

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN17LA309	08/09/2017 730 CDT	Regis# N528MB	Galesburg, IL	Apt: N/a
Acft Mk/Mdl AIR TRACTOR AT-802A		Acft SN 802A-0350	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
Eng Mk/Mdl PRATT & WHITNEY CANADA PT6A-67AG	Acft TT 4349	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 137	
Opr Name: LESCO AVIATION INC.	Opr dba:	Aircraft Fire: NONE		AW Cert: SPR

Events

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

On August 9, 2017, about 0730 central daylight time, an Air Tractor AT-802A, N528MB, sustained substantial damage during a forced landing near Galesburg, Illinois. The commercial pilot was not injured. The airplane was registered to and operated by Lesco Aviation Inc. under the provisions of 14 Code of Federal Regulations Part 137 without a flight plan. Day visual meteorological conditions prevailed for the local aerial-application flight that departed at 0630 from Monmouth Municipal Airport (C66), Monmouth, Illinois.

The pilot reported that the accident occurred about an hour into his first aerial-application flight of the day. He stated that he felt a slight "thud or bump" that he initially believed was the airplane flying through its own propeller wash during a turn. The pilot stated that the engine gauges were indicating normal parameters as he continued to line-up for another spray pass; however, before his next spray pass the engine experienced a similar "thud" that the pilot identified as a compressor stall. The pilot entered a climb to gain safe altitude and maneuvered the airplane away from nearby homes. The pilot reported that the engine experienced several more compressor stalls and observed sparks departing the engine exhaust ducts before it experienced a total loss of power. The pilot stated that a forced landing was made in a nearby agricultural field, and that the airplane ground-looped upon landing in the dense crop. The landing gear collapsed and there was substantial damage to the outboard right wing and aileron.

The engine, a Pratt & Whitney PT6A-67AG, serial number PCE-RD0221, was retained for a teardown examination.

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Accident Rpt# CEN17CA294 07/26/2017 1530 CDT Regis# N421CA Harrold, SD
Acft Mk/Mdl AIR TRACTOR INC AT 502B-B Acft SN 502B-2672 Acft Dmg: SUBSTANTIAL Rpt Status: Prelim Prob Caus: Pending
Fatal 0 Ser Inj 0 Flt Conducted Under: FAR 137
Opr Name: CUSTOM AIR INC Opr dba: Aircraft Fire: NONE

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Accident Rpt# CEN16LA247	06/26/2016 1400	Regis# N92DV	Longmont, CO	Apt: Vance Brand LMO
Acft Mk/Mdl BEECH E 90		Acft SN LW-292	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl PRATT & WHITNEY PT6-28		Acft TT 15829	Fatal 0 Ser Inj 1	Flt Conducted Under: FAR 091
Opr Name: MILE HI SKYDIVING CENTER, INC.,		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

1. Maneuvering - Miscellaneous/other

Narrative

HISTORY OF FLIGHT

On June 26, 2016, about 1400 mountain daylight time, a Beech E-90 King Air airplane, N92DV, was struck by an exiting skydiver while the airplane was maneuvering near Longmont, Colorado. The pilot and 14 skydivers were not injured and one skydiver sustained serious injuries. The airplane sustained substantial damage. The airplane was registered to Mile Hi Skydivers Inc. and operated by Mile Hi Skydiving Center, Inc., Longmont, Colorado, under the provisions of 14 Code of Federal Regulations Part 91 as a skydiving flight. Visual meteorological conditions prevailed and no flight plan was filed, but the flight was receiving visual flight rules (VFR) flight following. The local flight originated from Vance Airport (LMO), Longmont, Colorado, about 1345.

The pilot reported that the loading and takeoff portion of the flight were normal with no anomalies. The flight contained 15 skydivers, one of which was a student and the rest were licensed skydivers with varied levels of experience. At 5,000 ft above ground level (agl) the pilot configured the airplane for a jump and activated the jump indication lights. The student and one other skydiver safely exited the airplane at that time as "hop and pop" jumpers. The pilot de-configured the airplane and initiated a climb to the planned jump altitude. The pilot did not recall any jump indication lights being illuminated in the cabin during the climb and none of the remaining jumpers notified him of any illuminated jump lights. He continued the climb to 16,000 ft mean sea level (msl), which was 1,500 ft below normal exit altitude. At 12.2 nautical miles (nm) from the intended GPS waypoint, the pilot maintained a full power setting and continued the climb for 17,500 ft msl. The pilot stated that he activated the amber light, which indicated that the skydivers could open the door and spot check the area. Prior to reaching the jump location, which was 11.2 nm from the waypoint, he was in the process of configuring the airplane for the jump when he felt the flight controls shake, but the flight instruments appeared normal. He then felt a jolt in the flight controls and heard a "thud" sound. He looked back and noticed 3 skydivers had exited the airplane and 3 more were in the process of exiting. He switched the jump lights to red and instructed the remaining skydivers to remain in the airplane. The remaining skydivers told the pilot that someone had hit the tail. The pilot descended and landed the airplane at LMO.

The injured skydiver and two other skydivers (skydivers one, two, and three for report identification purposes only) stated that the amber jump light remained on after the "hop and pop" and was not turned off as expected. Skydiver two stated that he told a senior skydiver about the amber light but the senior skydiver was not concerned since he knew where to spot for the jump. No one notified the pilot that the amber light remained on. When the airplane arrived at 12,000 ft msl the light turned green and a Mile Hi employee opened the door. Skydivers one and two climbed out and held onto the airplane, while skydiver three remained in the doorway. They noted that the airspeed seemed faster than normal as they had difficulty holding on. Skydiver one was to swing his right leg away from the airplane and on the third leg swing they would all jump together. He struggled to swing his leg normally and on the third swing they jumped away from the airplane and tumbled immediately. Skydiver one struck the left horizontal stabilizer and was unable to move his arms. He continued to descend with his back to the ground until his automatic activation device deployed his parachute. He was transported to the hospital with serious injuries.

Another skydiver who was positioned near the pilot during the flight stated that they were on "what appeared to be a jump run" when the door was opened and the first group climbed out of the airplane. When the first group jumped the airplane was flying faster than normal based on the sound of the jumpers exit. He noticed the flap were retracted and another skydiver asked him if a "dent was always in the tail". A second group of skydivers exited the airplane and then the door was shut. He did not see the jump indication light color during the accident. Several others onboard mentioned that the yellow indication light had been on since the "hop and pops" had exited, then the light was green before the first group of three exited.

PERSONNEL INFORMATION

The pilot received initial training in the accident airplane conducted by the operator from April 21, 2016 to June 11, 2016. The training consisted of 11 flights and a total of 60.7 training hours. On June 11, 2016, the pilot passed the operators initial flight competency and proficiency check.

AIRCRAFT INFORMATION

According to the owner of Mile Hi, the jump indication lights are controlled by a rotary switch on the cockpit pedestal. There is one indication light on the pedestal and one light next to the jump door for the skydivers to see. When the light is off or red there are to be no jump activities. The amber light indicates that the door can be opened to spot check the area. The green light indicates that it's safe to jump. The lights can be viewed from anywhere in the airplane, unless another skydiver is blocking the view. If the green light is on and the airplane is obviously not configured for a safe jump, the skydivers should climb back into the airplane and not complete the jump.

METEOROLOGICAL INFORMATION

WRECKAGE AND IMPACT INFORMATION

The responding Federal Aviation Administration (FAA) inspector reported that the left horizontal stabilizer sustained substantial damage.

ADDITIONAL INFORMATION

FAA Advisory Circular (AC) 105-2E: Sport Parachuting

This AC provides suggestions to improve sport parachuting safety and disseminates information to assist all parties associated with sport parachuting to be conducted in compliance with 14 CFR Part 105. The AC states in part:

8. Pilot Responsibilities, b. Jump Pilot Training, (2) Flight Training, (d) Configuration for jump run and jumper exit including procedures for tail strike avoidance.

8. Pilot Responsibilities, e. Operational Requirements: The pilot in command (PIC) is solely responsible for the operational requirements of Parts 91 and 105, including compliance with the special operating limitations and placards required for flight with the door open or removed. The PIC is also responsible for ensuring that each occupant has been briefed on operation of his or her restraint system, procedures for ensuring aircraft W&B stays within limits while jumpers exit, and procedures to avoid tail strikes.

Skydiver's Video

A review of a skydiver's video, who exited the airplane in the group after the injured skydiver, revealed that the flaps were partially extended at the time of the video.

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Accident Rpt# GAA17CA150	02/06/2017 1600 CST	Regis# N246CA	Poplar Bluff, MO	Apt: Poplar Bluff Muni POF
Acft Mk/Mdl BEECH F90-UNDESIGNAT		Acft SN LA-27	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl PRATT & WHITNEY PT6A/60A		Acft TT 8640	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: THE H COMPANY		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

2. Approach-IFR final approach - Controlled flight into terr/obj (CFIT)

Narrative

The pilot reported the during an instrument meteorological condition flight, he elected to accomplish an area navigation approach. He reported that he descended to his minimum descent altitude of 800 feet, decreased the airspeed and began looking outside the cockpit for the runway. He recalled that the visibility was _ of a mile and about 20 seconds later the airplane struck tree tops. The pilot immediately executed the missed approach procedure and made an approach at an alternate airport. The right wing sustained substantial damage.

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

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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: Prelim Prob Caus: Pending
Fatal 0 Ser Inj 0 Flt Conducted Under: FAR 091
Opr Name: HELICOPTER PARTS INTERNATIONAL Opr dba: Aircraft Fire: NONE
INC

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA17CA056	10/25/2016 1500 EST	Regis# N161PD	Ponce, PR	Apt: Mercedita PSE
Acft Mk/Mdl BELL OH 58A-NO SERIES		Acft SN 71-20559	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ROLLS ROYCE T63A720		Acft TT 6497	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: PUERTO RICO POLICE DEPARTMENT		Opr dba:		Aircraft Fire: NONE
				AW Cert: NON

Events

2. Autorotation - Hard landing

Narrative

During an instructional flight, the helicopter was at an altitude of 40 to 50 ft above ground level, at 60 knots, when the flight instructor intended to demonstrate a simulated engine failure and run-on landing. Although the flight instructor had intended to recover from the maneuver prior to an actual run-on landing, he noticed that he did not have enough rotor rpm to recover and elected to continue with the run-on landing. The helicopter then landed hard on a taxiway and slid about 300 ft before coming to rest upright. The flight instructor added that there were no preimpact mechanical malfunctions or failures with the helicopter that would have precluded normal operation. Examination of the helicopter by a Federal Aviation Administration inspector revealed damage to the aft engine bulkhead and wrinkles in the helicopter panels near the tail boom and rotor gear box.

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Accident Rpt# GAA17CA132	02/01/2017 1630 PST	Regis# N519EH	Carson City, NV	Apt: Carson CXP
Acft Mk/Mdl BELL HELICOPTER TEXTRON 206-L1	Acft SN 45429	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual	Prob Caus: Pending
Eng Mk/Mdl ROLLS ROYCE 250-C30P	Acft TT 15845	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091	
Opr Name: AAROW AVIATION	Opr dba:	Aircraft Fire: NONE		AW Cert: STN

Events

2. Landing-flare/touchdown - Dynamic rollover

Narrative

The flight instructor on the controls of the high skid-equipped landing gear helicopter reported that he was the pilot in command (PIC). The PIC reported that he and another flight instructor were performing simulated emergency procedures during the flight. He reported that he attempted to demonstrate a simulated fixed pitch (right stuck anti-torque pedal) emergency procedure. He reported that during the maneuver the nose of the helicopter was about 40° nose right of centerline. He reduced the throttle and the nose corrected to about 20° nose right of centerline. The helicopter touched down on taxiway delta with minimal forward airspeed, and the aircraft bounced about 5 ft above the ground and yawed right about 1 _ turns. The helicopter touched down a second time about 65 ft south of the taxiway centerline and rolled onto its left side. The helicopter sustained substantial damage to the firewall, main rotor drive system and tail rotor drive system.

The Meteorological Aerodrome Report for the airport which the accident occurred and at the time the accident occurred, identified that the wind was out of the 110° at 08 kts.

The flight instructor seated in the right seat, reported that the wind at the time of the accident was out of 090° at 08 kts.

When the PIC was asked by the NTSB investigator-in-charge (IIC); was the collective placed in the full down position after touchdown, he could not remember. When asked if he increased the collective after the initial helicopter touchdown; he could not remember. When asked if he applied full left pedal to combat the right yaw, he said that he did not because the event happened quickly.

According to the Federal Aviation Administration Helicopter Flying Handbook (FAA-8083-21A) and The Helicopter Instructors Flying Handbook (FAA-8083-4) and Advisory Circular (AC) 90-95 Unanticipated rapid right yaw;

Loss of Tail Rotor Effectiveness (LTE) is a critical; low-speed aerodynamic flight characteristic which can result in an uncommanded rapid yaw rate which does not subside of its own accord and, if not corrected, can result in the loss of aircraft control.

AC 90-95 Section 7. d. 3. (page 7) defines Flight Characteristics and wind azimuths: Tail rotor vortex ring state occurs when the wind is out of (210° to 330°).

1. Winds within this region will result in the development of the vortex ring state of the tail rotor.

AC 90-95, Section 10. a. 1-2 (page 8) is titled Recommended Recovery Techniques and states:

a. If a sudden unanticipated right yaw occurs, the pilot should perform the following:

(1) Apply full left pedal. Simultaneously, move cyclic forward to increase speed. If altitude permits, reduce power.

(2) As recovery is effected, adjust controls for normal forward flight.

b. Collective pitch reduction will aid in arresting the yaw rate but may cause an increase in the rate of descent. Any large, rapid increase in collective to prevent

ground or obstacle contact may further increase the yaw rate and decrease rotor rpm.

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

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Incident Rpt# OPS16IA002	01/27/2016 804 EST	Regis#	Detroit, MI	Apt: Detroit Metropolitan Wayne Cou DTW
Acft Mk/Mdl BOMBARDIER INC CL600 2D24-900		Acft SN 15316	Acft Dmg: NONE	Rpt Status: Prelim Prob Caus: Pending
			Fatal 0 Ser Inj 0	
Opr Name:		Opr dba:		Aircraft Fire: NONE

Events

1. Takeoff - Runway incursion veh/AC/person

Narrative

On Wednesday, January 27, 2016, about 0804 eastern standard time (EST), a runway incursion occurred at Detroit Metropolitan Wayne County Airport (DTW), Detroit, Michigan when an airport operations vehicle (OPS), O373, was provided a clearance to operate on runway 22L, and Endeavor Air (Flagship) flight 3860 (FLG3860), a CRJ9, was cleared for takeoff on runway 22L. FLG3860 was operating under the provisions of 14 Code of Federal Regulations Part 121 as a regularly scheduled passenger flight to Norfolk International Airport (ORF), Norfolk, Virginia, and O373 was conducting a routine runway inspection on runway 22L. There was no damage to the aircraft or vehicle, and no reported injuries. Visual meteorological conditions prevailed at the time of the incident.

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Accident Rpt# CEN17LA314	08/10/2017 1810	Regis# N58424	Villa Grove, CO	Apt: N/a
Acft Mk/Mdl HUGHES 369D		Acft SN 1090593D	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
			Fatal 0 Ser Inj 1	Flt Conducted Under: FAR 133
Opr Name: PATROL HELICOPTERS INC.		Opr dba:		Aircraft Fire: NONE

Events

1. Maneuvering-low-alt flying - External load event (Rotorcraft)
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Narrative

On August 10, 2017, about 1810 mountain daylight time, a Hughes 369D helicopter, N58424, had its tail rotor impact a powerline near Villa Grove, Colorado. The pilot received serious injuries. The helicopter sustained substantial tailboom and fuselage damage. The helicopter was registered to Quicksilver Air Inc. and operated by Patrol Helicopters Inc. as a 14 Code of Federal Regulations Part 133 rotorcraft external load flight. Day visual] meteorological conditions prevailed in the area about the time of the accident, and the flight was not operated on a flight plan. The local flight originated from an unknown location.

At 1752, the recorded weather at the San Luis Valley Regional Airport/Bergman Field, near Alamosa, Colorado, was: Wind 340ø at 21 kts gusting to 33 kts; visibility 10 statute miles; present weather light thunderstorms and rain; sky condition broken clouds at 10,000 ft and broken clouds at 12,000 ft; temperature 23ø C; dew point 6ø C; altimeter 30.32 inches of mercury.

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Accident Rpt# WPR17LA180	08/05/2017 2000	Regis# N410NA	Pocatello, ID	Apt: Pocatello Rgnl PIH
Acft Mk/Mdl LOCKHEED P2V 5F-H		Acft SN 131482	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
Eng Mk/Mdl WESTINGHOUSE J34-WE-36A		Acft TT 8487	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 137
Opr Name: NEPTUNE AVIATION SERVICES INC		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPR

Events

1. Enroute-climb to cruise - Flight control sys malf/fail

Narrative

On August 5, 2017, about 2000 mountain daylight time, a Lockheed P2V-5, N410NA, was substantially damaged shortly after a departure from Pocatello Regional Airport (PIH), Pocatello, Idaho. The airline transport pilot, commercial pilot and passenger were not injured. The airplane was registered to and operated by Neptune Aviation Services, Inc. under contract with the United States Forest Service to provide aerial application services. Visual meteorological conditions prevailed and a flight plan was not filed for the local flight, which was conducted under the provisions of 14 Code of Federal Regulations Part 137.

According to the pilot-in-command (PIC), the flight departed on its third mission to disperse fire retardant over a nearby wildfire. During the airplane's climb, the PIC observed an uncommanded aft movement of the control yoke with a simultaneous increase in the airplane's pitch attitude. He instructed the first officer (FO) to retract the flaps while he re-trimmed the elevator, but they were not able to regain pitch control. The airplane's varicam indicator showed a few degrees of nose down trim and did not change for the remainder of the flight. The FO attempted to adjust his trim wheel and then re-trim the airplane using the emergency varicam, but the airplane continued to maintain a pitch up attitude. He then deployed 5ø of flaps at the PIC's instruction, which reduced the elevator backpressure. The PIC subsequently jettisoned the load of fire retardant over vacant farm land and then asked the FO to declare an emergency with the tower controller while the PIC entered a shallow left turn to intercept the downwind leg for Runway 21. As he made his control inputs he determined that the elevator was bound as he received little response from the elevator control.

The PIC had previously demonstrated approaches to land without making any adjustments to power or pitch, so he configured the airplane for an approach without trim or elevator control. They flew a wide traffic pattern and made small adjustments to compensate for altitude. During the final approach leg, the PIC used a combination of wing flaps and engine power for pitch up adjustments, crew coordinated application of elevator for trimmed pitch, and turns to make their pitch down adjustments. As the airplane reached about 500 feet above ground level, the crew deployed the airplane's remaining 5ø of flaps to increase the pitch attitude. Both the PIC and FO pulled hard on the yoke while the FO gently retarded the throttles and the PIC trimmed the emergency varicam.

Postaccident examination of the airplane revealed damage to the varicam. As this secondary control surface is directly connected to the elevators and provides a primary structural load path for all elevator loads, the damage was classified as substantial. Further examination of the varicam showed that the varicam actuator's outboard locating bolt had backed out of the drive coupling. The bolt head had not been safety wired.

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Accident Rpt# WPR15TA071	12/31/2014 1330 PST	Regis# N530KK	Las Vegas, NV	Apt: North Las Vegas KVG
Acft Mk/Mdl MD HELICOPTER INC 369FF		Acft SN 0174FF	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ROLLS ROYCE 250-C30		Acft TT 7314	Fatal 0 Ser Inj 2	Flt Conducted Under: FAR PUBU
Opr Name: LAS VEGAS METROPOLITAN POLICE DEPARTMENT		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

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

Narrative

On December 31, 2014, about 1330, Pacific standard time, an MD Helicopter Inc. 369FF, N530KK, was substantially damaged during an emergency autorotation landing following a sudden loss of engine power in Las Vegas, Nevada. The two commercial pilots on board sustained serious injuries. The helicopter was registered to, and operated by, the Las Vegas Metropolitan Police Department as a public aircraft flight. Visual meteorological conditions prevailed, and no flight plan was filed. The local flight originated from North Las Vegas Airport (VGT), Las Vegas, at 1322.

The pilot reported that he had taken off with 64 gallons of fuel and was orbiting over a fixed location when he noticed a drop in engine and rotor revolutions per minute (rpm). The pilot then rolled the helicopter out of the orbit, and the engine and rotor rpm stabilized momentarily at 97%. The pilot attempted to increase the engine and rotor rpm while turning west towards the North Las Vegas Airport. During the maneuver, the engine and rotor rpm rapidly degraded. The pilot entered an autorotation, and executed an emergency landing. The helicopter touched down hard, the tail impacted the ground, and separated from the airframe.

The helicopter was examined on-scene by a Federal Aviation Administration (FAA) inspector. The inspector stated that he was only able to look at one side of the engine because of how the helicopter was positioned on the ground, and that he did not identify anything unusual. He checked the flight controls and reported that everything was connected. The helicopter was recovered to the Las Vegas Metro Police Department's hangar at the North Las Vegas Airport. Two FAA inspectors examined the helicopter on January 7, 2015, and reported that the engine outer combustion chamber, external fuel line connected to the fuel nozzle, and the fuel nozzle connection had sustained impact damage. Additionally, the engine fuel nozzle b-nut was "finger tight."

On January 14, 2015, representatives from MD Helicopters and Rolls-Royce examined the helicopter with oversight provided by a FAA inspector. The helicopter sustained substantial damage to the lower fuselage structure, aft fuselage section, tailboom and landing gear. There was no damage to the main structural members of the fuselage and the transmission/static mast support structure. The aft cabin was intact with no visible damage. The underside of the fuselage displayed damage to the belly skin and supporting interior structure with major damage to the aft landing gear fitting and center beam.

The top aft surface of the composite engine air fairing showed evidence of main rotor blade contact along with the tailboom. The tailboom was severed into two segments. The forward segment was still attached to the upper aft boom fairing. The vertical and horizontal stabilizer were both firmly attached to the aft segment. The vertical stabilizer's stinger was broken off and the vertical and horizontal stabilizers both displayed impact damage from ground contact. The aft portion of the left and right landing gear struts were broken and splayed outward resulting in the helicopter coming to rest on the lower fuselage structure.

Cyclic and collective control continuity was verified. Damage to the tail rotor controls corresponded with tailboom damage. The tail rotor blades exhibited impact damage with bent spars or tear to the blade skin. The main rotor blade damage varied in severity and included blades being bent, chordwise wrinkling, leading/trailing edge and tip cap damage. One blade was fractured at the inboard end just outboard of the root fitting. Drive system continuity was verified. The main rotor system hub assembly and components displayed typical damage from main rotor blades contacting the tailboom during the hard landing. There was visible damage to the hub upper and lower shoe, feather bearings, pitch change housings, and droop stops. Damage was consistent with the excessive blade flapping and lead-lag excursions of the main rotor from sudden stoppage at low rotor rpm without engine power.

The fuel cells were near full and there was no reported fuel spillage at the accident site. A vacuum check from the fuel inlet line at the fuel pump to the fuel shut off valve was satisfactorily completed. The fuel cells were drained using the maintenance fuel pump located in the fuel cell and the left fuel cell cover removed. The fuel cells appeared undamaged and the fuel removed looked visually clean. The maintenance fuel pump was removed and the fuel inlet ports and fuel tank sump was inspected. No contamination or blockage was found. Inspection of the fuel line plumbing and fittings did not identify any damage or discrepancies.

Visual inspection found the engine and related systems sustained only minimal external damage. There was visible impact damage to the engine's outer combustor case, fuel nozzle and fuel line. The fuel nozzle was cleaned just prior to the accident flight and the fuel line was reported loose at the accident site, however the fuel line also exhibited impact damage. The engine manufacturer reported that past experience has shown that b-nuts that are not fully torqued on

the fuel nozzle may not affect normal engine operation, and that properly torqued b-nuts don't come loose under normal operating conditions.

There was no obvious evidence of fuel leakage in the engine area. Inspection of the engine mounts found the aft engine mount legs bent at the turn buckles. The left and right engine side mounts appeared undamaged. There were contact marks on the firewall from the engine driveshaft indicating movement of the engine during the crash sequence. With electrical power applied the engine trim switch (N2) was functional when tested. Some pneumatic and fuel line b-nuts had torque paint that was broken or misaligned. A check of air, fuel and oil lines found them to be at least hand tight. A check of the throttle and governor controls was completed with no discrepancies noted. The engine was removed from the airframe for further examination and testing.

Examination and functional testing of the engine was conducted on January 20, 2015 at Aeromaritime America Inc., located on Falcon Field in Mesa, Arizona. Representatives from the airframe and engine manufacturers were present and oversight was provided by a FAA inspector. The damaged outer combustion case, combustion liner and fuel nozzle were replaced with serviceable items. Except for the fuel line to the fuel nozzle and the fuel supply line at the fuel control, no other fuel or pneumatic lines were altered prior to the test cell run. The engine was run on the test cell and no operational discrepancies were noted, with the engine producing rated power. After the test cell run, a pneumatic leak check was performed on the pneumatic portion of the fuel control system. The scroll to Pc filter line was disconnected and 30 psi air pressure was applied to the Pc filter. A soap solution was used to check all fittings and lines in the system for leaks. The Pg accumulator line connection showed a formation of small air bubbles indicating a leak. The line was tightened with wrenches and the leak stopped. All the other lines were checked with a torque wrench and found to have 65 inch-pound or greater torque.

Two external fuel lines were examined by the NTSB investigator-in-charge, one line that had orange fire sleeve attached from end to end that connected the engine to the firewall, and the other, a black hose connecting the firewall to the fuel shut off valve. The fuel lines were examined visually using a borescope, and by sectioning the lines into segments. Additionally, the fuel filter was examined and found to be clear of debris. The examination of these items revealed that they were in very good functional condition with no anomalies identified.

A fuel sample was taken from the fuel line that runs between the firewall and the shutoff valve. The sample was a clear fluid with a petroleum odor and had a small amount of white particulate sediment. The sample was analyzed by a third party. The sample was examined using ASTM D2887 (Standard Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography) to determine the type of fuel in the sample. The distillation results for this sample were consistent with jet fuel (Jet-A). In addition, the visible particulates were tested using ASTM D5185 (Standard Test Method for Multi-element Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)). The results were sodium (Na) 82.8 mg/kg, zinc (Zn) 4.9 mg/kg, iron (Fe) 5.4 mg/kg, and magnesium (Mg) 6.7 mg/kg. The elements found are commonly occurring elements found in many things, including soil.

The most recent weight and balance was dated April 3, 2014, showed the helicopter empty weight as 1975.22 pounds. At the time of the accident the gross weight was calculated to be 2,810 lbs. It was determined that the helicopter had been operating within the published weight and balance limits. Maintenance records and a witness statement show that a 100-hour airframe and engine inspection had been completed on December 31st but had not been signed off as completed by maintenance personnel before the pilots took the helicopter.