NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

November 23, 2010

AIRWORTHINESS GROUP CHAIRMAN'S FACTUAL REPORT

A. ACCIDENT CEN09PA348

LOCATION:	Santa Fe, New Mexico
DATE:	June 9, 2009
TIME:	2135 mountain daylight time (MDT)
AIRCRAFT:	Agusta S.p.A. A109E, N606SP, Operated by New Mexico State Police, New Mexico

B. AIRWORTHINESS GROUP

Group Chairman:	Dan Baker National Transportation Safety Board Denver, Colorado
Member:	James Whitney Agusta Westland Philadelphia, Pennsylvania
Member:	Marc Gratton Pratt and Whitney Canada Corporation (PWC) Longueuil, Quebec Canada
Member:	Jesus Orozco New Mexico State Police Santa Fe, New Mexico

C. SUMMARY

On June 9, 2009, about 2135 mountain daylight time, an Agusta S.p.A. A-109E helicopter, N606SP, was destroyed after impacting terrain during a search and rescue mission near Santa Fe Mount Baldy, New Mexico. The commercial pilot and one passenger were fatally injured. A second passenger, the spotter, was seriously injured. The public use flight was being conducted under the provisions of Title 14 Code of Federal Regulations Part 91 without a flight plan. The local flight originated at the Santa Fe Municipal Airport (SAF), Santa Fe, New Mexico. Instrument meteorological conditions prevailed at the time of the accident.

The Airworthiness Group was formed to record and document the information regarding the helicopter wreckage and maintenance records. Investigators were unable to reach the accident site prior to the wreckage recovery due to the terrain and weather conditions. The wreckage was recovered on June 26 and transported to Beegles Aircraft, Greeley, Colorado. The Airworthiness Group first assembled at Beegles Aircraft on June 29, 2009, to perform the first examination of the wreckage. Two electronic engine computers (EEC) were removed from the wreckage and examined at PWC and subsequently sent to Hamilton Sundstrand for final download on October 7, 2009. A second wreckage exam occurred at Beegles Aircraft on January 12, 2010.

D. DETAILS OF THE INVESTIGATION

1.0 WRECKAGE DISTRIBUTION

The accident occurred in steep, rocky terrain approximately 15 miles northeast of Santa Fe, New Mexico, near Santa Fe Mount Baldy, located in the Pecos Wilderness area. The surviving spotter told investigators that after recovering a lost hiker, the helicopter took off and flew for about one to two minutes before it impacted an unknown object. He said the helicopter continued to fly for an unknown amount of time before "the pilot put it down" and the helicopter began rolling down the mountain. The pilot stated in a recorded radio transmissions "we hit a mountain." That radio transmission was continuous for 54 seconds and ended with "Hang on (unintelligible)." The initial impact point was not located. The second impact point was located at 35 degrees, 50.310 minutes north latitude and 105 degrees, 44.711 minutes longitude, at an elevation of 12,069 feet mean sea level (MSL). The ground strike evident at this point was a divot in soil or talus up to 5" deep, approximately 12" along the fall line of the slope and approximately 30" across the fall line of the slope[1]. After the second impact the helicopter descended approximately 600 vertical feet down an open slope covered in large boulders and scattered trees before coming to rest. Portions of the wreckage were located along the debris path. The tail boom was located at 35 degrees, 50.348 minutes north latitude and 105 degrees, 44.720 minutes longitude, at an altitude of 11,960 feet MSL. The farthest wreckage from the second impact site, the fuselage, was located .90 miles northeast of the peak of Santa Fe Mount Baldy at approximately 35 degrees, 50.429 minutes north latitude and 105 degrees, 44.772 minutes longitude, and an

[1] Extracted from "Observations of N606SP Wreckage during Salvage," K & I Field Services, Appendix 2.

elevation of about 11,484 feet MSL[2]. See Appendix 1, Figure 1, for a wreckage distribution diagram.

2.0. AIRCRAFT DESCRIPTION AND HISTORY

The Agusta S.p.A. A-109E helicopter is a twin engine, single main rotor helicopter that has a retractable tricycle landing gear. It has a maximum speed of 177 miles per hour and a service ceiling of 19,600 feet. The helicopter has a four blade main rotor system for lift and thrust and a tail rotor for directional control and anti-torque. The helicopter has four large doors, two located on either side of the helicopter, to provide entrance and exit for pilot and passengers. The four-blade main rotor is mounted on the main gearbox, which is directly above the cabin. Two Pratt and Whitney Canada PW206C turbo-shaft engines are mounted side by side aft of the main gearbox. Both engines have separate drive shafts to the main transmission, which reduces engine rpm and distributes torque upward to drive the main rotor, and aft through the tail rotor gearbox to drive the tail rotor. The helicopter was equipped with two front seats with dual controls and a club seating interior including three forward facing seats and three aft facing seats in the cabin area aft of the cockpit, allowing for seating for eight, including the two pilot seats.

The helicopter records show that the Agusta S.p.A. Aerospace Company manufactured the helicopter as an A-109E "Power", S/N 11209, on March 19, 2003. The records indicated S/N 11209 was initially registered as N260CF and was sold to the New Mexico Department of Public Safety on February 27, 2003. Serial number 11209 was assigned registration number N606SP on September 23, 2003. The helicopter had accumulated about 1,729.1 hours aircraft total time (ACTT) and 3014 landings prior to the accident flight.

3.0. AIRCRAFT INFORMATION

A review of the aircraft maintenance records indicate the helicopter had accumulated 1,727.9 total flight hours and 3013 landings as of the afternoon of the accident, prior to departing for the accident mission. Based on radio transmission and dispatch records the helicopter flew approximately 1.2 hours prior to performing one landing and picking up the lost hiker. The helicopter then flew for about three minutes before the accident.

The number one engine (No. 1), PW206C, S/N PCEBC0368, was installed new in the aircraft on February 14, 2003. The No. 1 engine was removed from the airplane for repair of a disintegrated power turbine disk on January 14, 2004, with 378.1 total engine hours. The engine was repaired and then reinstalled on August 31, 2005. The engine had accumulated approximately 1,667.1 total hours at the time of the accident. The number two engine (No. 2), PW206C, S/N PCE-BC0553, was installed new in the aircraft on October 13, 2005, at 567.3 hours ACTT. The engine had accumulated approximately 1,132 total hours at the time of the accident.

The helicopter was last fueled at Santa Fe Municipal Airport (SAF) on June 9, 2009, with 100 gallons of JET-A fuel.

[2] Coordinates and elevation were estimated by comparing photographs to topographic maps.

3.1. Cockpit/Fuselage

The fuselage came to rest in an area of large boulders, lying mostly upright in an easterly direction (Figure 2). The nose of the fuselage was not present. The cockpit section of the fuselage was attached to the cabin section by electrical wiring and various components in an inverted position. The upper deck was connected to the aft top of the cabin, but was collapsed downward. Crushing, deformation, and scratches in multiple directions were present on most exterior surfaces. Both engines were contained inside the engine bays. The landing gear position selector was in the Down position. The main landing gear struts were separated from the fuselage and the nose gear assembly was in several pieces. All three landing gear retraction actuators were in the down position.

3.2. Main Transmission and Rotor Assembly

The pylon installation, including the main gearbox, swashplate, main rotor hub, and servo actuators, was separated due to fractures of the forward and aft mounting legs and of the torque plate attachment points. All visible pylon installation hardware was noted in place. Sections of each main rotor were recovered. Sections of two main rotor blades were connected to the rotor hub (Figure 3). The other two blades had separated at the hub connecting pins (Figure 4). All four blades showed fracture and splintering of the fiberglass spar within about three feet of the hub connecting pins. The four dampeners were connected at both ends, with the spherical bearings in place. The swashplate rotating scissor was installed in the proper orientation and connected. The linkage to the pilot valves of the servo actuators was connected and the valve stems were integral and free to move axially. Two of the servos had sheared off the transmission case.

3.3. Flight Controls

Numerous fractures and interruptions occurred in the flight control system. All fractures and separations were consistent with overload or impact damage. No evidence of pre-impact loss of flight control continuity was noted. Flight control continuity was verified from the inside of the cockpit central console to the base of the left and right vertical posts, behind the cockpit. Flight control continuity was verified on the upper deck, including to the autopilot actuators, the mixing unit, and through to the connection to the hydraulic servo linkages. Tail rotor control continuity was verified from inside the tail boom to the tail rotor gearbox. Control continuity was confirmed on the rotor pylon.

3.4. Tail Boom

The tail boom was severed approximately three feet forward of the horizontal elevator (Figure 5). Continuity of rotation from the tail boom section of the tail rotor drive shaft, through the tail rotor gearbox, to the tail rotor was confirmed. The shear pins at both ends of the shaft were intact and rotated freely. All control linkages in the tail rotor installation were in place and connected. One pitch change link had failed in compression. The outboard ends of both

horizontal elevators exhibited deformation. The vertical stabilizer exhibited deformation and was bent downward toward the port side at greater than 90 degrees from the vertical position.

3.5. Tail Rotor Drive Assembly

The helicopter was equipped with a two blade rotor system. Each rotor blade was comprised of composite laminate material with a metal leading edge strip. The tail rotor blades were designed to measure 76.37 inches (1940 millimeters) from blade tip to blade tip. Each individual blade measured 34.37 inches (873 millimeters) from the inboard edge of the blade to the outboard tip.

The tail rotor gearbox, hub and blades, and related controls were connected to the tail boom final bulkhead. Tail rotor blade A, serial number L70, was splintered for about 6.5 inches at the outboard end and measured 31.0 inches from the inboard edge of the blade to the outboard most end of splintered material (Figure 6).

Tail rotor blade B, serial number L138, was splintered for about 6.5 inches at the outboard end and measured 31.75 inches from the inboard edge of the blade to the outboard most end of splintered material (Figure 7).

The tail rotor skid tube was bent upward in relation to its original position. Scratches and abrasions on the skid tube were noted in all directions (Figure 8).

4.0 POWERPLANTS

Both engine power turbine units showed separation of all blades approximately 0.04 inches from the power turbine disk. Rotation of both engines power shafts showed no connection to the power turbine. Both fuel filter by-pass indicators were exposed, but no visible contaminants were present in the filter or filter bowl. Fuel was present in both engine fuel systems. The presence of small metal particles was noted in the oil chip detectors. No contaminates were found in either engine oil filter.

The following Electronic Engine Control (EEC) computers were removed, for later download of data to be performed by PWC:

No. 1 EEC, Model EEC206-100, PN 816878-6-006, SN 02061777, Mod. L4
No. 2 EEC, Model EEC206-100, PN 816878-6-008, SN 05057856, Mod. L7

The EEC206-100 is a single channel digital Electronic Engine Control. In conjunction with a Mechanical Fuel Control (MFC), it monitors and adjusts fuel flow to the engine.

5.0. MAINTENANCE RECORDS

The helicopter was being inspected at regular intervals following a manufacturer developed progressive maintenance inspection schedule. Progressive aircraft maintenance

inspections were being conducted every 50 hours or 30 days. The last progressive airframe inspection occurred on May 28, 2009, at an ACTT of 1710.7 hours.

An annual type inspection was performed on the No. 1 engine on October 29, 2008, with 1414.0 total engine hours. An annual type inspection was performed on the No. 2 engine on October 29, 2008, with 1010.8 total engine hours.

6.0. TESTS AND RESEARCH

6.1. No. 1 EEC, Model EEC206-100, PN 816878-6-006, SN 02061777, Mod. L4

The EEC had the faults listed below found in the fault code memory for the last flight leg. Those 8 faults[3] are indicative of a sudden change in the gas generator speed (Ng) on the aircraft, as the systems of the aircraft shutdown or the EEC stops receiving aircraft data.

Event	Fault Code Description	Info
	Bits **Gas Generator Speed - Ng**	
1	9 EEC Fail Sol W/A real fault with speeds bit 11 Ng speed 86%	Command response
2	11 PLA Brake Relay W/A real fault with speeds bit 11 Ng speed 86%	Command response
3	26 Rotor Speed real fault with speeds bits 14 & 15 Ng speed 77%	EOC and Tooth Rate
4	27 NF/Q Probe A (Power Turbine Speed and Torque) bits 8, 11 & 13 Ng speed 77%	Rate and TS range
5	28 NF/Q Probe B (Power Turbine Speed and Torque) bits 8, 11, 13 & 15 Ng speed 77%	Rate Ts range and EOC
6	29 ARINC Input real fault with speeds ARINC data bits 10 & 14	ARINC synch/Loss of Ng speed 47.4%
7	31 LCF (Low Cycle Fatigue) Cycle real fault with speeds	Latched Interface

[3] Hamilton Sundstrand "FACTUAL NOTES, ELECTRONIC ENGINE CONTROLS, IN SUPPORT OF NTSB INVESTIGATION OF AB109 EVENT," Appendix 3.

fault	bit 9	Ng speed 76%	
8	49	NF/Q Interface real fault with speeds combined bits 8, 11, 13 & 15 Ng speed 74%	Same as faults 27 & 28

6.2. No. 2 EEC, Model EEC206-100, PN 816878-6-008, SN 05057856, Mod. L7

The EEC contained no faults in the fault code memory. The only data present was the RTD (Real Time Display) data (data programmed into the unit during production), and the Part Number (PN) and Serial Number (SN) of the EEC. This data is present in all EEC units.