Aviation Investigation Final Report

Location:	Mancos, Colorado	**Accident Number:**	DEN05FA103
Date & Time:	June 30, 2005, 13:57 Local	**Registration:**	N403CF
Aircraft:	Agusta A119	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The EMS helicopter had been dispatched to medivac a logger who had been injured in a trucking accident. The pilot made a low pass, then circled around to make his landing approach. A volunteer fireman, who was standing at the landing zone (LZ) and directing the helicopter, said the temperature was "about 80 degrees [F.]," and he advised the pilot that the winds were calm. The fireman said the helicopter was about 220 feet above tree level when "it dropped straight down." He heard no unusual engine sounds and did not see the impact. The on-scene examination revealed all four main rotor blades remained attached to the rotor hub and were drooped over the wreckage. Examination of the fuel control unit (FCU) revealed a 1/16-inch gap at the mating flange between the flow (fuel bypass passage, Po) and drive (air pressure passages, Px & Py) bodies. One of four retention-bolts was backed out and the packing was partially extruded. The bolt was too short, another bolt was too long, and the other two bolts were insufficiently torqued. Additionally, the flow and drive bodies were not perfectly flat. Further examination of the FCU revealed no functional anomalies.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: a loss of engine power for undetermined reasons and the pilot's inability to get into autorotation prior to impacting the ground. A factor contributing to the accident was the helicopter's low altitude when power was lost.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: APPROACH - VFR PATTERN - FINAL APPROACH

Findings
1. (C) REASON FOR OCCURRENCE UNDETERMINED

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
2. (C) AUTOROTATION - NOT POSSIBLE - PILOT IN COMMAND
3. (F) ALTITUDE - LOW
4. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On June 30, 2005, at 1357 mountain daylight time, an Agusta A119 helicopter, N403CF, operated by Tri-State Care Flight, LLC, of Bullhead City, Arizona, as "Care Flight 4" and piloted by a commercial pilot, was substantially damaged when it impacted terrain while approaching to land at a landing zone (LZ), 7.5 miles northeast of Mancos, Colorado. The pilot, flight nurse, and paramedic were fatally injured. Visual meteorological conditions prevailed, and a company visual flight rules (VFR) flight plan had been filed and activated for the emergency medical service (EMS) flight being conducted under Title 14 Code of Federal Regulations (CFR) Part 91. The flight originated at Animas Airpark (5CO0), Durango, Colorado, at 1242.

According to Tri-State Care Flight, the helicopter had been dispatched earlier to search for a 14-year-old drowning victim in the Animas River near Farmington, New Mexico. The helicopter crew eventually located the victim. While the helicopter was returning to Durango, it was dispatched to the Red Arrow Mines area, near Mancos, for a logger who had been injured in a trucking accident. The helicopter flew to 5CO0, where it was refueled from a company fuel truck (quantity unknown), then responded to the emergency.

According to a volunteer fireman who was standing at the LZ and directing the helicopter, the pilot made a low pass, then circled around to make his landing approach. The fireman said the temperature was "about 80 degrees [F.]," and he advised the pilot that the winds were calm. The pilot acknowledged this information. The fireman, who was looking directly at the approaching helicopter, said it was about 220 feet above tree level when "it dropped straight down." He said he heard no unusual engine sounds, and he did not see the impact. The first 9-1-1 telephone call was received by Montezuma County Dispatch at 1402.

The accident occurred during the hours of daylight in the Helmet Peak area, near Forest Road (FR) 567 and FR 322, 7-1/2 miles northeast of Mancos. The accident site was at an elevation of 9,731 feet msl, and at a location of 37 degrees, 23.620' north latitude, and 108 degrees, 08.320' west longitude.

CREW INFORMATION

The pilot, age 40, held a commercial pilot certificate with rotorcraft-helicopter and instrument-helicopter ratings, dated September 25, 1995. He also held a second class airman medical certificate, dated April 18, 2005, with no restrictions or limitations. According to Tri-State Care Flight records, the pilot had logged 2,215 total flight hours, of which 1,600 hours were as pilot-in-command, and 130 hours were in the Agusta A119. In addition, the pilot had logged 532

night hours, and 81 hours in actual instrument meteorological conditions. When he made application for his medical certificate, the pilot estimated he had accrued 2,500 total flight hours, of which 80 hours were logged in the previous 6 months. He was employed by Tri-State Care Flight as an EMS helicopter pilot on May 9, 2004.

The flight nurse, age 49, was employed by Tri-State Care Flight on September 6, 2004. His most recent medical recurrency check was accomplished on May 31, 2005, and his most recent helicopter recurrency check was accomplished on May 10, 2004.

The emergency medical technician-paramedic (EMT-P), age 33, was employed by Tri-State Care Flight on May 10, 2004. His most recent medical recurrency check was accomplished on May 31, 2005, and his most recent helicopter recurrency check was accomplished on May 10, 2004.

AIRCRAFT INFORMATION

N403CF (s/n 14009), a model A119, was manufactured by Agusta SPA. The Federal Aviation Administration issued the helicopter a standard airworthiness certificate in the normal category on July 6, 2000. The helicopter was powered by a Pratt & Whitney Canada, Inc., (hereinafter referred to as P&WC) PT6B-37A turboshaft engine (s/n PCE-PU0006), rated at 900 shaft horsepower. The helicopter has a gross weight of 2,720 kilograms (5,997 pounds), a fuel capacity of 157 gallons, and a ceiling of 15,000 feet.

According to the aircraft's maintenance records, the engine was installed in the airframe on September 11, 2000, the first run-up occurred on October 6, 2000, and ground and in-flight checks were completed on December 17, 2000. The helicopter was certified as being airworthy. Additional flight checks were made on December 18, 20, 28, and 29, 2000. The first annual inspection was performed on August 2, 2001. Additional annual inspections were performed on September 17, 2003, and April 15, 2004, the latter occurring at a total time of 394.3 hours. More recently, the helicopter was maintained under an FAA approved airworthiness inspection program (AAIP), to wit:

Phase A	March 10, 2005 642.6 hours
Phase B	April 4, 2005 699.6 hours
Phase C	May 22, 2005752.5 hours

At the accident site, the Hobbs meter read 816.2 hours.

On June 3, 2002, the fuel control unit (FCU) was removed and another FCU was installed. No reason was given. On January 2, 2003, that FCU and the fuel pump were removed and replaced with different units. Again, no reason was given.

METEOROLOGICAL INFORMATION

Routine Aviation Weather Reports (METARs), recorded at 1353 by the Cortez (CEZ) and Durango (DRO) ASOSs (Automated Surface Observing Systems), located 30 n.m. west-southwest and 30 n.m. southeast of the accident site, were as follows:

CEZ (1353): Wind, variable at 5 knots; visibility, 10 s.m. (or greater); sky condition, clear (below 12,000 ft.); temperature, 30 degrees Celsius (C.); dew point, -4 degrees C.; altimeter setting, 30.16 inches of Mercury; remarks: precipitation discriminator, sea level pressure, 1014.2 mb.

DRO (1404): Wind, variable at 5 knots, gusts to 16 knots; visibility, 10 s.m. (or greater); sky condition, clear (below 12,000 ft.); temperature, 29 degrees C.; dew point, -5 degrees C.; altimeter setting, 30.21 inches of Mercury.

WRECKAGE AND IMPACT INFORMATION

FAA's Northwest Mountain (ANM) Regional Operations Center (ROC) notified the National Transportation Safety Board of the accident at 1434 on June 30, and its investigator arrived on site approximately 0900 on July 1.

The on-scene examination disclosed a ground scar, aligned on a magnetic heading of 106 degrees, containing skid marks and a separated left skid. The helicopter was next to and at the end of the ground scar, and was aligned on a magnetic heading of 360 degrees. All four rotor blades were still attached to the hub. The blades drooped over the wreckage. There were no contact marks on the hydraulic accumulators. The pitch link and swash plate control rods were all intact and attached. The tail boom was severed just aft of the engine and was to the right side of the helicopter. It was aligned on a magnetic heading of 265 degrees. The tail rotor separated at the gearbox, and lay to the left and next to the tail boom.

Cockpit examination revealed the following instrument readings:

Vertical speed: 100 fpm UP
Altimeter: 9,500 feet
Kollsman window: 30.22 in. Hg.
Airspeed: 0 kts.
Attitude indicator: Level, 20 degrees nose up
HSI heading/course/needle: 110 degrees/115 degrees/centered/NAV, HDG, VERT flags exposed
Magnetic compass: 349 degrees
Torque: 0
RPM: 101%
ITT: 0
XMSN oil temperature/pressure: 0/0

Engine oil temperature/pressure: 0/0
Fuel pressure: 22 psi
Hydraulic pressure: 14/0
Voltmeter: 15
Ammeter: 0
Fuel: 4/0
Hobbs meter: 816.2

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on the three crewmembers on July 1, 2005. In each case, the cause of death was attributed to "multiple fractures and internal injuries due to blunt trauma"; the manner of death was listed as "accidental." A toxicological screen revealed no carbon monoxide, cyanide, ethanol, or drugs in the pilot's blood.

TESTS AND RESEARCH

On behalf of NTSB, the engine was disassembled and inspected at P&WC under the auspices of the Canadian Transportation Safety Board (TSB). No anomalies were noted.

The Electronic Governing Unit (EGU) was sent to Woodward Governor Co., Rockford, Illinois, for evaluation. The EGU bench test met calibration requirements. The Electronic Engine Control (EEC) was set to Hamilton Standard, Windsor Locks, Connecticut, for evaluation. No calibration hysteresis was noted. The annunciator panels and engine instruments were sent to NTSB's Materials Laboratory for examination. According to the engineer's report, the Engine/Rotor Tachometer needles were fixed in place and indicated rotational speeds of 7 and 39 percent, respectively. All other engine instrument needles were free to move. No impact marks were seen. The XMSN OIL PRESS (transmission oil pressure) filaments was extensively stretched and deformed, and the ENG OUT filaments exhibited some deformation and localized stretching. The MASTER CAUTION exhibited localized stretching.

According to P&WC, there was "an opening (gap) at the lower section of the fuel control unit (FCU) flow and drive bodies mating flanges with disengagement of the bottom left side retention bolt (No. 3). [This] bolt ... was shorter than specified for that location and thread engagement within the flow body was approximately 2 full threads. The fuel bypass passage (Po) preformed packing was partially extruded at the flange opening.

The report continued: "The FCU drive body flange mating with the flow body was found to have an irregular surface flatness. The drive body boltholes had markings matching the bolt thread spacing. Raised material was observed in boltholes No. 3 and No. 4. Furthermore, the raised material was consistent with relative movement between the drive body and the bolt.

"The No. 3 flow body bolt hole fractured threads showed three types of surface features. Some areas were consistent with a shear fracture surface resulting from a force pulling on the bolt ... and other areas exhibited features consistent with rubbing.

"A third area exhibiting a different mode of fracture has contaminants on its fracture surface. The absence of such contaminants on the adjacent rubbed area is indicative that this portion of fracture surface was pre-existing. This contaminated surface exhibited a topography showing evidence of striations consistent with fatigue mechanism. A portion of the shear overload fracture initiated from this portion of the fracture surface."

"Additionally, the fractured threads revealed evidence of deformation not consistent with a shear fracture along the root of the fractured thread. This deformation and its orientation are consistent with a contact along this edge after the fracture. Furthermore, evidence of a partial shearing of the threads occurring during a prior event was also observed."

The fuel control unit (FCU) was sent to Honeywell in South Bend, Indiana, for further examination. The examination showed that the fuel control unit damage was the result of heavy impact. The "interchanging the screws could result in a loss of clamping load due to lack of thread engagement or due to interference (bottoming). The clamping load applied by each screw is proportional to the applied torque (20 - 25 in-lbs). Visual examination of the 'pulled' screw revealed 2.5 threads were engaged." Stress analysis tests verified "a thread engagement of 2.5 threads would allow for proper torqueing of the screws." A tolerance study determined that "the long screw (installed in the short screw position) would not bottom; therefore the clamping load was retained."

The FCU was returned to P&WC for additional tests including mechanical and electrical quality, dimensional measurements, non-destructive SEM (scanning beam electron microscope) evaluation of the fractured bolt hole threads, and tomography of the deformed FCU drive body (see P&WC Final Report, Excerpts). The additional testing revealed no functional anomalies.

ADDITIONAL INFORMATION

At the time of the accident, the Commission on Accreditation of Medical Transport Systems (CAMTS) had not accredited Tri-State Care Flight although their surveyors had inspected their facilities. Tri-State Care Flight was eventually accredited in April 2006.

While at the accident site, NTSB's investigator was approached by family members of the deceased crew. They said that two weeks before the accident, the pilot had complained of "rpm droop." According to the helicopter maintenance records, the pilot filed the following discrepancy/irregularity report on June 18: "On final approach to KDRO, aircraft experienced Nr and N2 droop. Upon landing, Nr and N2 droop with collective movement." Corrective action was: "AFTT 795.6. Troubleshot engine bleed air system. Found loose bleed air line to P3 filter. Tightened line and performed ground operational check. OPS normal. Aircraft is approved for return to service."

In addition to the Federal Aviation Administration, parties to the investigation included Agusta SPA, Pratt & Whitney Canada, and Honeywell.

The wreckage was released to the insurance company on October 30, 2006.

Pilot Information

Certificate:	Commercial	**Age:**	40,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	April 1, 2005
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	2215 hours (Total, all aircraft), 130 hours (Total, this make and model), 1600 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Agusta	**Registration:**	N403CF
Model/Series:	A119	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	14009
Landing Gear Type:	Skid	**Seats:**	5
Date/Type of Last Inspection:	May 1, 2005 Annual	**Certified Max Gross Wt.:**	5997 lbs
Time Since Last Inspection:	422 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	753 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	PT6B-37A
Registered Owner:	Tri-State Care Flight LLC	**Rated Power:**	900 Horsepower
Operator:		**Operating Certificate(s) Held:**	On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CEZ,5914 ft msl	**Distance from Accident Site:**	30 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	240°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.15 inches Hg	**Temperature/Dew Point:**	30°C / -4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Durango, CO (5CO0)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Mancos, CO	**Type of Clearance:**	None
Departure Time:	12:42 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	3 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	37.400554,-108.142219

Administrative Information

Investigator In Charge (IIC):	Scott, Arnold
Additional Participating Persons:	Lynn S Higgins; FAA Flight Standards District Office; Salt Lake City, UT Paolo Ferreri; Agusta Aerospace Corporation; Philadelphia, PA Alessandro Crespi; Agusta Aerospace Corporation; Philadelphia, PA Marc Hemmings; Pratt & Whitney Canada; Montreal David W Dodson; Honeywell; South Bend, IN Ken Miller; Honeywell; South Bend, IN
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