined that the airplane's maneuvering and speed during the period from the beginning of the radar data to 1156:45 were well within the airplane's flight envelope.

The secondary set of radar data started after 1156:45, when the airplane was about 5 miles southwest of Maricopa. Ten more radar returns were recorded, but only one recorded an altitude. The point that recorded the altitude was the fifth data point, at 1156:59, and it indicated 7,700 ft msl. Several of the data points were very closely grouped together with no associated altitude information recorded. Acrobatic maneuvering could account for the loss of the altitude information, as the airplane's transponder may not have been properly positioned, relative to the radar antenna.

By 1156:59, the airspeed had slowed to about 100 kts. Additionally, climbing to 7,700 ft, would have required a significant nose-up pitch attitude and a rate of climb of over 8,000 ft/min from the previously known radar point at 1156:45. The last secondary radar return was located about 2,600 ft from the airplane wreckage location.

ADDITIONAL INFORMATION

The F-51D Aircraft Flight Manual states that "no intentional power-on spins or snap rolls are permitted, as it is impossible to do a good snap roll and most attempts end up in a power spin." The manual further states that "no intentional power-off spins are permitted below 12,000 ft."

The manual also states that "power-on spins should never be intentionally performed in this airplane. In a power-on spin, the nose of the airplane remains 10 to 20 degrees above the horizon, and recovery control has no effect upon the airplane until the throttle is completely retarded." In the "Power-On Spin Recovery" section, the manual states if you should ever get into a power spin: "close the throttle completely and apply controls as for the power-off spin recovery. As many as 5 or 6 turns are made after the rudder is applied for recovery, and 9,000 to 10,000 ft of altitude is lost." Additionally, the manual warns that "power-on spins

are extremely dangerous in this airplane."

Subtracting the accident site elevation from the airplane's highest altitude recorded (7,700 ft msl), would allow for about 6,426 ft of altitude for a spin recovery.

According to the manual, the airplane's estimated stall speeds at a gross weight of 9,000 lbs, with gear and flaps up, are 101 mph level, 109 mph at 30° of bank, and 121 mph at 45° of bank. At a gross weight of 10,000 lbs, with gear and flaps up, the stall speeds are 106 mph level, 115 mph at 30° of bank, and 128 mph at 45° of bank.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA16LA195	05/27/2016 1930 EDT	Regis# N1345B	New York, NY	Apt: N/a
Acft Mk/Mdl REPUBLIC P 47D-D		Acft SN 44-90447	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl PRATT AND WHITNEY R-2800-69		Acft TT 553	Fatal 1 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: AMERICAN AIRPOWER MUSEUM		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPE

Events

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

Narrative

HISTORY OF FLIGHT

On May 27, 2016, about 1930 eastern daylight time, a Republic P-47D, N1345B, ditched in the Hudson River near New York, New York, following a total loss of engine power. The commercial pilot was fatally injured and the airplane was substantially damaged. The experimental, exhibition-category airplane was registered to a corporation and was operated by the American Airpower Museum under the provisions of 14 Code of Federal Regulations Part 91 as an aerial observation flight. Day visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed. The local flight originated from Republic Airport (FRG), Farmingdale, New York, about 1900.

The accident airplane was part of a three-ship formation participating in a photo shoot. The #2 pilot in the formation reported that they flew along the beach, on the south side of Long Island, then into the visual flight rules corridor next to John F Kennedy International Airport (JFK). They were about 1,100 ft above the water and proceeding north along the Hudson River about 140 knots. Over the radio, he heard the pilot of the accident airplane report that he had "smoke." (The pilot made a distress call to the Newark Liberty International Airport (EWR) air traffic control tower.) The #2 pilot subsequently saw smoke from the accident airplane then saw the propeller "seize up." The accident pilot maneuvered the airplane for a forced landing in the Hudson River. The #2 pilot observed that the accident airplane's canopy was only partially open; as the airplane descended, touched down on the water, and sank a few seconds later in the Hudson River south of the George Washington Bridge. Attempts by first responders to rescue the pilot were unsuccessful.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with airplane single- and multi-engine land, airplane single-engine sea, rotorcraft-helicopter, and instrument airplane ratings. He also held a Federal Aviation Administration (FAA) airframe and powerplant mechanic certificate. The pilot held an FAA second-class medical certificate and reported 6,400 total hours of flight experience on his application for that certificate, dated August 5, 2015.

AIRCRAFT INFORMATION

The airplane was a low-wing, single-seat, World War II-era fighter airplane with retractable landing gear in a tailwheel configuration. It was powered by a Pratt and Whitney R2800-69, 18-cylinder radial engine and a Hamilton Standard four-bladed, constant-speed propeller.

According to maintenance logbook entries, a condition inspection was completed on May 9, 2015, at a Hobbs time of 553.0 hours. At that time, the engine oil was changed and the oil screen was inspected; no contaminants were observed.

A representative of the corporation that owned the airplane reported that the engine was "low time, less than 400 hours" and that the airplane was due for its next condition inspection on June 1, 2016. The airplane was maintained in a hangar, and the engine "ran well with no recent complaints."

METEOROLOGICAL INFORMATION

EWR was located about 9 miles southwest of the accident location. The 1951 weather observation included wind from 150° at 8 knots, visibility 10 statute miles, few clouds at 5,500 ft, scattered clouds at 18,000 ft, a broken ceiling at 25,000 ft, temperature 28°C, dew point 19°C, and altimeter setting 29.99 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

National Transportation Safety Board - Aircraft Accident/Incident Database

The wreckage was recovered from the river the following day near the 79th Street Boat Basin and transported to the West 30th Street Heliport, New York, New York. An initial examination of the wreckage revealed that the airframe was generally intact. The engine remained attached to the airframe. A cursory examination of the engine revealed that the No. 18 cylinder was damaged, consistent with an in-flight occurrence. Oil was present on the exterior of the engine.

The wreckage was moved to a storage facility where additional examinations were performed by an FAA inspector. The inspector noted that the engine was internally seized and would not rotate. He tried to remove the cylinders; however, all cylinders were damaged and could not be removed from the crankcase. Metallic debris and oil were found inside the supercharger. Four intake manifolds were removed for examination; they were also oil-soaked and contained metal particles. Due to the internal damage to the engine and the inability to remove cylinders, further examination of the engine was not attempted.

MEDICAL AND PATHOLOGICAL INFORMATION

The Office of the Chief Medical Examiner, City of New York, performed an autopsy of the pilot. The cause of death was drowning, and the manner of death was accident.

The FAA's Bioaeronautical Research Sciences Laboratory, Oklahoma City, Oklahoma, performed toxicology testing on specimens from the pilot. Diphenhydramine was detected in the blood and urine at levels too low to quantify.

Diphenhydramine is a sedating antihistamine used to treat allergy symptoms and as a sleep aid and carries the following Federal Drug Administration warning: "May impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g. driving, operating heavy machinery)."

SURVIVAL ASPECTS

An examination of the cockpit seat belt/harness restraints and the canopy system was performed by the NTSB Survival Factors Group Chairman. When examined at the wreckage storage facility, the cockpit canopy was in the full-open position. The cockpit control stick and instrument panel were undamaged. The pilot seat, which was designed to move up and down by engaging a lever adjacent to the seat, operated in a normal manner. The four-point seat belt restraint system consisted of a lap belt and shoulder harness. The system was fastened and unfastened by the investigator and functioned in a normal manner.

The cockpit canopy was designed to be operated by hand, by a motor controlled from an internal switch in the cockpit, or by an external switch located forward of the left of the cockpit window in an access panel. The extremes of travel were limited by two limit switches mounted on the deck behind the pilot seat. The entire operating mechanism was covered by the aft portion of the canopy while in the closed position.

To operate the canopy from inside the airplane, the internal lock release is pushed forward to the full stop. This action disengages the clutch on the canopy motor. While holding forward pressure on the lock release, the pilot can manually move the canopy freely on its rails. To automatically move the canopy, the pilot would select the open or closed position on the canopy switch, which was located in front of the lock release on the left cockpit sidewall.

An examination of the internal and external lock release mechanism was performed. Both lock releases disengaged the motor and allowed the canopy to move freely on its rails. The automatic motor switches were not tested due to flammable fluids in the area and lack of a power source.

To jettison the canopy, the pilot was required to pull the jettison T-handle mounted on the front frame of the canopy. This action allowed the locking pins to be pulled from the two jettison fittings that held the canopy to the roller assemblies. All three fittings would then be free, and the canopy could be jettisoned in-flight or removed on the ground. An examination of the jettison handle was performed. The T-handle was pulled by the investigator and the canopy subsequently released from the rail and departed the cockpit area.

The procedures for ditching the airplane were found in the pilot's Flight Operating Instructions (AN 01-65BC-1A). Section IV, bullet 8 on page 37 described the procedures for ditching:

"If it becomes necessary to abandon the airplane over water and it is not desirable to bail out, the following procedure is suggested. (1) Make sure safety belt and shoulder harness are secure. (2) Lower flaps. (3) Jettison canopy. (4) Make normal approach glide into the wind. Hold off until stall speed is reached, then set down tail first. (5) Ditch into the wind on upslope wave."

The pilot's flight helmet was recovered at the accident scene. The flight helmet shell showed no signs of impact damage and all functions of the helmet operated normally.

National Transportation Safety Board - Aircraft Accident/Incident Database

Incident Rpt# WPR15IA080	12/29/2014 1900 MST	Regis# N7041X	Phoenix, AZ	Apt: Phoenix-mesa Gateway IWA
Acft Mk/Mdl ROBINSON HELICOPTER R22 BETA II	Acft SN 4663	Acft Dmg: NONE	Rpt Status: Factual	Prob Caus: Pending
Eng Mk/Mdl LYCOMING O-360-J2A	Acft TT 337	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091	Aircraft Fire: NONE
Opr Name: QUANTUM HELICOPTERS	Opr dba:		AW Cert: STN	

Summary

The private pilot reported that he was practicing for the commercial pilot helicopter examination and was operating in the airport traffic pattern. The pilot stated that, while entering downwind, he climbed the helicopter to 1,900 ft and was accelerating it to 75 knots when he felt an "abnormal vibration" and smelled "something burning." The low rotor rpm light illuminated, and the low rotor rpm horn sounded. He subsequently entered an autorotation, made an emergency call, and landed successfully off the runway on dirt. Postaccident examination of the helicopter revealed that the fanshaft had fractured circumferentially; the helicopter had a total time of 337 hours. Examination of the fanshaft revealed a crack in the fanwheel's base, which had beach marks that ran from the fanshaft's bearing surface out and down to the mounting surface, consistent with fatigue. The roller bearings and the races bearing surfaces had minor surface damage. The bearings and races were cut away from the fan shaft, which revealed a v-shaped fracture surface that had two cracks emanating from it. This area had sustained damage from the two halves contacting each other with every rotation of the crankshaft, and some material was missing. The fracture origin could not be determined due to the damage. The only anomaly identified during the examination was that the fanwheel was out of balance; however, this likely resulted from the fanshaft failure.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The failure of the fanshaft due to fatigue.

Events

1. Approach-VFR pattern downwind - Sys/Comp malf/fail (non-power)
2. Approach-VFR pattern downwind - Off-field or emergency landing

Findings - Cause/Factor

1. Aircraft-Aircraft power plant-Engine (reciprocating)-(general)-Fatigue/wear/corrosion - C
2. Aircraft-Aircraft power plant-Engine (reciprocating)-(general)-Failure - C

Narrative

HISTORY OF FLIGHT

On December 29, 2014, about 1900 mountain standard time, a Robinson Helicopter Company R22 Beta, N7041X, made an autorotation landing at the Phoenix-Mesa Gateway Airport, Phoenix, Arizona. Quantum Helicopters was operating the helicopter under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The private pilot was not injured, and the helicopter was not damaged. The local instructional flight departed Chandler, Arizona, at an undetermined time. Visual meteorological conditions, and no flight plan had been filed.

The pilot was practicing for the commercial pilot helicopter examination and was operating in the taxiway Charlie pattern. While entering downwind for runway 30, the pilot stated that he climbed to 1,900 ft and was accelerating the helicopter to 75 knots when he felt an "abnormal vibration" and smelled "something...burning." The low rotor rpm light illuminated, and the low rotor rpm horn sounded. He entered an autorotation, made an emergency call, and landed successfully off the runway in the dirt.

An examination on site determined that the fanshaft fractured circumferentially. The helicopter had a total time of 337 hours.

TESTS AND RESEARCH

Fanshaft Examination

The roll pin alignment mark remained aligned, which indicated no movement between the shaft and the fanwheel. The fanwheel to fanshaft mating surfaces exhibited no galling or evidence of slipping.

Investigators checked the fanwheel balance. The forward face registered 10.2 grams (maximum limit was 0.5), and the aft face registered 6.42 grams (maximum limit was 0.50). There were no indications of modifications or repairs since the part was new.

A crack was observed in the base of the fanwheel. Cutting the base in a non-affected area exposed both surfaces of the crack. A visible beach marks appeared to run from the bearing surface of the shaft out/down to the mounting surface.

The roller bearings and the bearing surfaces of the races had minor surface damage. After cutting the bearing and race away from the fanshaft, a v-shaped fracture surface that had two cracks emanating from it was observed. This area sustained damage from the two halves contacting each other with every rotation of the crankshaft, and some material was missing. A definite origin could not be determined.

The bearing surface on the fanshaft and the inner diameter of the inner bearing race were discolored (reddish/brown), and the inner race had an area of material buildup adjacent to the fractures in the shaft.