Aviation Investigation Final Report

Location:	Flagstaff, Arizona	**Accident Number:**	DEN08MA116
Date & Time:	June 29, 2008, 15:47 Local	**Registration:**	N407GA
Aircraft:	Bell 407	**Aircraft Damage:**	Destroyed
Defining Event:	Midair collision	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Air Medical (Medical emergency)		

Analysis

Both Emergency Medical Services (EMS) helicopters were on approach to the Flagstaff Medical Center (FMC) helipad to drop off patients. During the flights, the N407MJ pilot had established two-way communications with his communications center and provided position reports, and the N407GA pilot had established two-way communications with FMC's communications center (which was his company's communication center and which also monitored and advised all traffic at the helipad) and provided position reports. The FMC communications center transportation coordinator advised the N407GA pilot that N407MJ would also be dropping off a patient at FMC. The coordinator also advised N407MJ's communication center that N407GA would be landing at FMC, but the N407MJ's communication center did not inform the N407MJ pilot nor was it required to do so.

Established arrival and departure procedures for the FMC helipad required pilots to contact the FMC communications center at the earliest opportunity or at a minimum of 5 miles from the helipad. According to the FMC communications center's staff, N407MJ's pilot did not make the required contact with the communications center at any time during the flight.

About 3 minutes before the collision, N407GA dropped off a medical crewmember at the local airport (about 5 miles south of the medical center) to reduce the weight on the aircraft and to improve aircraft performance during landing at the medical center. According to witness information, flight-track data, and a hospital surveillance video, N407GA approached the helipad from the south, flying past or slightly inside the southeast tip of the noise abatement area on a direct line toward a final approach position just east of the helipad. However, according to helipad arrival guidelines and company procedures, N407GA should have

approached the helipad from farther to the east. (After the on-scene accident site investigation, the Air Methods regional chief pilot, accompanied by NTSB investigators, flew the accident route in another Air Methods Bell 407 using GPS data retrieved from N407GA. According to the regional chief pilot, the “trained route” was much farther to the east and not in a direct line to the hospital.) N407MJ approached the helipad from the northeast, and it is likely that the pilot would have been visually scanning the typical flight paths, as described in the noise abatement and helipad arrival guidelines, that other aircraft approaching the medical center would have used. Thus, if N407GA had approached from a more typical direction, the pilot of N407MJ may have been more likely to see and avoid it.

At the time of the collision, both pilots were at a point in the approach where their visual attention typically would have been more focused on the helipad in preparation for landing, rather than on scanning the surrounding area for other traffic. The helicopters collided approximately 1/4 mile east of the helipad. There were no communications from either helicopter just prior to or after the collision.

Neither helicopter was equipped with a traffic collision avoidance system, nor was such a system required. Had such a system been on board, it likely would have alerted the pilots to the traffic conflict so they could take evasive action before collision. No radar or air traffic control services were available for the helipad operations to ensure separation. However, if N407MJ's pilot had contacted the FMC communications center, as required, the FMC transportation coordinator likely would have told him directly that another aircraft was expected at the helipad. If the pilot had known to expect another aircraft in the area, he would have been more likely to look for the other aircraft.

Nevertheless, the pilots were responsible for maintaining vigilance and to see and avoid other aircraft at all times. Under 14 Code of Federal Regulations Sections 91.111 and 91.113, all pilots are responsible for keeping a safe distance from other aircraft and for maintaining vigilance so as to see and avoid other aircraft. Advisory Circular 90-48C, "Pilots' Role in Collision Avoidance," amplifies the see-and-avoid concept by stating that all pilots should remain constantly alert to all traffic movement within their field of vision and that they should scan the entire visual field outside of their aircraft to ensure that conflicting traffic would be detected.

Examination of the wreckages revealed that N407MJ's tail rotor contacted the forward fuselage of N407GA, and N407GA's main rotor blades contacted and separated N407MJ's tail boom. The recovered wreckages showed no evidence of any preimpact structural, engine, or system failures.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Both helicopter pilots' failure to see and avoid the other helicopter on approach to the helipad. Contributing to the accident were the failure of N407GA's pilot to follow flight arrival route guidelines, and the failure of N407MJ's pilot to follow communications guidelines requiring him to report his position within a minimum of 5 miles from the helipad.

Findings

Personnel issues	Monitoring other aircraft - Pilot
Personnel issues	Incorrect action selection - Pilot

Factual Information

History of Flight

Approach	Midair collision (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

"THIS CASE WAS MODIFIED MAY 29, 2009."

HISTORY OF FLIGHT

On June 29, 2008, at 1547 mountain standard time, a Bell 407 emergency medical service (EMS) helicopter, N407GA, and a Bell 407 EMS helicopter, N407MJ, collided in mid air while approaching the Flagstaff Medical Center (FMC) helipad (3AZ0), Flagstaff, Arizona. Both helicopters were destroyed. N407GA's commercial pilot, flight nurse, and patient sustained fatal injuries; and N407MJ's commercial pilot, flight paramedic, flight nurse, and patient sustained fatal injuries. N407GA was operated by Air Methods Corporation, Englewood, Colorado, and registered to FMC, Flagstaff, Arizona. N407MJ was operated by Classic Helicopter Services, Page, Arizona, and registered to M&J Leisure, L.L.C., Ogden, Utah. Visual meteorological conditions prevailed, and company flight plans were filed for the 14 Code of Federal Regulations Part 135 air medical flights. N407GA's flight departed Flagstaff Pulliam Airport (FLG), Flagstaff, Arizona, at 1544, and N407MJ's flight departed the Grand Canyon National Park Service South Rim helibase, Tusayan, Arizona, at 1517.

Audio recordings were obtained from Classic's communications center (Classic Control), Guardian Control, FMC, and the FLG Air Traffic Control Tower (ATCT).

At 1516, the pilot for the Air Methods helicopter, N407GA, call sign Angel 1, contacted Guardian Control via aircraft radios and reported that they were departing Winslow, Arizona, with four people on board; the pilot, two flight nurses, and a patient. The pilot stated that his estimated time en route was 25 minutes and he was either going to land at FLG or at FMC. He was not sure if he would be at the proper weight to land with enough power to execute a safe out of ground effect hover at FMC with all four occupants onboard.

At 1517, the pilot of Angel 1 contacted Guardian Control via onboard radios and requested the current weather conditions at FLG. The on-call transportation coordinator (TC) provided the requested information, and within two minutes, she contacted FMC and told them that Angel 1 was inbound to the helipad in approximately 23 minutes.

At 1517, the pilot for Classic helicopter, N407MJ, call sign Lifeguard 2, contacted Classic Control via onboard radios and reported that they had departed the south rim of the Grand Canyon and were en route to the FMC with an estimated time of arrival of 32 minutes. There

were four people on board; the pilot, a flight nurse, a flight paramedic, and a patient.

Approximately one minute later, the pilot on Angel 1 called Guardian Control via onboard radios and reported that they were going to "drop one" at FLG before proceeding to FMC.

At 1523, the dispatcher on duty at Classic Control contacted Guardian Control via landline and reported that Lifeguard 2 was en route to the FMC and would be arriving from the north. He also reported that it would be a "cold drop" and the emergency department at the hospital had already been notified. The Guardian Control TC then informed the Classic dispatcher that Angel 1 was also en route and would be landing at FMC in 20 minutes. The Classic dispatcher then stated, "Ohh okay, I'll let them know when I talk to them next, and I'll tell them to be sure and get a hold of you."

At the end of this call, the Guardian Control TC called FMC's emergency department (ED) via land-line and stated that Lifeguard 2 would also be landing at the hospital in "about 28 minutes...and they know about mine coming in." The person who answered the landline responded, "All right." The TC then contacted the pilot of Angel 1 via onboard radio and informed him that Lifeguard 2 would also be landing at FMC in approximately 28 minutes. The Angel 1 pilot responded, "Roger will be looking for 'em thanks."

At 1532, the pilot of Lifeguard 2 contacted Classic Control via onboard radios, provided a position report and said they were 15 minutes from landing at FMC. The dispatcher on duty responded, "Comm center copies all sir...I'll talk to you on the ground in 15 minutes, 1532." This was the last recorded communication from the Lifeguard 2 pilot.

Also at 1532, the Angel 1 pilot contacted Guardian Control via onboard radios and reported that they were 10 minutes from landing at FLG in order to drop off a flight nurse due to weight considerations.

At 1534, the Angel 1 pilot called Guardian Control via onboard radios and asked the TC to contact FMC and request additional ground support to assist in moving the patient from the helicopter. The TC then contacted FMC and made the request.

At 1541, the Angel 1 pilot contacted the FLG ATCT via onboard radios and reported that he was one mile out. A controller provided traffic advisories and cleared Angel 1 to land.

At 1543, the Angel 1 pilot contacted the FLG ATCT via onboard radios and said, "...Angel 1 would like to depart to the north to the hospital with foxtrot." A controller responded, "Lifeguard Angel 1 wind variable at five taxiway alpha cleared for take off northbound to the hospital approved."

At 1544, the Angel 1 pilot contacted Guardian Control via onboard radios and stated, "Control Angel 1 if you haven't figured it out we've uh landed at the...airport departed and we're about two minutes out of the hospital." The TC responded and copied the transmission. This was

the last recorded communication from the Angel 1 pilot.

At 1550, the Classic dispatcher contacted Guardian Control via landline and asked the TC if she had had any contact with "my ship." The TC said, "negative."

A review of the recorded transmissions made between both medical crews and the hospital revealed that both of the medical crews contacted the FMC ED and provided medical reports on their respective patients.

A Classic medical crewmember contacted FMC via an onboard cellular phone at 1525. The conversation ended 1528, at which time the crewmember reported an estimated arrival time of 18 minutes, or 1546.

The Air Methods medical crewmember contacted FMC via onboard radio (Med Channel 3/EMSCOMM) at 1532. The conversation ended at 1534; at which time the crewmember provided an estimated time of arrival of 15 minutes, or 1549.

Each crewmember spoke with a different nurse and physician. A review of both transmissions indicated normal communications and that both patients were medically stable.

The hospital staff that received the phone calls from both aircraft did not provide any information about the other helicopter that was also en route to the FMC. There is no requirement for FMC staff to provide arrival or departure information regarding other aircraft to medical flight crews. If any information is provided it is given as a courtesy only.

A surveillance camera, mounted on a parking garage at FMC, captured the collision on digital video. The video depicted one helicopter approaching from north and one helicopter approaching from the south, and shows both aircraft descending after the collision. The NTSB Vehicle Recorders Laboratory, Washington, DC, examined the video, and extracted a series of still images which showed the collision sequence.

N407GA was equipped with a GPS-based OuterLink tracking system that recorded the helicopter's position every 30 seconds. A review of the data revealed that N407GA flew in a straight line from FLG to the location of the accident site, about 1/4-mile east of the FMC helipad. The data indicated that the aircraft had not initiated a turn onto final approach when the data ended.

N407MJ was equipped with a GPS-based Sky Router tracking system, which recorded the helicopter's position every five minutes. A review of the data revealed that the last recorded position was approximately ten miles northwest of the helipad. In addition, a Garmin GPSMAP 496 handheld GPS was located in the wreckage. The unit was shipped to the Vehicle Recorders Division at NTSB Headquarters, Washington, DC where it was downloaded on June 30, 2008. Examination of the unit revealed that it was not programmed to record the helicopter's flight track and there was no usable stored data for the accident flight.

No Federal Aviation Administration (FAA) radar services were available for the airspace surrounding FMC.

One witness, located approximately 1 mile southwest of the accident site, observed the collision of the two helicopters. He observed "a light aircraft" traveling west to east. As the aircraft turned to the south, he noticed a second helicopter traveling from the east to the west. The first helicopter appeared to be at the same altitude as the second helicopter when it started a turn to the south. The witness stated, "I saw both aircraft on what appeared to be a collision course. From the angle I was at, the second helicopter (red and white) did not appear to change direction and the first collided with it."

Two other witnesses observed the collision from the back porch of their residence approximately 1/2 mile south and west of the accident site. They observed the [Air Methods] helicopter approaching from the south and east on a "usual landing pattern." One of these witnesses observed a second helicopter "approaching the other from the [right], back side" just prior to the collision. The other witness observed the second helicopter just as the helicopters collided.

Another witness observed the collision from her residence four-tenths of a mile north and west of the accident site. She first heard a helicopter approaching from the north. She then heard a second helicopter coming from the south. The witness stated that she "looked up just as the northbound helicopter apparently clipped the rotor of the southbound [helicopter]. At that time, they both were in a turn to the hospital."

Several people witnessed the collision and reported seeing both helicopters descending into wooded terrain about 1/2-mile east from the heliport. There was a small fire noted rising from the hilly terrain, followed by a loud explosion about ten minutes after the collision.

PERSONNEL INFORMATION

N470GA; Air Methods Corporation

Pilot Information

The pilot, age 51, held a commercial pilot certificate for single-engine land airplanes and rotorcraft-helicopters, and an instrument rating for both airplanes and helicopters. His most recent first-class medical certificate was issued on September 12, 2007, and contained the limitation of "Cleared Class I with near vision restriction."

A review of the pilot's last Flight Training and Qualification Record revealed that his last Airman Competency/Proficiency Check was accomplished on August 15, 2007. At the time of the accident, the pilot had accrued a total of approximately 5,241 hours, including 4,500 hours in helicopters.

In the previous three months, the pilot had accrued 150 hours, including 53 hours at night. During the last 30 days, the pilot flew 51 hours, including 19 hours at night. All of this time was accrued in the Bell 407. According to the company the pilot attended and satisfactorily completed all company initial, recurrent, and NVG training courses.

The pilot was hired on October 7, 2003, as a full-time EMS pilot flying the Bell 407 at the operator's base in Flagstaff, Arizona. When hired, the pilot had accrued a total of approximately 4,353.6 hours, including 341.2 hours as pilot-in-command (PIC) in the Bell 407. According to the operator, he did not work elsewhere as a pilot at the time of the accident.

During his tenure at Air Methods, he served as the Safety Officer and the Safety Coordinator, and was also night-vision goggle (NVG) qualified.

A search of the National Driver Register found no record of driver's license suspension or revocation.

Flight Nurse Information

The flight nurse, who was dropped off at FLG before the accident, was hired by FMC on June 26, 1995, as an emergency medical technician (EMT) with Guardian Medical Transport (GMT). On March 27, 2006, he became a flight registered nurse (RN).

The flight nurse had been employed with Northern Arizona Healthcare for four years and was authorized for medical flights on fixed-wing aircraft and helicopters. In the summer months, he normally worked onboard the helicopters because of his low body weight. He was considered a neo-natal specialist and received his training in the Army.

He worked a continuous 48-hour shift starting at 0800. He came on duty after four days rest at 0800 on the day of the accident. At the time of the accident, he had been on duty approximately seven hours and 44 minutes.

The flight nurse stated that the pilot came on duty at 0900. Prior to any flights that day, he had a conversation with the pilot, and the other flight nurse about a recent EMS accident that had occurred two days prior. They discussed what may have happened on that flight and how important it was to be safe since "they all wanted to go home at the end of their shift."

He always flew with another flight nurse specializing in adult care. He had flown often with the pilot and other flight nurse, and described his relationship with them as "excellent." They communicated well and the pilot was always open to medical crew input.

The crew's first flight occurred around 1030 from FLG to Cottonwood, Arizona, for an infant pick-up. Upon their return, they stopped at FLG and dropped off the other flight nurse for weight restrictions (who later drove to FMC to rejoin the crew). The flight continued to FMC,

where the helicopter landed without incident. The pilot stayed at FMC, cleaned the helicopter, and then flew back to FLG. The two flight nurses drove back to FLG with the infant isolette.

After returning to FLG, the crew had a 1 1/2 hour break before being dispatched to Winslow, Arizona, for an adult patient pick-up. The patient weighed approximately 260 pounds and there would likely be a weight restriction (about 100 pounds) on the return flight requiring the neo-natal nurse to be dropped FLG. Approximately five minutes after they departed Winslow, he heard the pilot contact Guardian Control and reported they were about 20 minutes from FLG. He also heard Guardian Control report that Classic was inbound to FMC and had an estimated time of arrival (ETA) of 28 minutes.

About 15 minutes later, he heard the pilot report that he was 15 minutes out and would be landing at FLG to drop him off.

According to the flight nurse, the medical crew can hear the pilot communications, and he did not hear any communications from or about the Classic helicopter. In addition, he did not hear the Air Methods pilot discuss the Classic flight after the initial notification. The entire crew is trained to practice a "sterile cockpit" during takeoff and once the approach to land is established unless there is an emergency. Only the pilot talks to Guardian Control and ATC. The medical crews only communicate on the medical radios to respective emergency departments and relay patient information.

During previous flights, he had noticed several helicopters operating in and around the FMC heliport. If there were multiple aircraft in the area, they will have to hold, then approach and do a "hot drop." He described it as "musical chairs."

The medical crew is trained to be an extra set of eyes if the patient is stabilized. The flight nurse stated he would visually clear the left side of the helicopter for the pilot on each flight, and that it was rare for two pilots to talk air-to-air.

N407MJ; Classic Helicopter Services

Pilot Information

The pilot, age 55, held a commercial pilot certificate for single-engine land airplanes and rotorcraft-helicopters, and an instrument rating for both airplanes and helicopters.

His most recent second-class medical certificate was issued on March 4, 2008, and contained the limitation that he must wear corrective lenses for near vision.

According to the operator, the pilot had accrued a total of approximately 14,500 hours, including, approximately 9,780 hours in helicopters. A review of the pilot's last Flight Training and Qualification Record revealed that on May 31, 2008, he had completed a recurrent Federal Aviation Regulation (FAR) Part 135 check ride in a Bell 407 with an FAA designated check

airmen, who was the operator's chief pilot. At that time, the pilot reported a total of 841.1 hours as pilot-in-command (PIC) in the Bell 407; 251.1 hours in the last 12 months, 88.9 hours in the last six months, and 46.6 hours in the last 30 days. All of this flight time was accrued in the Bell 407.

Classic Helicopter Services hired the pilot on May 7, 2007, as a full-time EMS pilot based in Page, Arizona. He satisfactorily completed Part 135 requalification training per the company-training manual with an FAA designated check airman, who was the operator's Lead Pilot.

According to the operator, he did not work as a pilot elsewhere at the time of the accident and only flew the Bell 407.

The pilot had been previously employed as an EMS pilot for Classic between 1998 and 2005, in Page, Arizona. At that time, he flew a Bell 206L and 407. During his tenure at Classic, he served as the EMS Safety Officer and was NVG qualified.

Between 2005 and 2007, the pilot flew an Agusta A119 helicopter as an EMS pilot for TriState CareFlight in Bullhead City, Arizona. He was NVG qualified and served as Safety and Training Manager. In addition, he had graduated from the Helicopter Association International (HAI) Safety Management Course.

The pilot had extensive flight experience operating in the Grand Canyon as a helicopter pilot. He also served on active duty in the US Army and in the US Army Reserves as a UH-1 pilot and OH-58A instructor.

A search of the National Driver Register found no record of driver's license suspension or revocation.

He began his shift June 23, 2008 and was scheduled to end his seven-day shift on June 30, 2008. His normal duty hours were 12-hour shifts that started at 0700 and ended 1900, Monday thru Sunday.

Flight Nurse Information

The flight nurse was employed as a RN with Intermountain Health Care and as a flight nurse with Classic. He was also a member of the US Army Reserve as a Combat Medic Instructor. The nurse began employment with Classic on April 27, 2007.

A typical shift for Classic's medical crew consisted of a three-day, 72-hour shift. The flight nurse was on the last day of a back-to-back three-day shift, which had started on June 24, 2008.

Flight Paramedic Information

The flight paramedic was a Paramedic/Ranger with Grand Canyon National Park and Classic Helicopter Service. He was also a member of the US Army Reserve as a Combat Medic Instructor and certified as an EMT-Paramedic within the State of Arizona with an expiration of June 15, 2009.

A typical shift for Classic's medical crew consisted of a three-day, 72-hour shift. The flight paramedic was on the last day of a back-to-back three-day shift, which had started on June 24, 2008.

AIRCRAFT INFORMATION

N470GA; Air Methods Corporation

The aircraft operated by Air Methods Corporation, N407GA, was a 1997 Bell Textron Canada model 407 helicopter, serial number 53104. The helicopter was powered by a Rolls-Royce/Allison model 250-C47B turbo-shaft engine, serial number CAE847119. The helicopter was certificated under FAA type certificate H2SW. The helicopter had a tri-color paint scheme: the main body was red, with dark blue, and titanium silver accents.

According to the operator's maintenance records, the helicopter had accumulated 9,372.6 hours total flight time as the day of the accident. The engine had accumulated 9,112.0 hours, which comprised of 19,635 cycles.

The helicopter was maintained under an FAA Approved Aircraft Inspection Program (AAIP). The most recent progressive phase inspections were completed on June 21, 2008. The inspections consisted of event 4, event 10, and event 21 procedures as outlined in the AAIP. The records indicated that the operator had complied with all applicable FAA Airworthiness Directives (ADs). In addition, the maintenance records contained no significant maintenance action/discrepancies within 30 days of the accident.

N407MJ; Classic Helicopter Services

The aircraft operated by Classic Helicopter Services, N407MJ, was a 1996 Bell Textron Canada model 407 helicopter, serial number 53079. The helicopter was powered by a Rolls-Royce/Allison model 250-C47B turbo-shaft engine, serial number CAE847227. The helicopter was certificated under FAA type-certificate H2SW. The helicopter had a tri-color paint scheme: the main body was concord blue, with metallic gold accents, and the aft fuselage underside was a cream color. In addition, the helicopter was equipped with high visibility anti-collision strobe lights that were co-located with the position lights on the horizontal stabilizer end caps (Classic's operations procedures included those strobes in the ON position during day and night flights).

According to the operator's maintenance records, the accident helicopter had accumulated 4,540.3 hours total flight time as of the day of the accident. The engine had accumulated

6,025.8 hours, which was comprised of 7,025 cycles.

The helicopter was maintained in accordance with the Bell Helicopter maintenance schedule. The most recent progressive inspection was completed on June 19, 2008. The inspection consisted of an event 3 procedure as outlined in the maintenance schedule. The records indicated that the operator had complied with all applicable FAA ADs.

The maintenance records noted that the engine was replaced on June 27, 2008, due to cracking found on the exhaust gas collector. The helicopter had been flown 2.0 hours with the replacement engine prior to the day of the accident. On June 25, 2008, the tail rotor yoke assembly was replaced because the feathering bearings were loose. The helicopter had been flown 5.2 hours since that work was completed. No other significant maintenance action/discrepancies were recorded during the 30-day period prior to the accident.

METEOROLOGICAL INFORMATION

At 1456, the FLG METAR (routine aviation weather report), located approximately 5 miles south of FMC, reported the wind from 320 degrees at seven knots, gusting to 14 knots, visibility ten statute miles (or greater), sky clear, temperature 26 degrees Celsius, dew point minus one degree Celsius, and an altimeter setting of 30.37 inches of Mercury.

At 1556, the FLG METAR reported the wind from 240 degrees at eight knots, visibility ten statute miles (or greater), sky clear, temperature 28 degrees Celsius, dew point minus three degrees Celsius, and an altimeter setting of 30.33 inches of Mercury.

COMMUNICATIONS/DISPATCH INFORMATION

Air Methods Corporation

Guardian Air operates a full time 24-hour, 7 days a week, centralized communications center called Guardian Control. They have visual flight rules (VFR) flight following responsibility for three fixed wing airplanes, three helicopters, and are direct employees of Guardian Air. The center is staffed with transportation coordinators (TCs), who are trained as communications specialists under the Air Methods FAA approved training program. Some TCs have accreditations from the National Association of Air Medical Communications Specialists (NAACS).

The center is co-located with the helicopter operations at FLG. The center has three computer screens; the middle screen is used to show the GPS track of their aircraft on a map. The other two screens are for the use of the TCs. Radios are used to talk directly with the aircraft, and a radio scanner is monitored for local issues.

Guardian Control is staffed with one TC during slow periods and two during the busier times. Typically they work 12-hour schedules alternating between night and day shifts. TC duties

include: call taking, coordinating assets for medical requests, offering flights to pilots, providing assistance for requests received by the crew during missions, recording flight information into various computer systems, flight following, and post accident incident plan (PAIP) notification.

On duty pilots will brief with Guardian Control daily. Pilots call into the center to advise fuel loading, weather status, crew information, and any restrictions that are in place. This information is written on a grease board on the wall of the center.

Flights originate with a phone call to the center. The closest most appropriate aircraft is selected and the crew is alerted via pager. Responding to the pager, the pilot and crew will call Guardian Control for details. The pilot does a risk assessment and makes a decision as to whether the flight can be completed.

If the mission is accepted the transportation coordinator will build the flight plan in the Air Methods Flight Log program and into their CAD system.

The center will flight follow the aircraft from departure to the completion of the flight and all required position reports.

The TC on-duty at the time of the accident had been employed as a transportation specialist at Guardian Control for 1 1/2 years. She is a licensed paramedic and had previous dispatch/communications experience with the Navajo County Police Department.

She had also completed the Air Methods transportation coordinator-training program, which certified her as a FAA Communications Specialist, and she satisfactorily completed recurrent training on April 28, 2008. She normally works a 12-hour, two days on, three days off or three days on, three days off shift. She had been on duty for approximately 8 hours and 45 minutes at the time of the accident.

The TC also stated that she got a call from Classic's communications center wondering if she had heard from the pilot of Classic helicopter, N407MJ. She said "no." She noted that N407GA was one minute overdue on the OuterLink tracking system and tried to contact the pilot. She was unable to reach him. She then heard that there had been an accident at Buffalo Park over the EMS scanner, which was followed by a confirmation that N407MJ and N407GA had collided and crashed east of the FMC helipad.

She also stated that the pilot of the Classic helicopter had not contacted Guardian Control. This was the first time in 1 1/2 years that a Classic pilot had not called Guardian Control. She was not sure why he did not call.

Classic Helicopter Services

Classic Helicopter Services operates a full time 24-hour, seven days a week, centralized

communications center called Classic Control. They have VFR flight following responsibility for two EMS helicopters, and one fixed wing EMS airplane, operated by an affiliated company under a separate air carrier certificate. All pilots, medical crewmembers, and dispatchers are direct employees of Classic or their affiliated company. The four full time dispatchers and the two part-time dispatchers are trained under Classic's internal dispatch training program.

Classic Control is co-located with the helicopter and fixed wing operations in Classic's two-story building and hangar at the Page Municipal Airport, Page, Arizona. It is equipped with two computer screens; one screen is used to show the GPS position of their aircraft on a map. The other computer screen is for the use of the dispatcher. A recorded ultra high frequency (UHF) radio is used to talk directly with the aircraft in flight, and a recorded very high frequency (VHF) radio is used to communicate with each of the three on-duty pilots and each of the nine on-duty medical crewmembers. The dispatchers have access to six telephone lines, and two of those phone lines are recorded.

Classic Control is usually staffed with only one dispatcher. Typically they work a 12-hour schedule alternating between night and day shifts and are typically on duty for seven days and then off duty for seven days. The dispatcher's duties include: call taking, coordinating assets for medical requests, making radio calls to medical crews and to pilots about those medical missions, providing assistance for requests received by the crew during missions, including assistance with weather data, and current weather radar, recording information about each mission into the folder for that mission, flight following, PAIP notification.

Flights originate with a phone call to the center. The first up helicopter or the fixed wing airplane is selected, and the pilot and the two medical crewmembers are alerted by a direct call on handheld portable radios, which are carried by each of those three persons.

The pilot does a risk assessment and makes a decision as to whether the flight can be completed. If the mission is accepted, the dispatcher will continue to complete the entries in the folder for each separate mission.

Classic Control will flight follow the aircraft from departure to the completion of the flight and all required position reports with each of these events being recorded by handwritten entry on the paper communications log.

On July 4, 2008, NTSB investigators interviewed the dispatcher who was on-duty at the time of the accident, who is also the supervisor of Classic Control. The dispatcher had been employed by Classic since September 10, 1997, and was promoted to supervisor in 1999. His duty hours consisted of a seven-day shift that began on Monday and ended on Sunday, followed by seven days in a row off duty. His shift began at 0600 and ended at 1800.

He stated that two of the communications radio channels and two of the telephone lines are automatically recorded. The system will record any time the microphone is activated or anytime there is any signal or any noise on the radio channel. There are about six telephone

lines at the facility, however, the recording system only records conversations made on the two telephone lines as follows: VHF portable hand held radio conversations; UHF conversations on both Channel 1 to their repeater on Navajo Mountain, and on their Channel 2, both UHF channels share the same receive frequency; telephone calls on the "Bat Phone" or emergency line, which is the incoming line for the toll-free emergency line; and one of the non-emergency lines, which is the line that crews will normally use to make their incoming calls to Classic Control. Each helicopter is equipped with a permanently mounted cell phone, which is not recorded.

The dispatcher told investigators that on the day of the accident both helicopters and the fixed-wing airplane had been dispatched, which he stated was a relatively rare occurrence. He handled all three flights and coordinated with the respective facilities.

At 1532 the pilot of Lifeguard 2 gave a 15-minute position report via the onboard radio. The dispatcher acknowledged the call but did not inform the pilot of the inbound Air Methods helicopter. He said "we normally would notify our aircraft about another helicopter that was inbound at the same time." At that time, he said he was unconcerned because the Guardian Control TC had told him that she would notify the pilot of Lifeguard 2 of the other inbound helicopter. In addition, he knew the Lifeguard 2 pilot was "so anal" about contacting Guardian Control prior to landing at FMC.

Investigators played the recorded audio from the 1523 telephone call recorded by Guardian Control (The dispatcher said he knew that Guardian had recorded the telephone call, but he had not heard the tape). After listening to the Guardian Control recording, he said he was amazed because he realized that he did not remember the correct arrival time of Guardian Air at FMC. He said he was amazed because he had incorrectly remembered his conversation with the Guardian Control TC about who was supposed to advise Lifeguard 2 about N407GA. He said, "I would have never guessed that [pilot] would have failed to call Guardian" on his arrival at Flagstaff because he was "so anal about making all of the calls correctly."

AERODROME INFORMATION

The FMC helipad (3AZ0) is a private use hospital heliport at an elevation of 7,016 feet. The helipad is located atop the emergency department roof on the southeast corner of the hospital campus and was designed in compliance with FAA Advisory Circular (AC) 150/5390-2A, Heliport Design. The helipad is 40-foot wide and 80-foott long and is constructed of corrugated aluminum matting, which is heated to prevent ice accumulation. A tricolor green/amber/white beacon serves to identify FMC and has an illuminated windsock for wind information. A closed circuit video monitoring system that is activated with a motion-sensor was installed at the vestibule entrance into the hospital from the pad. At the time of the accident, the camera was operational, but did not capture the accident sequence. However, another motion-sensor security camera was installed on the top of a hospital-parking garage located approximately 50 yards from the helipad. The camera faced a general direction of 70 degrees and was mounted on a concrete-based fixture and affixed to a metal pole about ten feet high. Prior to

the accident, a hospital guest activated the camera, and it captured the collision of the two helicopters.

The southern half of the helipad, identified with an "H" and amber perimeter lights, is the designated take off and landing area. The northern half of the helipad is for helicopter parking only. There are no aircraft services available at FMC helipad.

To facilitate operations and communications between EMS operators and FMC, on October 18, 1999, the hospital implemented Guidelines of Practice (HP 700-02) regarding FMS Helipad Operations. The guidelines address helipad characteristics, communication procedures, arrival/departure procedures, safety, reporting of violations, and potential consequences of repeat violations.

The guidance states that helicopters operating at FMC are advised to establish communications with Guardian Control at the earliest opportunity. It is required that all inbound aircraft will notify Guardian Control at the earliest convenience, but not less than a minimum of 5 miles out. The guidance stated, "Timely communication with Guardian Air Control is especially paramount when multiple helicopters are inbound to the facility."

When these frequencies are programmed into the VHF radios, it allows for both monitoring and transmitting either air-to-ground or air-to-air communications. EMS pilots can also monitor the FLG ATCT frequency for potential traffic in the area.

In addition to the standard aviation navigation/communication radios and the VHF radio used to communicate with Guardian Control, there is another UHF radio frequency (Med Channel), which is used for the aircraft to communicate with the ED. This radio is commonly referred to as EMSCOMM (EMS Communication) and is used to transmit patient status and information along with estimated arrival times to the hospital.

Guardian Control is broadcasted/received via the Mount Elden Repeater located five miles northeast of FMC. According to Classic, mountain peaks block the signal when they approach from the northwest. However, they are able to receive the signal once they are within ten miles of the heliport. During the time they cannot receive the Mount Elden repeater, they will use an onboard cellular phone. However, they still have enough time and distance (about ten miles) to contact Guardian Control via onboard radios prior to landing. Guardian Control does not have the ability to shut down or deselect a repeater.

Helicopters operating at FMC are encouraged to follow the noise abatement guidelines depicted in the heliport's Guidelines of Practice. Arrivals and departures from the east are advised to use Switzer Mesa as an initial point while flights from the west are advised to use Basha's Plaza. Operators are asked to avoid noise abatement areas whenever possible and are advised to maintain an altitude of 8,000 feet mean sea level (msl) when flying over the city of Flagstaff. All approaches and arrivals into the heliport are made to the southern pad, designated by the "H." Due to the single landing area, there are no simultaneous operations

conducted on the FMC helipad. If two helicopters arrive in close proximity, the first will land to the "H," then slide to the parking area before the second helicopter lands on the "H." An alternative would be for the first helicopter to hot-drop their patient, then reposition to FLG, thereby clearing the helipad for the other arriving helicopter.

The procedures stated that when an operator is ready to depart the helipad, the pilot would contact Guardian Control. All departures commence at the "H."

Air Methods Arrival Training and Accident Route of Flight

The Air Methods regional chief pilot and the director of compliance stated that the pilot of N407GA had not flown the arrival route “as trained.” During the on-scene investigation, the regional chief pilot, accompanied by NTSB investigators, flew the accident route in another Air Methods Bell 407 using GPS data retrieved from N407GA. According to the regional chief pilot, the “trained route” was much farther to the east, and not in a direct line to the hospital.

A subsequent flight route plot for N407GA was made using GPS tracking evidence overlayed on a local map depicting the noise abatement area, FMC’s location, and the accident site. The plot indicates that N407GA either narrowly penetrated or narrowly missed the southeast tip of the noise abatement area. An exact plot could not be determined because the last GPS marker was just south of the noise abatement area, and there are no other GPS contact points between this location and the accident site; the GPS tracking system on board N407GA recorded the helicopter’s position every 30 seconds, making a precise line of flight plot difficult.

WRECKAGE AND IMPACT INFORMATION

The accident site was located approximately 1/4 mile east of the FMC helipad. The Air Methods helicopter, N407GA, came to rest on level, sparsely wooded terrain at 7,057 feet elevation. The Classic Aviation Services helicopter, N407MJ, came to rest on sloping, wooded terrain at 7,021 feet elevation; about 300 feet west of the Air Methods helicopter. A rocky embankment, about 25 feet in height, separated the two helicopters.

According to GPS data, the Air Methods helicopter main wreckage was positioned 0.26 nautical miles (nm) from the FMC helipad on a 073 degree magnetic bearing. The Classic helicopter main wreckage was positioned 0.22 nm from the FMC helipad on a 081-degree magnetic bearing.

N470GA; Air Methods Corporation

General

The Air Methods helicopter, N407GA, was destroyed due to the mid-air collision and

subsequent collision with terrain, post-impact explosion and fire. The helicopter impacted terrain subsequent to the mid-air collision. Burned vegetation and trees surrounded the wreckage. The helicopter came to rest upright, with the fuselage orientated on an approximate magnetic heading of 060 degrees.

The fuselage, engine, main rotor transmission, and rotor mast were involved in the post-impact fire. The engine, transmission, and rotor mast were positioned to the right of and adjacent to the main fuselage. The aft fuselage and tailboom were separated from the main wreckage. They came to rest about 15 feet west of the fuselage, and were oriented approximately 90-degrees relative to the main fuselage orientation. The aft fuselage exhibited damage consistent with the post-impact fire, with the damage decreasing aft. The tailboom did not exhibit substantial fire damage.

Fuselage

The cockpit, cabin, and aft fuselage were discolored and soot covered consistent with the effects of a post-impact fire. The fire had consumed the top and sides of the fuselage, and the cockpit and cabin areas were exposed. The aircraft also exhibited damage consistent with impact forces. A section of the lower right fuselage nose, including the pitot tube, was separated from the remainder of the fuselage. It came to rest in the debris path about 150 feet southeast of the main wreckage.

The flight controls were damaged consistent with impact forces and post-impact fire. The cyclic and collective controls were present in the cockpit area. Both were separated at the base fittings. The throttle was in the "Fly" position when observed at the accident site. The splines at the base of the collective appeared intact. Co-pilot controls were not installed. The cyclic and collective control tubes in the cockpit floor area appeared intact to the base of the vertical tunnel. Within the vertical tunnel (broom closet), the flight control tubes were fractured in a manner consistent with overload failures. Control tube rod ends were also bent and fractured.

The main rotor servo actuators remained partially attached to the bulkhead at the top of the vertical tunnel. The units were damaged consistent with impact forces and were discolored due to the post-impact fire.

The on-board medical oxygen bottle was observed in two pieces. An end fragment came to rest about 75 feet northeast of the fuselage. The second piece, which contained the valve and pressure gauge, remained with the fuselage. Both pieces exhibited discoloration and sooting consistent with fire damage.

Main Rotor System

The main rotor blades remained attached to their respective yoke flexures on the main rotor hub. The rotor hub, mast, and main transmission, with the transmission mounts attached,

came to rest as a unit, adjacent to the fuselage. The main rotor blades were deformed. The components exhibited sooting and discoloration consistent with the post-impact fire. The main rotor transmission mount was fractured along the left, aft support. The remaining supports were deformed, but they did not appear fractured.

The pitch change links were fractured, with the appearance of the fracture surfaces consistent with overload failure. The opposing pitch change link rod ends remained attached to the rotating swashplate, with the exception of one of the links. One swashplate attachment arm was separated, along with the mating portion of the pitch change link. The non-rotating portion of the swashplate appeared intact. The control links remained attached to the swashplate at the rod ends; however, the links were fractured.

The main transmission was intact. Partial rotation of the main drive shaft produced corresponding rotation of the main rotor mast. The main drive shaft was fractured aft of the transmission. The K-flex coupling between the drive shaft and the transmission remained intact. The K-flex coupling at the aft end of the first drive shaft segment was fractured. Appearance of the fracture surfaces was consistent with overload failures. Rotational continuity was observed between the main rotor and tail rotor drive shafts, through the engine gearbox and freewheeling unit.

The four main rotor blades remained attached to the yoke flexures at the rotor mast. The blade bolts appeared intact and properly installed. All four blades exhibited fire damage at the inboard ends of the blades. The blades were arbitrarily numbered one through four for identification purposes. The corresponding color designation of the blades could not be determined due to the fire damage.

Blade one exhibited discoloration and delamination along the inboard 4 1/2 feet of the blade. Blue and red chordwise marks, consistent with paint transfer, were observed on the leading edge over an approximate length of five inches. Blade two sustained impact and thermal damage. Blue chordwise marks, consistent with paint transfer, were observed on the leading edge, approximately two inches in the length. The inboard 5 1/2 feet of the leading edge abrasion strip was separated from the blade and recovered approximately 150 feet south of the fuselage. Blade three exhibited fire damage along the entire length of the blade. Identification of any leading edge transfer marks was precluded by fire damage. Blade four exhibited fire damage along the entire length of the blade; with the exception of a section about three feet in length near mid-span. The blade root hub was discolored but appeared intact. Discoloration due to fire damage prevented the identification of any leading edge transfer marks.

Engine

The engine came to rest adjacent to the main rotor mast and fuselage. The entire engine was discolored consistent with the post impact fire. The compressor impeller was intact; however, several impeller blades exhibited leading edge nicks and gouges. Abrasion and scrape marks

were observed on the compressor support. The power turbine and gas producer sections appeared intact. The combustion housing and engine exhaust stack were deformed. The engine gearbox housing was intact, with the exception of a section approximately two inches square.

The engine control unit (ECU) sustained damage consistent with the fire. The ECU housing was fractured in several places exposing the components. The ECU was retained for further examination.

Tailboom / Tail Rotor

The tailboom and a section of the aft fuselage separated from the remainder of the airframe. The tailboom remained securely attached to the aft fuselage segment. The aft fuselage section and forward portion of the tailboom exhibited discoloration consistent with fire damage. The remainder of the tailboom did not exhibit any thermal damage.

The tailboom was fractured about 21 inches aft of the tailboom-to-fuselage attachment point. The skin was buckled adjacent to the fracture. The aft fuselage section came to rest on its right side. The tailboom aft of the fracture came to rest upright. The tail rotor drive shaft and pitch control rod were continuous across the fracture. However, the tail rotor pitch control rod was bent in the vicinity of the fracture.

The remainder of the tailboom was intact, including the tail rotor drive shaft, transmission, and pitch change links. However, the forward flange of one drive shaft segment was fractured. Rotation of the drive shaft aft of the fractured flange produced a corresponding rotation of the tail rotor blades, without binding. Both tail rotor blades remained attached to the hub. One blade exhibited an area of skin delamination near the trailing edge about mid-span consistent with impact damage. Otherwise, the blades exhibited only minor abrasions and scratches.

The vertical fin stabilizer separated from the aft end of the tailboom at the attachment screws. It came to rest immediately adjacent to the tailboom consistent with separation at the time of the impact. The right horizontal stabilizer and end cap were separated from the tailboom about seven inches outboard of the tailboom. The separated portion of the horizontal stabilizer remained securely attached to the tailboom. The upper and lower sections of the end cap were separated from the stabilizer, and from each other, at the outboard end of the horizontal stabilizer. Both end cap sections were recovered from the debris path.

Landing Gear/Skids

All the landing gear (skid) components came to rest with the main wreckage, and were lying in proper position relative to the airframe. Both skids were fractured. The landing gear crosstubes were deformed downward (flattened) on both the left and right sides. The extent of deformation was greater on the right side, consistent with a right side low, vertical impact.

N407MJ; Classic Helicopter Services

General

The Classic Helicopter Services helicopter, N407MJ, was destroyed due to the mid-air collision and subsequent collision with trees and terrain. No fire damage was noted on the helicopter.

The main wreckage consisted of the fuselage, engine, transmission, and main rotor hub and blades. Three trees located approximately 35 feet east of the fuselage were broken off approximately 25 to 40 feet above ground level. Multiple tree branches and limbs exhibited fresh breaks were located on the ground in the vicinity of the fuselage. The tail boom was separated from the fuselage. It came to rest approximately 73 feet east of the fuselage.

Fuselage

The fuselage was fragmented into three sections. The forward (cockpit) section came to rest inverted, nose down at an angle of about 45-degrees relative to the terrain, against two trees. The mid (cabin) section of the fuselage was separated from the forward section. It came to rest on its left side adjacent to the forward section. The engine, main rotor transmission, and rotor mast were also on their left side, in position, relative to the mid section. The aft fuselage section came to rest on its left side, nearly inverted, against a tree. A 12-inch section of the tailboom remained attached to the fuselage. The fuselage nose was crushed aft. The left side of the fuselage was separated completely, exposing the cockpit and forward cabin areas.

The flight controls were damaged consistent with impact forces. The cyclic and collective controls were present in the cockpit area. Both were separated near the base. Co-pilot controls were not installed. The cyclic and collective control tubes in the cockpit floor area appeared intact to the base of the vertical tunnel. The control tubes within the vertical tunnel (broom closet) were bound, but appeared intact. Control tube rod ends were intact. The anti-torque pedals were present. The control rod was severed about six inches inboard of the bellcrank. The rod end remained attached.

The main rotor servo actuators remained attached to the bulkhead at the top of the vertical tunnel. The units were damaged consistent with impact forces. The control rods were bent, but appeared intact.

Main Rotor System

The main rotor blades remained attached to the rotor hub. The rotor hub, mast, and transmission remained secured to the fuselage roof beam structure by the transmission mounts. They came to rest with the engine and the remainder of the fuselage.

The transmission housing and mounts appeared intact. The main drive shaft segment remained securely attached to the transmission at the K-flex coupling. The main drive shaft

segment was intact, but exhibited circumferential scoring along its length. The K-flex coupling at the aft end of the shaft was fractured in a manner consistent with overload. The transmission exhibited continuity through the unit. Rotation of the forward end of the main drive shaft produced corresponding rotation of the main rotor mast.

The main rotor mast, blade mounting yokes, and pitch change horns appeared intact. One pitch change link was intact. The remaining three pitch change links were fractured. The ends of the links were still attached to the horns and rotating swashplate via the rod ends, with one exception. One clevis on both the rotating and non-rotating halves of the swashplate was fractured. Appearance of the fracture surfaces on the swashplate and the pitch change links was consistent with overload failures. Flight control linkage to the non-rotating portion of the swashplate remained attached and was intact. One control rod was deformed. The support brackets common to the linkage bellcranks were fractured.

The four main rotor blades remained attached to the yoke flexures at the rotor mast. The blade bolts appeared intact and properly installed. The blades were arbitrarily numbered one through four for identification. The corresponding color of each blade is also included for reference.

Blades one, two, and three were fragmented, dented, and deformed consistent with impact damage. The tips of these blades had separated and were recovered in the accident debris path. Blade one (blue) exhibited blue paint transfer marks over a 5 1/2 inch length. In addition, green and white paint transfer was observed near the leading edge. Blade two (orange) exhibited a 3-inch wide area of white paint transfer marks along the leading edge of the blade. Chordwise scratches were also observed. Blade three (red) exhibited white paint transfer marks over a 3-inch wide area, and chordwise scratches on the upper and lower surfaces near the area of paint transfer. Blade four (green) was intact; however, the blade exhibited leading edge denting. Blue paint transfer was observed on the upper and lower surfaces of the leading edge over a 7-inch width.

Engine

The engine remained secured to the airframe by the engine mounts. It came to rest partially inverted, forward (inlet) end downward orientation. The forward engine mount was intact. The aft engine mount was separated from the airframe and deformed. The compressor impeller disc was intact; however, the blades exhibited leading edge gouges. Scrape marks were observed on the compressor front support consistent with impeller rotation at the time of impact. The impeller disc exhibited resistance and binding when rotated by hand. Continuity to the starter-generator was observed during rotation. The turbine wheel appeared intact. The turbine wheel rotated and exhibited continuity to the output shaft.

Tailboom / Tail Rotor

The tailboom separated from the airframe about 12 inches aft of the tailboom-to-fuselage

joint. The forward 12-inch section of the tailboom remained attached to the fuselage. The skin was deformed, twisted, and torn at the separation point.

The tail rotor gearbox, and vertical fin stabilizers had separated from the aft end of the tailboom, and came to rest adjacent to the tailboom. The pitch change linkage remained attached to the gearbox. The gearbox appeared intact. The tail rotor mast and tail rotor blades remained attached to the gearbox. The gearbox exhibited continuity when the input drive shaft was rotated. The pitch control links were bent, and the pitch control mechanism appeared functional.

The tail rotor drive shaft segment immediately forward of the gearbox remained attached at the flexible Thomas coupling; however, the coupling was fractured. The forward end of the drive shaft exhibited rotational scoring. Two drive shaft segments remained attached to the tailboom, and they were bent and dented. The forward drive shaft segments had separated from the mating segments.

Both tail rotor blades remained secured to the tail rotor hub assembly and mast. One tail rotor blade exhibited leading edge crushing damage over the inboard portion of the blade, and deformation along the trailing edge. Blue and red paint transfer marks were observed on the face of the blade and on the trailing edge near mid-span. Black transfer marks were observed on the leading edge near mid-span. The second tail rotor blade exhibited crushing damage over the inboard 1/2 span of the blade. Blue paint transfer was observed in this area. The inboard 5 1/2 inches of the blade leading edge exhibited black transfer marks.

The horizontal stabilizer and end caps were fragmented. The outboard 2/3 of the right horizontal stabilizer had separated from the airframe. The remaining inboard portion of the assembly remained securely attached to the tailboom. The separation was oriented forward-aft, parallel to the longitudinal axis of the aircraft. The right end cap was intact and remained securely attached to the separated section of the horizontal stabilizer.

The left horizontal stabilizer separated into three fragments. The inboard section remained attached to the tailboom. This section was approximately 18-inches in length at the leading edge and orientated at a 27-degree angle relative to the longitudinal axis of the aircraft. The second fragment of the left horizontal stabilizer was about 6-inches in length. The stabilizer exhibited a distinct upward bend adjacent to the fracture surface consistent with an impact from below. The third fragment consisted of the remainder of the stabilizer, with the end cap attached. Additionally, a section of the left end cap was separated from the remainder of the assembly. The fragment consisted of the upper-aft portion of the end cap, above the horizontal stabilizer. The skin adjacent to the separation was bent inboard.

The horizontal stabilizer and end cap fragments were distributed along the top edge of the embankment in the vicinity of the N407GA main wreckage.

The tailboom exhibited a cut through the lower skin in the area below the horizontal stabilizer.

This cut was orientated at an approximate angle of 38 degrees relative to the longitudinal axis of the aircraft. The carry-thru structure of the horizontal stabilizer was deformed upward, but appeared intact. The deformation continued to the inboard portion of the horizontal stabilizer. The horizontal stabilizer vane had separated from the airframe; however, it was also deformed consistent with the adjacent damage.

The tailboom was creased on the left side at the forward end near the separation from the fuselage. It was oriented upward at an angle of about 37 degrees relative to the ground reference. The forward portion of the deformation exhibited blue transfer marks. The skin was torn through along an approximate one-inch length at the lower-forward end of the crease. The crease was sharp and distinct at the lower-forward end, and became shallower as it progressed upward and aft.

Landing Gear/Skids

The landing skid assembly separated from the airframe and was located adjacent to the airframe at the accident site. The right skid was intact. The left skid was fractured at 2 locations between the forward and aft crosstube saddles. The forward crosstube was fractured above both the left and right saddles. Both the left and right steps had separated from the crosstube legs. The left leg of the aft crosstube was deformed inboard about 60 degrees. Both the forward and aft crosstube legs on the right side of the aircraft were deformed outboard approximately 30 degrees. Fracture surfaces were consistent with overload failure.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on all occupants by the Office of the Coconino County Medical Examiner, Flagstaff, Arizona. All occupants' cause of death was listed as multiple blunt force injuries. Specimens for toxicological tests were taken from the pilots and medical crewmembers by the medical examiner.

The FAA's Civil Aeromedical Institute's Forensic and Accident Research Center, Oklahoma City, Oklahoma, examined the specimens taken by the medical examiner. Toxicological tests performed on all specimens were negative for carbon monoxide, cyanide, ethanol, and all screened drugs, with the following exception; the Classic pilot's blood contained 0.041 (ug/mL, ug/g) Normeperidine, and an unspecified amount of Normeperidine was detected in the urine.

Normeperidine is a metabolite of meperidine, a prescription narcotic painkiller, used for the control of severe pain, and commonly known by the trade name Demerol.

On June 23, 2008, the Classic pilot had been involved in an assault with a trespasser on his property and was being treated for minor injuries. The pilot’s wife noted that he had been administered Demerol in the emergency room for pain from the assault injuries and that he was not in any discomfort from the injuries at the time of the accident.

TESTS AND RESEARCH

Engine Control Units

General

The ECU had the capability to store real-time data related to engine operating parameters, fault history, and abnormal engine condition (incident) information. System anomalies were recorded as Last Engine Run Faults, Accumulated Faults, and Time Stamped Faults. Last Engine Run Faults represented a record of fault conditions detected during the most recent engine run only. Accumulated faults comprised a record of faults recorded by the unit since the memory was last cleared. This included last engine run faults. Time Stamped Faults contained an accounting of recent fault and exceedance detections, with the associated engine operating time parameter.

An Incident Recorder monitored a set of engine control parameters for abnormal conditions. In the case that an anomaly or incident was detected, the recorder provided for 12 seconds of pre-incident data (10 data sets), and 48 seconds of post-incident data (40 data sets) to be written to non-volatile memory.

N407GA; Air Methods Corporation

The ECU recovered from N407GA was model number EMC-35A, serial number JG8ALK0554. The unit exhibited impact and thermal damage. Partial disassembly of the unit revealed extensive damage to the components containing the non-volatile memory. As a result, no data could be extracted from the unit.

N407MJ; Classic Helicopters Services

The ECU recovered from N407MJ was model number EMC-35A, serial number JG0ALK0653. It had sustained damage consistent with impact forces. Internal damage to the unit was minor and extraction of the non-volatile memory was successful.

Engine history data noted an ECU operating time of 3,556.53 hours and an engine run time of 1,374.80 hours. The ECU operating time represents the cumulative time that electrical power had been applied to the unit. Maintenance personnel cannot access this parameter. The engine run time is incremented when the engine is actually running. Maintenance personnel normally set this parameter at installation.

The data contained a power turbine speed (Np) exceedance that occurred at an engine run time of 1371:01:18.216. The exceedance lasted for 0.96 seconds and reached a peak value of 103.09 percent. A turbine speed in excess of 102.1 percent triggers an exceedance event. According to the ECU manufacturer, Np parameter values in excess of the limit are not

uncommon due to occasional flight operations such as quick landings or descents, and do not necessarily indicate any system or operational anomalies.

The ECU incident recorder contained two events. The first occurred at 1374:54:52.896 and was triggered by a loss of rotor speed below 92 percent. The actual rotor speed recorded during the event was 86 percent. The second event occurred at 1374:54:53.208 and was associated with a torque rate sensor exceedance. A sensor exceedance is generated when the sample-to-sample change exceeds 1,500 percent per second. This event was partially recorded in the history data. According to the ECU manufacturer, the absence of an associated timestamp was possibly because electrical power was removed from the unit at the time the data was being written into non-volatile memory.

The incident recorder function in the ECU provided ten data sets prior to the incidents and 40 data sets after, for a total of 50 data sets. However, only records three through 11 contained any data. The absence of data on records one and two was likely due to an interruption of electrical power before the information could be transferred into non-volatile memory. A loss of power to the ECU also likely caused the absence of data on records 12 through 50.

The data indicated that the engine control system was in Auto mode with no indication of a fault condition prior to the initial event. After the two events, the data indicated the ECU was operating in a degraded condition due to the confirmed senor fault.

Radios

General

The communications radios were removed from both aircraft in an attempt to retrieve the frequencies selected at the time electrical power was interrupted. Both aircraft were equipped with Bendix/King radios for communication and navigation on assigned aviation frequency ranges. The Bendix/King radios are designed to hold two frequencies. One is denoted as "Use" and the other is denoted as "Stby." The in-use ("Use") frequency is active for receiving and transmitting. The standby ("Stby") frequency can be exchanged with the in-use frequency by depressing the button on the bezel.

To support the EMS mission, the aircraft were also equipped with multi-band transceivers for communication with ground based police, fire, and emergency medical personnel. The multi-band radios had the capability to communicate on VHF/UHF FM frequency bands.

N407GA; Air Methods Corporation

The KX165 (s/n 60021) exhibited impact and thermal damage. The faceplate was removed and a new one installed on the accident unit. When powered up, the unit displayed the communications in-use frequency as 134.55 and the standby frequency as 122.75. The navigation in-use frequency was 113.85 and the standby frequency was 108.75. The transmit

and receive functions of the unit tested within specifications. The transmission power when tested was 15 watts. The manufacturer's specification was 10 watts minimum.

The KX165 (s/n 65129) also exhibited impact and thermal damage. The faceplate was removed and a new one installed on the accident unit. When powered up, the unit displayed the communications in-use frequency as 123.02 and the standby frequency as 136.87. The navigation in-use frequency was 116.90 and the standby frequency was 113.80. The transmit and receive functions of the unit tested within specifications. The transmission power tested within specifications at 15 watts.

The multi-band radio system was comprised of Global/Wulfsberg RT-138F and RT-406F FM transceivers, paired with a Northern Airborne Technologies TH-250 radio control head. The selected frequencies were retained in the control head unit and not in the transceivers.

The radio control head sustained impact and thermal damage. Examination of the component determined that the unit was set to power-up on specific preset frequencies, and not necessarily the frequency set at the time it was powered down. The component was set to power-up on channel 031 for RT#1 and channel 047 for RT#2. However, the manufacturer noted that the transceiver type retrieved from the unit was incorrect for a Flexcomm interface. This may be an indication that the memory circuits were damaged to some extent.

N407MJ; Classic Helicopter Services

The aviation radios recovered from N407MJ were a Bendix/King KX165 Nav-Comm (p/n 060-1025-25 / s/n 58421) and a KY196A Comm (p/n 064-1054-30 / s/n 8345).

The KX165 (s/n 58421) sustained impact damaged and could not be powered up directly. The electronic component containing the non-volatile memory was removed and installed into a host radio unit. When powered up, the host unit displayed the communications in-use frequency as 125.30 and the standby frequency as 122.80. The navigation in-use frequency was 117.60 and the standby frequency was 108.40.

The KY196A (s/n 8345) had sustained minor damage. The unit was connected to an electrical harness and powered-up in the as-received condition. The in-use frequency displayed was 134.55 and the standby frequency was 120.62. The transmit and receive functions of the unit tested within specifications. The transmission power tested within specifications at 20 watts.

The multi-band radio system consisted of a Technisonic Industries Ltd. Model TFM-500 unit (s/n JA1563). The unit exhibited impact damage to the faceplate and the forward printed-circuit boards. The damaged faceplate was replaced and power was applied to the unit. Examination of the radio determined that the unit was set to display the most recently tuned frequencies at each power-up sequence. Functional testing of the VHF and UHF bands was normal, and no mechanical anomalies were observed. The frequencies displayed upon power-up were:

Display line 1 (VHF) - 023 GARFCORPT 156.0150RT
Display line 2 (UHF) - 001 CLASSIC1 463.6250RT
Display line 3 - GD1 NPS Guardn 171.6250RX
Display line 4 - BS VHF TONE OFF PWR-HI

ORGANIZATIONAL INFORMATION

Air Methods Corporation

Air Methods is a FAR Part 135 Air Carrier, which held on-demand operations specifications. Company headquarters are located in Englewood, Colorado. The Chief Executive Officer, Board of Directors, Chief Pilot, Director of Operations, Director of Maintenance, and the Director of Safety reside in Colorado.

Air Methods was established in Colorado in 1982 and now serves as the largest provider of air medical emergency transport services and systems throughout the United States. Air Methods operates a fleet of more than 342 helicopters and fixed-wing aircraft in 42 states. It currently employs nearly 1,100 pilots.

Air Methods Corporation and its subsidiaries provide air medical emergency transport services and systems in the United States. It operates in three segments: Community-Based System, Hospital-Based System, and Products.

The Community-Based System (CBS) segment provides air medical transportation services, which include medical care, aircraft operation and maintenance, communications and control, and medical billing and collection services. As of December 31, 2007, this segment operated 135 helicopters and four fixed wing aircraft. Under the CBS delivery model, Air Methods employees provide medical care to patients en route

The Hospital-Based System (HBS) segment provides air medical transportation services and medically equipped helicopters and airplanes for hospitals. As of December 31, 2007, this segment operated 187 helicopters and 16 fixed wing aircraft. Under the HBS delivery model, employees or contractors of Air Methods, and the customer hospitals en route, provide medical care.

The Air Methods operation based at Flagstaff was considered a HBS. Northern Arizona Healthcare, who owns/operates FMC, maintains the helipad, owns the aircraft, and employs the pilots, medical crews, and the transportation coordinators. This also includes all of the staff at Guardian Control and the maintenance facility based at FLG.

The Products segment involves the design, manufacture, and installation of aircraft medical interiors and other aerospace and medical transport products for domestic and international

customers.

LifeCom is Air Methods recently renovated, fully equipped national communications center in Omaha, Nebraska, where they offer communications and satellite-tracking capabilities. Medical billing and collections are processed from their San Bernardino, California, facility. Air Methods Operational Control Center (OCC) in Englewood, Colorado, monitors all flights. The Flight Management System (FMS) is a custom designed computer application that monitors and provides real-time weather and flight alerts for company aircraft. The OCC is staffed 24 hours a day, 7 days a week.

A voluntary accreditation, Air Methods encourages all of their CBS programs to seek and maintain Commission on Accreditation of Medical Transport Systems (CAMTS) certification. CAMTS is an independent agency that audits and accredits fixed and rotor wing air medical transport and critical care ground services in the United States to a set of industry-established standards.

Classic Helicopter Services

Classic began service with one helicopter and a medical crew of two basic EMT's on Memorial Day 1988. Classic began as a seasonal service to assist the National Park Service in transporting trauma patients from the Lake Powell area to a trauma center. Classic started lifeguard air ambulance operations because the park service would often call Classic tour helicopters from Bryce Canyon to airlift injured people from Lake Powell.

Classic works closely with the National Park Service, Navajo Nation EMS, Arizona and Utah Highway Patrol, City of Page, Arizona Fire Department, and the various other agencies in Utah and Arizona.

At the time of the accident, Classic operated two Bell 407 helicopters and a fixed-wing Beech E90 King Air. Their communications center is monitored 24 hours a day, 7 days a week.

Classic has logged over 5,000 missions since they began service in 1988.

ADDITIONAL INFORMATION

FMC Guidelines of Practice

According to FMC's Guidelines of Practice, any violations of safety practices and/or the published procedures will be reported to the FMC Director of Security/Safety. The Director will then follow-up with the operator and "seek compliance for the reported violations."

In an interview, FMC's Director of Safety/Security stated there were currently six operators authorized to operate from the FMC helipad. He said that there had not been any violations of the Guidelines of Practice, but if there had there been, he would talk to the operator directly.

He reported that FMC did not have any on-going disciplinary problems with any operator at the time of the accident.

The Director of Safety/Security stated that he used to coordinate annual Safety Committee meetings with all of the helicopter operators, but he had a "problem getting all the vendors together." He had not held a meeting in "a while" and could not recall when the last meeting had been conducted. The Director reviewed FMC's Safety Meeting records, which revealed that the last Safety Committee meeting was in July 2004. According to the meeting notes, only one of the operators attended. As a result, the following statement was placed in the Meeting Notes, "It has been determined that when a helicopter vendor has been reasonably notified about helipad safety meetings and does not send representation; the vendor is stating there are no safety issues they need to have addressed and are accepting the committee's actions. All vendors have been given committee contact information and are encouraged to use it if they are unable to have a representative at the meetings."

The Director also stated that FMC's Guidelines of Practice are revised every three years per hospital policy or if there is a need to revise the procedures. The last revision was completed on September 11, 2007. He stated that he mailed and faxed the revised procedures to each operator.

Federal Aviation Regulations (FARs)

FAR 91.111 addresses operating near other aircraft. It states in part that no person may operate an aircraft so close to another aircraft as to create a collision hazard. FAR 91.113 states in part that vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft.

Advisory Circular (AC) 90-48C Pilots' Role in Collision Avoidance

According to AC 90-48C, "...the flight rules prescribed in Part 91 of the Federal Aviation Regulations (FARs) set forth the concept of "See and Avoid." This concept requires that vigilance shall be maintained at all times, by each person operating an aircraft, regardless of whether the operation is conducted under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR).

"Pilots should also keep in mind their responsibility for continuously maintaining a vigilant lookout regardless of the type of aircraft being flown. Remember that most MAC [mid-air collision] accidents and reported MAC [near mid-air collisions] occur during good VFR weather conditions and during the hours of daylight."

The AC further states, "pilots should remain constantly alert to all traffic movement within their field of vision as well as periodically scan the entire visual field outside of their aircraft to ensure detection of conflicting traffic. The probability of spotting a potential collision threat increases with the time spent looking outside, but certain techniques may be used to increase

the effectiveness of the scan time. The human eyes tend to focus somewhere, even in a featureless sky. In order to be most effective, the pilot should shift glances and refocus at intervals. Pilots should also realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distance objects. Peripheral vision can be most useful in spotting collision threats from other aircraft. Pilots are reminded of the requirements to move one's head in order to search around the physical obstructions, such as door and window posts."

OTHER INFORMATION

The weather conditions that existed at the accident site during the time of the accident were recorded to be clear skies and daylight conditions prevailed. The Classic helicopter was equipped with a Garmin 496 global positioning system (GPS), which contained a terrain awareness warning system (TAWS) feature. The Air Methods helicopter was not equipped with TAWS. Both helicopters were not equipped with traffic collision avoidance systems (TCAS). The accident flights were being tracked by a flight following program, and both flights did receive flight dispatch services prior to and during the flights. Additionally, formal flight risk assessments were performed prior to the flights.

On February 7, 2006, the NTSB issued four safety recommendations to the FAA addressing EMS operations. They are as follows:

NTSB Recommendation No. A-06-12 - Require all EMS operators to comply with 14 CFR Part 135 operations specifications during the conduct of all flights with medical personnel onboard.

NTSB Recommendation No. A-06-13 - Require all EMS operators to develop and implement flight risk evaluation programs that include training all employees involved in the operation, procedures that support the systematic evaluation of flight risks, and consultation with others trained in EMS flight operations if the risks reach a predefined level.

NTSB Recommendation No. A-06-14 - Require EMS operators to use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance in flight risk assessment decisions.

NTSB Recommendation No. A-06-15 - Require EMS operators to install terrain awareness and warning systems on their aircraft and to provide adequate training to ensure that flight crews are capable of using the systems to safely conduct EMS operations.

These four recommendations were also placed on the NTSB's "Most Wanted List of Safety Improvements" in October 2008.

Additionally, the NTSB stated in its January 2006 Special Investigation Report on EMS Operations that they were pleased that the FAA encouraged the use of night vision imaging systems in EMS operations, and that the NTSB would continue to monitor the applicability and

usage of these devices in the EMS industry.

Also, on December 21, 2007, the NTSB issued two safety recommendations to the FAA regarding the use of radar altimeters in EMS night operations. They are as follows:

NTSB Recommendation No. A-07-111 - Require helicopter EMS operators to install radar altimeters in all helicopters used in HEMS night operations.

NTSB Recommendation No. A-07-112 - Ensure that the minimum equipment lists for helicopters used in helicopter EMS operations require that radar altimeters be operable during flights conducted at night.

Pilot Information

Certificate:	Commercial	**Age:**	51,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	September 12, 2007
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 15, 2007
Flight Time:	5245 hours (Total, all aircraft), 1313 hours (Total, this make and model), 150 hours (Last 90 days, all aircraft), 51 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N407GA
Model/Series:	407	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	53104
Landing Gear Type:	Skid	**Seats:**	6
Date/Type of Last Inspection:	June 20, 2008 AAIP	**Certified Max Gross Wt.:**	5000 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	9372.6 Hrs at time of accident	**Engine Manufacturer:**	Rolls-Royce
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	250B-C47B
Registered Owner:	Flagstaff Medical Center	**Rated Power:**	
Operator:	Air Methods Corp.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	QMLA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FLG,7015 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	15:56 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.32 inches Hg	**Temperature/Dew Point:**	28°C / -3°C
Precipitation and Obscuration:			
Departure Point:	FLAGSTAFF, AZ (FLG)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Flagstaff, AZ (3AZ0)	**Type of Clearance:**	VFR
Departure Time:	15:44 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Flagstaff Medical Center East 3AZ0	**Runway Surface Type:**	
Airport Elevation:	7016 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Unknown

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	3 Fatal	**Latitude, Longitude:**	35.200832,-111.634162

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	David Keenan; Federal Aviation Administration; Washington, DC Dennis McCall; Air Methods Corporation; Denver, CO Matthew Stein; Classic Helicopter Services; Page, AZ Mark Stuntzner; Bell Helicopter; Fort Worth, TX Jon-Adam Michael; Rolls-Royce; Indianapolis, IN Al Duquette; Professional Helicopters Pilots Association; Jasper, TX
Original Publish Date:	May 7, 2009
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=68325

Aviation Investigation Final Report

Location:	Flagstaff, Arizona	**Accident Number:**	DEN08MA116
Date & Time:	June 29, 2008, 15:47 Local	**Registration:**	N407MJ
Aircraft:	Bell 407	**Aircraft Damage:**	Destroyed
Defining Event:	Midair collision	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Air Medical (Medical emergency)		

Analysis

Both Emergency Medical Services (EMS) helicopters were on approach to the Flagstaff Medical Center (FMC) helipad to drop off patients. During the flights, the N407MJ pilot had established two-way communications with his communications center and provided position reports, and the N407GA pilot had established two-way communications with FMC's communications center (which was his company's communication center and which also monitored and advised all traffic at the helipad) and provided position reports. The FMC communications center transportation coordinator advised the N407GA pilot that N407MJ would also be dropping off a patient at FMC. The coordinator also advised N407MJ's communication center that N407GA would be landing at FMC, but the N407MJ's communication center did not inform the N407MJ pilot nor was it required to do so.

Established arrival and departure procedures for the FMC helipad required pilots to contact the FMC communications center at the earliest opportunity or at a minimum of 5 miles from the helipad. According to the FMC communications center's staff, N407MJ's pilot did not make the required contact with the communications center at any time during the flight.

About 3 minutes before the collision, N407GA dropped off a medical crewmember at the local airport (about 5 miles south of the medical center) to reduce the weight on the aircraft and to improve aircraft performance during landing at the medical center. According to witness information, flight-track data, and a hospital surveillance video, N407GA approached the helipad from the south, flying past or slightly inside the southeast tip of the noise abatement area on a direct line toward a final approach position just east of the helipad. However, according to helipad arrival guidelines and company procedures, N407GA should have

approached the helipad from farther to the east. (After the on-scene accident site investigation, the Air Methods regional chief pilot, accompanied by NTSB investigators, flew the accident route in another Air Methods Bell 407 using GPS data retrieved from N407GA. According to the regional chief pilot, the “trained route” was much farther to the east and not in a direct line to the hospital.) N407MJ approached the helipad from the northeast, and it is likely that the pilot would have been visually scanning the typical flight paths, as described in the noise abatement and helipad arrival guidelines, that other aircraft approaching the medical center would have used. Thus, if N407GA had approached from a more typical direction, the pilot of N407MJ may have been more likely to see and avoid it.

At the time of the collision, both pilots were at a point in the approach where their visual attention typically would have been more focused on the helipad in preparation for landing, rather than on scanning the surrounding area for other traffic. The helicopters collided approximately 1/4 mile east of the helipad. There were no communications from either helicopter just prior to or after the collision.

Neither helicopter was equipped with a traffic collision avoidance system, nor was such a system required. Had such a system been on board, it likely would have alerted the pilots to the traffic conflict so they could take evasive action before collision. No radar or air traffic control services were available for the helipad operations to ensure separation. However, if N407MJ's pilot had contacted the FMC communications center, as required, the FMC transportation coordinator likely would have told him directly that another aircraft was expected at the helipad. If the pilot had known to expect another aircraft in the area, he would have been more likely to look for the other aircraft.

Nevertheless, the pilots were responsible for maintaining vigilance and to see and avoid other aircraft at all times. Under 14 Code of Federal Regulations Sections 91.111 and 91.113, all pilots are responsible for keeping a safe distance from other aircraft and for maintaining vigilance so as to see and avoid other aircraft. Advisory Circular 90-48C, "Pilots' Role in Collision Avoidance," amplifies the see-and-avoid concept by stating that all pilots should remain constantly alert to all traffic movement within their field of vision and that they should scan the entire visual field outside of their aircraft to ensure that conflicting traffic would be detected.

Examination of the wreckages revealed that N407MJ's tail rotor contacted the forward fuselage of N407GA, and N407GA's main rotor blades contacted and separated N407MJ's tail boom. The recovered wreckages showed no evidence of any preimpact structural, engine, or system failures.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Both helicopter pilots' failure to see and avoid the other helicopter on approach to the helipad. Contributing to the accident were the failure of N407GA's pilot to follow flight arrival route guidelines, and the failure of N407MJ's pilot to follow communications guidelines requiring him to report his position within a minimum of 5 miles from the helipad.

Findings

Personnel issues	Monitoring other aircraft - Pilot
Personnel issues	Lack of communication - Pilot

Factual Information

History of Flight

Approach	Midair collision
Uncontrolled descent	Collision with terr/obj (non-CFIT)

"THIS CASE WAS MODIFIED MAY 29, 2009."

HISTORY OF FLIGHT

On June 29, 2008, at 1547 mountain standard time, a Bell 407 emergency medical service (EMS) helicopter, N407GA, and a Bell 407 EMS helicopter, N407MJ, collided in mid air while approaching the Flagstaff Medical Center (FMC) helipad (3AZ0), Flagstaff, Arizona. Both helicopters were destroyed. N407GA's commercial pilot, flight nurse, and patient sustained fatal injuries; and N407MJ's commercial pilot, flight paramedic, flight nurse, and patient sustained fatal injuries. N407GA was operated by Air Methods Corporation, Englewood, Colorado, and registered to FMC, Flagstaff, Arizona. N407MJ was operated by Classic Helicopter Services, Page, Arizona, and registered to M&J Leisure, L.L.C., Ogden, Utah. Visual meteorological conditions prevailed, and company flight plans were filed for the 14 Code of Federal Regulations Part 135 air medical flights. N407GA's flight departed Flagstaff Pulliam Airport (FLG), Flagstaff, Arizona, at 1544, and N407MJ's flight departed the Grand Canyon National Park Service South Rim helibase, Tusayan, Arizona, at 1517.

Audio recordings were obtained from Classic's communications center (Classic Control), Guardian Control, FMC, and the FLG Air Traffic Control Tower (ATCT).

At 1516, the pilot for the Air Methods helicopter, N407GA, call sign Angel 1, contacted Guardian Control via aircraft radios and reported that they were departing Winslow, Arizona, with four people on board; the pilot, two flight nurses, and a patient. The pilot stated that his estimated time en route was 25 minutes and he was either going to land at FLG or at FMC. He was not sure if he would be at the proper weight to land with enough power to execute a safe out of ground effect hover at FMC with all four occupants onboard.

At 1517, the pilot of Angel 1 contacted Guardian Control via onboard radios and requested the current weather conditions at FLG. The on-call transportation coordinator (TC) provided the requested information, and within two minutes, she contacted FMC and told them that Angel 1 was inbound to the helipad in approximately 23 minutes.

At 1517, the pilot for Classic helicopter, N407MJ, call sign Lifeguard 2, contacted Classic Control via onboard radios and reported that they had departed the south rim of the Grand Canyon and were en route to the FMC with an estimated time of arrival of 32 minutes. There

were four people on board; the pilot, a flight nurse, a flight paramedic, and a patient.

Approximately one minute later, the pilot on Angel 1 called Guardian Control via onboard radios and reported that they were going to "drop one" at FLG before proceeding to FMC.

At 1523, the dispatcher on duty at Classic Control contacted Guardian Control via landline and reported that Lifeguard 2 was en route to the FMC and would be arriving from the north. He also reported that it would be a "cold drop" and the emergency department at the hospital had already been notified. The Guardian Control TC then informed the Classic dispatcher that Angel 1 was also en route and would be landing at FMC in 20 minutes. The Classic dispatcher then stated, "Ohh okay, I'll let them know when I talk to them next, and I'll tell them to be sure and get a hold of you."

At the end of this call, the Guardian Control TC called FMC's emergency department (ED) via land-line and stated that Lifeguard 2 would also be landing at the hospital in "about 28 minutes...and they know about mine coming in." The person who answered the landline responded, "All right." The TC then contacted the pilot of Angel 1 via onboard radio and informed him that Lifeguard 2 would also be landing at FMC in approximately 28 minutes. The Angel 1 pilot responded, "Roger will be looking for 'em thanks."

At 1532, the pilot of Lifeguard 2 contacted Classic Control via onboard radios, provided a position report and said they were 15 minutes from landing at FMC. The dispatcher on duty responded, "Comm center copies all sir...I'll talk to you on the ground in 15 minutes, 1532." This was the last recorded communication from the Lifeguard 2 pilot.

Also at 1532, the Angel 1 pilot contacted Guardian Control via onboard radios and reported that they were 10 minutes from landing at FLG in order to drop off a flight nurse due to weight considerations.

At 1534, the Angel 1 pilot called Guardian Control via onboard radios and asked the TC to contact FMC and request additional ground support to assist in moving the patient from the helicopter. The TC then contacted FMC and made the request.

At 1541, the Angel 1 pilot contacted the FLG ATCT via onboard radios and reported that he was one mile out. A controller provided traffic advisories and cleared Angel 1 to land.

At 1543, the Angel 1 pilot contacted the FLG ATCT via onboard radios and said, "...Angel 1 would like to depart to the north to the hospital with foxtrot." A controller responded, "Lifeguard Angel 1 wind variable at five taxiway alpha cleared for take off northbound to the hospital approved."

At 1544, the Angel 1 pilot contacted Guardian Control via onboard radios and stated, "Control Angel 1 if you haven't figured it out we've uh landed at the...airport departed and we're about two minutes out of the hospital." The TC responded and copied the transmission. This was

the last recorded communication from the Angel 1 pilot.

At 1550, the Classic dispatcher contacted Guardian Control via landline and asked the TC if she had had any contact with "my ship." The TC said, "negative."

A review of the recorded transmissions made between both medical crews and the hospital revealed that both of the medical crews contacted the FMC ED and provided medical reports on their respective patients.

A Classic medical crewmember contacted FMC via an onboard cellular phone at 1525. The conversation ended 1528, at which time the crewmember reported an estimated arrival time of 18 minutes, or 1546.

The Air Methods medical crewmember contacted FMC via onboard radio (Med Channel 3/EMSCOMM) at 1532. The conversation ended at 1534; at which time the crewmember provided an estimated time of arrival of 15 minutes, or 1549.

Each crewmember spoke with a different nurse and physician. A review of both transmissions indicated normal communications and that both patients were medically stable.

The hospital staff that received the phone calls from both aircraft did not provide any information about the other helicopter that was also en route to the FMC. There is no requirement for FMC staff to provide arrival or departure information regarding other aircraft to medical flight crews. If any information is provided it is given as a courtesy only.

A surveillance camera, mounted on a parking garage at FMC, captured the collision on digital video. The video depicted one helicopter approaching from north and one helicopter approaching from the south, and shows both aircraft descending after the collision. The NTSB Vehicle Recorders Laboratory, Washington, DC, examined the video, and extracted a series of still images which showed the collision sequence.

N407GA was equipped with a GPS-based OuterLink tracking system that recorded the helicopter's position every 30 seconds. A review of the data revealed that N407GA flew in a straight line from FLG to the location of the accident site, about 1/4-mile east of the FMC helipad. The data indicated that the aircraft had not initiated a turn onto final approach when the data ended.

N407MJ was equipped with a GPS-based Sky Router tracking system, which recorded the helicopter's position every five minutes. A review of the data revealed that the last recorded position was approximately ten miles northwest of the helipad. In addition, a Garmin GPSMAP 496 handheld GPS was located in the wreckage. The unit was shipped to the Vehicle Recorders Division at NTSB Headquarters, Washington, DC where it was downloaded on June 30, 2008. Examination of the unit revealed that it was not programmed to record the helicopter's flight track and there was no usable stored data for the accident flight.

No Federal Aviation Administration (FAA) radar services were available for the airspace surrounding FMC.

One witness, located approximately 1 mile southwest of the accident site, observed the collision of the two helicopters. He observed "a light aircraft" traveling west to east. As the aircraft turned to the south, he noticed a second helicopter traveling from the east to the west. The first helicopter appeared to be at the same altitude as the second helicopter when it started a turn to the south. The witness stated, "I saw both aircraft on what appeared to be a collision course. From the angle I was at, the second helicopter (red and white) did not appear to change direction and the first collided with it."

Two other witnesses observed the collision from the back porch of their residence approximately 1/2 mile south and west of the accident site. They observed the [Air Methods] helicopter approaching from the south and east on a "usual landing pattern." One of these witnesses observed a second helicopter "approaching the other from the [right], back side" just prior to the collision. The other witness observed the second helicopter just as the helicopters collided.

Another witness observed the collision from her residence four-tenths of a mile north and west of the accident site. She first heard a helicopter approaching from the north. She then heard a second helicopter coming from the south. The witness stated that she "looked up just as the northbound helicopter apparently clipped the rotor of the southbound [helicopter]. At that time, they both were in a turn to the hospital."

Several people witnessed the collision and reported seeing both helicopters descending into wooded terrain about 1/2-mile east from the heliport. There was a small fire noted rising from the hilly terrain, followed by a loud explosion about ten minutes after the collision.

PERSONNEL INFORMATION

N470GA; Air Methods Corporation

Pilot Information

The pilot, age 51, held a commercial pilot certificate for single-engine land airplanes and rotorcraft-helicopters, and an instrument rating for both airplanes and helicopters. His most recent first-class medical certificate was issued on September 12, 2007, and contained the limitation of "Cleared Class I with near vision restriction."

A review of the pilot's last Flight Training and Qualification Record revealed that his last Airman Competency/Proficiency Check was accomplished on August 15, 2007. At the time of the accident, the pilot had accrued a total of approximately 5,241 hours, including 4,500 hours in helicopters.

In the previous three months, the pilot had accrued 150 hours, including 53 hours at night. During the last 30 days, the pilot flew 51 hours, including 19 hours at night. All of this time was accrued in the Bell 407. According to the company the pilot attended and satisfactorily completed all company initial, recurrent, and NVG training courses.

The pilot was hired on October 7, 2003, as a full-time EMS pilot flying the Bell 407 at the operator's base in Flagstaff, Arizona. When hired, the pilot had accrued a total of approximately 4,353.6 hours, including 341.2 hours as pilot-in-command (PIC) in the Bell 407. According to the operator, he did not work elsewhere as a pilot at the time of the accident.

During his tenure at Air Methods, he served as the Safety Officer and the Safety Coordinator, and was also night-vision goggle (NVG) qualified.

A search of the National Driver Register found no record of driver's license suspension or revocation.

Flight Nurse Information

The flight nurse, who was dropped off at FLG before the accident, was hired by FMC on June 26, 1995, as an emergency medical technician (EMT) with Guardian Medical Transport (GMT). On March 27, 2006, he became a flight registered nurse (RN).

The flight nurse had been employed with Northern Arizona Healthcare for four years and was authorized for medical flights on fixed-wing aircraft and helicopters. In the summer months, he normally worked onboard the helicopters because of his low body weight. He was considered a neo-natal specialist and received his training in the Army.

He worked a continuous 48-hour shift starting at 0800. He came on duty after four days rest at 0800 on the day of the accident. At the time of the accident, he had been on duty approximately seven hours and 44 minutes.

The flight nurse stated that the pilot came on duty at 0900. Prior to any flights that day, he had a conversation with the pilot, and the other flight nurse about a recent EMS accident that had occurred two days prior. They discussed what may have happened on that flight and how important it was to be safe since "they all wanted to go home at the end of their shift."

He always flew with another flight nurse specializing in adult care. He had flown often with the pilot and other flight nurse, and described his relationship with them as "excellent." They communicated well and the pilot was always open to medical crew input.

The crew's first flight occurred around 1030 from FLG to Cottonwood, Arizona, for an infant pick-up. Upon their return, they stopped at FLG and dropped off the other flight nurse for weight restrictions (who later drove to FMC to rejoin the crew). The flight continued to FMC,

where the helicopter landed without incident. The pilot stayed at FMC, cleaned the helicopter, and then flew back to FLG. The two flight nurses drove back to FLG with the infant isolette.

After returning to FLG, the crew had a 1 1/2 hour break before being dispatched to Winslow, Arizona, for an adult patient pick-up. The patient weighed approximately 260 pounds and there would likely be a weight restriction (about 100 pounds) on the return flight requiring the neo-natal nurse to be dropped FLG. Approximately five minutes after they departed Winslow, he heard the pilot contact Guardian Control and reported they were about 20 minutes from FLG. He also heard Guardian Control report that Classic was inbound to FMC and had an estimated time of arrival (ETA) of 28 minutes.

About 15 minutes later, he heard the pilot report that he was 15 minutes out and would be landing at FLG to drop him off.

According to the flight nurse, the medical crew can hear the pilot communications, and he did not hear any communications from or about the Classic helicopter. In addition, he did not hear the Air Methods pilot discuss the Classic flight after the initial notification. The entire crew is trained to practice a "sterile cockpit" during takeoff and once the approach to land is established unless there is an emergency. Only the pilot talks to Guardian Control and ATC. The medical crews only communicate on the medical radios to respective emergency departments and relay patient information.

During previous flights, he had noticed several helicopters operating in and around the FMC heliport. If there were multiple aircraft in the area, they will have to hold, then approach and do a "hot drop." He described it as "musical chairs."

The medical crew is trained to be an extra set of eyes if the patient is stabilized. The flight nurse stated he would visually clear the left side of the helicopter for the pilot on each flight, and that it was rare for two pilots to talk air-to-air.

N407MJ; Classic Helicopter Services

Pilot Information

The pilot, age 55, held a commercial pilot certificate for single-engine land airplanes and rotorcraft-helicopters, and an instrument rating for both airplanes and helicopters.

His most recent second-class medical certificate was issued on March 4, 2008, and contained the limitation that he must wear corrective lenses for near vision.

According to the operator, the pilot had accrued a total of approximately 14,500 hours, including, approximately 9,780 hours in helicopters. A review of the pilot's last Flight Training and Qualification Record revealed that on May 31, 2008, he had completed a recurrent Federal Aviation Regulation (FAR) Part 135 check ride in a Bell 407 with an FAA designated check

airmen, who was the operator's chief pilot. At that time, the pilot reported a total of 841.1 hours as pilot-in-command (PIC) in the Bell 407; 251.1 hours in the last 12 months, 88.9 hours in the last six months, and 46.6 hours in the last 30 days. All of this flight time was accrued in the Bell 407.

Classic Helicopter Services hired the pilot on May 7, 2007, as a full-time EMS pilot based in Page, Arizona. He satisfactorily completed Part 135 requalification training per the company-training manual with an FAA designated check airman, who was the operator's Lead Pilot.

According to the operator, he did not work as a pilot elsewhere at the time of the accident and only flew the Bell 407.

The pilot had been previously employed as an EMS pilot for Classic between 1998 and 2005, in Page, Arizona. At that time, he flew a Bell 206L and 407. During his tenure at Classic, he served as the EMS Safety Officer and was NVG qualified.

Between 2005 and 2007, the pilot flew an Agusta A119 helicopter as an EMS pilot for TriState CareFlight in Bullhead City, Arizona. He was NVG qualified and served as Safety and Training Manager. In addition, he had graduated from the Helicopter Association International (HAI) Safety Management Course.

The pilot had extensive flight experience operating in the Grand Canyon as a helicopter pilot. He also served on active duty in the US Army and in the US Army Reserves as a UH-1 pilot and OH-58A instructor.

A search of the National Driver Register found no record of driver's license suspension or revocation.

He began his shift June 23, 2008 and was scheduled to end his seven-day shift on June 30, 2008. His normal duty hours were 12-hour shifts that started at 0700 and ended 1900, Monday thru Sunday.

Flight Nurse Information

The flight nurse was employed as a RN with Intermountain Health Care and as a flight nurse with Classic. He was also a member of the US Army Reserve as a Combat Medic Instructor. The nurse began employment with Classic on April 27, 2007.

A typical shift for Classic's medical crew consisted of a three-day, 72-hour shift. The flight nurse was on the last day of a back-to-back three-day shift, which had started on June 24, 2008.

Flight Paramedic Information

The flight paramedic was a Paramedic/Ranger with Grand Canyon National Park and Classic Helicopter Service. He was also a member of the US Army Reserve as a Combat Medic Instructor and certified as an EMT-Paramedic within the State of Arizona with an expiration of June 15, 2009.

A typical shift for Classic's medical crew consisted of a three-day, 72-hour shift. The flight paramedic was on the last day of a back-to-back three-day shift, which had started on June 24, 2008.

AIRCRAFT INFORMATION

N470GA; Air Methods Corporation

The aircraft operated by Air Methods Corporation, N407GA, was a 1997 Bell Textron Canada model 407 helicopter, serial number 53104. The helicopter was powered by a Rolls-Royce/Allison model 250-C47B turbo-shaft engine, serial number CAE847119. The helicopter was certificated under FAA type certificate H2SW. The helicopter had a tri-color paint scheme: the main body was red, with dark blue, and titanium silver accents.

According to the operator's maintenance records, the helicopter had accumulated 9,372.6 hours total flight time as the day of the accident. The engine had accumulated 9,112.0 hours, which comprised of 19,635 cycles.

The helicopter was maintained under an FAA Approved Aircraft Inspection Program (AAIP). The most recent progressive phase inspections were completed on June 21, 2008. The inspections consisted of event 4, event 10, and event 21 procedures as outlined in the AAIP. The records indicated that the operator had complied with all applicable FAA Airworthiness Directives (ADs). In addition, the maintenance records contained no significant maintenance action/discrepancies within 30 days of the accident.

N407MJ; Classic Helicopter Services

The aircraft operated by Classic Helicopter Services, N407MJ, was a 1996 Bell Textron Canada model 407 helicopter, serial number 53079. The helicopter was powered by a Rolls-Royce/Allison model 250-C47B turbo-shaft engine, serial number CAE847227. The helicopter was certificated under FAA type-certificate H2SW. The helicopter had a tri-color paint scheme: the main body was concord blue, with metallic gold accents, and the aft fuselage underside was a cream color. In addition, the helicopter was equipped with high visibility anti-collision strobe lights that were co-located with the position lights on the horizontal stabilizer end caps (Classic's operations procedures included those strobes in the ON position during day and night flights).

According to the operator's maintenance records, the accident helicopter had accumulated 4,540.3 hours total flight time as of the day of the accident. The engine had accumulated

6,025.8 hours, which was comprised of 7,025 cycles.

The helicopter was maintained in accordance with the Bell Helicopter maintenance schedule. The most recent progressive inspection was completed on June 19, 2008. The inspection consisted of an event 3 procedure as outlined in the maintenance schedule. The records indicated that the operator had complied with all applicable FAA ADs.

The maintenance records noted that the engine was replaced on June 27, 2008, due to cracking found on the exhaust gas collector. The helicopter had been flown 2.0 hours with the replacement engine prior to the day of the accident. On June 25, 2008, the tail rotor yoke assembly was replaced because the feathering bearings were loose. The helicopter had been flown 5.2 hours since that work was completed. No other significant maintenance action/discrepancies were recorded during the 30-day period prior to the accident.

METEOROLOGICAL INFORMATION

At 1456, the FLG METAR (routine aviation weather report), located approximately 5 miles south of FMC, reported the wind from 320 degrees at seven knots, gusting to 14 knots, visibility ten statute miles (or greater), sky clear, temperature 26 degrees Celsius, dew point minus one degree Celsius, and an altimeter setting of 30.37 inches of Mercury.

At 1556, the FLG METAR reported the wind from 240 degrees at eight knots, visibility ten statute miles (or greater), sky clear, temperature 28 degrees Celsius, dew point minus three degrees Celsius, and an altimeter setting of 30.33 inches of Mercury.

COMMUNICATIONS/DISPATCH INFORMATION

Air Methods Corporation

Guardian Air operates a full time 24-hour, 7 days a week, centralized communications center called Guardian Control. They have visual flight rules (VFR) flight following responsibility for three fixed wing airplanes, three helicopters, and are direct employees of Guardian Air. The center is staffed with transportation coordinators (TCs), who are trained as communications specialists under the Air Methods FAA approved training program. Some TCs have accreditations from the National Association of Air Medical Communications Specialists (NAACS).

The center is co-located with the helicopter operations at FLG. The center has three computer screens; the middle screen is used to show the GPS track of their aircraft on a map. The other two screens are for the use of the TCs. Radios are used to talk directly with the aircraft, and a radio scanner is monitored for local issues.

Guardian Control is staffed with one TC during slow periods and two during the busier times. Typically they work 12-hour schedules alternating between night and day shifts. TC duties

include: call taking, coordinating assets for medical requests, offering flights to pilots, providing assistance for requests received by the crew during missions, recording flight information into various computer systems, flight following, and post accident incident plan (PAIP) notification.

On duty pilots will brief with Guardian Control daily. Pilots call into the center to advise fuel loading, weather status, crew information, and any restrictions that are in place. This information is written on a grease board on the wall of the center.

Flights originate with a phone call to the center. The closest most appropriate aircraft is selected and the crew is alerted via pager. Responding to the pager, the pilot and crew will call Guardian Control for details. The pilot does a risk assessment and makes a decision as to whether the flight can be completed.

If the mission is accepted the transportation coordinator will build the flight plan in the Air Methods Flight Log program and into their CAD system.

The center will flight follow the aircraft from departure to the completion of the flight and all required position reports.

The TC on-duty at the time of the accident had been employed as a transportation specialist at Guardian Control for 1 1/2 years. She is a licensed paramedic and had previous dispatch/communications experience with the Navajo County Police Department.

She had also completed the Air Methods transportation coordinator-training program, which certified her as a FAA Communications Specialist, and she satisfactorily completed recurrent training on April 28, 2008. She normally works a 12-hour, two days on, three days off or three days on, three days off shift. She had been on duty for approximately 8 hours and 45 minutes at the time of the accident.

The TC also stated that she got a call from Classic's communications center wondering if she had heard from the pilot of Classic helicopter, N407MJ. She said "no." She noted that N407GA was one minute overdue on the OuterLink tracking system and tried to contact the pilot. She was unable to reach him. She then heard that there had been an accident at Buffalo Park over the EMS scanner, which was followed by a confirmation that N407MJ and N407GA had collided and crashed east of the FMC helipad.

She also stated that the pilot of the Classic helicopter had not contacted Guardian Control. This was the first time in 1 1/2 years that a Classic pilot had not called Guardian Control. She was not sure why he did not call.

Classic Helicopter Services

Classic Helicopter Services operates a full time 24-hour, seven days a week, centralized

communications center called Classic Control. They have VFR flight following responsibility for two EMS helicopters, and one fixed wing EMS airplane, operated by an affiliated company under a separate air carrier certificate. All pilots, medical crewmembers, and dispatchers are direct employees of Classic or their affiliated company. The four full time dispatchers and the two part-time dispatchers are trained under Classic's internal dispatch training program.

Classic Control is co-located with the helicopter and fixed wing operations in Classic's two-story building and hangar at the Page Municipal Airport, Page, Arizona. It is equipped with two computer screens; one screen is used to show the GPS position of their aircraft on a map. The other computer screen is for the use of the dispatcher. A recorded ultra high frequency (UHF) radio is used to talk directly with the aircraft in flight, and a recorded very high frequency (VHF) radio is used to communicate with each of the three on-duty pilots and each of the nine on-duty medical crewmembers. The dispatchers have access to six telephone lines, and two of those phone lines are recorded.

Classic Control is usually staffed with only one dispatcher. Typically they work a 12-hour schedule alternating between night and day shifts and are typically on duty for seven days and then off duty for seven days. The dispatcher's duties include: call taking, coordinating assets for medical requests, making radio calls to medical crews and to pilots about those medical missions, providing assistance for requests received by the crew during missions, including assistance with weather data, and current weather radar, recording information about each mission into the folder for that mission, flight following, PAIP notification.

Flights originate with a phone call to the center. The first up helicopter or the fixed wing airplane is selected, and the pilot and the two medical crewmembers are alerted by a direct call on handheld portable radios, which are carried by each of those three persons.

The pilot does a risk assessment and makes a decision as to whether the flight can be completed. If the mission is accepted, the dispatcher will continue to complete the entries in the folder for each separate mission.

Classic Control will flight follow the aircraft from departure to the completion of the flight and all required position reports with each of these events being recorded by handwritten entry on the paper communications log.

On July 4, 2008, NTSB investigators interviewed the dispatcher who was on-duty at the time of the accident, who is also the supervisor of Classic Control. The dispatcher had been employed by Classic since September 10, 1997, and was promoted to supervisor in 1999. His duty hours consisted of a seven-day shift that began on Monday and ended on Sunday, followed by seven days in a row off duty. His shift began at 0600 and ended at 1800.

He stated that two of the communications radio channels and two of the telephone lines are automatically recorded. The system will record any time the microphone is activated or anytime there is any signal or any noise on the radio channel. There are about six telephone

lines at the facility, however, the recording system only records conversations made on the two telephone lines as follows: VHF portable hand held radio conversations; UHF conversations on both Channel 1 to their repeater on Navajo Mountain, and on their Channel 2, both UHF channels share the same receive frequency; telephone calls on the "Bat Phone" or emergency line, which is the incoming line for the toll-free emergency line; and one of the non-emergency lines, which is the line that crews will normally use to make their incoming calls to Classic Control. Each helicopter is equipped with a permanently mounted cell phone, which is not recorded.

The dispatcher told investigators that on the day of the accident both helicopters and the fixed-wing airplane had been dispatched, which he stated was a relatively rare occurrence. He handled all three flights and coordinated with the respective facilities.

At 1532 the pilot of Lifeguard 2 gave a 15-minute position report via the onboard radio. The dispatcher acknowledged the call but did not inform the pilot of the inbound Air Methods helicopter. He said "we normally would notify our aircraft about another helicopter that was inbound at the same time." At that time, he said he was unconcerned because the Guardian Control TC had told him that she would notify the pilot of Lifeguard 2 of the other inbound helicopter. In addition, he knew the Lifeguard 2 pilot was "so anal" about contacting Guardian Control prior to landing at FMC.

Investigators played the recorded audio from the 1523 telephone call recorded by Guardian Control (The dispatcher said he knew that Guardian had recorded the telephone call, but he had not heard the tape). After listening to the Guardian Control recording, he said he was amazed because he realized that he did not remember the correct arrival time of Guardian Air at FMC. He said he was amazed because he had incorrectly remembered his conversation with the Guardian Control TC about who was supposed to advise Lifeguard 2 about N407GA. He said, "I would have never guessed that [pilot] would have failed to call Guardian" on his arrival at Flagstaff because he was "so anal about making all of the calls correctly."

AERODROME INFORMATION

The FMC helipad (3AZ0) is a private use hospital heliport at an elevation of 7,016 feet. The helipad is located atop the emergency department roof on the southeast corner of the hospital campus and was designed in compliance with FAA Advisory Circular (AC) 150/5390-2A, Heliport Design. The helipad is 40-foot wide and 80-foott long and is constructed of corrugated aluminum matting, which is heated to prevent ice accumulation. A tricolor green/amber/white beacon serves to identify FMC and has an illuminated windsock for wind information. A closed circuit video monitoring system that is activated with a motion-sensor was installed at the vestibule entrance into the hospital from the pad. At the time of the accident, the camera was operational, but did not capture the accident sequence. However, another motion-sensor security camera was installed on the top of a hospital-parking garage located approximately 50 yards from the helipad. The camera faced a general direction of 70 degrees and was mounted on a concrete-based fixture and affixed to a metal pole about ten feet high. Prior to

the accident, a hospital guest activated the camera, and it captured the collision of the two helicopters.

The southern half of the helipad, identified with an "H" and amber perimeter lights, is the designated take off and landing area. The northern half of the helipad is for helicopter parking only. There are no aircraft services available at FMC helipad.

To facilitate operations and communications between EMS operators and FMC, on October 18, 1999, the hospital implemented Guidelines of Practice (HP 700-02) regarding FMS Helipad Operations. The guidelines address helipad characteristics, communication procedures, arrival/departure procedures, safety, reporting of violations, and potential consequences of repeat violations.

The guidance states that helicopters operating at FMC are advised to establish communications with Guardian Control at the earliest opportunity. It is required that all inbound aircraft will notify Guardian Control at the earliest convenience, but not less than a minimum of 5 miles out. The guidance stated, "Timely communication with Guardian Air Control is especially paramount when multiple helicopters are inbound to the facility."

When these frequencies are programmed into the VHF radios, it allows for both monitoring and transmitting either air-to-ground or air-to-air communications. EMS pilots can also monitor the FLG ATCT frequency for potential traffic in the area.

In addition to the standard aviation navigation/communication radios and the VHF radio used to communicate with Guardian Control, there is another UHF radio frequency (Med Channel), which is used for the aircraft to communicate with the ED. This radio is commonly referred to as EMSCOMM (EMS Communication) and is used to transmit patient status and information along with estimated arrival times to the hospital.

Guardian Control is broadcasted/received via the Mount Elden Repeater located five miles northeast of FMC. According to Classic, mountain peaks block the signal when they approach from the northwest. However, they are able to receive the signal once they are within ten miles of the heliport. During the time they cannot receive the Mount Elden repeater, they will use an onboard cellular phone. However, they still have enough time and distance (about ten miles) to contact Guardian Control via onboard radios prior to landing. Guardian Control does not have the ability to shut down or deselect a repeater.

Helicopters operating at FMC are encouraged to follow the noise abatement guidelines depicted in the heliport's Guidelines of Practice. Arrivals and departures from the east are advised to use Switzer Mesa as an initial point while flights from the west are advised to use Basha's Plaza. Operators are asked to avoid noise abatement areas whenever possible and are advised to maintain an altitude of 8,000 feet mean sea level (msl) when flying over the city of Flagstaff. All approaches and arrivals into the heliport are made to the southern pad, designated by the "H." Due to the single landing area, there are no simultaneous operations

conducted on the FMC helipad. If two helicopters arrive in close proximity, the first will land to the "H," then slide to the parking area before the second helicopter lands on the "H." An alternative would be for the first helicopter to hot-drop their patient, then reposition to FLG, thereby clearing the helipad for the other arriving helicopter.

The procedures stated that when an operator is ready to depart the helipad, the pilot would contact Guardian Control. All departures commence at the "H."

Air Methods Arrival Training and Accident Route of Flight

The Air Methods regional chief pilot and the director of compliance stated that the pilot of N407GA had not flown the arrival route “as trained.” During the on-scene investigation, the regional chief pilot, accompanied by NTSB investigators, flew the accident route in another Air Methods Bell 407 using GPS data retrieved from N407GA. According to the regional chief pilot, the “trained route” was much farther to the east, and not in a direct line to the hospital.

A subsequent flight route plot for N407GA was made using GPS tracking evidence overlayed on a local map depicting the noise abatement area, FMC’s location, and the accident site. The plot indicates that N407GA either narrowly penetrated or narrowly missed the southeast tip of the noise abatement area. An exact plot could not be determined because the last GPS marker was just south of the noise abatement area, and there are no other GPS contact points between this location and the accident site; the GPS tracking system on board N407GA recorded the helicopter’s position every 30 seconds, making a precise line of flight plot difficult.

WRECKAGE AND IMPACT INFORMATION

The accident site was located approximately 1/4 mile east of the FMC helipad. The Air Methods helicopter, N407GA, came to rest on level, sparsely wooded terrain at 7,057 feet elevation. The Classic Aviation Services helicopter, N407MJ, came to rest on sloping, wooded terrain at 7,021 feet elevation; about 300 feet west of the Air Methods helicopter. A rocky embankment, about 25 feet in height, separated the two helicopters.

According to GPS data, the Air Methods helicopter main wreckage was positioned 0.26 nautical miles (nm) from the FMC helipad on a 073 degree magnetic bearing. The Classic helicopter main wreckage was positioned 0.22 nm from the FMC helipad on a 081-degree magnetic bearing.

N470GA; Air Methods Corporation

General

The Air Methods helicopter, N407GA, was destroyed due to the mid-air collision and subsequent collision with terrain, post-impact explosion and fire. The helicopter impacted terrain subsequent to the mid-air collision. Burned vegetation and trees surrounded the wreckage. The helicopter came to rest upright, with the fuselage orientated on an approximate magnetic heading of 060 degrees.

The fuselage, engine, main rotor transmission, and rotor mast were involved in the post-impact fire. The engine, transmission, and rotor mast were positioned to the right of and adjacent to the main fuselage. The aft fuselage and tailboom were separated from the main wreckage. They came to rest about 15 feet west of the fuselage, and were oriented approximately 90-degrees relative to the main fuselage orientation. The aft fuselage exhibited damage consistent with the post-impact fire, with the damage decreasing aft. The tailboom did not exhibit substantial fire damage.

Fuselage

The cockpit, cabin, and aft fuselage were discolored and soot covered consistent with the effects of a post-impact fire. The fire had consumed the top and sides of the fuselage, and the cockpit and cabin areas were exposed. The aircraft also exhibited damage consistent with impact forces. A section of the lower right fuselage nose, including the pitot tube, was separated from the remainder of the fuselage. It came to rest in the debris path about 150 feet southeast of the main wreckage.

The flight controls were damaged consistent with impact forces and post-impact fire. The cyclic and collective controls were present in the cockpit area. Both were separated at the base fittings. The throttle was in the "Fly" position when observed at the accident site. The splines at the base of the collective appeared intact. Co-pilot controls were not installed. The cyclic and collective control tubes in the cockpit floor area appeared intact to the base of the vertical tunnel. Within the vertical tunnel (broom closet), the flight control tubes were fractured in a manner consistent with overload failures. Control tube rod ends were also bent and fractured.

The main rotor servo actuators remained partially attached to the bulkhead at the top of the vertical tunnel. The units were damaged consistent with impact forces and were discolored due to the post-impact fire.

The on-board medical oxygen bottle was observed in two pieces. An end fragment came to rest about 75 feet northeast of the fuselage. The second piece, which contained the valve and pressure gauge, remained with the fuselage. Both pieces exhibited discoloration and sooting consistent with fire damage.

Main Rotor System

The main rotor blades remained attached to their respective yoke flexures on the main rotor

hub. The rotor hub, mast, and main transmission, with the transmission mounts attached, came to rest as a unit, adjacent to the fuselage. The main rotor blades were deformed. The components exhibited sooting and discoloration consistent with the post-impact fire. The main rotor transmission mount was fractured along the left, aft support. The remaining supports were deformed, but they did not appear fractured.

The pitch change links were fractured, with the appearance of the fracture surfaces consistent with overload failure. The opposing pitch change link rod ends remained attached to the rotating swashplate, with the exception of one of the links. One swashplate attachment arm was separated, along with the mating portion of the pitch change link. The non-rotating portion of the swashplate appeared intact. The control links remained attached to the swashplate at the rod ends; however, the links were fractured.

The main transmission was intact. Partial rotation of the main drive shaft produced corresponding rotation of the main rotor mast. The main drive shaft was fractured aft of the transmission. The K-flex coupling between the drive shaft and the transmission remained intact. The K-flex coupling at the aft end of the first drive shaft segment was fractured. Appearance of the fracture surfaces was consistent with overload failures. Rotational continuity was observed between the main rotor and tail rotor drive shafts, through the engine gearbox and freewheeling unit.

The four main rotor blades remained attached to the yoke flexures at the rotor mast. The blade bolts appeared intact and properly installed. All four blades exhibited fire damage at the inboard ends of the blades. The blades were arbitrarily numbered one through four for identification purposes. The corresponding color designation of the blades could not be determined due to the fire damage.

Blade one exhibited discoloration and delamination along the inboard 4 1/2 feet of the blade. Blue and red chordwise marks, consistent with paint transfer, were observed on the leading edge over an approximate length of five inches. Blade two sustained impact and thermal damage. Blue chordwise marks, consistent with paint transfer, were observed on the leading edge, approximately two inches in the length. The inboard 5 1/2 feet of the leading edge abrasion strip was separated from the blade and recovered approximately 150 feet south of the fuselage. Blade three exhibited fire damage along the entire length of the blade. Identification of any leading edge transfer marks was precluded by fire damage. Blade four exhibited fire damage along the entire length of the blade; with the exception of a section about three feet in length near mid-span. The blade root hub was discolored but appeared intact. Discoloration due to fire damage prevented the identification of any leading edge transfer marks.

Engine

The engine came to rest adjacent to the main rotor mast and fuselage. The entire engine was discolored consistent with the post impact fire. The compressor impeller was intact; however,

several impeller blades exhibited leading edge nicks and gouges. Abrasion and scrape marks were observed on the compressor support. The power turbine and gas producer sections appeared intact. The combustion housing and engine exhaust stack were deformed. The engine gearbox housing was intact, with the exception of a section approximately two inches square.

The engine control unit (ECU) sustained damage consistent with the fire. The ECU housing was fractured in several places exposing the components. The ECU was retained for further examination.

Tailboom / Tail Rotor

The tailboom and a section of the aft fuselage separated from the remainder of the airframe. The tailboom remained securely attached to the aft fuselage segment. The aft fuselage section and forward portion of the tailboom exhibited discoloration consistent with fire damage. The remainder of the tailboom did not exhibit any thermal damage.

The tailboom was fractured about 21 inches aft of the tailboom-to-fuselage attachment point. The skin was buckled adjacent to the fracture. The aft fuselage section came to rest on its right side. The tailboom aft of the fracture came to rest upright. The tail rotor drive shaft and pitch control rod were continuous across the fracture. However, the tail rotor pitch control rod was bent in the vicinity of the fracture.

The remainder of the tailboom was intact, including the tail rotor drive shaft, transmission, and pitch change links. However, the forward flange of one drive shaft segment was fractured. Rotation of the drive shaft aft of the fractured flange produced a corresponding rotation of the tail rotor blades, without binding. Both tail rotor blades remained attached to the hub. One blade exhibited an area of skin delamination near the trailing edge about mid-span consistent with impact damage. Otherwise, the blades exhibited only minor abrasions and scratches.

The vertical fin stabilizer separated from the aft end of the tailboom at the attachment screws. It came to rest immediately adjacent to the tailboom consistent with separation at the time of the impact. The right horizontal stabilizer and end cap were separated from the tailboom about seven inches outboard of the tailboom. The separated portion of the horizontal stabilizer remained securely attached to the tailboom. The upper and lower sections of the end cap were separated from the stabilizer, and from each other, at the outboard end of the horizontal stabilizer. Both end cap sections were recovered from the debris path.

Landing Gear/Skids

All the landing gear (skid) components came to rest with the main wreckage, and were lying in proper position relative to the airframe. Both skids were fractured. The landing gear crosstubes were deformed downward (flattened) on both the left and right sides. The extent of deformation was greater on the right side, consistent with a right side low, vertical impact.

N407MJ; Classic Helicopter Services

General

The Classic Helicopter Services helicopter, N407MJ, was destroyed due to the mid-air collision and subsequent collision with trees and terrain. No fire damage was noted on the helicopter.

The main wreckage consisted of the fuselage, engine, transmission, and main rotor hub and blades. Three trees located approximately 35 feet east of the fuselage were broken off approximately 25 to 40 feet above ground level. Multiple tree branches and limbs exhibited fresh breaks were located on the ground in the vicinity of the fuselage. The tail boom was separated from the fuselage. It came to rest approximately 73 feet east of the fuselage.

Fuselage

The fuselage was fragmented into three sections. The forward (cockpit) section came to rest inverted, nose down at an angle of about 45-degrees relative to the terrain, against two trees. The mid (cabin) section of the fuselage was separated from the forward section. It came to rest on its left side adjacent to the forward section. The engine, main rotor transmission, and rotor mast were also on their left side, in position, relative to the mid section. The aft fuselage section came to rest on its left side, nearly inverted, against a tree. A 12-inch section of the tailboom remained attached to the fuselage. The fuselage nose was crushed aft. The left side of the fuselage was separated completely, exposing the cockpit and forward cabin areas.

The flight controls were damaged consistent with impact forces. The cyclic and collective controls were present in the cockpit area. Both were separated near the base. Co-pilot controls were not installed. The cyclic and collective control tubes in the cockpit floor area appeared intact to the base of the vertical tunnel. The control tubes within the vertical tunnel (broom closet) were bound, but appeared intact. Control tube rod ends were intact. The anti-torque pedals were present. The control rod was severed about six inches inboard of the bellcrank. The rod end remained attached.

The main rotor servo actuators remained attached to the bulkhead at the top of the vertical tunnel. The units were damaged consistent with impact forces. The control rods were bent, but appeared intact.

Main Rotor System

The main rotor blades remained attached to the rotor hub. The rotor hub, mast, and transmission remained secured to the fuselage roof beam structure by the transmission mounts. They came to rest with the engine and the remainder of the fuselage.

The transmission housing and mounts appeared intact. The main drive shaft segment

remained securely attached to the transmission at the K-flex coupling. The main drive shaft segment was intact, but exhibited circumferential scoring along its length. The K-flex coupling at the aft end of the shaft was fractured in a manner consistent with overload. The transmission exhibited continuity through the unit. Rotation of the forward end of the main drive shaft produced corresponding rotation of the main rotor mast.

The main rotor mast, blade mounting yokes, and pitch change horns appeared intact. One pitch change link was intact. The remaining three pitch change links were fractured. The ends of the links were still attached to the horns and rotating swashplate via the rod ends, with one exception. One clevis on both the rotating and non-rotating halves of the swashplate was fractured. Appearance of the fracture surfaces on the swashplate and the pitch change links was consistent with overload failures. Flight control linkage to the non-rotating portion of the swashplate remained attached and was intact. One control rod was deformed. The support brackets common to the linkage bellcranks were fractured.

The four main rotor blades remained attached to the yoke flexures at the rotor mast. The blade bolts appeared intact and properly installed. The blades were arbitrarily numbered one through four for identification. The corresponding color of each blade is also included for reference.

Blades one, two, and three were fragmented, dented, and deformed consistent with impact damage. The tips of these blades had separated and were recovered in the accident debris path. Blade one (blue) exhibited blue paint transfer marks over a 5 1/2 inch length. In addition, green and white paint transfer was observed near the leading edge. Blade two (orange) exhibited a 3-inch wide area of white paint transfer marks along the leading edge of the blade. Chordwise scratches were also observed. Blade three (red) exhibited white paint transfer marks over a 3-inch wide area, and chordwise scratches on the upper and lower surfaces near the area of paint transfer. Blade four (green) was intact; however, the blade exhibited leading edge denting. Blue paint transfer was observed on the upper and lower surfaces of the leading edge over a 7-inch width.

Engine

The engine remained secured to the airframe by the engine mounts. It came to rest partially inverted, forward (inlet) end downward orientation. The forward engine mount was intact. The aft engine mount was separated from the airframe and deformed. The compressor impeller disc was intact; however, the blades exhibited leading edge gouges. Scrape marks were observed on the compressor front support consistent with impeller rotation at the time of impact. The impeller disc exhibited resistance and binding when rotated by hand. Continuity to the starter-generator was observed during rotation. The turbine wheel appeared intact. The turbine wheel rotated and exhibited continuity to the output shaft.

Tailboom / Tail Rotor

The tailboom separated from the airframe about 12 inches aft of the tailboom-to-fuselage joint. The forward 12-inch section of the tailboom remained attached to the fuselage. The skin was deformed, twisted, and torn at the separation point.

The tail rotor gearbox, and vertical fin stabilizers had separated from the aft end of the tailboom, and came to rest adjacent to the tailboom. The pitch change linkage remained attached to the gearbox. The gearbox appeared intact. The tail rotor mast and tail rotor blades remained attached to the gearbox. The gearbox exhibited continuity when the input drive shaft was rotated. The pitch control links were bent, and the pitch control mechanism appeared functional.

The tail rotor drive shaft segment immediately forward of the gearbox remained attached at the flexible Thomas coupling; however, the coupling was fractured. The forward end of the drive shaft exhibited rotational scoring. Two drive shaft segments remained attached to the tailboom, and they were bent and dented. The forward drive shaft segments had separated from the mating segments.

Both tail rotor blades remained secured to the tail rotor hub assembly and mast. One tail rotor blade exhibited leading edge crushing damage over the inboard portion of the blade, and deformation along the trailing edge. Blue and red paint transfer marks were observed on the face of the blade and on the trailing edge near mid-span. Black transfer marks were observed on the leading edge near mid-span. The second tail rotor blade exhibited crushing damage over the inboard 1/2 span of the blade. Blue paint transfer was observed in this area. The inboard 5 1/2 inches of the blade leading edge exhibited black transfer marks.

The horizontal stabilizer and end caps were fragmented. The outboard 2/3 of the right horizontal stabilizer had separated from the airframe. The remaining inboard portion of the assembly remained securely attached to the tailboom. The separation was oriented forward-aft, parallel to the longitudinal axis of the aircraft. The right end cap was intact and remained securely attached to the separated section of the horizontal stabilizer.

The left horizontal stabilizer separated into three fragments. The inboard section remained attached to the tailboom. This section was approximately 18-inches in length at the leading edge and orientated at a 27-degree angle relative to the longitudinal axis of the aircraft. The second fragment of the left horizontal stabilizer was about 6-inches in length. The stabilizer exhibited a distinct upward bend adjacent to the fracture surface consistent with an impact from below. The third fragment consisted of the remainder of the stabilizer, with the end cap attached. Additionally, a section of the left end cap was separated from the remainder of the assembly. The fragment consisted of the upper-aft portion of the end cap, above the horizontal stabilizer. The skin adjacent to the separation was bent inboard.

The horizontal stabilizer and end cap fragments were distributed along the top edge of the embankment in the vicinity of the N407GA main wreckage.

The tailboom exhibited a cut through the lower skin in the area below the horizontal stabilizer. This cut was orientated at an approximate angle of 38 degrees relative to the longitudinal axis of the aircraft. The carry-thru structure of the horizontal stabilizer was deformed upward, but appeared intact. The deformation continued to the inboard portion of the horizontal stabilizer. The horizontal stabilizer vane had separated from the airframe; however, it was also deformed consistent with the adjacent damage.

The tailboom was creased on the left side at the forward end near the separation from the fuselage. It was oriented upward at an angle of about 37 degrees relative to the ground reference. The forward portion of the deformation exhibited blue transfer marks. The skin was torn through along an approximate one-inch length at the lower-forward end of the crease. The crease was sharp and distinct at the lower-forward end, and became shallower as it progressed upward and aft.

Landing Gear/Skids

The landing skid assembly separated from the airframe and was located adjacent to the airframe at the accident site. The right skid was intact. The left skid was fractured at 2 locations between the forward and aft crosstube saddles. The forward crosstube was fractured above both the left and right saddles. Both the left and right steps had separated from the crosstube legs. The left leg of the aft crosstube was deformed inboard about 60 degrees. Both the forward and aft crosstube legs on the right side of the aircraft were deformed outboard approximately 30 degrees. Fracture surfaces were consistent with overload failure.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on all occupants by the Office of the Coconino County Medical Examiner, Flagstaff, Arizona. All occupants' cause of death was listed as multiple blunt force injuries. Specimens for toxicological tests were taken from the pilots and medical crewmembers by the medical examiner.

The FAA's Civil Aeromedical Institute's Forensic and Accident Research Center, Oklahoma City, Oklahoma, examined the specimens taken by the medical examiner. Toxicological tests performed on all specimens were negative for carbon monoxide, cyanide, ethanol, and all screened drugs, with the following exception; the Classic pilot's blood contained 0.041 (ug/mL, ug/g) Normeperidine, and an unspecified amount of Normeperidine was detected in the urine.

Normeperidine is a metabolite of meperidine, a prescription narcotic painkiller, used for the control of severe pain, and commonly known by the trade name Demerol.

On June 23, 2008, the Classic pilot had been involved in an assault with a trespasser on his property and was being treated for minor injuries. The pilot’s wife noted that he had been administered Demerol in the emergency room for pain from the assault injuries and that he

was not in any discomfort from the injuries at the time of the accident.

TESTS AND RESEARCH

Engine Control Units

General

The ECU had the capability to store real-time data related to engine operating parameters, fault history, and abnormal engine condition (incident) information. System anomalies were recorded as Last Engine Run Faults, Accumulated Faults, and Time Stamped Faults. Last Engine Run Faults represented a record of fault conditions detected during the most recent engine run only. Accumulated faults comprised a record of faults recorded by the unit since the memory was last cleared. This included last engine run faults. Time Stamped Faults contained an accounting of recent fault and exceedance detections, with the associated engine operating time parameter.

An Incident Recorder monitored a set of engine control parameters for abnormal conditions. In the case that an anomaly or incident was detected, the recorder provided for 12 seconds of pre-incident data (10 data sets), and 48 seconds of post-incident data (40 data sets) to be written to non-volatile memory.

N407GA; Air Methods Corporation

The ECU recovered from N407GA was model number EMC-35A, serial number JG8ALK0554. The unit exhibited impact and thermal damage. Partial disassembly of the unit revealed extensive damage to the components containing the non-volatile memory. As a result, no data could be extracted from the unit.

N407MJ; Classic Helicopters Services

The ECU recovered from N407MJ was model number EMC-35A, serial number JG0ALK0653. It had sustained damage consistent with impact forces. Internal damage to the unit was minor and extraction of the non-volatile memory was successful.

Engine history data noted an ECU operating time of 3,556.53 hours and an engine run time of 1,374.80 hours. The ECU operating time represents the cumulative time that electrical power had been applied to the unit. Maintenance personnel cannot access this parameter. The engine run time is incremented when the engine is actually running. Maintenance personnel normally set this parameter at installation.

The data contained a power turbine speed (Np) exceedance that occurred at an engine run time of 1371:01:18.216. The exceedance lasted for 0.96 seconds and reached a peak value of 103.09 percent. A turbine speed in excess of 102.1 percent triggers an exceedance event.

According to the ECU manufacturer, Np parameter values in excess of the limit are not uncommon due to occasional flight operations such as quick landings or descents, and do not necessarily indicate any system or operational anomalies.

The ECU incident recorder contained two events. The first occurred at 1374:54:52.896 and was triggered by a loss of rotor speed below 92 percent. The actual rotor speed recorded during the event was 86 percent. The second event occurred at 1374:54:53.208 and was associated with a torque rate sensor exceedance. A sensor exceedance is generated when the sample-to-sample change exceeds 1,500 percent per second. This event was partially recorded in the history data. According to the ECU manufacturer, the absence of an associated timestamp was possibly because electrical power was removed from the unit at the time the data was being written into non-volatile memory.

The incident recorder function in the ECU provided ten data sets prior to the incidents and 40 data sets after, for a total of 50 data sets. However, only records three through 11 contained any data. The absence of data on records one and two was likely due to an interruption of electrical power before the information could be transferred into non-volatile memory. A loss of power to the ECU also likely caused the absence of data on records 12 through 50.

The data indicated that the engine control system was in Auto mode with no indication of a fault condition prior to the initial event. After the two events, the data indicated the ECU was operating in a degraded condition due to the confirmed senor fault.

Radios

General

The communications radios were removed from both aircraft in an attempt to retrieve the frequencies selected at the time electrical power was interrupted. Both aircraft were equipped with Bendix/King radios for communication and navigation on assigned aviation frequency ranges. The Bendix/King radios are designed to hold two frequencies. One is denoted as "Use" and the other is denoted as "Stby." The in-use ("Use") frequency is active for receiving and transmitting. The standby ("Stby") frequency can be exchanged with the in-use frequency by depressing the button on the bezel.

To support the EMS mission, the aircraft were also equipped with multi-band transceivers for communication with ground based police, fire, and emergency medical personnel. The multi-band radios had the capability to communicate on VHF/UHF FM frequency bands.

N407GA; Air Methods Corporation

The KX165 (s/n 60021) exhibited impact and thermal damage. The faceplate was removed and a new one installed on the accident unit. When powered up, the unit displayed the communications in-use frequency as 134.55 and the standby frequency as 122.75. The

navigation in-use frequency was 113.85 and the standby frequency was 108.75. The transmit and receive functions of the unit tested within specifications. The transmission power when tested was 15 watts. The manufacturer's specification was 10 watts minimum.

The KX165 (s/n 65129) also exhibited impact and thermal damage. The faceplate was removed and a new one installed on the accident unit. When powered up, the unit displayed the communications in-use frequency as 123.02 and the standby frequency as 136.87. The navigation in-use frequency was 116.90 and the standby frequency was 113.80. The transmit and receive functions of the unit tested within specifications. The transmission power tested within specifications at 15 watts.

The multi-band radio system was comprised of Global/Wulfsberg RT-138F and RT-406F FM transceivers, paired with a Northern Airborne Technologies TH-250 radio control head. The selected frequencies were retained in the control head unit and not in the transceivers.

The radio control head sustained impact and thermal damage. Examination of the component determined that the unit was set to power-up on specific preset frequencies, and not necessarily the frequency set at the time it was powered down. The component was set to power-up on channel 031 for RT#1 and channel 047 for RT#2. However, the manufacturer noted that the transceiver type retrieved from the unit was incorrect for a Flexcomm interface. This may be an indication that the memory circuits were damaged to some extent.

N407MJ; Classic Helicopter Services

The aviation radios recovered from N407MJ were a Bendix/King KX165 Nav-Comm (p/n 060-1025-25 / s/n 58421) and a KY196A Comm (p/n 064-1054-30 / s/n 8345).

The KX165 (s/n 58421) sustained impact damaged and could not be powered up directly. The electronic component containing the non-volatile memory was removed and installed into a host radio unit. When powered up, the host unit displayed the communications in-use frequency as 125.30 and the standby frequency as 122.80. The navigation in-use frequency was 117.60 and the standby frequency was 108.40.

The KY196A (s/n 8345) had sustained minor damage. The unit was connected to an electrical harness and powered-up in the as-received condition. The in-use frequency displayed was 134.55 and the standby frequency was 120.62. The transmit and receive functions of the unit tested within specifications. The transmission power tested within specifications at 20 watts.

The multi-band radio system consisted of a Technisonic Industries Ltd. Model TFM-500 unit (s/n JA1563). The unit exhibited impact damage to the faceplate and the forward printed-circuit boards. The damaged faceplate was replaced and power was applied to the unit. Examination of the radio determined that the unit was set to display the most recently tuned frequencies at each power-up sequence. Functional testing of the VHF and UHF bands was normal, and no mechanical anomalies were observed. The frequencies displayed upon power-

up were:

Display line 1 (VHF) -	023	GARFCORPT	156.0150RT	
Display line 2 (UHF) -	001	CLASSIC1	463.6250RT	
Display line 3 -	GD1	NPS Guardn	171.6250RX	
Display line 4 -	BS	VHF TONE	OFF	PWR-HI

ORGANIZATIONAL INFORMATION

Air Methods Corporation

Air Methods is a FAR Part 135 Air Carrier, which held on-demand operations specifications. Company headquarters are located in Englewood, Colorado. The Chief Executive Officer, Board of Directors, Chief Pilot, Director of Operations, Director of Maintenance, and the Director of Safety reside in Colorado.

Air Methods was established in Colorado in 1982 and now serves as the largest provider of air medical emergency transport services and systems throughout the United States. Air Methods operates a fleet of more than 342 helicopters and fixed-wing aircraft in 42 states. It currently employs nearly 1,100 pilots.

Air Methods Corporation and its subsidiaries provide air medical emergency transport services and systems in the United States. It operates in three segments: Community-Based System, Hospital-Based System, and Products.

The Community-Based System (CBS) segment provides air medical transportation services, which include medical care, aircraft operation and maintenance, communications and control, and medical billing and collection services. As of December 31, 2007, this segment operated 135 helicopters and four fixed wing aircraft. Under the CBS delivery model, Air Methods employees provide medical care to patients en route

The Hospital-Based System (HBS) segment provides air medical transportation services and medically equipped helicopters and airplanes for hospitals. As of December 31, 2007, this segment operated 187 helicopters and 16 fixed wing aircraft. Under the HBS delivery model, employees or contractors of Air Methods, and the customer hospitals en route, provide medical care.

The Air Methods operation based at Flagstaff was considered a HBS. Northern Arizona Healthcare, who owns/operates FMC, maintains the helipad, owns the aircraft, and employs the pilots, medical crews, and the transportation coordinators. This also includes all of the staff at Guardian Control and the maintenance facility based at FLG.

The Products segment involves the design, manufacture, and installation of aircraft medical

interiors and other aerospace and medical transport products for domestic and international customers.

LifeCom is Air Methods recently renovated, fully equipped national communications center in Omaha, Nebraska, where they offer communications and satellite-tracking capabilities. Medical billing and collections are processed from their San Bernardino, California, facility. Air Methods Operational Control Center (OCC) in Englewood, Colorado, monitors all flights. The Flight Management System (FMS) is a custom designed computer application that monitors and provides real-time weather and flight alerts for company aircraft. The OCC is staffed 24 hours a day, 7 days a week.

A voluntary accreditation, Air Methods encourages all of their CBS programs to seek and maintain Commission on Accreditation of Medical Transport Systems (CAMTS) certification. CAMTS is an independent agency that audits and accredits fixed and rotor wing air medical transport and critical care ground services in the United States to a set of industry-established standards.

Classic Helicopter Services

Classic began service with one helicopter and a medical crew of two basic EMT's on Memorial Day 1988. Classic began as a seasonal service to assist the National Park Service in transporting trauma patients from the Lake Powell area to a trauma center. Classic started lifeguard air ambulance operations because the park service would often call Classic tour helicopters from Bryce Canyon to airlift injured people from Lake Powell.

Classic works closely with the National Park Service, Navajo Nation EMS, Arizona and Utah Highway Patrol, City of Page, Arizona Fire Department, and the various other agencies in Utah and Arizona.

At the time of the accident, Classic operated two Bell 407 helicopters and a fixed-wing Beech E90 King Air. Their communications center is monitored 24 hours a day, 7 days a week.

Classic has logged over 5,000 missions since they began service in 1988.

ADDITIONAL INFORMATION

FMC Guidelines of Practice

According to FMC's Guidelines of Practice, any violations of safety practices and/or the published procedures will be reported to the FMC Director of Security/Safety. The Director will then follow-up with the operator and "seek compliance for the reported violations."

In an interview, FMC's Director of Safety/Security stated there were currently six operators authorized to operate from the FMC helipad. He said that there had not been any violations of

the Guidelines of Practice, but if there had there been, he would talk to the operator directly. He reported that FMC did not have any on-going disciplinary problems with any operator at the time of the accident.

The Director of Safety/Security stated that he used to coordinate annual Safety Committee meetings with all of the helicopter operators, but he had a "problem getting all the vendors together." He had not held a meeting in "a while" and could not recall when the last meeting had been conducted. The Director reviewed FMC's Safety Meeting records, which revealed that the last Safety Committee meeting was in July 2004. According to the meeting notes, only one of the operators attended. As a result, the following statement was placed in the Meeting Notes, "It has been determined that when a helicopter vendor has been reasonably notified about helipad safety meetings and does not send representation; the vendor is stating there are no safety issues they need to have addressed and are accepting the committee's actions. All vendors have been given committee contact information and are encouraged to use it if they are unable to have a representative at the meetings."

The Director also stated that FMC's Guidelines of Practice are revised every three years per hospital policy or if there is a need to revise the procedures. The last revision was completed on September 11, 2007. He stated that he mailed and faxed the revised procedures to each operator.

Federal Aviation Regulations (FARs)

FAR 91.111 addresses operating near other aircraft. It states in part that no person may operate an aircraft so close to another aircraft as to create a collision hazard. FAR 91.113 states in part that vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft.

Advisory Circular (AC) 90-48C Pilots' Role in Collision Avoidance

According to AC 90-48C, "...the flight rules prescribed in Part 91 of the Federal Aviation Regulations (FARs) set forth the concept of "See and Avoid." This concept requires that vigilance shall be maintained at all times, by each person operating an aircraft, regardless of whether the operation is conducted under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR).

"Pilots should also keep in mind their responsibility for continuously maintaining a vigilant lookout regardless of the type of aircraft being flown. Remember that most MAC [mid-air collision] accidents and reported MAC [near mid-air collisions] occur during good VFR weather conditions and during the hours of daylight."

The AC further states, "pilots should remain constantly alert to all traffic movement within their field of vision as well as periodically scan the entire visual field outside of their aircraft to ensure detection of conflicting traffic. The probability of spotting a potential collision threat

increases with the time spent looking outside, but certain techniques may be used to increase the effectiveness of the scan time. The human eyes tend to focus somewhere, even in a featureless sky. In order to be most effective, the pilot should shift glances and refocus at intervals. Pilots should also realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distance objects. Peripheral vision can be most useful in spotting collision threats from other aircraft. Pilots are reminded of the requirements to move one's head in order to search around the physical obstructions, such as door and window posts."

OTHER INFORMATION

The weather conditions that existed at the accident site during the time of the accident were recorded to be clear skies and daylight conditions prevailed. The Classic helicopter was equipped with a Garmin 496 global positioning system (GPS), which contained a terrain awareness warning system (TAWS) feature. The Air Methods helicopter was not equipped with TAWS. Both helicopters were not equipped with traffic collision avoidance systems (TCAS). The accident flights were being tracked by a flight following program, and both flights did receive flight dispatch services prior to and during the flights. Additionally, formal flight risk assessments were performed prior to the flights.

On February 7, 2006, the NTSB issued four safety recommendations to the FAA addressing EMS operations. They are as follows:

NTSB Recommendation No. A-06-12 - Require all EMS operators to comply with 14 CFR Part 135 operations specifications during the conduct of all flights with medical personnel onboard.

NTSB Recommendation No. A-06-13 - Require all EMS operators to develop and implement flight risk evaluation programs that include training all employees involved in the operation, procedures that support the systematic evaluation of flight risks, and consultation with others trained in EMS flight operations if the risks reach a predefined level.

NTSB Recommendation No. A-06-14 - Require EMS operators to use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance in flight risk assessment decisions.

NTSB Recommendation No. A-06-15 - Require EMS operators to install terrain awareness and warning systems on their aircraft and to provide adequate training to ensure that flight crews are capable of using the systems to safely conduct EMS operations.

These four recommendations were also placed on the NTSB's "Most Wanted List of Safety Improvements" in October 2008.

Additionally, the NTSB stated in its January 2006 Special Investigation Report on EMS Operations that they were pleased that the FAA encouraged the use of night vision imaging

systems in EMS operations, and that the NTSB would continue to monitor the applicability and usage of these devices in the EMS industry.

Also, on December 21, 2007, the NTSB issued two safety recommendations to the FAA regarding the use of radar altimeters in EMS night operations. They are as follows:

NTSB Recommendation No. A-07-111 - Require helicopter EMS operators to install radar altimeters in all helicopters used in HEMS night operations.

NTSB Recommendation No. A-07-112 - Ensure that the minimum equipment lists for helicopters used in helicopter EMS operations require that radar altimeters be operable during flights conducted at night.

Pilot Information

Certificate:	Commercial	**Age:**	55,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 4, 2008
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 31, 2008
Flight Time:	14500 hours (Total, all aircraft), 4241 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N407MJ
Model/Series:	407	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	53079
Landing Gear Type:	Skid	**Seats:**	7
Date/Type of Last Inspection:	June 19, 2008 Continuous airworthiness	**Certified Max Gross Wt.:**	5000 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	4503 Hrs as of last inspection	**Engine Manufacturer:**	Rolls-Royce
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	250B-C47B
Registered Owner:	M&J Leisure, L.L.C.	**Rated Power:**	
Operator:	Classic Helicopter Limited, L.C.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Classic Helicopter Lifeguard	**Operator Designator Code:**	JAPA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FLG,7015 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	15:56 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.32 inches Hg	**Temperature/Dew Point:**	28°C / -3°C
Precipitation and Obscuration:			
Departure Point:	Tusayan, AZ	**Type of Flight Plan Filed:**	Company VFR
Destination:	FLAGSTAFF, AZ (3AZ0)	**Type of Clearance:**	VFR
Departure Time:	15:17 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Flagstaff Medical Center East 3AZ0	**Runway Surface Type:**	
Airport Elevation:	7016 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Unknown

Wreckage and Impact Information

Crew Injuries:	3 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	35.200832,-111.634162

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	David Keenan; Federal Aviation Administration; Washington, DC Dennis McCall; Air Methods Corporation; Denver, CO Matthew Stein; Classic Helicopter Services; Page, AZ Mark Stuntzner; Bell Helicopter; Fort Worth, TX Jon-Adam Michael; Rolls-Royce; Indianapolis, IN Al Duquette; Professional Helicopters Pilots Association; Jasper, TX
Original Publish Date:	May 7, 2009
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=68325