Aviation Investigation Final Report

Location:	Tucson, Arizona	**Accident Number:**	WPR10FA371
Date & Time:	July 28, 2010, 13:42 Local	**Registration:**	N509AM
Aircraft:	AMERICAN EUROCOPTER LLC AS 350 B3	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The single-engine helicopter was operating near its maximum gross weight and was on a repositioning flight back to its home base. About 6 minutes into the flight, cruising at 800 feet above ground level (agl), the helicopter experienced a complete loss of engine power. Witnesses observed the helicopter, which had been flying steadily in a southeast direction, suddenly descend rapidly into a densely populated residential area. Descent rates calculated from the last 10 seconds of radar data were consistent with an autorotation. The witnesses reported that, as the helicopter neared the ground, its descent became increasingly vertical. Examination of the accident site revealed that the helicopter was in a level attitude with little forward speed when it impacted a 5-foot-high concrete wall, which penetrated the fuselage and ruptured the fuel tank. A postimpact fire consumed the cabin and main fuselage of the helicopter.

An open roadway intersection was located about 300 feet beyond the accident site, in line with the helicopter's flight path. It is likely that the pilot was attempting to make an autorotative approach to the open area; however, he was unable to reach it because he had to maneuver the helicopter over a row of 40-foot-tall power lines that crossed the helicopter's flight path near the accident site. This maneuver depleted the rotor rpm, which, as reported by the witnesses, caused the helicopter's descent to become near vertical before it impacted the concrete wall, which was across the street from the power lines.

The pilot had no training flights during the 317 days since his most recent 14 Code of Federal Regulations Part 135 check flight. The lack of recent autorotation training/practice, although not required, may have negatively impacted the pilot's ability to maintain proficiency in engine failure emergency procedures and autorotations. However, because the engine failed suddenly at low altitude over a congested area, more recent training may not have changed the outcome.

External examination of the engine at the accident site revealed that the fuel inlet union that connected to the fuel injection manifold and provided fuel from the hyrdomechanical unit to the combustion section had become detached from the boss on the compressor case. The two attachment bolts and associated nuts were not present on the union flange nor were they located within the helicopter wreckage debris. Separation of the fuel inlet union from the fuel injection manifold interrupted the supply of fuel to the engine and resulted in a loss of engine power. Postaccident engine runs performed with an exemplar engine showed that, with loose attachment bolts and nuts, the union initially remained installed and fuel would not immediately leak. As the engine continued to operate, the loose nuts would progressively unscrew themselves from the bolts. With the bolts removed, the union would ultimately eject from the boss, and the engine would lose power due to fuel starvation.

The helicopter's engine had undergone maintenance over several days preceding the accident. The maintenance was related to fuel coking of the fuel injection manifold. The operator's mechanics removed the engine from the helicopter and separated the modules. Another engine with the identical problem was also undergoing the same maintenance procedure at the time. A repair station technician was contracted to complete the maintenance on both engines. The operator's mechanics and the repair station technician disassembled the accident engine and set it aside. They then performed the required maintenance on the other engine, before returning to complete the work on the accident engine. While working on the accident engine, the repair station technician disassembled module 3, replaced the fuel injection manifold, and then reassembled the engine. This work required that the fuel inlet union be removed and reinstalled. It is likely that the technician did not tighten the bolts and nuts securing the union with a torque wrench and only finger tightened them. The engine was reinstalled into the helicopter by the operator's maintenance personnel. The repair station technician was serving as both mechanic and inspector, and he inspected his own work. There were no procedures established by the operator or the repair station to ensure that the work performed by the technician was independently inspected. Further, although 14 Code of Federal Regulations 135.429, applicable to Part 135 operators using aircraft with 10 or more passenger seats, states, in part, “No person may perform a required inspection if that person performed the item of work required to be inspected,” there is no equivalent requirement for aircraft, such as the accident helicopter, with 9 or fewer passenger seats. An independent inspection of the work performed by the technician may have detected the improperly installed fuel inlet union.

In 2008, the Federal Aviation Administration (FAA) principal maintenance inspector (PMI) for the repair station removed the repair station's authorization to perform work at locations other than its primary fixed location. However, the Repair Station Manual was not updated to reflect this change, and the PMI did not follow up on the change, nor did he log the change in the FAA’s tracking system. The PMI was unaware that, in the year before the accident, the repair station had performed work for the operator at locations other than the repair station’s primary fixed location at least 19 times. The FAA's inadequate oversight of the repair station allowed the repair station to routinely perform maintenance at locations other than its primary fixed location even though this practice was not authorized.

The duty pilot performed a 7.5-minute abbreviated post maintenance check flight the evening before the accident. A full maintenance check flight conducted in accordance with the manufacturer's flight manual should, under normal conditions, take 30 to 45 minutes to complete. Had a full check flight been performed, it is likely that the union would have detached from the boss during the check flight. Because the helicopter would not have been operating near its maximum gross weight and the check flight would have been conducted over an open area, the pilot would have had greater opportunities for a successful autorotative landing.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
The repair station technician did not properly install the fuel inlet union during reassembly of the engine; the operator’s maintenance personnel did not adequately inspect the technician's work; and the pilot who performed the post maintenance check flight did not follow the helicopter manufacturer's procedures. Also causal were the lack of requirements by the Federal Aviation Administration, the operator, and the repair station for an independent inspection of the work performed by the technician. A contributing factor was the inadequate oversight of the repair station by the Federal Aviation Administration, which resulted in the repair station performing recurring maintenance at the operator’s facilities without authorization.

Findings

Personnel issues	Replacement - Maintenance personnel
Personnel issues	Post maintenance inspection - Maintenance personnel
Personnel issues	Incomplete action - Flight crew
Organizational issues	Document revision tracking - FAA/Regulator
Organizational issues	Oversight of reg compliance - FAA/Regulator
Organizational issues	Oversight of maintenance - Maintenance provider
Organizational issues	Emergency proc training - Operator

Factual Information

History of Flight

Enroute-cruise	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Emergency descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On July 28, 2010, at 1342 mountain standard time, an American Eurocopter AS 350 B3, N509AM, descended rapidly and collided with terrain in an urban area of Tucson, Arizona. The helicopter was operated by Air Methods Corporation, as LifeNet 12, on a repositioning flight, under the provisions of Title 14 Code of Federal Regulations Part 91. The commercial pilot and two medical flight crew members were fatally injured. The helicopter was substantially damaged, and consumed by a post impact fire. Visual meteorological conditions prevailed, and a company flight plan had been filed. The repositioning flight originated at the Marana Regional Airport, Tucson, at 1332, and the intended destination was the Air Methods base in Douglas, Arizona.

Witnesses reported observing the helicopter flying steadily in a southeast direction when it started to descend rapidly. Witnesses also stated that the helicopter made some unusual 'whump, whump' sounds, and rapid intermittent popping sounds, which were followed by unusual quietness as the helicopter descended. As the helicopter turned and got closer to the ground its flight trajectory became increasingly vertical. The helicopter impacted a 5-foot-high concrete wall and was consumed by a post impact fire.

The accident helicopter (N509AM) was positioned at the Marana Regional Airport on July 24 to undergo engine maintenance related to a fuel coking problem. The helicopter's engine was removed, and the fuel manifold was removed and replaced. This process involved removing all the external engine piping and harnesses, separating the engine modules, removing and replacing the fuel manifold, and reassembling the engine. The engine was reinstalled on the evening of Tuesday, July 27, and the Marana base pilot and base mechanic performed a 7.5-minute post maintenance check flight.

At 1132 on Wednesday, July 28, 2010, the Douglas aircrew arrived at Marana in the area's spare helicopter, N106LN. The crew swapped out the medical equipment from N106LN to the accident helicopter, N509AM. At 1329, the pilot called Life Com and reported that LifeNet 12 (N509AM) had departed Marana with 3 people, 2 hours 55 minutes of fuel, and an estimated time en route to Douglas of 55 minutes.

Radar data provided by the Federal Aviation Administration (FAA) recorded the first radar return of LifeNet 12, transponder code 0461, at 1334:33, 2,600 feet mean sea level (msl), slightly southeast of Marana. The terrain elevation between Marana and Tucson is approximately 2,300 feet msl. The track proceeded on a course of 112 degrees magnetic for 17 miles directly to the accident location. The helicopter gradually climbed to 3,200 feet by 1339:19, and continued to maintain altitude between 3,000 and 3,200 feet msl until 1341:23. The final two radar returns were 1341:28 at 2,600 feet msl, and 1341:33 at 2,400 feet msl, and were located in the vicinity of the accident site.

LifeNet 12 initially checked in with Tucson TRACON about 1333," Tucson Approach, LifeNet 12 on 23, correction, 2400." Tucson TRACON acknowledged LifeNet 12 and asked what the request was. LifeNet 12 responded, "….we just came off of Marana, we're gonna be heading southeast bound low level though your area back to Douglas VFR." Tucson TRACON responded,"LifeNet 12, Tucson Approach, roger, you are radar contact 4 miles southeast of Marana Airport. Tucson altimeter is 30.01." LifeNet 12 replied, "30.01 LifeNet 12 thanks."

No other communications with LifeNet 12 were recorded. At 1341:38, the Tucson TRACON controller noticed that LifeNet 12 had dropped off the radar display and attempted to contact LifeNet 12 unsuccessfully numerous times.

The radar data, consisting of latitude, longitude, and mode C altitude, was used to determine the helicopter's ground speed, altitude changes, rate of climb changes, and headings. The ground speed averaged between 120 and 130 knots between the first radar return and the final radar return. The altitude increased from 250 feet agl to 750 feet agl in the first 3.5 minutes of the flight and stabilized between 750 and 850 feet for the next 2.5 minutes. Then the altitude decreased at 200 feet per minute (fpm) for 10 seconds, leveled off for 10 seconds at 750 feet, then descended rapidly (approximate rate of descent was 2,300 fpm) for the final 10 seconds of data. The ground speed decreased from 132 knots towards 70 knots over the last 20 seconds of data. The heading was consistent along 112 degrees magnetic heading for the initial 6.6 minutes of data and then changed to 132 degrees during the final 20 seconds of data. The helicopter entered its final descent from approximately 800 feet agl about 30 seconds before the final radar return. The final 10 seconds of data is consistent with an autorotative descent. The distance traveled over the ground by the helicopter during the last 30 seconds of radar data was approximately 1.3 miles, and approximately 0.25 miles over the final 10 seconds.

In the vicinity of the accident location, there was an open roadway intersection that was free of obstacles. This open area was about 570 feet from the final radar return, and about 300 feet from the point of ground impact, in line with the final flight path trajectory of the helicopter.

External examination of the engine at the accident site revealed that the fuel inlet union was detached from the boss on the compressor case. The fuel supply line remained attached to the union and the hydro-mechanical unit (HMU) via the adjusted valve. The intermediate gasket was located in the fuselage debris, directly below the union.

PERSONNEL INFORMATION

Pilot

The pilot, age 61, held a commercial pilot certificate with ratings for airplane single engine land, rotorcraft-helicopter, instrument-airplane and helicopter, issued on November 11, 2008. He held a second-class medical certificate with the limitation that he wear corrective lenses for intermediate vision, issued on January 5, 2010. Prior to being employed by Air Methods, the pilot flew for the US Army, and US Border Patrol. According to colleagues, he retired from the Border Patrol in 2002. In 2002, the pilot was hired by Rocky Mountain Helicopters and was retained after Air Methods acquired the company. During his time in the US Border Patrol, all the pilots received two check flights year. During these check flights they would fly with an instructor pilot, and practiced full landing autorotations.

Pilot information provided by Air Methods dated June 25, 2008, documented the pilot’s total flight time at 13,900 hours, 9,465 rotary-wing hours, 4,500 single engine fixed wing hours, and 100 hours of total instrument time. The pilot’s duty log maintained by Air Methods documented that he accumulated 86.9 hours between January 1 and July 28, 2010, and 7.5 hours within the 30 days prior to the accident. Pilot training records provided by Air Methods documents that he received AS 350 pilot transition training from Aerospatiale, and was qualified as pilot-in-command on February 10, 1989. He received ground and flight training for the AS 350 B3 in August 2002. The pilot received his most recent annual FAR 135.293 and FAR 135.299 Airman Competency/Proficiency Check on Sept 14, 2009. All areas of the examination were graded as ‘S’ (satisfactory) and no discrepancies were noted. Instrument procedures were not practiced; however, an ILS approach arrival was performed, and use of an autopilot was check marked ‘not authorized.’ Power failure, autorotation to a power recovery, and hovering autorotations were performed. The listed aircraft the pilot was authorized to operate were the AS 350 B2, AS 350 B3 2B, and AS 350 B3 2B1.

A review of the pilot’s training records for the previous 4 years was conducted. During the 50 months prior to the accident, the pilot had completed 6.9 hours of training flights and approximately 4.4 hours of proficiency check flights totaling 11.3 hours. The pilot completed one semi-annual training flight and three recurrent training flights during those 50 months, and had no training flights where he would have practiced autorotations between his most recent FAR 135.293 check flight and the day of the accident, a span of 317 days. All the training events were graded as “meets FAA pilot training standards (PTS)” and power recovery autorotations were practiced on each training flight and each competency/proficiency check.

Helicopter Services of Nevada (HSN) Mechanic

The mechanic who replaced the fuel manifold was employed as a technician for Helicopter Services of Nevada (HSN). He is an A&P, and had been employed at HSN since September 2009 as the Director of Maintenance for Turbomeca Engines. Prior to coming to HSN, he worked for 23 years at Turbomeca.

In his position at HSN he oversaw four mechanics, and was responsible for arranging work for his employees. Under contract with Turbomeca, the technicians for Helicopter Services of Nevada perform repairs and Level 3 maintenance. They also perform maintenance at their facility in Boulder City. The majority of their work is in the field through the contract with Turbomeca. The mechanic had accomplished his initial Level 3 Turbomeca training in 1998.

AIRCRAFT INFORMATION

The helicopter was a Eurocopter AS 350 B3, serial number 4698, and was manufactured in 2009. The FAA Airworthiness certificate was issued September 9, 2009. FAA registration records show that Air Methods acquired the helicopter December 23, 2009. It was configured for medical transport of a single patient on a gurney. The gurney was located on the left side of the helicopter and extended over the left side of the cockpit into the left side of the cabin. The crew consists of a single pilot, a flight nurse, and paramedic. A review of the helicopter's maintenance records revealed that it had 352 total hours at the time of the accident, and the most recent maintenance inspection was the Air Methods' 20-hour B61 engine inspection at 352 engine and aircraft hours, on July 27, 2010.

In the accident pilot's off call to LifeCom he reported "2+55" (2 hours 55 minutes) of fuel, which equates to a fuel load of 90%. Mission fuel is usually 2 hours, and the flight to Douglas would have taken 55 minutes, therefore, the helicopter would have landed at Douglas with a mission fuel load of 2 hours. Weight and balance calculations were done by the pilot utilizing a spreadsheet program, available at each base and tailored for each specific helicopter. The actual weight and balance calculation performed by the pilot for the accident flight was not recorded at Marana and was not located in the wreckage (presumed destroyed). The spreadsheet program, designated AS350-B3-Dual Hyd, N509AM (Rev 4 – 3 Feb 09), listed the helicopter weight as 3,329 pounds, pilot weight as 210 pounds, medical crew weights as 210 pounds and 260 pounds, medical equipment weight as 310 pounds, and liquid oxygen (LOX) weight as 18 pounds. Total helicopter weight (without fuel) was 4,330 pounds. The spreadsheet then produces a table that computes fuel load and cargo capacity (loading table). The loading table lists the maximum fuel load as 90% (860 pounds), which will keep the helicopter slightly below gross weight and allows for no additional cargo/passengers. The total aircraft weight with this load was 5,190 pounds, and the moment arm was at 131.2 inches. The flight manual lists the maximum gross weight as 5,225 pounds.

According to the fueling receipt from Tucson Aeroservice Center, dated July 28, 2010, for aircraft N509AM, the quantity of fuel purchased was 105 gallons. The lineman that fueled the helicopter recalled the pilot requesting that 100 gallons of fuel be added to the helicopter, and that when he was done fueling, the fuel load was not 100%. The aircraft weight and balance record that was located in the helicopter flight manual and retrieved from the aircraft wreckage was dated December 12, 2009. The operational empty weight that was listed in the weight and balance document was 3,314 pounds and the longitudinal moment arm listed was 138 inches. Based on the crew weights, equipment loading, and the pilot's 2+55 endurance calculation (the helicopter had a 90% (860 lbs) fuel load), would put the helicopter inside the weight and balance envelope at 5,182 lbs at takeoff.

The 15 lb difference between the helicopter empty weight documented in the weight and balance sheet and the spreadsheet program could not be completely explained by the operator. However, it was observed that the version of the spreadsheet used by the accident crew was dated February 3, 2009, and the most recent helicopter weight and balance documentation was dated December 12, 2009.

Helicopter Maintenance Review

Interviews conducted with the mechanics that had recently worked on the helicopter, and the pilot who flew the helicopter prior to the accident aircrew accepting the helicopter, revealed that the helicopter had been sent to Marana for maintenance related to an engine coking problem. According to a Turbomeca representative, fuel coking means that the injection manifold becomes coated with carbon deposits. As the engine temperature decreases, the tolerances usually decrease so that the engine will sometimes rotate with associated noise and the gas generator can seize when the engine cools down, preventing next starting. Fuel coking does not affect flight performance. The replacement of the fuel manifold is considered a level 3 maintenance action, and the Air Methods mechanics at Marana were authorized to perform up to level 2 maintenance. Helicopter Services of Nevada (HSN), who was authorized to perform level 3 maintenance, was contracted by Air Methods to perform the work at Marana.

Between July 24 and July 26, the engine was removed by Air Methods maintenance personnel, and the engine modules were separated. During this time, an additional engine with fuel coking also had to have the fuel manifold replaced. The accident engine was disassembled first, and the mechanics realized that they would need additional parts and tooling to complete the work. The accident engine was set aside and the second engine was disassembled and the fuel manifold replaced. As the Air Methods mechanics completed the work on the second engine, the HSN technician replaced the fuel manifold on the accident engine. During the work on the accident engine, module 3 was disassembled, the fuel injection manifold replaced, the engine reassembled by HSN technician, including the fuel inlet union. The engine was reinstalled into the helicopter by Air Methods maintenance personnel. The HSN technician inspected his own work, and as an HSN technician working away from its fixed location he had the authority to inspect his own work. The Air Methods mechanics stated that they did not specifically inspect the HSN technician’s work, however, they did inspect the engine after it was installed into the helicopter. Title 14 Code of Federal Regulations Part 135 does not require an independent inspection of maintenance.

In interviews with the Air Methods mechanics and HSN technician, they all reported feeling a sense of pressure to complete the maintenance and return the helicopters to service.

The Marana duty pilot performed a ground run of the helicopter, and after the ground run, the engine’s hydromechanical unit (HMU) was found to be leaking. The next day, July 27, the HMU leak was resolved and the pilot again performed a ground run. The pilot received permission from the Area Aviation Manager to put the base out of service while he performed the post maintenance check flight. Air Methods “AVL Hub Interface” system recorded that the maintenance test flight occurred on July 27, from 1743 to 1750 hours. According to the pilot the following flight checks were performed: droop check, rate of climb check, cruise power check, flight limit indicator check, flame out check, and autorotation. The pilot stated that the entire post maintenance check flight took 7.5 minutes. No records of the test flight results were retained.

The AS 350 B3 Flight Manual, Section 8.3.2, contains a matrix that illustrates what post maintenance checks need to be performed for various maintenance action or components replaced. For maintenance on an engine, FADEC, or module the following checks are to be performed after the ground run: hover flight, maximum continuous power climb, maximum take off power check, and maximum continuous power level flight. According to the American Eurocopter Chief Pilot, these checks usually take between 30 and 45 minutes to complete.

The Marana duty pilot stated that he had not received any training specific to post maintenance check flights and that any Air Methods pilot qualified in model can perform a maintenance check flight.

Helicopter Maintenance Records Review

The Maintenance Group Chairman reviewed the maintenance records for the helicopter. Immediately following the accident, Air Methods supplied electronic copies of the records. On August 12, 2010, an NTSB air safety investigator from the Denver Regional Office retrieved the hard copy records from the Air Methods facility. The Maintenance Group Chairman reviewed the records at the Denver Regional Office on August 24, 2010.

The helicopter began operating in the Air Methods fleet in December 2009. The last inspection was a 20-hour inspection that was completed on July 27, 2010, at a total time of 352 hours.

Review of the airworthiness directives (ADs) did not reveal any ADs that were not in compliance. Review of the maintenance records showed that on June 21, 2010, the engine cycles had exceeded the inspection requirements outlined in Airworthiness Directive 2009-09-03. The airworthiness directive was due at 600 hours or 500 cycles, whichever occurred first. At the time of the inspection, the engine had accrued 308.34 hours and 515.28 cycles. The company identified the oversight and complied with the airworthiness directive.

Review of the Air Methods maintenance records showed that on July 22, 2010, at 351.06 hours, the Air Methods "Aircraft Record of Maintenance" form noted "Aircraft won't crank," Air Methods Record of Maintenance Log Leaf #595941.

On July 23, at 352 hours, the engine was removed for repair due to "fuel coking."

On July 24, the form noted "Removed and replaced injection manifold referencing Arriel2 MTI [Maintenance Technical Instruction] No. X292M13032, update No. 4, January 30, 2008. Assembled referencing Arriel 2B1MM [Maintenance Manual] X292N54502, Revision No. 19, March 30, 2009. Work performed under WO [Work Order]#M517@FAA CRW KBMR477F, Helicopter Services of Nevada."

The work order and Turbomeca Technical Maintenance Report records completed by the Helicopter Services of Nevada technician were intermixed. According to HSN WO M-517, the cover page indicated the work order was pertinent to engine SN 46268; however, subsequent pages were applicable to engine SN 23366 and SN46268. Review of Helicopter Services of Nevada work order M-517 showed the following entries, all dated July 26:

"Disassembled engine 23366 to access M03 [module 3] S/N 20007. Removed fuel manifold 0292217030 S/N ANR 54450 and installed 0292217030 S/N 1956B references MTI No. X292MI3032."

"Reassembled engine 23366 to accommodate engine. Referencing Arriel 2B1. M.M. X292N54502 revision 19 March 30, 2009. Ground runs, oil pressure, and vibration good."

"HMU [Hydro-Mechanical Unit] is leaking from drain. Customer to replace TU43 seal. "

On HSN Work Order M-518, WO number M-517 was crossed out and M-518 was written in its place. The engine serial number noted on the document was 46268. The corrective action was indicated as follows:

"Disassembled engine 46268 to access MO 3, SN 9853. Removed fuel manifold PN 0292217030 SN ANR 2451 and installed 0292217030 SN 861B. Referencing MTI No. X292M13032 update No. 4, Jan 30, 2008."

On July 26, the Air Methods maintenance records stated "Reinstalled repaired engine SN46268 I/A/W Turbomeca Maintenance Manual, Chap 71 & 72. Ground run check OK. Front oil pressure check at 50 PSI. Rear oil pressure check at 19 PSI. Fuel Temp of 82 degrees, engine vibe check at 6 mms. The drive shaft balance check at .47 IPS." A later entry noted "HMU valve seal leaking."

On July 27, "Removed HMU SN 26003 from aircraft and replaced valve seal. Reinstalled HMU SN 26003 in aircraft I/A/W Turbomeca Arriel 2B1 Maintenance Manual Chap 73, PN 95601706620 valve seal, 1 EA, PN 9794410095 oring4ea, PN 9794710300 -ring, 1EA, PN 9682001605, O-ring 1EA, PN979441032, O-ring 1EA, PN 979441075, O-ring 1EA, PN 9794710200, O-ring 1EA, PN 9794710028 O-ring 1EA." During this maintenance, the mechanic completed AD 2007-10-07, the HMU Coupling Shaft Spline Inspection.

Also on July 27, the Air Methods 20-hour engine inspection was completed and the following entry was noted: "I certify that this aircraft has been inspected I/A/W Air Methods Turbomeca Arriel 2B1 engine 20 hour B61 inspection and was found to be in an airworthy condition at this time. Next compliance due by 372+7, A/C T.T. 372+7 ENG T.T. PWR Ck: 96.2 NG, 795 CT4, 71 TQ, 392 NR, ZP 5780, 24.8 OAT, T4 Margin -40 degrees, TQ Margin 2.5 degrees."

Injection Manifold Replacement

Replacement of the injection manifold is outlined in Turbomeca Maintenance Technical Instruction (MTI) X292M13032Rev4. The MTI instructs the technician to disassemble the engine and remove the injection manifold. It is then inspected. Once it is determined if components will be repaired or replaced, the injection manifold (or replacement) is reinstalled, and the engine reassembled. The full manufacturer's guidance, MTI X292M13032Rev4, is included as an attachment to this report.

In the MTI guidance, it states the following:

Removal of the jet union (Refer to Figure 501) (Detail C)
-Remove the nuts (72-43-00-01-304) (x2).
-Remove the screws (72-43-00-01-302) (x2).
-Remove the jet union (72-43-00-01-300).
-Remove and discard the special seal (72-43-00-01-340).
-Remove and discard the preformed packings (72-43-00-01-330) (x2).
Remove the screw (72-43-00-01-350) and discard the seal (72-43-00).
For reinstallation, it states the following:
Installation of the jet union (Refer to Figure 1006)
-Lubricate and install the preformed packings (72-43-00-01-330) (x2) on the jet union (72-43-00-01 -300).
-Install the special seal (72-43-00-01-340) on the flange of the intermediate casing (72-43-00-02-170).
-Install the jet union assembly (72-43-00-01-300) on the flange of the intermediate casing.
-Attach with the screws (72-43-00-01-302) (x2) and the nuts (72-43-00-01-304) (x2).
-Install the screw (72-43-00-01-350) with its seal (72-43-00-01-360) on the jet union
-(72-43-00-0 1 -300).
-Torque the nuts (72-43-00-01-304) (x2) and the screw (72-43-00-01-350) to 0.24 daN.m.
As installed, the jet union is visible when looking at the exterior of the engine. No torque striping is required.

Turbomeca authorizes reuse of hardware as noted in the maintenance manual.

According to the Eurocopter Maintenance Manual (71.00.03.401, Section 09-31, Page 01.00), when an engine is removed and installed, maintenance personnel need to refer to the flight manual, Section 8, in addition to engine documentation, the maintenance manual, and the standard practices manual. On Page 07.00 of this document, it states to perform a checkout ground run as per the Flight Manual Section 8.

In addition to those items listed in the maintenance manual, post maintenance operational check flights are required. In the Flight Manual, Section 8, it states that in addition to the flight report, VEMD [Vehicle and Engine Multifunction Display] ground run checks, a hover flight, maximum continuous power climb, maximum takeoff power check, and maximum continuous power level flight checks must be performed.

Engine Flame-Out: Audio Warnings, Visual Indications, & Pilot Emergency Procedure.

Section 3 of the AS 350 B3 Flight Manual provides information regarding helicopter emergencies, the warnings or alerts associated with a particular emergency, and the procedures to follow once the emergency has been identified. Continuous tone audio warnings are provided when the rotor (NR) is below 360 rpm (310 Hz tone), and when the maximum takeoff power limitation is exceeded (285 Hz tone). An intermittent tone is heard when NR is above 410 rpm (310 Hz). A gong is generated each time a red warning appears on the warning panel. Vy = 65kts – (1kt/1000 feet)

Section 3.2 contains Engine Flame-Out information. The procedures listed for an engine flame-out in cruise flight are as follows:

1. Collective pitch….. Reduce (to maintain NR in green arc)
2. IAS…………………..Vy
- If relight impossible or after tail rotor failure
3. Twist grip…………. IDLE detent
4. Maneuver the aircraft into the wind on final approach
- At height ˜ 70 ft (21 m)
5. Cyclic …………….. Flare
- At 20/25 ft (6/8 m) and at constant attitude
6. Collective pitch……. GRADUALLY INCREASE (to reduce the rate of descent and forward speed)
7. Cyclic…………… FORWARD (to apply a slightly nose-up landing attitude (<10°)
8. Pedal…………….. ADJUST (to cancel any sideslip tendency)
9. Collective pitch…… INCREASE
- After touch-down
10. Cyclic, collective, pedal ADJSUT (to control ground run)
- Once the aircraft has stopped
11. Collective pitch…… FULL DOWN
12. Rotor brake……… APPLY below 170 rotor rpm

Step 1 of the engine flame-out procedure refers to maintaining the NR (rotor rpm) in the green arc (375-405 rpm). The rotor rpm gauge is a dual gauge representing engine free turbine speed (NF) and rotor rpm (NR) displayed using LED bars along the arc of the gauge. The gauge itself is approximately 2 inches in diameter and, in the accident helicopter, installed in the lowest left portion of the pilot’s instrument panel. According to the airframe manufacturer, this is not a standard location for this instrument in the AS350B3.

The AS 35 B3 Flight Manual states in section 5.10 Glide Distance in Autorotation, that at 65 kts, NR=410 rpm, the glide ratio is 0.54 NM/1000 feet.

Additional information about autorotation performance is addressed in the Operations Group Chairman's Factual Report located in the official docket of this investigation.

WRECKAGE AND IMPACT INFORMATION

Airframe

The helicopter wreckage was upright, on a heading of 055 degrees magnetic, along the east verge of a north-south residential street. The center fuselage structure straddled a 5-foot-tall cement-block wall, with the nose resting on a garden shed. Both the shed and the wall were fragmented by the impact, with fire consuming the shed, its contents, and vegetation within a 15-foot radius of the fuselage. The top of a tree located 5-feet east of the helicopter nose had been severed at the 12-foot level. A 40-foot-tall set of power lines paralleled the street on the opposite verge, about 50-feet west of the main wreckage. No impact marks or damage were observed to the power lines, or any other adjacent tree or structure. Fragments of the fuel tank were found about 30 feet to the southwest, and the odor of jet fuel was present throughout the site.

The left foot pedal of the tail rotor control was found in the forward position, and it was deformed forward and down. The collective control was in the full down position, with the rotary throttle set to 'VOL' (flight position). The cyclic control exhibited buckling deformation to its shaft at the cabin floor, with the control pointing forward and to the right. The flight control linkages located beneath the cabin floor were deformed and impinged against the cross members. The remaining linkages aft of the cabin were consumed by fire through to the flight control servo actuators. The rotor brake and fuel shutoff valve control assemblies sustained thermal damaged, with both controls pointing to the forward position.

The aft 15-foot-long section of the tail boom remained in line with the fuselage, but was separated in the area of the exhaust heat shield. The tail boom junction frame and attachment members were consumed by fire. The horizontal stabilizer remained attached to the tail boom, with the left stabilizer bent upwards about 15 degrees midspan. The lower surfaces of the stabilizer and the tail boom section in the area of the doubler fittings sustained crush damage and dimpled indentations consistent with road surface contact. The upper vertical fin remained attached to the tail cone, which had separated from the tail boom just forward of the fin attachment fittings. The lower fin had separated at its root, and sustained vertical accordion crush damage through its entire length. The tail guard had separated from the fin and was found about 40 feet southwest of the tail. The underside of the guard exhibited dimpled indentations and gouges on its left edge, consistent in shape to contact with the road surface. A corresponding skid-length indentation was noted in the road surface adjacent to the tail cone, on a heading of 045 degrees.

The tail rotor gearbox remained intact and affixed to the tail boom structure. Oil was observed through the gearbox sight window, and rotation of the tail rotor yoke resulted in a corresponding rotation of the tail rotor drive shaft at the tail boom heat shield. Both blades remained firmly affixed at the rotor hub, were largely intact, and their associated pitch change links were noted connected to both the rotating plate, and blade control horns. The tail rotor push-pull tube was continuous from the rotor hub bell crank through to the tail boom heat shield. Forward of the heat shield, the remaining control tube and drive shaft were fire consumed through to the area of the steel forward drive shaft. The cylinder casing and control lines of the yaw pedal servo actuator were fire consumed; the associated servo rod end and input control bolts remained in place.

The main rotor blades had sustained varying degrees of fire damage and could not be identified by color. All three blade leading edges remained relatively intact, with the blades still connected through their full length to the hub blade attach pin. The Starflex hub, elastomer blocks, swash plate, and sleeves were partially consumed by fire, and located within the immediate vicinity the rotor mast assembly.

Engine

The engine and its associated gearbox remained attached and were located within the primary fuselage structure. The engine remained in-line with the fuselage, and had had come to rest on its left side.

External examination of the engine at the accident site revealed that the fuel inlet union, located on the lower right-hand side of the engine, was detached from the boss on the compressor case. The fuel supply line remained attached to the union and to the hydro-mechanical unit (HMU) via the adjusted valve. The intermediate gasket was located in the fuselage debris, directly below the union. The remaining wreckage and ground area were extensively examined utilizing a series of magnets and sifting grates, but did not reveal the presence of the two five-point bolts and self locking nuts for mounting the union to the compressor case flange.

There was no evidence found of any pre-existing failures of the helicopter airframe.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot on July 30, 2010, by the Tucson Police Department, Pima County, Arizona. The opinion of the Forensic Pathologist was that the cause of death was ascribed to multiple blunt force and thermal injuries.

Forensic toxicology was performed on specimens obtained during the autopsy of the pilot by the FAA Bioaeronautical Science Research Lab, CAMI, Oklahoma City, Oklahoma. The toxicology report stated no carbon monoxide detected in blood, no cyanide detected in blood, no ethanol detected in vitreous, and atropine was detected in blood and liver.

TESTS AND RESEARCH

Arriel 2B1Fuel Injection System

Fuel is delivered directly into the combustion chamber through use of a radial fuel supply, centrifugal fuel injection system. The injector assembly consists of a stationary distributor (manifold) and a rotating injection wheel located within the combustion chamber. The manifold contains a series of holes, which deliver fuel to the wheel. Holes within the injection wheel, which is mounted between the compressor and turbine shaft, act as fuel spraying jets. Pressure integrity between the wheel and the manifold is achieved by labyrinth seals, with rotation of the injection wheel resulting in the extraction of fuel through centrifugal force.

An internal supply line provides fuel to the manifold. The supply line routes from the manifold and along the outer combustor casing, where it protrudes through a boss on the compressor case. The exposed line protrudes in the form of a nipple through a flange on the case boss. An engine fuel inlet union, consisting of a mounting flange and seal, provide the interface between the internal fuel line nipple, and external fuel supply lines. The union is affixed to the compressor case flange with two five-point bolts (P/N: 72-43-00-01-304) and two self locking nuts (P/N: 72-43-00-01-302). Vacuum seal is provided by the use of a metallic intermediate gasket at the flange, and fuel seal is provided by two o-ring seals on the internal fuel supply line nipple. A leak test plug is provided in the body of the union to test the seal integrity of the interface. The union is connected to the external fuel supply line through a B-Nut fitting.

Fuel Inlet Union Tests
A group of engine test runs were performed on an exemplar Arriel 2B1 engine at the Turbomeca facility in Bordes, France. The tests were conducted under the supervision of investigators from the Bureau d'Enquêtes et d'Analyses (BEA). The purpose of the tests was to assess the engine's operating abilities with the fuel inlet union incorrectly affixed to the engine case flange.

The series of engine runs was performed in a test cell with the fuel inlet supply line union partially attached to the compressor case flange in the following configurations:

-Union inserted over inlet fuel nipple with no attachment nuts and bolts installed.
-Union partially inserted over inlet fuel nipple to first o-ring seal, with no attachment nuts and bolts installed.
-Union inserted, with attachment nuts and bolts installed, and hand-tightened only.
-Union inserted over inlet fuel nipple, utilizing only one attachment nut and bolt, tightened by hand.

The tests were performed at varying engine power levels, simulating startup and flight modes. The data revealed that with the union installed without its associated mounting nuts and bolts, it was possible to start and run the engine with no observable fuel leak. During the test with the union nuts and bolt tightened by hand, the engine ran for 3 minutes and 32 seconds before the nuts began to unscrew from the bolts.

The tests further revealed that with both nuts and bolts removed, the union would ultimately eject from the boss and nipple, resulting in an expulsion of about 0.5 liters of fuel, followed by a subsequent engine shutdown.

The group examined comparative dimensions for new and used union nuts and bolts. The results revealed that when tightened by hand, a new bolt would engage about two threads into the nut before friction was felt, resulting in an exposed bolt shank length of about 17 millimeters. By comparison, a used nut and bolt were similarly tightened, resulting in an exposed bolt shank length of about 13.5 millimeters. The threaded end of the used bolt was also observed to extend beyond the end of the nut by about half a thread. Comparative dimensions taken from an exemplar engine installation revealed that with the nuts and bolts installed and tightened to the specified torque on the union flange, approximately 1.5 threads were exposed beyond the nut, resulting in a bolt shank length of about 13 millimeters.

ORGANIZATIONAL AND MANAGEMENT INFORMATION

Helicopter Services of Nevada (HSN) and FAA oversight of HSN

Helicopter Services of Nevada LLC was designated by the FAA as a domestic repair station under Title 14 CFR 145.53, repair station certificate number KBMR477F. In the limitations sections of the operations specifications, it stated that Helicopter Services of Nevada was authorized to "Perform levels 1, 2, and 3 maintenance functions in accordance with the manufacturer's maintenance program and maintenance instructions. To include removal and installation of power plant, rigging of fuel control unit and power turbine generators."

According to the FAA approved operations specifications effective at the time of the accident, in section A004. Summary of Special Authorizations and Limitations, it stated the following:

The certificate holder is not authorized and shall not:

Perform work, including continuous operations, at additional locations other than at a primary fixed location.

Perform work, excluding continuous operations, at additional locations other than at a primary fixed location.

On November 4, 2010, the operations specifications were changed and stated the following:

The certificate holder, in accordance with the reference paragraphs, is authorized to:

Perform work, excluding continuous operations, at additional locations other than at its primary Fixed Location.

According to FAA Order 8900.1, when providing surveillance of a 14 CFR part 145 repair station that performs aircraft maintenance away from its fixed location, the following circumstances apply:

Special Circumstances. When a special circumstance arises that allows work to be done away from the repair station on a temporary basis.

1) Temporary Basis—Short Term. When a special circumstance arises such as a blown tire, radio, or navigation equipment changes, etc.

2) Temporary Basis—Extended. When the repair or alteration requires the repair station to make repairs or alterations over an extended period, e.g., the aircraft is in for extended maintenance and an interior shop is requested to install a new interior at that location.

3) Recurring Basis. When it is necessary to perform such work on a recurring basis with operations specification (OpSpec) D100 authority.

The order notes, "The circumstances in subparagraphs A1) and A2) require the repair station to submit a request to the principal inspector (PI) for evaluation on a case by case basis, except for emergency short term work when the repair station has a procedure in its manual. In this case, the repair station only needs to notify the PI in accordance with the procedure."

The PMI reported that in 2008 he removed Helicopter Services of Nevada's authorization to perform work away from their permanent station on a continuous basis. He indicated that he also verbally requested that the Repair Station Manual be updated to reflect this change. However, the manual was not changed and the PMI did not follow up on the request, nor did he log it in an FAA tracking system. The PMI indicated that Helicopter Services of Nevada was authorized to perform maintenance on a temporary basis at additional locations, but was not authorized to perform maintenance at outside locations on a recurring basis. The PMI indicated that a recurring basis would be defined as performing the same maintenance at the same location for the same company three or more times per month. He was uncertain if Helicopter Services of Nevada exceeded this limit.

Review of Air Methods work orders from July 2009 to July 2010 for work performed by Helicopter Services of Nevada showed that 26 work orders had been created. Of those, 19 were performed at Air Methods' facilities, 2 were performed at Helicopter Services of Nevada facilities, and 5 locations were unknown.

According to the owner of Helicopter Services of Nevada, the removal of the authorization to

“Perform work, excluding continuous operations, at additional locations other than at its primary Fixed Location” was a clerical error by the FAA. Additionally, the owner did not identify the change when signing page A004 of the Helicopter Services of Nevada operations specifications.

Helicopter Services of Nevada was designated as a Turbomeca Service Center. As a Service Center, they provided levels 1, 2, and 3, maintenance service, parts, and tools. The Turbomeca Service Center technicians complete a Turbomeca-designed checklist and engine build form when performing field maintenance. Turbomeca does not require its outside service centers to document their work with the forms, and they are allowed to develop their own forms to document the work. The Turbomeca forms are included as an attachment to this report. Helicopter Services of Nevada developed their own work order forms and checklists that were completed when work items were accomplished.

In interviews with the HSN mechanic, he reported that when an in-house inspection is performed, FAA 8130-3 form, the work order package form, as well as a final inspection are completed. He reported that when mechanics are working in the field, they do not complete an 8130-3 form, and do not do the thorough inspections and paperwork that occurs when engines come into the repair station due to the specific nature of the field work items requested.

Air Methods Operations

Air Methods is a commercial on-demand air taxi operator specializing in helicopter emergency medical services (HEMS). The company was established in 1980 in Colorado, and currently operates in 45 states. Air Methods received its Title 14 Code of Federal Regulations (CFR) Part 135 Operating Certificate, number QMLA253U, on March 1, 1992. Air Methods acquired LifeNet as part of its acquisition of Rocky Mountain Holdings, in 2002.

In accordance with 14 CFR Part 135.21, Air Methods kept current a General Operating Manual (GOM), which identified management policies and responsibilities, training/currency policies, and the procedures under which flights are to be conducted. The latest revision of the GOM was revision 4, dated November 11, 2009.

Section BA-8 of the GOM establishes the minimum cruising altitude employed by Air Methods flight crews, “At all times, with the exception of takeoff and landing, Air Methods’ pilots will operate at an altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface. While en route, Air Methods’ helicopter pilots will maintain at least the following minimum altitudes: DAY: 300 feet AGL, NIGHT: 500 feet AGL. In all cases, aircraft will not be operated so as to pose a danger to persons or property on the surface.” Additionally, a letter of agreement (LOA) between Tucson Airport Traffic Control Tower, Tucson Terminal Radar Approach Control, and LifeNet stipulated that LifeNet helicopters could request a published helicopter route through the Tucson Class C airspace and would operate at 3,200 feet msl (500 feet agl) or below unless otherwise coordinated.

Air Methods Pilot Training

Chapter 3 of the Air Methods Pilot Training Program addresses the Recurrent Training Curriculum. The curriculum consists of 4 hours of ground training each for IFR and VFR operations, and recommends a minimum of 4 hours of flight training for IFR and 2 hours for VFR operations. However, an instructor can recommend a flight test before the completion of the recommended hours. The flight training is broken down into 4 modules. Each module addresses various normal, instrument, emergency procedures, and the fourth module addresses night operations. Autorotations are practiced in module 2, and hovering autorotations are practiced in module 3. Each module appears to be organized around 1 hour of flight time.

Annex 1, Flight Training Maneuvers, AS350, of the Air Methods Pilot Training Program delineates in detail all flight terms, definitions, and maneuver procedures for the Eurocopter AS350 helicopter. Section 1-33 and 1-34 describe the procedures to practice simulated engine failure resulting in straight-in and turning autorotations. All practice autorotations are to conclude with a power recovery terminating in a 3- to 5-foot hover.

Two of the operator’s check airmen stated that typically a Flight Proficiency Check (FAR 293 check) is preceded by a training flight. The training flight usually consists of standard commercial maneuvers, normal, shallow, and steep approaches, sloped landings, engine failures, hydraulics off flight, basic instruments, and an instrument approach. Three to five practice autorotations are performed towards the end of the training flight and terminate in a 3- to 5-foot hover power recovery. If a pilot is not performing up to standards they have the authority to provide extra training. Additionally, if a pilot feels they need extra training they can request additional training, which is coordinated through the appropriate chain of command and approved by the Chief Pilot or Aviation Training Manager. This policy is set forth in section B-6 of the Air Methods Operations Manual. Even though this policy is in effect, one of the check airmen interviewed said that it is very rare that pilots request additional training. He could only recall one instance and the training in question was IMC instrument recovery practice. Both check airmen stated that each pilot is provided two training flights a year; one just before the FAR 293 check flight and another approximately 6 months (semi-annual training) between check flights. One of the other pilots at the Douglas base stated that he had not received his semi-annual training flight this year (Air Methods training policy changed in February 2010, eliminating the semi-annual training policy).

One of the check airmen interviewed stated that Air Methods has two dedicated training helicopters that are moved from base to base and used to conduct training and check flights. A training flight usually lasts 1 -1.5 hours, and a check flight is usually 1 hour. About half the time a dedicated training helicopter is not available and the base has to reconfigure their helicopter to conduct training and check flights. Helicopter reconfiguration involves removing the patient litter, installing the copilot's seat and the second set of flight controls. The entire reconfiguration maintenance action takes about 4 hours to complete, and then another 4 hours to return the helicopter to mission configuration.

Federal Aviation Administration Information/Oversight

Oversight of Air Methods Corporation (QMLA) FAR Part 135 operating certificate is accomplished primarily by a certificate management team (CMT) based at the Denver Flight Standards District Office in Denver, Colorado. The current staffing is 27 CMT members as follows: There is one assigned Principal Operations inspector, one Principal Maintenance inspector, and one Principal Avionics inspector who are assisted by 8 operations inspectors, 7 maintenance inspectors, and 3 avionics inspectors. (There is also an additional Principal Maintenance Inspector and Principal Avionics Inspector assigned to provide oversight of the company's FAR Part 145 repair stations.) The CMT is comprised of an Operations and an Airworthiness unit. Each unit has an assigned operations and airworthiness supervisor respectively. Each unit receives administrative support by 1 each assigned administrative assistant. A complete review of FAA oversight is contained in the Operations Group Chairman's Factual Report located in the official docket of this investigation.

Pilot Information

Certificate:	Commercial	**Age:**	61,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
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:**	January 5, 2010
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 14, 2009
Flight Time:	14262 hours (Total, all aircraft), 1800 hours (Total, this make and model), 35 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	AMERICAN EUROCOPTER LLC	**Registration:**	N509AM
Model/Series:	AS 350 B3	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	4698
Landing Gear Type:	Skid	**Seats:**	4
Date/Type of Last Inspection:	July 27, 2010 AAIP	**Certified Max Gross Wt.:**	5225 lbs
Time Since Last Inspection:	1 Hrs	**Engines:**	1
Airframe Total Time:	352 Hrs as of last inspection	**Engine Manufacturer:**	
ELT:	C126 installed, not activated	**Engine Model/Series:**	
Registered Owner:	WELLS FARGO BANK NORTHWEST NA TRUSTEE	**Rated Power:**	
Operator:	Air Methods	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	LifeNet	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KTUS,2643 ft msl	**Distance from Accident Site:**	9 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	34°C / 17°C
Precipitation and Obscuration:			
Departure Point:	Marana, AZ (KAVQ)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Douglas, AZ (KDGL)	**Type of Clearance:**	VFR
Departure Time:	13:34 Local	**Type of Airspace:**	

Airport Information

Airport:	Marana Regional Airport KAVQ	**Runway Surface Type:**	
Airport Elevation:	2031 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	3 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	32.256111,-110.956665

Administrative Information

Investigator In Charge (IIC):	McKenny, Van
Additional Participating Persons:	Frank J Loscalzo; Federal Aviation Administration; Scottsdale, AZ Bob Hendrickson; Federal Aviation Administration; Washington, DC Scott Tyrrell; Federal Aviation Administration; Forth Worth, TX Archie Whitten; Turbomeca USA; Grand Prairie, TX Bryan Larimore; Turbomeca USA; Grand Prairie, TX Joe Syslo; American Eurocopter; Grand Prairie, TX Bruce Webb; American Eurocopter; Grand Prairie, TX Don Lambert; Air Methods; Englewood, CO Dennis McCall; Air Methods; Englewood, CO Michael W Koenes; Air Methods; Englewood, CO Larry Grandy; Aviation Accident Consultants; Carlsbad, CA David Lokk; Helicopter Services Nevada; Boulder City, NV
Original Publish Date:	May 3, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=76783