

		NTSB ID: CEN09MA117		Aircraft Registration Number: N748P	
		Occurrence Date: 01/04/2009		Most Critical Injury: Fatal	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place Morgan City	State LA	Zip Code 70680	Local Time 1409	Time Zone CST	
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility: 14			
Aircraft Information Summary					
Aircraft Manufacturer SIKORSKY		Model/Series S-76C		Type of Aircraft Helicopter	
Revenue Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident: *** Note: NTSB investigators traveled in support of this investigation and used data obtained from various sources to prepare this aircraft accident report. *** HISTORY OF FLIGHT On January 4, 2009, at 1409 Central Standard Time (CST), a Sikorsky S-76C++ helicopter, N748P, registered to and operated by PHI, Inc. (PHI), as a 14 CFR Part 135 air taxi flight using day visual flight rules (VFR), crashed into marshy terrain approximately 7 minutes after takeoff and 12 miles southeast of the departure heliport. The helicopter sustained substantial damage. Both pilots and six of the seven passengers were killed, and 1 passenger was critically injured. The helicopter departed Lake Palourde Base Heliport, a PHI base (7LS3), in Amelia, Louisiana, and was en route to the South Timbalier oil platform ST301B to transport workers from two different oil exploration companies. No flight plan was filed with the Federal Aviation Administration (FAA), nor was one required. A company flight following plan was filed with the PHI Communications Center that included weather updates, pertinent advisories, and position reports. The flight was tracked via Outerlink, a satellite based fleet-tracking system used by the PHI communications center based in Lafayette, Louisiana. The helicopter departed 7LS3 at 1402. The helicopter's flight track, recorded by the Outerlink system, ended about 7 minutes after departure, at 1409. There were no reports of any distress calls or emergency transmissions from the flight crew on the PHI radio frequencies, or on any monitored air traffic control frequencies. A search and rescue operation was initiated at 1414 after the US Air Force received a 406 MHz Emergency Locator Transmitter (ELT) distress signal with the helicopter's unique identifier and location. Notification was made to PHI and the United States Coast Guard. Shortly thereafter, the helicopter wreckage was found partially submerged in a marshy bayou, near the location of the last Outerlink track. Data and audio recordings retrieved from the helicopter's combination cockpit voice recorder (CVR) and flight data recorder (FDR) indicated that the helicopter was in level cruise flight at 850 feet mean sea level (msl), traveling at 135 knots indicated air speed, when a loud "bang" occurred. Immediately following the "bang," sounds were recorded consistent with rushing wind, engine power reductions on both engines, and main rotor rpm decay. AIRCRAFT INFORMATION General Information The twin-engine, 14-seat, 2-year-old helicopter was equipped with glass cockpit instrumentation, a combination cockpit voice recorder (CVR) and flight data recorder (FDR), an enhanced ground proximity warning system (EGPWS), solid state quick access recorder (SSQAR), and a VXP vibration recorder.					
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The two Turbomeca Arriel 2S2 turbo shaft engines were equipped with digital engine control units (DECU). All of these devices were recovered and evaluated for recorded information.

Engine Control Quadrant Design

The Sikorsky S-76C++ helicopter has an overhead engine control quadrant that houses two engine fire extinguisher T-handles, two engine power control levers (ECL), two fuel selector valve control levers, and various switches for other essential functions. The fire extinguisher T-handles, which are about 4 inches aft of the captain's and first officer's windshield, are normally in the full forward position, and are held in place by a spring-loaded pin that rests in a detent. Force is required to move the handles out of the detent and aft. In the event of an in-flight engine fire indication, the affected engine's fire extinguisher T-handle will illuminate, and the flight crew is trained to pull the illuminated handle full aft. In doing so, a mechanical cam on the T-handle lifts the trigger on the ECL out of a wedge-shaped stop, allowing the handle to move aft, which reduces the fuel flow to the affected engine. Eventually, the fuel flow to the engine is shut off as the fire extinguisher T-handle continues aft and pushes the fuel selector valve to the OFF position. The fire extinguisher system is then automatically armed and ready for the pilots to release the fire extinguishing agent into the appropriate engine compartment.

The S-76C++ engine control quadrant is physically similar to previous models of the S-76 series (S-76A, S-76B, S-76C, S-76C+), in that the ECLs are located in the overhead engine control quadrant. The S-76A, S-76B, and S-76C use push-pull cables to manually control the engine throttle positions on each engine's hydro-mechanical units. The S-76C+ uses an electronic engine control design with a manual push-pull cable reversionary mode. The ECLs of the S-76C++ series are based on a dual-channel allelectronic engine control design, in that the ECLs are attached to potentiometers that transmit ECL position electronically to each respective electronic engine control unit.

Windscreens

In 2007, about 2 years prior to the accident, PHI removed the original, factory-installed laminated glass windshields in N748P and installed lighter-weight cast acrylic windshields manufactured by Aeronautical Accessories Incorporated (AAI). The Federal Aviation Administration approved use of the replacement windshields under Supplemental Type Certificate SR01340AT, issued to AAI on April 16, 1997. The FAA also issued Parts Manufacturer Approval to AAI on August 3, 1998, for manufacturing of the replacement windshields. The helicopter's windshields were replaced again in 2008, about 1 year before the accident, due to cracking at the mounting holes.

Low Rotor Speed Warning Systems

The S-76C++ helicopter's integrated instrument display system (IIDS) provides the flight crew with engine and main rotor system performance information. Three IIDS screens are mounted in the instrument panel; one in front of the captain, one in front of the co-pilot, and one in the center of the instrument panel (the main rotor [Nr] information is only displayed on the pilot's and copilot's IIDS.) The Nr data is provided to the flight crew by a broad colorbar on the right side of the IIDS. The IIDS Nr colorbar is green when the helicopter's Nr is between 106 and 108 percent, yellow when the Nr is between 91 and 105 percent, and red when Nr is 90 percent and below, warning the flight crew of a critical, unsafe flight conditions requiring immediate action. The helicopter was not equipped with an audible alarm or a master warning light to alert the flight crew of a low Nr condition, nor was one required by 14 CFR Part 29. The IIDS also provides a visual caution legend such as "1 out of fly" to the crew any time an engine speed selector is out of the FLY detent with the weight off wheels.

PERSONNEL INFORMATION

A review of the accident flight crew's training records indicated that both pilots had accomplished all required training and had completed emergency initial and recurrent training in ground school and in the Sikorsky S-76C++ simulator.

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The 63-year-old captain had approximately 15,373 flight hours when the accident occurred, of which 14,673 were in rotorcraft; 8,549 as pilot-in-command; and 5,423 in the S-76. He held an airline transport pilot certificate for helicopters, and a commercial pilot certificate for fixed-wing airplanes. He also held an instrument rating for helicopters and airplanes. His last FAA flight proficiency check was on October 27, 2008. His first class FAA medical was issued on August 11, 2008, with a restriction that he wear corrective lenses while flying. He had flown 219 hours in helicopters in the preceding 90 days.

The 46-year-old co-pilot had approximately 5,524 flight hours, of which 1,290 were in helicopters, with 962 in the S-76. He held an airline transport pilot certificate for helicopters and a commercial certificate for fixed-wing airplanes. He also had a flight instructor certificate valid for giving instruction in single/multi-engine airplanes and helicopters. His instrument rating was valid for both airplanes and helicopters. His last FAA flight proficiency check was on April 25, 2008, and his last FAA first class medical was issued on February 26, 2008, with a restriction that he wear corrective lenses while flying. He had flown 205 hours in helicopters during the preceding 90 days.

METEOROLOGICAL INFORMATION

The weather conditions reported at Amelia, Louisiana, at 1430 CST were scattered cloud layers at 1,500 feet and 3,500 feet; a broken cloud layer at 10,000 feet; visibility 10 miles; winds at 160 degrees at 6 knots; temperature of 24 degrees Celsius; and a dew point of 19 degrees Celsius.

WRECKAGE AND IMPACT INFORMATION

The majority of the major components were accounted for and recovered from the accident scene. Examination of the accident site indicated that the helicopter impacted on its left side on an approximate heading of 120 degrees. Extensive deformation on the left side of the helicopter was noted and exhibited signatures consistent with hydrodynamic and soft terrain impact. The largest portion of the helicopter came to rest in a marsh area and consisted primarily of the upper deck from above the cockpit area to the aft engine compartment. The corresponding lower fuselage section was adjacent to the upper deck. The two sections remained attached by wiring harnesses only.

The tail boom was separated from the fuselage at the forward attach point (fuselage station 300) and exhibited extensive impact damage. The vertical pylon was partially separated from the tail boom and was deformed to the right side of the aircraft. The left-hand horizontal stabilizer was separated from the tail boom and the right stabilizer was attached but damaged.

The number 2, 3, and 4 tail rotor driveshaft segments, along with their respective hanger bearings, appeared to have been pulled forward during the impact sequence and exhibited minimal rotational scoring/damage. The coupling disk packs were securely attached to each associated coupling and exhibited minimal distortion. The number 4 driveshaft was observed separated approximately six inches forward of the intermediate gearbox attach point. The number 5 driveshaft was securely attached to the intermediate gearbox and the tail rotor gearbox.

The tail rotor system exhibited extensive damage. The tail rotor gearbox output housing and gear separated from the gearbox center housing. The gear teeth appeared normal and did not exhibit any pre-impact anomaly. The blue, yellow, and black tail rotor blades exhibited minimal rotational impact damage. The black and yellow tail rotor blades had fractured just outboard of their respective hub retention plates. The blue blade was securely attached to the hub and the red blade was observed broken with "broom straw" damage approximately seven inches from the root end of the blade. The remaining section of the tail rotor gearbox housing was observed securely attached to the upper vertical pylon. The tail gearbox magnetic chip plug was removed and observed free of ferrous debris.

The four main transmission mounts were securely attached to the deck structure and did not exhibit any pre-impact damage. The transmission rotated freely. Continuity from the two input shafts to the main rotor head and tail takeoff was established. The magnetic chip plugs were removed and observed clean with oil still remaining inside of them. The transmission fluid level was observed to be in its normal state.

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The main rotor blade system exhibited impact damage consistent with low-speed rotation. The yellow and black main rotor blades were observed attached to the hub and predominately intact with some impact damage. The red blade had separated approximately 27 inches from the root end of the blade, and the remaining portion of the blade was recovered. The blue blade exhibited two separations, one at approximately 40 inches from the root and another about 12 feet from the root. With the exception of a small tip portion, approximately 8 feet of the blue blade was not recovered.

The main rotor hub was observed securely attached to the main rotor shaft and exhibited substantial impact damage. The drive links and swashplate were intact and did not exhibit pre-impact damage. The four pitch control rods were observed securely attached and undamaged. The three main rotor servo actuators and associated hydraulic lines were securely attached and did not exhibit any pre-impact anomalies. The three primary servo actuators all displayed a part number of 76650-09805-111 and had experienced a recorded 1,104 hours of operations since overhaul, with an approximate total time of 3,400 hours.

The engines were mounted in the airframe engine compartment. The No. 1 (left) engine exhibited significant deformation of the left side and both engines were deformed from their respective mounts in a left-to-right direction. There was no evidence of fire, fuel leaks, or oil leaks.

The No. 1 and No. 2 axial compressor wheels rotated easily. There was evidence of some ingestion of mud and debris. The axial compressor wheel and blades were intact with some tip bending. The power turbine wheel rotated easily. The power turbine wheel and blades were intact and there were signs of blade rub on the bottom of the housing, consistent with a hard landing or impact. The short shafts were observed pulled out of the engine output coupling for both engines but securely attached to the transmission inputs. The flexible couplings and triangular flange exhibited minimal deformation.

Complete control continuity could not be established from the cockpit aft to the mixing unit due to impact damage and crush deformation of the airframe. Control continuity was established from the mixing unit to the flight control servos to the main rotor blades. No pre-impact anomalies were observed. All hydraulic fluid reservoirs were found to be full of hydraulic fluid with no evidence of leakage noted.

FLIGHT RECORDER INFORMATION

Data from the Penny and Giles combination FDR and CVR were analyzed at the NTSB's Recorders Laboratory with download assistance from the manufacturer's facility in England and the US Army Safety Center in Fort Rucker, Alabama. Both recorders captured the entire accident flight.

The CVR recorded the sound of a bang and a loud air noise followed by a substantial increase in the background noise level that was recorded on both intercom microphones and the cockpit area microphone. Less than a second after the bang and loud air noise, the CVR captured the sound of decreasing rotor and engine rpm. Seventeen seconds later, the recording ended.

The non-volatile memory (NVM) from the engines' digital Engine Electronic Control Units (EECUs) was successfully downloaded and no faults were recorded.

TESTS AND RESEARCH**Engine Examinations**

On January 22, 2009, the No. 2 engine, a Turbomeca Arriel 2S2, SN 21010, was disassembled under NTSB supervision. Other than impact damage, no anomalies were noted. The engine's hydromechanical unit (HMU) was removed and examined. It was determined that it could be run on a test bench. Prior to running the HMU, the position of the resolver and the manual microswitch were determined. The resolver was at 59.33 degrees, which equates to a fuel flow of about 137 pounds per hour and an N1 of about 86.8 percent. The manual microswitch was found to be in the open or neutral position, indicating that the HMU was in the automatic mode.

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The HMU was then run on the test bench with no significant out-of-limits noted; however, there was a fuel leak observed that appeared to be from the varilip seal. As fuel pressure increased, the fuel leak decreased.

On January 23, 2009, the No. 1 engine, a Turbomeca Arriel 2S2, SN 21022, was disassembled. Other than impact damage, no anomalies were noted. The engine's HMU was removed and examined. Impact damage to the unit precluded it from being run on the test bench. The position of the resolver and the manual microswitch were determined. The resolver was at 28.38 degrees, which equates to a fuel flow of about 250 pounds per hour and an N1 of about 98.0 percent. The manual microswitch was found to be in the open or neutral position, indicating that the HMU was in the automatic mode.

Flight Computer Memory Download and Testing

The FZ-706 Digital Flight Computer, P/N 7015480-903, S/N 05061626, was connected to test equipment and the error codes were successfully recovered. The most recent error codes included Error 20 (Actuator Reference Fail) and Error 18 (LVC Fail - Line Voltage Compensation). These codes are produced in pairs and occur when the avionics DC supply voltage is activated prior to turning on AC power (normal occurrence). The unit was then subjected to the Final Acceptance Test Procedure (ATP) and passed all ATP tests.

The FZ-706 Digital Flight Computer, P/N 7015480-903, S/N 05051607, was connected to test equipment and the error codes were successfully recovered. The most recent error codes included Error 18 (LVC Fail - Line Voltage Compensation) and Error 30 (Yaw Trim Fail). There were no date/time entries associated with the error codes; therefore, no conclusion could be made as to when they were generated. The unit was then subjected to the Final ATP and passed all ATP tests.

Testing of Bird Strike Remnants

A bird specialist with the U.S. Department of Agriculture (USDA) examined the helicopter for evidence of a bird strike. Initial visual examinations did not detect conspicuous evidence of a bird strike. Swabs were then taken from the pilot-side windscreen, from an area of the windscreen that exhibited concentric ring fractures. Similar concentric rings were visible in the gel coat of the fuselage area just above the windscreen. The sample was sent to the Smithsonian Institution Feather Identification Lab for identification. Results from DNA testing on that sample showed that microscopic remains of a hawk variety bird were present.

Additional swabs for bird remains were taken from the fuselage, empennage, various inlets, including the engines, and from the main rotor hub and main rotor blades. Examination revealed the presence of small parts of feathers under a right side windscreen seal, and in the folds of the right engine's inlet air filter.

Material consistent with bird remains was also discovered on the right windshield adjacent to the upper windshield frame structure. Additional samples were also found in the engine air filters. The Smithsonian Institution's feather identification laboratory in Washington, D.C., identified all of the remains as belonging to a female red-tailed hawk, which has an average weight of 2.4 pounds.

Main Rotor Actuator Examinations

The systems group chairman directed computed tomography scanning of the main rotor actuators on January 9-11, 2009, and the entire systems group convened on January 26 and 27, 2009, in Santa Clarita, California, at the servo manufacturer's facility to examine and document the main rotor servo actuators. The three main rotor servo actuators were subjected to X-ray computed tomography (CT) and digital radiography scanning to document the internal condition of the components. The scanning was conducted from January 9- 11, 2009. For the CT scans, each component was imaged by using approximately 300 to 500 slices with a resulting image file size of slightly over 2 megabytes for each slice. The slices were each 0.5 mm thick with a cross sectional pixel dimension within each slice of approximately 0.27 mm x 0.27 mm. The total number of slices collected was 1312, and the total scanning time was 59 hours. For the digital radiograph (DR) images, the actuators were subjected to a process similar to a conventional X-ray.

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The image was gathered using the same detector used for the CT scans, but the actuator remained stationary and the images contain elements superimposed on each other.

Each data set was evaluated using the VGStudioMax software package to create a three-dimensional reconstructed image of the component. At some points, the actuator was too thick for the X-rays to penetrate with a high enough frequency to generate a good image. For each of the actuators, no evidence of broken parts, clogged hydraulic passages, or internal debris was found.

All three main rotor servo actuators were visually examined and no significant faults were found. All lockwire and cotter pins were in place. After the units were examined, they were all cleaned with a low-pressure solvent wash prior to being loaded into the functional test bench.

Prior to functional testing, hydraulic samples were taken by capturing the fluid in the servos as it came out of the return port. The samples were collected for both actuator stages for each actuator. Patch testing was conducted on all of the fluid samples and the results showed no contamination of the fluid.

The aft servo test results were all within the listed test tolerances. The lateral servo test results were all within the listed test tolerances except for the interstage position error test and the input force level (both systems pressurized, retract direction) test. The forward servo test results were all within the listed test tolerances except for the system 1 low side pressure switch test results.

The units were all disassembled and the removed components were examined. All of the plasma coatings were intact on the piston heads and no cracks or missing material was noted. There were some areas on the plasma coating that were shiny and appeared to be consistent with wear polishing. These areas were on the outboard side of the system 1 piston and the inboard side of the system 2 piston. These shiny areas were most pronounced on the aft servo pistons, less pronounced on the forward servo piston heads, and not present on the lateral servo piston heads. The balance tubes were removed and those seals were also intact and did not appear to be worn.

ADDITIONAL INFORMATION

Helicopter Windshield Requirements

Title 14 Code of Federal Regulations (CFR) 29.631 includes general requirements for bird strike resistance for transport-category helicopters and states that, at a minimum, the helicopter should be capable of safe landing after impact with a 2.2-pound bird at a specified velocity. Title 14 CFR Part 27 contains no bird strike requirements for normal-category helicopters, even though they are frequently used for commercial operations such as emergency medical services and sightseeing flights. In addition, current FAA requirements for helicopter windshields in 14 CFR 27.775 and 29.775 do not mention bird strike resistance and simply indicate that "windshields and windows must be made of material that will not break into dangerous fragments." No definition is provided for the term "dangerous fragments," nor is there guidance as to how a manufacturer would show compliance with the requirement.

In contrast, performance-based requirements for airplane windshields specifically address bird strikes. According to 14 CFR 25.775, windshields for transport-category airplanes "must withstand, without penetration, the impact of a four-pound bird" at a specified velocity and also must be designed to minimize the danger to pilots from flying windshield fragments. According to 14 CFR 23.775, windshields for commuter-category airplanes "must withstand, without penetration, the impact of a two-pound bird" at a specified velocity.

A 2006 study by Dolbeer, Wright, and Cleary, ("Bird Strikes to Civil Helicopters in the United States, 1990-2005," 8th Annual Meeting of Bird Strike Committee - USA, August 2006) which summarized the data for bird strikes on helicopters in the FAA's National Wildlife Strike Database, concluded that (1) helicopters were significantly more likely to be damaged by bird strikes than airplanes, (2) windshields on helicopters were more frequently struck and damaged than windshields on airplanes, and (3) helicopter bird strikes were also more likely to lead to injuries to crew or passengers.

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The authors concluded that the "high percentage of windshields damaged for helicopters, combined with the disproportionate number of human injuries, indicates that improvements are needed in windshield design and strength for these aircraft."

Replacement of Sikorsky S-76 Windshields

All S-76C++ model helicopters are delivered with laminated glass heated windshields that are 0.30-inch thick with a 0.12-inch thermally tempered glass ply outboard, a 0.12-inch chemically tempered glass ply inboard, and 0.06-inch polyvinyl butyral interlayer between them. In 1985, Sikorsky tested the laminated glass heated windshield for impact resistance for compliance with a European airworthiness requirement. During the tests, 26-inch square panels were impacted with 2-pound birds at a speed of 160 knots at an angle of 35 degrees. In some tests, the exterior glass layer cracked after the impact, but the birds did not penetrate the windshield panels.

In the early 1980's, PHI had delamination issues with the original equipment manufacturer (OEM) glass laminated windshields. In 1984, a PHI customer-owned S-76A, which PHI operated, was purchased with monolithic cast acrylic windshields. At that time PHI became aware that replacement monolithic cast acrylic windshields were available. In the following years (mid 1980's to 1990's), PHI began replacing glass laminated windshields on most of its S-76 fleet. Eventually, all newly purchased PHI helicopters were equipped with monolithic cast acrylic windshields manufactured by AAI. These windshields were manufactured under the AAI PMA and STC SR01340AT. PHI also concurrently removed the main gearbox-mounted AC generator that provides power for the windshield heaters. The cast acrylic windshields are not equipped with heating elements, and thus do not require the AC generator to be installed.

At the time of the accident in January 2009, PHI had a fleet of 46 S-76's, all of which were equipped with monolithic cast acrylic windshields. As of September 11, 2009, PHI still had a fleet of 46 S-76's, 32 of which had been re-fitted with OEM-type glass laminated windshields. This left a fleet of 14 S-76A++ (older aircraft) which still had monolithic cast acrylic windshields.

Other Sikorsky S-76 helicopters in PHI's fleet also had their original windshields replaced with the cast acrylic windshields. AAI did not perform any bird impact testing on the cast acrylic windshields supplied for the S-76. The NTSB is aware of an additional bird strike incident on April 19, 2006, involving an S-76A++ helicopter operated by PHI that was equipped with a cast acrylic windshield identical to the one in the accident helicopter. The examination revealed a near-circular hole with radiating cracks near the top center of the right windshield. The bird penetrated the windshield and pushed the right throttle to idle. The trapped remains of the bird prevented the right throttle from being re-engaged, but the pilot was able to land the helicopter safely.

S-76A Certification Basis

The original S-76A, Transport Helicopter Category B, was certified on November 21, 1978 (FAA Type Certificate number H1NE). The certification basis for the S-76A and all subsequent models of this series (Sikorsky S-76A, S-76B and S-76C helicopters) is 14 CFR Part 29 amendments 29-1 through 29-11. Additional regulations were complied with to higher amendment levels, but they are unrelated to the helicopter structure.

Sikorsky Windshield & Windscreen Certification Basis

According to Part 29, AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT, Subpart D--Design and Construction Personnel and Cargo Accommodations Section 29.775, Windshields and windows: "Nonsplintering safety glass must be used in glass windshields and windows."

S-76C Certification Basis

The S-76C was certified in March of 1991 and was not required to meet the requirements in place at the time the Sikorsky Aircraft Corporation applied to add the S-76C model helicopter to the existing S-76 type certificate.

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The S-76C Transport Helicopter, Categories A and B, were certified on March 15, 1991, and April 12, 1991, respectively. Although the S- 76C was certified in 1991, in accordance with their normal practices the FAA allowed Sikorsky to use the certification requirements in place at the time of the initial S-76A dated 1978. The practice of applying the requirements that existed at the date of the original certification is known as "grandfathering." The requirements in place for windshields and windscreens in 1991 were:

Section 29.775 - Windshield and windows:

"Windshields and windows must be made of material that will not break into dangerous fragments" (Amendment 29-31, Effective October 22, 1990).

S76A Windshield Testing

Sikorsky Aircraft intended to market the S-76A to the North Sea offshore oil operators. As the FAA had not yet established any bird strike criteria, Sikorsky and the windshield supplier qualified the glass-plastic laminate and later glass-glass laminate windscreens to the British Civil Aviation Requirements (BCAR), which required the windshield to resist penetration of a two pound bird at 160 knots. Tests were conducted in 1978 using the glass-plastic laminate (Canadian National Research Council Report LTR-ST.993) and in 1982 using the glass-glass laminate (PPG Report QSR-129910; Page 10-11). Both windshield designs passed the BCAR certification tests at impact speeds of 160-173 knots. Thus in 1978, the Sikorsky-installed windshields had already exceeded the FAA's requirements that would have been imposed on a new aircraft at the time of the S-76C certification in 1991.

S-76B Windshield Testing

In order to comply with the British Civil Aviation Requirements (BCAR) during the S-76B certifications in October 1985 (Transport Helicopter Category B) and February 1987 (Transport Helicopter Category A), six windshields were tested in August 1985. The six test specimens were fabricated to a standard 26 x 26 inch bolted design and impacted with two-pound birds at velocities slightly above the 160-knot requirement. The first three windows were shot at ambient room temperatures of 70 +/- 5 degrees F, the fourth and fifth panels 32 +/- 5 degrees F and the last panel 20 +/- 5 degrees F.

For the first impact test the speed was 163.9 knots at a temperature of 73 degrees F. The panel survived the impact without any broken plies. Due to the undamaged condition the panel was tested again at a speed of 163.5 knots and a temperature of 71 degrees F. The panel passed the impact test without penetration although the outboard glass ply broke while the inboard glass ply remained intact. The third impact test was conducted at room temperature at a speed of 165.1 knots. The panel passed without penetration although the outboard glass ply was broken. The inboard ply remained intact after the impact. The two required 30 degrees F shots were conducted on the same panel, as the first shot did not cause any damage to the panel. The initial cold shot was conducted between 30 degrees F and 32 degrees F at a speed of 161.2 knots. The second cold shot was conducted between 30 degrees F and 31 degrees F at a speed of 163.3 knots. The outboard glass ply was broken and the inboard glass ply remained undamaged and intact.

The fifth test was conducted at a temperature between 20 degrees F and 21 degrees F at a speed of 165.0 knots. The outboard glass ply was broken and the inboard glass ply remained intact. An additional test was conducted on one of the panels with a broken outboard ply. The test was conducted at 78 degrees F at a speed of 158.6 knots; no additional damage was noted. The panel was tested a third time at a speed of 161.8 knots with a two-pound gel package; again no damage to the inboard glass ply was noted. The final test did, however, cause the maximum stress and strain levels on the inboard glass ply.

All of the specimens tested met the prescribed test conditions of no penetration of a 2.0-pound bird at velocities slightly above 160 knots for the S-76B.

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Supplemental Type Certificate Certification Basis/Cast Acrylic Windshield Information

The windshields in the accident helicopter were monolithic cast acrylic replacement windshields supplied by a third-party manufacturer, AAI. Installation and use of the replacement windshields was approved by the FAA under Supplemental Type Certificate (STC) SR01340AT, which was issued to AAI on April 16, 1997. The FAA also issued a Parts Manufacturer Approval (PMA) to AAI on August 3, 1998, for the manufacture of the replacement windshields.

AAI applied for the STC on November 27, 1996, and received approval on April 16, 1997. At that time, they were allowed to make parts only for their own use in their own aircraft. They would not be allowed to sell any windshields to other persons until after receiving their PMA approval.

As a holder of a PMA, AAI was authorized to manufacture the parts identified and to sell to any persons wishing to install the parts into a type certificated product per 14 CFR 21.303. The FAA Form 8110-3, Statement of Compliance with Federal Aviation Regulations, indicated that the FAA approval basis for the test and analysis were per 14 CFR 21.303(c)(4). The following is an excerpt from the FAA standards:

Part 21 CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS; Subpart K--Approval of Materials, Parts, Processes, and Appliances; Section 21.303; Replacement and modification parts.

(c) An application for a Parts Manufacturer Approval is made to the [Manager of the Aircraft Certification Office for the geographic area] in which the manufacturing facility is located and must include the following:

(4) Test reports and computations necessary to show that the design of the part meets the airworthiness requirements of the Federal Aviation Regulations applicable to the product on which the part is to be installed, unless the applicant shows that the design of the part is identical to the design of a part that is covered under a type certificate. If the design of the part was obtained by a licensing agreement, evidence of that agreement must be furnished.

(h) Each holder of a Parts Manufacturer Approval shall establish and maintain a fabrication inspection system that ensures that each completed part conforms to its design data and is safe for installation on applicable type certificated products. The system shall include the following:

(6) Current design drawings must be readily available to manufacturing and inspection personnel, and used when necessary. (Amendment 21-67, Effective October 25, 1989).

FAA Certification Requirements for Transport Category Rotorcraft

The following are the standards cited in 14 CFR Part 29, AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT; Subpart D--Design and Construction; General; Section 29.631; "Bird Strike":

"The rotorcraft must be designed to ensure capability of continued safe flight and landing (for Category A) or safe landing (for Category B) after impact with a 2.2-lb (1.0 kg) bird when the velocity of the rotorcraft (relative to the bird along the flight path of the rotorcraft) is equal to VNE or VH (whichever is the lesser) at altitudes up to 8,000 feet. Compliance must be shown by tests or by analysis based on tests carried out on sufficiently representative structures of similar design.(Amendment 29-40, Effective 8/8/96)"

A review of the STC data package provided by the FAA revealed no documentation to indicate that AAI complied with the intent of 14 CFR 29.775 as specified in either section 2.1 or 2.2, or compliance with 14 CFR 29.631, as specified in section 3.1. As with a Type Certificate (TC), the applicable regulations for an STC are based on the date of application or an earlier date as agreed to by the Administrator, known as "grandfathering." The AAI STC was applied for on November 27, 1996. The FAA Form 8110-3 only indicates that the windshields are compliant with 14 CFR 21.303(h)(6). The FAA Form 8110-3 should also have made reference to 14 CFR 29.775 per section 2.1, had they been allowed to do so by the FAA, "grandfathered," or based upon the STC application date 14 CFR 29.631 as defined in section 3.1 and 14 CFR 29.775 as defined in section 2.2. In addition, compliance with section 14 CFR 29.303(C)(4), tests and analysis, as defined above was indicated as the FAA approval basis for AAI's PMA. No records of the tests and analysis have been located by the NTSB or provided to the NTSB by either the FAA or the STC holder, AAI.

National Transportation Safety Board

FACTUAL REPORT**AVIATION**

NTSB ID: CEN09MA117

Occurrence Date: 01/04/2009

Occurrence Type: Accident

Narrative (Continued)**Manufacturer Safety Alert Regarding S-76 Windscreens**

On May 19, 2009, Sikorsky Aircraft Corporation issued a safety advisory (SSA-76-09-002) to all S-76 operators regarding the reduced safety factor of acrylic windshields (both cast and stretched) as compared to laminated glass windshields. According to the advisory, the S-76 laminated glass windshield demonstrated more tolerance to penetrating damage resulting from in-flight impacts (such as bird strikes) compared to acrylic windshields. Sikorsky expressed concern that the presence of a hole through the windshield, whether created directly by object penetration or indirectly through crack intersections, may cause additional damage to the helicopter, cause disorientation or injury to the flight crew, increase pilot workload, and create additional crew coordination challenges.

U.S. Army Windshield Tests

The U.S. Army generally no longer uses cast acrylic windshields. Cast acrylic windshields may still be used in certain applications where it is necessary for an ejection seat to be able to easily break through the canopy. Two U.S. Army reports compared the impact resistance of windshields constructed of cast acrylic and different materials. One U.S. Army study ("UH-1 Ballistic and Bird Impact Test Study," Report AMMRC CTR 75-7, April 1975) reported on bird strike tests of Bell UH-1 helicopter windshields made of different materials. The UH-1 windshield materials tested included cast acrylic, polycarbonate, and a composite constructed of a layer of polycarbonate bonded to a layer of chemically tempered glass. The report concluded, in part, that the polycarbonate and the polycarbonate bonded to glass both offer far greater bird strike protection than a standard cast acrylic windshield. The report further indicated that a cast acrylic windshield at a cruising speed of 90 knots is incapable of defeating a bird strike, and that the Plexiglas breaks into large fragments that could cause serious injury to the flight crew.

Another U.S. Army report ("Design, Test and Acceptance Criteria for Helicopter Transparent Enclosures," Report USARTL-TR-78-26, 1978) documented a study of the low-energy impact response of a number of different windshield materials. The materials tested included a tempered-glass laminate, a laminate of glass and stretched acrylic, monolithic stretched acrylic, monolithic cast acrylic, and monolithic polycarbonate. The report concluded that the cast acrylic needed to be three times as thick as the stretched acrylic or the polycarbonate to provide a similar level of protection against impact.

Hazards of Bird Strikes on Aircraft

Following its investigation of a March 4, 2008, crash of a Cessna 500 airplane, N113SH, that had a bird strike in Oklahoma City, Oklahoma, (NTSB Aircraft Accident Report NTSB/AAR-09/05) the NTSB issued Safety Recommendation A-09-75 on September 29, 2009, asking the FAA to "require all 14 Code of Federal Regulations (CFR) Part 139 airports and 14 CFR Part 121, Part 135, and Part 91 Subpart K aircraft operators to report all wildlife strikes, including, if possible, species identification, to the National Wildlife Strike Database."

Low Rotor Speed Warning Systems

Some single- and twin-engine helicopter models are equipped with an audible alarm and/or warning light to alert the flight crew of a low Nr condition. For instance, Bell Helicopter twin-engine models 212, 412, and 430 are equipped with an audible alarm and a warning light to notify the flight crew if the rotor rpm starts decaying and falls below the specified threshold. On July 9, 2009, the FAA issued a notice of proposed rulemaking (NPRM), titled "Flightcrew Alerting," that proposed revisions to 14 CFR 25.1322 regarding definitions, prioritization, color requirements, and performance for flight crew alerting for transport-category airplanes. The NPRM proposes to incorporate redundant sensory cuing (such as aural and visual) into alerts for conditions requiring immediate flight crew awareness. The revisions are based on human factors principles, with the intent to ensure that alerting systems in newly certificated aircraft facilitate flight crew performance. In a letter, the NTSB indicated that it supported the proposed revisions and acknowledged the significant advances in technology and alerting capabilities of aircraft. In addition, the NTSB recognized the importance of providing salient, recognizable cues through at least two different sensory systems by a combination of aural, visual, or tactile indications.

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FACTUAL REPORT**AVIATION**

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Occurrence Type: Accident

Narrative (Continued)

Based on the main rotor speed decay information provided by Sikorsky, the flight crew of N748P had about 6 seconds or less to react to the decaying Nr condition.

When the S-76 was certificated in 1978, 14 CFR 29.33 did not require an audible alarm or warning system for low Nr conditions. The subsequent revision to 14 CFR 29.33 in 1978 required a low Nr warning system in single-engine helicopters and in multi-engine helicopters that did not have a device that automatically increases power on the operating engine if one engine fails. Since the S-76 has a system that automatically increases power on the operating engine in order to maintain Nr, the accident helicopter would not have required an alarm or warning system even if the latest revision did apply. The NTSB is aware that both the Sikorsky S-92A and the S-76D (which is currently undergoing certification) have an audible low Nr warning, even though these aircraft are equipped with a system that automatically increases power in the working engine. Requirements for normal-category helicopters in 14 CFR 27.33 are similar.

Flight Crew Training for Simultaneous Dual-Engine Failure

A review of the accident flight crew's training records indicated that both pilots had fulfilled all training requirements and had completed Sikorsky S-76C++ emergency initial and recurrent training in ground school and in the simulator. The emergency procedures section of the Sikorsky S-76 flight manual describes the dual-engine failure procedure while hovering, during takeoff and initial climb, and during cruise. Upon dual-engine failure, the helicopter will yaw to the left due to the reduction in torque as engine power decreases. An immediate collective pitch reduction would be required to maintain Nr within safe limits. In most instances, if dual-engine failure occurs a safe autorotation landing could be made.

According to PHI, prior to the January 4, 2009, accident, line oriented flight training (LOFT) for dual-engine failure was conducted in both ground school and in a simulator for visual and instrument flight rules conditions. Training was conducted so that one engine failed at a time, ultimately resulting in autorotation. Training for simultaneous sudden failure of both engines was part of initial training but was not part of annual recurrent training. Since the accident PHI modified LOFT to include sudden simultaneous dual-engine failure training both on the ground and in the simulator during initial and annual recurrent training.

A review of NTSB data indicates that from 1982 to present the NTSB has investigated 52 accidents involving loss of engine power in dual-engine helicopters, 23 of which resulted in substantial damage. In general, the causes of the dual-engine loss of power were due to fuel exhaustion, fuel contamination, and operational errors, among other factors.

Materials Laboratory Examination of Windscreen Components

The parts examined from the wreckage at the NTSB's Materials Laboratory included pieces recovered from the left and right windshields and pieces from the canopy structure that supported the windshields. The canopy structure included two pieces of the canopy and sill from above the windshields, pieces of the left and right doorpost structures that supported the outboard edges of the windshields, the center post that supported the inboard edges of both windshields, and pieces from the center of the nose and instrument panel that supported the bottom forward edges of the windshields and where the bottom of the center post was attached.

No defects in the materials, manufacturing, or construction were observed. There was no indication of any pre-existing damage that contributed to the accident.

The left and right windshields were mirror images of each other. The windshield material was specified to be aircraft-grade cell cast acrylic sheet per military specification L-P-391, Item A, Type 1, Grade C, with a thickness of 0.312 inch. Markings indicate that the left windshield was manufactured in January, 2008, and the right windshield was manufactured in February, 2008.

The top edges of the windshields were approximately 30 inches long.

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: CEN09MA117

Occurrence Date: 01/04/2009

Occurrence Type: Accident

Narrative (Continued)

The inboard edges were approximately 43 inches long. The bottom forward edges were approximately 34 inches long. The outboard bottom edges were approximately 17 inches long and the aft outboard edges were approximately 42 inches long.

Each windshield was attached to the canopy structure by 75 screws, which threaded into nutplates that were riveted to the canopy. Thickness measurements from random locations on the right windshield ranged from 0.307 inch to 0.324 inch. Thickness measurements from random locations on the left windshield ranged from 0.282 inch to 0.290 inch.

The helicopter impacted the ground along its lower left side and separated along a generally horizontal plane into an upper part and a lower part. The upper part remained oriented along the line of flight, but the lower part came to rest with the nose directed to the left of the line of flight.

In the area of the windshields, the upper canopy structure was separated from the lower canopy structure by fractures at the top of each doorpost and at the base of the horizontal arm of each wishbone, along with fractures at the top and bottom of the center post. There were no fractures through the frame of either windshield along the doorpost structures themselves. The center post was also substantially intact and remained connected to the upper canopy structure by electrical wires.

On the right side, the doorpost was separated from the upper canopy by several fractures through the composite structure and by rivet pullout. Approximately 4 inches in from the outboard edge of the right windshield there was a vertical fracture through the lip supporting the windshield formed by the bonded canopy and sill pieces.

Examination of the upper canopy revealed a puncture in the roof above the right windshield. A roughly rectangular area of the canopy was cut open to investigate the cause of the puncture, extending from 16 and 24 inches to the right of the centerline and from 1 to 4 inches above the edge of the windshield. No specific cause of the puncture was identified by visual examination. Swabs were also taken from this location for assessment of potential bird remains.

In an area between 8 and 16 inches to the right of the centerline, the paint on the canopy above the top edge of the windshield exhibited a series of roughly horizontal parallel cracks. These cracks occupied an area that extended up approximately 6 inches from the edge of the windshield. In the area from 8 to 12 inches to the right of the centerline, and from 2 to 6 inches above the top edge of the windshield, the paint cracks were shorter and were continuous across the aft end of the fore-and-aft crack found at 8.5 inches to the right of the centerline. The most outboard of these cracks in the paint were found in an area not adjacent to any cracks in the underlying composite structure, whereas other areas of paint cracks were generally found to be adjacent to cracks or fractures in the underlying structure, within 1 inch or so.

The canopy and sill structures above the left windshield were fractured in two locations and these fractures were part of a system of fractures that separated the smaller left-side piece of the roof and sill structure from the rest of the canopy structure. On-scene photographs indicate that the two pieces of the upper canopy were still connected by electrical wiring.

The center post was separated from the upper canopy structure by fractures through the composite material accompanied by impact-related disbonding and delaminations.

All of the fractures observed in the windshields were typical of brittle overstress, with fractures occurring on planes of maximum tension. Fracture features generally showed that the crack progressed more rapidly at one free surface than at the other, indicating fracture under tensile stresses resulting from bending, but some areas of fracture under nearly in-plane tension were also observed. Features on the fracture surfaces were used to determine crack propagation directions and the direction of bending. There were some cracks where the direction of bending changed from one part of the crack to another; in some cases this transition occurred smoothly and in other cases the crack arrested and then re-initiated under bending in the opposite direction. Primary or early cracks were identified by the continuity of the fracture surface and fracture features; secondary cracks either initiated or terminated at primary cracks.

National Transportation Safety Board

FACTUAL REPORT**AVIATION**

NTSB ID: CEN09MA117

Occurrence Date: 01/04/2009

Occurrence Type: Accident

Narrative (Continued)

There was little symmetry between the fracture patterns in the two windshields. The left windshield was fractured into smaller pieces, consistent with the ground impact of the helicopter on its left side.

The fractures in the windshields originated at multiple locations and consisted of several different systems of fractures. Although some small pre-existing cracks (on the order of 0.01 inch in length) were observed at the surfaces within the holes in the windshields for the attachment screws, the pattern of fractures in the windshields is inconsistent with fracture initiation resulting from a single pre-existing crack reaching a critical size.

In general, the pieces of the windshields separated from the supporting frame by fractures that ran near or through the attachment screw holes. Not all of the pieces of either windshield were recovered, despite an extensive search of the bayou surface both around the point of impact as well as extending backward up the flight path. In general, the pieces that remained attached to the frame pieces after the accident were relatively small, typically extending 3 inches or less from the frame. The largest windshield fragments that remained attached to frame components after the accident were along the top edges and along the upper right side of the center post. The fractures in the right windshield along the top edge and on the center post generally formed a pattern of concentric curves and radial lines centered approximately 13 inches to the right of the centerline, at or above the top edge of the windshield. The center of this pattern coincided with the area of parallel cracks in the paint on canopy. Two of the secondary radial cracks in this area were centered on the crack in the canopy and sill structure 8.5 inches to the right of the centerline, just outboard of a vertical rib stiffening the bonded canopy and sill.

Similar Bird Strike Incidents

A similar bird strike incident occurred on November 13, 1999, in Florida involving an S-76C+ helicopter, N276TH, operated by Palm Beach County. The bird did not penetrate the laminated glass windshield, but the impact force of the bird cracked the outer ply of the windshield and dislodged the fire extinguisher T-handles out of their detent; in this case, the ECLs did not move.

The investigation also revealed an event in 2006 involving an S-76A++ helicopter windshield that was struck by a seagull. That helicopter was equipped with STC cast acrylic windshields identical to those on the helicopter involved in this accident. A photograph that was taken after the impact was examined by NTSB investigators. The examination revealed that the seagull penetrated the windshield and became lodged in the interior trim. Along the top edge of the windshield, fractures intersected the 2nd through 7th windshield mounting screw holes counting out from the center.

Updated on Dec 1 2010 7:43AM

 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: CEN09MA117				
		Occurrence Date: 01/04/2009				
		Occurrence Type: Accident				
Landing Facility/Approach Information						
Airport Name Lake Palourde Base Heliport		Airport ID: 7LS3	Airport Elevation 5 Ft. MSL	Runway Used N/A	Runway Length	Runway Width
Runway Surface Type:						
Runway Surface Condition:						
Approach/Arrival Flown: NONE						
VFR Approach/Landing: None						
Aircraft Information						
Aircraft Manufacturer SIKORSKY		Model/Series S-76C		Serial Number 760629		
Airworthiness Certificate(s): Normal						
Landing Gear Type: Retractable - Tricycle						
Amateur Built Acft? No		Number of Seats: 14		Certified Max Gross Wt. 11700 LBS	Number of Engines: 2	
Engine Type: Turbo Shaft		Engine Manufacturer: turbomeca		Model/Series: Ariel 2S2		Rated Power: 817 HP
- Aircraft Inspection Information						
Type of Last Inspection AAIP		Date of Last Inspection		Time Since Last Inspection Hours		Airframe Total Time 3288 Hours
- Emergency Locator Transmitter (ELT) Information						
ELT Installed?/Type Yes / C126		ELT Operated? Yes		ELT Aided in Locating Accident Site? Yes		
Owner/Operator Information						
Registered Aircraft Owner PHI INC		Street Address 2001 SE EVANGELINE TRWY				
		City LAFAYETTE		State LA	Zip Code 70508-2156	
Operator of Aircraft PHI INC		Street Address 2001 SE EVANGELINE TRWY				
		City LAFAYETTE		State LA	Zip Code 70508-2156	
Operator Does Business As:				Operator Designator Code:		
- Type of U.S. Certificate(s) Held:						
Air Carrier Operating Certificate(s): On-demand Air Taxi						
Operating Certificate:			Operator Certificate:			
Regulation Flight Conducted Under: Part 135: Air Taxi & Commuter						
Type of Flight Operation Conducted: Non-scheduled; Domestic; Passenger Only						
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 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: CEN09MA117																																																																																													
		Occurrence Date: 01/04/2009																																																																																													
		Occurrence Type: Accident																																																																																													
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Name		City		State	Date of Birth																																																																																										
On File		On File		On File	On File																																																																																										
Age	63																																																																																														
Sex: M	Seat Occupied: Right	Occupational Pilot? Yes		Certificate Number: On File																																																																																											
Certificate(s): Airline Transport; Commercial																																																																																															
Airplane Rating(s): Multi-engine Land; Single-engine Land																																																																																															
Rotorcraft/Glider/LTA: Helicopter																																																																																															
Instrument Rating(s): Airplane; Helicopter																																																																																															
Instructor Rating(s): None																																																																																															
Current Biennial Flight Review? 10/2008																																																																																															
Medical Cert.: Class 1		Medical Cert. Status: With Waivers/Limitations		Date of Last Medical Exam: 08/2008																																																																																											
<table border="1"> <thead> <tr> <th rowspan="2">- Flight Time Matrix</th> <th rowspan="2">All A/C</th> <th rowspan="2">This Make and Model</th> <th rowspan="2">Airplane Single Engine</th> <th rowspan="2">Airplane Multi-Engine</th> <th rowspan="2">Night</th> <th colspan="2">Instrument</th> <th rowspan="2">Rotorcraft</th> <th rowspan="2">Glider</th> <th rowspan="2">Lighter Than Air</th> </tr> <tr> <th>Actual</th> <th>Simulated</th> </tr> </thead> <tbody> <tr> <td>Total Time</td> <td>15373</td> <td>5423</td> <td>50</td> <td>650</td> <td>754</td> <td>121</td> <td>53</td> <td>14673</td> <td></td> <td></td> </tr> <tr> <td>Pilot In Command(PIC)</td> <td>8549</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Instructor</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Instruction Received</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Last 90 Days</td> <td>219</td> <td>219</td> <td></td> <td></td> <td></td> <td>14</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Last 30 Days</td> <td>75</td> <td>75</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Last 24 Hours</td> <td>7</td> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>						- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air	Actual	Simulated	Total Time	15373	5423	50	650	754	121	53	14673			Pilot In Command(PIC)	8549										Instructor											Instruction Received											Last 90 Days	219	219				14					Last 30 Days	75	75									Last 24 Hours	7	7								
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Seatbelt Used? Yes		Shoulder Harness Used? Yes		Toxicology Performed? Yes																																																																																											
				Second Pilot? Yes																																																																																											
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Type of Airspace:																																																																																															
Weather Information																																																																																															
Pilot's Source of Wx Information:																																																																																															
Automated Report																																																																																															

 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: CEN09MA117	
		Occurrence Date: 01/04/2009	
		Occurrence Type: Accident	

Weather Information					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
7R3	1430	CST	5 Ft. MSL	12 NM	345 Deg. Mag.
Sky/Lowest Cloud Condition: Scattered			1500 Ft. AGL	Condition of Light: Day	
Lowest Ceiling: Broken		10000 Ft. AGL		Visibility: 10 SM	Altimeter: 30.03 "Hg
Temperature: 24 °C	Dew Point: 19 °C	Weather Conditions at Accident Site: Visual Conditions			
Wind Direction: 160	Wind Speed: 6	Wind Gusts:			
Visibility (RVR): Ft.	Visibility (RVV) SM				
Precip and/or Obscuration: No Obscuration; No Precipitation					

Accident Information					
Aircraft Damage: Destroyed		Aircraft Fire: Unknown		Aircraft Explosion: None	

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL	
First Pilot	1				1	
Second Pilot	1				1	
Student Pilot						
Flight Instructor						
Check Pilot						
Flight Engineer						
Cabin Attendants						
Other Crew						
Passengers	6	1			7	
- TOTAL ABOARD -	8	1			9	
Other Ground						
- GRAND TOTAL -	8	1			9	

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 National Transportation Safety Board FACTUAL REPORT AVIATION	NTSB ID: CEN09MA117	
	Occurrence Date: 01/04/2009	
	Occurrence Type: Accident	
Administrative Information		
Investigator-In-Charge (IIC) William H. Gamble		
Additional Persons Participating in This Accident/Incident Investigation: Wibur D Keith Federal Aviation Administration Baton Rouge, LA Robert Drake Federal Aviation Administration Washington, DC Kirk Gustafson Federal Aviation Administration Burlington, ME Christopher Lowenstein Sikorsky Stratford, CT Joan Gregoire Turbomeca USA Grand Prairie, TX Michael Hurst Petroleum Helicopters, Inc. Lafayette, LA Matthew Rigsby Federal Aviation Administration Fort Worth, TX Harold Reichel National Transportation Safety Board Washington, DC Scott Warren National Transportation Safety Board Washington, DC Erin Gormley National Transportation Safety Board Washington, DC		
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