Aviation Investigation Final Report

Location:	Camp Bastion,	**Accident Number:**	DCA12FA024
Date & Time:	January 16, 2012, 06:15 UTC	**Registration:**	N5748M
Aircraft:	Bell 214	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

Witness accounts from the flight crew of the helicopter flying behind the accident helicopter indicated that, after both helicopters had climbed to an altitude between about 800 to 1,000 feet, the accident helicopter rolled sharply to the right and entered a steep, nose-down pitch, at which time the aft tailboom separated from the helicopter. The helicopter's nose-down pitch attitude continued until ground impact.

There was no evidence of abnormal engine operation at the time of the accident or a failure of the tail rotor system or a major airframe structural component before the in-flight breakup. The damage observed on the right collective lever arm, idler link, and collective sleeve bearing support assemblies were consistent with an overtravel of the collective sleeve, which resulted in a severe and sudden reduction in main rotor collective pitch. Also, the damage to the left and right sides of the idler link showed that the left and right collective lever arms were in their installed position at the time of the collective sleeve overtravel.

Bell Helicopter Textron's math model simulation of the Bell 214 helicopter's response to a sudden and severe reduction of main rotor collective pitch (resulting from a failure of the collective flight control system) showed that the helicopter would respond with a severe right roll and a simultaneous nose-down pitch attitude. The math model simulation also showed that a sudden and severe reduction of main rotor collective pitch would cause the main rotor hub to exceed its flapping angle and the main rotor blade tips to deflect downward and possibly contact the tailboom due to the reduced amount of clearance.

The results of the math model simulation were closely aligned with the witness accounts from the flight crew of the helicopter behind the accident helicopter and the damage observed on the helicopter wreckage. For example, the nose-down pitch and right roll observed in the math model simulation was similar to the reported pitch and roll of the accident helicopter when the accident sequence began. Also, the main rotor mast showed damage consistent with mast bumping that resulted when the main rotor hub significantly exceeded its flapping angle. Thus, the evidence showed that, when the accident helicopter's main rotor hub exceeded its flapping angle, the resulting loss of clearance between the main rotor

system blades and the tailboom caused the main rotor blades to contact the tailboom. This contact was severe enough to cause the aft tailboom section to completely separate from the rest of the tailboom, leading to a loss of pitch control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

the overtravel of the collective sleeve, which led to a severe and sudden reduction in main rotor blade collective pitch, resulting in a loss of control of the helicopter. The reason for the collective sleeve overtravel could not be determined since much of the collective control system was consumed in the post crash fire.

Findings

Aircraft	Main rotor mast/swashplate - Failure
Aircraft	Main rotor head system - Failure
Aircraft	Pitch control - Attain/maintain not possible
Aircraft	Rotorcraft tail boom - Damaged/degraded

Factual Information

History of Flight

Enroute-climb to cruise	Sys/Comp malf/fail (non-power)
Enroute-climb to cruise	Flight control sys malf/fail
Enroute-climb to cruise	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

On January 16, 2012, about 1045 Afghanistan time (0615 UTC), a Bell 214ST helicopter, N5748M, crashed 7 miles south of Camp Bastion in the Helmand province of Afghanistan. The helicopter was operated by AAR Airlift Group under contract to the Department of Defense (DOD) Air Mobility Command (the air component of the US Transportation Command). The flight was conducted under the provisions of 14 *Code of Federal Regulations* (CFR) Part 135. Visual meteorological conditions prevailed at the time of the accident. The three crewmembers, who were US citizens, died as a result of their injuries from the accident. The helicopter was destroyed by impact forces and postcrash fire. There were no reports of any hostilities in the area at the time of the accident.

The accident helicopter was operating between several forward operating bases in Afghanistan along with another Bell 214 helicopter (N391AL) to transport military personnel between bases. The accident helicopter used the call sign "Slingshot 72"; the other helicopter used the call sign "Slingshot 71." Both helicopters departed Shindand Air Base about 0901 and flew to Camp Farah. Slingshot 72 was the lead helicopter for that flight. The Slingshot 71 flight crewmembers stated that they could see Slingshot 72 during the flight, even though the helicopters were separated "by a couple of miles."

At Camp Farah, the engines on both helicopters were shut down, and the helicopters were refueled. Two passengers then boarded each helicopter for the next flights, which departed Camp Farah about 0934 for Camp Bastion. The helicopters arrived at Camp Bastion about 1031, and the passengers disembarked the helicopters. The engines continued to run while the helicopters were at Camp Bastion. Four passengers then boarded Slingshot 71; no passengers boarded Slingshot 72. The pilot-in-command (PIC) of Slingshot 71 stated that the crew chief of each helicopter (one of the three crewmembers aboard each helicopter) performed a walk-around inspection while the helicopters were at Camp Bastion.

About 1040, both helicopters departed Camp Bastion for Shindand Air Base on a heading of 190º and climbed to a cruise altitude between about 800 and 1,000 feet. Slingshot 72 was the lead helicopter, and Slingshot 71 was trailing the helicopter by about ¼ to ½ mile. The Slingshot 71 PIC and second-in-command (SIC) stated that Slingshot 72 was flying slightly above and to the right of their helicopter. According to the SIC of Slingshot 71, "it was a normal climbout…" and that "they were climbing at a rate of about 300 feet per minute (FPM) at an airspeed of 120 knots."

The SIC of Slingshot 71, who was the pilot flying, saw Slingshot 72 enter a "sharp" bank to the right; he estimated that the bank was about 70º to 80º. The SIC then saw Slingshot 72 begin to "come apart." The

SIC stated that he flew Slingshot 71 to the left to avoid the large amount of debris coming from Slingshot 72, which included large pieces of structure. The SIC reported that the tailboom of Slingshot 72 began to "separate and fold" and estimated that about two-thirds of the tailboom came off the helicopter. The SIC then saw Slingshot 72 pitch down about 75º to 80º, impact the ground, and burst into flames.

The PIC of Slingshot 71, who was the pilot monitoring, stated that, after making a radio frequency change, he looked up and saw Slingshot 72 in a "steep pitch down." The PIC stated that "nothing seemed wrong" with Slingshot 72 when he had looked down to make the radio frequency change. The PIC also stated that he saw structure starting to come off Slingshot 72 and that the debris looked similar to "confetti." The PIC noticed that the tailboom of Slingshot 72 appeared to be folded under the helicopter and stated that he could see the "zinc' color of the inside of the tailboom. Afterward, the PIC observed Slingshot 72 descend "straight down," impact the ground, and burst into flames. The PIC reported that the flight crew of Slingshot 72 made no radio transmissions indicating any problems.

The flight crew of Slingshot 71 contacted controllers at the Camp Bastion tower, who coordinated crash rescue efforts. Also, Slingshot 71 circled the wreckage several times so that the crewmembers could look for any survivors aboard Slingshot 72. After US forces reached the area and secured the accident site, Slingshot 71 departed the area and landed uneventfully at Camp Bastion. The Slingshot 72 wreckage was then recovered and moved to a secure location at Camp Bastion.

On January 18, 2012, the National Transportation Safety Board (NTSB) accepted full delegation of this accident investigation from the Ministry of Transport and Civil Aviation of the Islamic Republic of Afghanistan in accordance with the provisions of Annex 13 to the Convention on International Civil Aviation. Afterward, the helicopter wreckage was sent from Afghanistan to the United States for examination and analysis.

Information

Certificate:	**Age:**
Airplane Rating(s):	**Seat Occupied:**
Other Aircraft Rating(s):	**Restraint Used:**
Instrument Rating(s):	**Second Pilot Present:**
Instructor Rating(s):	**Toxicology Performed:**
Medical Certification:	**Last FAA Medical Exam:**
Occupational Pilot:	**Last Flight Review or Equivalent:**
Flight Time:	

The three crewmembers aboard the accident helicopter were the PIC, the SIC, and the crew chief.

The PIC, age 48, held an airline transport pilot certificate issued on March 2, 2011, for the BH-214ST and BK 117 helicopters with airplane single-engine land and instrument airplane ratings. The PIC held a second-class medical certificate issued on May 9, 2011, with the limitation that he must wear corrective

lenses while exercising the privileges of the certificate. A review of FAA records found no prior accident, incident, or enforcement actions.

The PIC was hired by AAR Airlift Group in January 2011. His most recent recurrent ground training occurred on March 1, 2011, and his most recent proficiency check in the Bell 214 helicopter and PIC line check occurred on June 16, 2011. According to employment records from AAR Airlift Group, the PIC had accumulated about 7,250 hours total pilot flying time, including about 480 hours in the Bell 214 helicopter. He had flown about 115 and 12 hours in the last 90 and 30 days, respectively.

The SIC, age 51, held an airline transport pilot certificate issued on April 9, 2011, for the BH-214ST helicopter with an airplane single-engine land rating. The SIC held a second-class medical certificate issued on August 3, 2011, with no limitations. A review of FAA records found no prior accident, incident, or enforcement actions.

The SIC was hired by AAR Airlift Group in November 2011. His most recent recurrent ground training occurred on December 19, 2011, his most recent proficiency check in the Bell 214 helicopter occurred on November 28, 2011, and his most recent SIC line check occurred on December 30, 2011. According to employment records from AAR Airlift Group, the SIC had accumulated about 4,170 hours total pilot flying time, including about 120 hours as an SIC in the Bell 214 helicopter. He had flown about 250 and 14 hours in the last 90 and 30 days, respectively.

On the day of the accident, the PIC and SIC were scheduled for 14 flights. The accident occurred during the sixth flight of the day. The PIC and SIC had been on duty for about 4 hours when the accident occurred.

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N5748M
Model/Series:	214 ST	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	28102
Landing Gear Type:	Skid	**Seats:**	10
Date/Type of Last Inspection:	March 11, 2011 Annual	**Certified Max Gross Wt.:**	17500 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo shaft
Airframe Total Time:	11538 Hrs as of last inspection	**Engine Manufacturer:**	General Electric
ELT:	Installed, not activated	**Engine Model/Series:**	CT7-2A
Registered Owner:	EP Aviation	**Rated Power:**	
Operator:	AAR Airlift	**Operating Certificate(s) Held:**	Rotorcraft external load (133), On-demand air taxi (135)

The accident helicopter, serial number 28102, was built in 1984 and was approved for operations conducted under 14 CFR Parts 91 and 135. Records showed that, as of January 15, 2012 (the day before the accident), the helicopter had accumulated a total time of 12,346 flight hours.

The Bell 214ST helicopter has a two-bladed, semi-rigid main rotor system, which provides helicopter lift and thrust, and a two-bladed, semi-rigid tail rotor system, which provides main rotor anti-torque and directional control. The helicopter is equipped with two General Electric CT7-2A turboshaft engines that provide power to the main and tail rotor systems via a geared transmission system and drive shafts. The helicopter's flight controls for cyclic, collective, and anti-torque/directional control are hydraulically assisted. The automatic flight controls consist of a stability control and augmentation system, attitude and altitude retention system, and a fly-by-wire elevator system.

The accident helicopter was equipped with a portable Garmin GPS unit, which could store route of flight and flight time information for up to 50 individual flights. The GPS recorded date, time, latitude, longitude, and altitude parameters and derived groundspeed and course from the recorded parameters. The data extracted from the GPS aboard the accident helicopter included the flight from Camp Farah to Camp Bastion and the accident flight. These data were recorded between 0928:41 and 1044:37. The data showed that the accident helicopter was traveling at a groundspeed of about 145 knots when the last parameters were recorded.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	
Precipitation and Obscuration:			
Departure Point:	Camp Bastion	**Type of Flight Plan Filed:**	
Destination:		**Type of Clearance:**	VFR
Departure Time:		**Type of Airspace:**	Unknown

The sky condition was reported to be clear with unrestricted visibility at the time of the helicopters' departure from Camp Bastion. The wind was reported to be variable at 6 knots.

Wreckage and Impact Information

Crew Injuries:	3 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	31.783611,64.210281(est)

Detailed information about the accident site and photographs of the site were provided to the NTSB by the US military and AAR Airlift Group's director of ground support operations in Afghanistan. The accident site consisted of a primary impact area and a scattered debris field, which measured about 1,575 feet north-south by 656 feet east-west. The primary impact area consisted of the main fuselage, which had been fully consumed by the postcrash fire. The forward tailboom section was found separated from the main fuselage about 49 feet north of the primary impact area, and the aft tailboom section (containing the vertical stabilizer and tail rotor) was found about 279 feet north of the primary impact area. The main debris field was located south of the primary impact area (distance unknown) and included an engine cowling, a door, and one of the two main rotor blades. The other main rotor blade was found about 426 feet southwest of the primary impact area.

Examination of the wreckage found that only one of the two collective lever arms (subsequently identified as the right collective lever arm) was recovered from the accident site. Also, the areas on the main transmission's main rotor mast where the missing (left) collective lever arm was installed did not exhibit damage similar to the significant damage found in the areas where the right collective lever arm had been attached before the helicopter impacted the ground. Examination of the two holes for the bolts that secured the two collector lever arms together found no indications of hole enlargement or longitudinal wear marks on the inside of bolt holes.

The right collective lever arm was not attached to the idler link or the collective sleeve. The idler link had two impact marks in similar locations on the left and right sides of its outboard edges. The impact mark on the left side of the idler link was smaller than the mark on the right side. According to Bell Helicopter Textron, the impact marks on the idler link were consistent with an overtravel of the collective lever arm in the direction of an upward movement of the collective sleeve.

Impact marks were observed on the upper edge of both sides of the swashplate support assembly window. These impact marks matched the damage to the upper two of the four bolts used to secure the bearing assemblies on both sides of the collective sleeve. On the left bearing assembly, the upper left bolt head was completely sheared off; on the right bearing assembly, the upper left bolt head exhibited a downward bend. Bell Helicopter Textron indicated that these impact marks were also consistent with an overtravel of the collective sleeve in the upward direction. The left bearing assembly was relatively intact, and the right bearing assembly showed significant deformation and damage.

The visible portions of the main rotor mast had two areas with impact damage that were located 180º opposite of each other and were aligned with the flapping direction of the main rotor hub. The impact damage on the main rotor mast showed evidence consistent with mast bumping, which occurs on a two-bladed semi-rigid rotor system when the system exceeds its teetering limit and strikes the mast of the

helicopter with sufficient force to cause mast deformation and potentially mast failure.

Continuity of tail rotor drive and tail rotor control were confirmed within the separated aft tailboom section but could not be confirmed forward of the aft tailboom section because of breaks in the tail drivetrain and control system and the loss of components due to the postcrash fire. No evidence indicated a loss of tail rotor drive or tail rotor control before the in-flight separation of the aft tailboom section. Further examination of the tailboom wreckage found overload fractures on the four tailboom attachment fittings.

Both engines showed damage consistent with ground impact forces and exposure to the postcrash fire. Examination of both engines showed evidence that was consistent with the engines producing power at the time of impact.

The left cyclic, right cyclic, and collective hydraulic actuators from the accident helicopter's flight control system were examined in detail at Bell Helicopter Textron facilities in Fort Worth, Texas. The examination found no evidence indicating abnormal operation.

A review of maintenance records for the collective flight control system showed that the collective torque shaft support bracket had been replaced the day before the accident. The support bracket installation was found in the wreckage, and no evidence indicated that the installation of the replacement support bracket was faulty. The maintenance records did not include any discrepancy related to the collective flight control system that led to the replacement of the support bracket or any troubleshooting performed to determine that the support bracket needed replacement. The maintenance records showed that a functional check flight was completed after the support bracket replacement with no noted defects.

Flight recorders

The helicopter was equipped with an Allied Signal 980-6020-023 cockpit voice recorder (CVR). The CVR recorded 30 minutes of digital audio stored in solid-state memory modules. The recording consisted of four channels of audio information, including one channel for each flight crewmember and one channel for the cockpit area microphone.

The CVR had sustained substantial heat and structural damage. The crash-protected memory unit was removed from the CVR housing, and the memory module was extracted. Examination of the memory module showed that some of the control and memory chip connections to the memory board had been compromised. As a result, a chip-level recovery of the 14 memory chips on the board was accomplished.

The memory image on each of the 14 memory chips was read into a binary file format, and the 14 binary files were processed using software provided by the CVR manufacturer. The resulting file, which was identical in format to the file that would have been created if the memory module had not been damaged, was processed to create four 30-minute digital audio files.

The chip-level recovery found that all four channels contained audio that was unusable. None of the audio channels had voice or background sounds. Thus, the audio was consistent with the CVR being

inoperative or misconfigured at the time of the accident.

Medical and Pathological Information

Postaccident toxicology tests were not performed on the PIC and the SIC.

Tests and Research

Because the left collective lever arm was not recovered and asymmetric damage was found on the idler link and collective sleeve bearing assemblies, the NTSB asked Bell Helicopter Textron to perform a math model simulation to predict the Bell 214 helicopter's response to a failure of the collective flight control system and the resulting reduction of main rotor collective pitch. The math model results showed that the helicopter would respond with a severe right roll and nose-down pitch attitude. A second math model simulation considered the effect of a pilot aft cyclic input in response to the attitude upset of the helicopter. The results of this math model showed that, with or without a pilot aft cyclic input 1 second after the reduction in collective pitch, the main rotor blades would deflect downward and result in an almost complete loss of clearance from the tailboom.

Organizational and Management Information

AAR Airlift Group Inc. was headquartered in Palm Bay, Florida. All company aircraft in Afghanistan were dedicated for exclusive use by the DOD. The company provided its pilots with commercial air transportation to and from Afghanistan at the beginning and end of each pilot's duty rotation (typically 30 days in Afghanistan followed by 30 days off in the United States). While in Afghanistan, pilots were scheduled to fly up to 10 hours per day and were restricted to a 14-hour duty day. Pilots normally worked a 12-hour duty period that started at 0600 and ended at 1800. The company stated that it complied with Part 135 crew rest requirements and that pilots' duty schedules included designated time off.

AAR Airlift Group reported that Bell 214 helicopter ground training was conducted in Melbourne, Florida, and that recurrent ground training was also conducted in Afghanistan. All Bell 214 flight training was conducted in the helicopter. All instrument flight rules training and some visual flight rules (VFR) training was conducted in Melbourne, and VFR flight training was also conducted in Afghanistan. The company stated that it followed the manufacturer's maintenance manual, BHT-214ST-MM, for maintenance procedures.

At the time of the accident, the Part 135 certificate for AAR Airlift Group was held at the Orlando, Florida, Flight Standards District Office. The principal operations inspector (POI) for AAR Airlift Group stated that, at the time of the accident, he had been the POI for the company for about 9 months. During that time, he had visited the company's headquarters at least six times, observed training or checkrides about three times, and reviewed written records. The POI also stated that he found no problems with company manuals and training. The POI further stated that he had not observed any of the company's operations in Afghanistan (because, as of February 2012, he was not allowed to travel there) but that he had no concerns with these operations.

The assistant POI, who had been assigned to the AAR Airlift Group certificate for about 4 months at the time of the accident, stated that he was generally at the company's headquarters at least once every 2 weeks. The assistant POI also stated that he had observed one oral examination for a Part 135 checkride aboard a Bell 214 helicopter and that the examination went "fine." He had reviewed AAR Airlift Group training records and stated that there was "nothing that jumps out" about the records. The assistant POI further stated that he was "satisfied with what I have seen" regarding the company's efforts to follow Part 135 regulations and that he had not received any complaints about the company from pilots or others. In addition, the assistant POI stated that, as of July 2012, he was planning to "possibly" travel to Afghanistan to perform oversight of the company there.

Additional Information

The DOD reported that it conducted in-theater oversight of AAR Airlift Group. This oversight was conducted by an evaluator in Afghanistan who observed company operations, procedures, aircraft, and facilities. The evaluator was generally an operations specialist but was occasionally a maintenance specialist. DOD stated that it strived to conduct in-theater oversight twice a year (in 6-month intervals).

The operations evaluators assessed in-flight operations. The evaluators used a cockpit evaluation form, which was similar to a pilot checklist, during their assessment and shared completed cockpit evaluation forms with the FAA. The maintenance evaluators examined aircraft, stations, and any maintenance records that were in Afghanistan. All evaluation records and discrepancies were tracked, and corrective actions were taken for the discrepancies. The NTSB's review of the DOD's operational reports and cockpit evaluations of the company from July 2010 to July 2011 (the company was known as Presidential Airways until January 1, 2011) showed satisfactory operations.

Between October 24 and 27, 2011, the DOD conducted a biennial survey of the company's operations in Afghanistan. The NTSB's review of the survey results indicated that all operational areas met the DOD quality and safety standards prescribed in Federal regulations.

Administrative Information

Investigator In Charge (IIC):	Bower, Daniel
Additional Participating Persons:	
Original Publish Date:	November 19, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=82685