NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Gardena, CA 90248

June 24, 2011

GROUP CHAIRMAN'S FACTUAL REPORT

OPERATIONS GROUP

WPR10FA371

- *Contains Five Imbedded Photos* -

A. ACCIDENT

Accident Number: WPR10FA371
Operator: Air Methods Corporation DBA LifeNet
Location: Tucson, AZ
Date: July 28, 2010
Time: 1342 mst
Airplane: Eurocopter AS350 B3, N509AM

B. OPERATIONS GROUP

Chairman: Van McKenny
Group Chairman
National Transportation Safety Board
Gardena, CA 90248

Member: Dennis McCall
Air Methods Corporation
Englewood, CO 80112

Member: Bob Hendrickson
Federal Aviation Administration
Washington, DC 20591

Member: Larry Grandy
OPEIU Local 109
Carlsbad, CA 92010

Member: Bruce Webb
American Eurocopter
Grand Prairie, TX 75052

C. SUMMARY

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 crewmembers were killed. 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 Marana Regional Airport, Tucson, at 1332, and the intended destination was Douglas, Arizona.

Witnesses reported observing the helicopter flying steadily in a southeast direction when it started to descend rapidly and enter a left-hand turn. Witnesses also stated that the helicopter made some unusual 'whump, whump' sounds, and rapid intermittent popping sounds, which was 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 six foot high concrete wall and was consumed by a post impact fire.

Radar data indicated that, prior to entering the rapid descent, the helicopter was on a steady southeast course, at 131 knots ground speed, and 900 feet above ground level (agl). The last 10 seconds of radar data indicated that the helicopter descended 700 feet. The last radar return was at 1341:33, approximately 50 feet agl, and 320 feet from the accident site. The pilot did not transmit a radio distress call.

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

D. DETAILS OF THE INVESTIGATION

The Operations Group was formed during the on-scene phase of the investigation on July 30, 2010. At this time, the Maintenance Records Group and Airworthiness Groups were also formed. Interviews were conducted by members of the Operations Group with the LifeNet station pilot at Marana, LifeNet A&P mechanic, first responders, and Air Methods Aviation Compliance Manager.

Between August 3, 2010, and August 30, 2010, the Operations Group Chairman conducted additional telephone interviews with LifeNet aircrew based at the Douglas, Arizona, base. During this time the Air Methods General Operating Manual, Training Manual, AS 350 B3 pilot operating handbook, helicopter weight and balance, helicopter performance information, and the pilot's FAA medical and airman records were examined.

Personnel interviewed were:

1. Mr. Clarence W. Dickerson, A&P mechanic, LifeNet
2. Mr. Dennis McCall, Aviation Compliance Manager, Air Methods
3. Mr. Gage Camp, pilot, LifeNet
4. Mr. Jerry Fijalka, Area Aviation Manager, Air Methods
5. Ms. Nina Hughes, Flight Medic, LifeNet
6. Mr. Patrick Hughes, Pilot, LifeNet
7. Mr. Chris Steeb, Company Check Airman, Air Methods
8. Mr. Robert Wasik, Pilot, LifeNet
9. Ms. Debbie Waters, Flight Paramedic, LifeNet
10. Ms. Lilly Pesqueria, Paramedic, Tucson Fire Dept
11. Mr. Adam Bower, Paramedic, Tucson Fire Dept
12. Mr. Gary Young, Paramedic, Tucson Fire Dept
13. Mr. Larry Delfs, Paramedic, Tucson Fire Dept
14. Mr. Mike Garcia, Captian, Tucson Fire Dept
15. Ms. Susan Berg, Witness
16. Mr Octavio DeMenca, Witness
17. Mr. David Dennis, Witness
18. Mr. Richard Carrasco, Witness

19. Mr. Larry Duncan, Witness
20. Mr. Steve Giffney, Witness
21. Mr. Dale Gray, Witness
22. Mr. Jason Orlandos, Witness
23. Mrs. Vera Kelley, Wife of the pilot
24. Mr. Joseph Milora, Friend of the pilot
25. Bob Juate, Tucson Aeroservice Center

The following written statements were reviewed:

1. Ms Erin Byers, Communications Specialist, Air Methods
2. Mr. Mike Derry, Communications Specialist, Air Methods
3. Ronnie Montgomery, Communications Specialist, Air Methods

1. Company History & 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. Air Methods is the largest provider of air medical emergency transport services throughout the United States, and provides air medical emergency transport services under two separate operating models; the Community-Based Model and the Hospital Based Model. They operate 305 helicopters and 13 airplanes out of 239 bases. In 2009, Air Methods flew a total of 139,196 flight hours, and conducted 99,249 transports. The company has experienced steady expansion and acquired the following helicopter emergency medical service (HEMS) operations over the last 13 years; Mercy Air Service (1997), ARCH (2000), Rocky Mountain Holdings (2002), CJ Systems (2007), and Omniflight North Georgia/Atlanta (2009). An organizational chart of the company in shown in Figure 1.

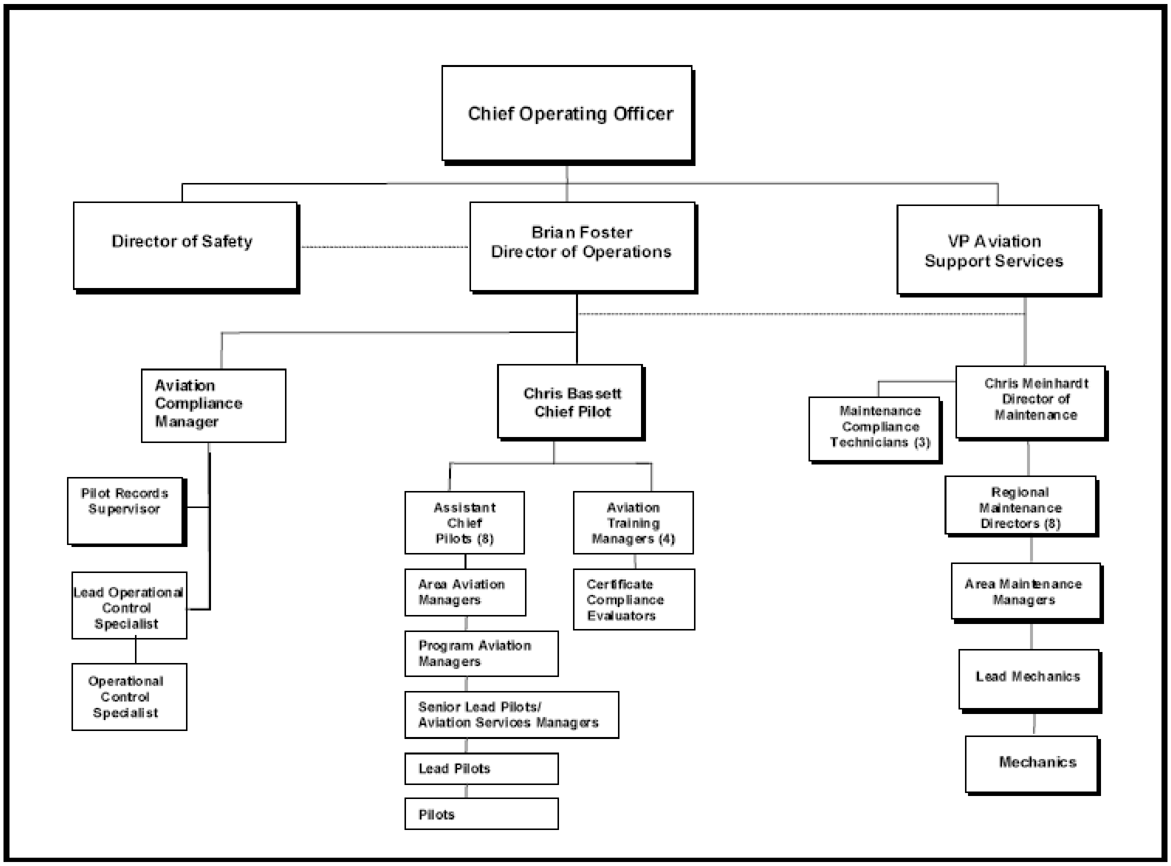

Fig 1 - Air Methods organizational chart.

Air Methods operates in accordance with FAA approved Operations Specifications (Ops Spec) for Title 14 CFR Part 135 under certificate number QMLA253U. The latest Ops Spec revision was dated July 12, 2010. Contained in the Ops Spec was authorization to conduct on-demand operations, single engine instrument flight rules (IFR) passenger-carrying operations, use of an autopilot in lieu of a second-in-command, and night vision goggle operations.

1.1 General Operating Manual (GOM)

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.

1.2 Accident Helicopter's Area of Operations

The accident helicopter and crew operated in the Southern Arizona Air Methods Operating Area, which includes Arizona bases at Douglas, Wilcox, Safford, Sierra Vista, Marana, and Florence, and Nevada bases at Henderson, Pahrump, and Mesquite, with 11 EMS equipped helicopters. The Southern Arizona Area operates using the Community-Based Model, where Emergency Medical System (EMS) helicopters and their crews are provided flight requests through a central communications center (LifeCom) in Omaha, Nebraska. LifeCom receives the request for services from the local/state run area dispatch system (medical emergency dispatch service (MEDS) in Arizona), they notify the pilot of the services request, enter the flight plan, receive the aircraft's 'off call', and provide flight following. When LifeCom enters the flight plan into the system, the Air Methods Operational Control Center (OCC) in Englewood, Colorado, is notified. The OCC performs flight monitoring and ongoing risk assessment, and a computer system monitors the aircraft position. The OCC can issue a weather warning if the aircraft is within 30 nm of potentially serious weather conditions. A communications system referred to as Skyconnect provides satellite communication via satellite phones that are built into the aircraft's communications suite.

1.3 Area Aviation Manager

The Area Aviation Manager reports directly to the Assistant Chief Pilot and is responsible for a wide range of activities at the bases in the operating area, including monitoring crew scheduling, pilot training and currency, compliance with Federal Aviation Regulations (FAR's) and safety issues, and oversight of the daily operational activities of the aviation staff. The Area Aviation Manager for Southern Arizona has held this position for 6 years. He holds an Airline Transport Pilot (ATP) certificate for rotorcraft-helicopters, flight instructor certificate (rotorcraft-helicopter), has approximately 7,000 hours of total flight time, 2,000 hours in the AS350, and is a company check airman.

According to the Area Aviation Manager, the typical request for services comes from the Air Methods Communications center in Omaha (Life Com). Life Com receives the request from the requesting agency, which in Arizona is MEDS (dispatch). Life Com then contacts the closest HEMS base for tasking. MEDS will request services from only one source, if that source declines the request, then it will move to another source. There are no simultaneous requests sent out to competing HEMS organizations. Life Com contacts the closest base, and the pilot has the authority to accept or decline the request. There are no penalties associated with declining a flight request or of the base being out of service. Air Methods actively encourages pilots to turn down flight requests if the flight cannot be done safely.

The Base Lead Pilot reports directly to the Area Aviation Manager and is responsible for supervising the base line pilots in the performance of their duties, monitoring pilot currency requirements, correcting safety issues, and base pilot scheduling. The Base Lead Pilot for the Douglas base was hired by LifeNet in February 2004, and oversaw the three other base pilots. He holds an ATP certificate (fixed wing) and commercial certificate (rotorcraft-helicopter), has about 6,000 hours of total flight time, and 800 hours in the AS350.

1.4 Pilot Scheduling

The pilots belong to a pilot's union and scheduling is dictated by the collective bargaining agreement (CBA). The CBA states that the pilots at each base determine the appropriate schedules of service consistent with company and customer service requirements, and maintain schedules of service, which provide 1 day off for each day scheduled. The Douglas base pilots were scheduled in a 7 days on, 7 days off, duty cycle. Each 7-day duty period consisted of 4 day shifts and 3 night shifts, or vice versa, to balance the total time between day and night shifts. The typical day shift was from 0700 to 1900, and the typical night shift was from 1900 to 0700. Most pilots arrive about 20 minutes prior to the scheduled turnover time. The Douglas base had a double wide trailer home with private rooms where the aircrews can rest, relax, or spend their off duty hours.

1.5 Operational Risk Assessment Program

Air Methods has developed and implemented an operational risk assessment program to assist pilots in identifying, assessing, managing risks, and provides mitigation guidance. The risk assessment matrix is utilized for each flight assignment, and is recorded in the daily flight log. The matrix breaks down the categories of risk as green (A-normal operation), blue (B-caution), yellow (C-extreme caution), and orange (D-critical decision to be made). The pilot uses weather criteria and cross references with aircraft status, environment specifics, and fatigue, for both day and night operations. Lifecom Communications center in Omaha tape recorded the accident pilot reporting a risk assessment value of “B” for the accident flight. According to Air Methods, a risk assessment value of “B” is common in southern Arizona due to the proximity of mountainous terrain.

1.6 Air Methods Operational Control Center

Air Methods has a central Operational Control Center (OCC) located in Englewood, Colorado, to assist with operational supervision and control. The OCC is primarily responsible for the flight monitoring while providing advisory/alert information affecting Air Methods aircraft. Advisories/alerts may include, but are not limited to, flying in the vicinity of marginal or deteriorating weather conditions, temporary flight restrictions (TFR), ground proximity, or any other significant possibility that could become a hazard to flight. All alerts are communicated to the pilot or the appropriate communications center responsible for flight following. The OCC communicates to Air Methods aircraft through a cell phone communications panel (Skyconnect) that is built into the aircrafts' instrument panel The OCC is also responsible for initiating and managing Air Methods post accident/incident response plan.

2. Accident/Incident History

A review of NTSB records for accidents associated with the operator found documentation of 27 previous occurrences since 1989 involving Air Methods aircraft.

Date	Aircraft	Location	Accident Type[1]
2-Nov-89	Bell 206L-3	St Paul, MN	Operational- fuel exhaustion
1 Jul 91	Bell 412	Grand Junction, CO	Mechanical- drive shaft failure
02-Sep-92	Bell 206L3	Bayfield, CO	Operational- high density alt
22-Apr-94	Bell 412/SP	Winston, NC	Operational- weather related
14-Dec-97	Bell 407	Littleton, CO	Operational- wire strike
11-Jan-98	Bell 222UT	Sandy, UT	Operational- weather related
15-May-99	Bell 222UT	Rockton, IL	Operational- hard landing
14-Apr-00	Bell 222U	St Paul, MN	Mechanical- control sys failure
28-Jul-00	Bell 222-U	St Paul, MN	Operational- collision with object
29-Dec-01	Pilatus PC-12	Sunriver, OR	Operational- loss of control
31-Aug-02	Sikorsky S76A+	Miami, FL	Operational- collision with object
08-Apr-04	Eurocopter EC 130 B4	Watkins, CO	Operational- weather related
23-May-04	Bell 412	San Antonio, TX	Operational- collision with object
09-Aug-04	Eurocopter EC-130 B4	Englewood, CO	Mechanical- transmission cowling
02-Nov-04	Eurocopter AS 350 B3	Sierra Vista, AZ	Mechanical- fuel control system
05-Jan-05	Eurocopter AS350-D	Falkner, MS	Operational- weather related
10-Aug-06	Bell 206L-3	Salt Lake City, UT	Operational- collision with object
10-Dec-06	Bell 412SP	Hesperia, CA	Operational- weather related
15-Oct-07	Bell 407	St Cloud, MN	Operational- weather related
10-May-08	Eurocopter EC 135 T2+	La Crosse, WI	Operational- collision with object
30-May-08	Eurocopter EC135 P2+	Pottsville, PA	Operational- procedural
29-Jun-08	Bell 407	Flagstaff, AZ	Operational- mid air collision
15-Jun-09	Beech B100	Rapid City, SD	Operational- weather related
24-Jun-09	Eurocopter AS 350 B2	Morgantown, WV	Operational- hard landing
24-Sep-09	Eurocopter AS 350 B3	Tucson, AZ	Operational- hard landing
22-Oct-09	Eurocopter AS 350 B3	Marana, AZ	Operational- hard landing
17-Jan-10	Eurocopter AS350 B3	Tucson, AZ	Mechanical- drive coupling failure

Five accidents were identified as having maintenance or mechanical causes.

1. On July 1, 1991, in cruise flight, the engine to transmission drive shaft forward coupling of a Bell 412 overheated and failed. The pilot executed an autorotation. During the landing flare, the pilot did not maintain adequate rotor rpm and the helicopter landed hard. Company maintenance personnel dispatched the helicopter with a known drive shaft coupling grease leak, which they had

[1] Accident Type referrers to the Safety Board's assigned Probable Cause. Operational type accidents are those that were a result of operation of the aircraft by the pilot/crew and the associated decision making. Mechanical type accidents are those that involve maintenance error or mechanical failure.

attempted to stop by using an unapproved silicon sealant. The Safety Board determined the probable cause of the accident was the pilot's failure to maintain adequate main rotor rpm to touchdown. Contributing to the accident was the disconnected engine to transmission drive shaft and the inadequate inspection by company maintenance personnel.[2]

2. On April 14, 2000, while in cruise flight, the pilot lost control of a Bell 222U helicopter and an uncontrolled forced landing was made onto the top of a two-story industrial warehouse. The pylon mounted actuator support assembly had separated from the transmission case. The support assembly, attachment hardware, and portions of the transmission case were sent to the NTSB Materials Laboratory for analysis. According to the NTSB Materials Laboratory Factual Report, "... all of the studs showed progressive fatigue cracking from multiple origins. The Safety Board determined that the probable cause was the loss of clamp-up force between the transmission case and the pylon mounted actuator support assembly, which resulted in fatigue failure of the threaded studs and dowel pins, the failure of the flight control system, helicopter control not being possible after the flight control failure, and the inadequate maintenance procedures by the company maintenance personnel.[3]

3. On August 9, 2004, a Eurocopter EC-130 B4 had just undergone maintenance and was preparing for a second test flight. A thorough preflight had been conducted for the first test flight. While preparing for the second flight, another maintenance technician opened the transmission cowling. The pilot and two avionics technicians boarded the helicopter from the left side, without performing an additional preflight or walk around. The pilot performed a run-up and lifted the helicopter to a hover when an individual on the ground noticed that the cowling was open. The lead mechanic then signaled to the pilot for him to land. As the helicopter set back down, the transmission cowling detached and impacted a main rotor blade and the tail boom. The Safety Board determined that the probable cause was the pilot's failure to perform a preflight inspection.[4]

4. On November 2, 2004, a Eurocopter AS 350 B3 experienced a partial loss of power during the transition from an out of ground effect hover to forward flight, and collided with the ground in a parking lot. About 10 seconds after the transition to forward flight, at 35 knots and between 150 to 200 feet above ground level, the pilot sensed the engine turbine start to spool down towards idle. He saw a red 'GOV' light illuminated on the instrument panel. The pilot did not disengage the flight notch on the collective twist grip to manually control the fuel flow to the engine and proceeded to fly the helicopter about 1/8 mile towards the parking lot, working the collective to try to keep the helicopter above the trees and the roofs of the houses. The helicopter landed hard, collapsing the landing skids, and the ship slid about 100 feet. After the helicopter came to rest, the main rotor was still rotating at a slower rpm, and the engine was operating at what seemed like a low idle speed. The Safety Board determined that the probable

[2] NTSB accident identification number: DEN91LA095
[3] NTSB accident identification number: CHI00FA111
[4] NTSB accident identification number: DEN04CA122

cause was an inconsistency between the engines' two N2 sensor signals that caused the fuel control to enter a fixed mode, which limited the power available.[5]

5. On January 17, 2010, the pilot of a Eurocopter AS 350 B3 reported that he lifted the helicopter from the helicopter pad for a flight to pick up a patient. The pilot positioned the helicopter into a 25-foot hover, and just as he was beginning the transition to forward flight, he heard a loud bang, and the helicopter experienced a partial power loss. The pilot lowered the collective slightly and landed hard on the helicopter pad. The post accident airframe examination revealed that the nuts to the bolts that attach the engine-to-main gear box flex coupling were not present on the bolts. An examination of the bolts and flex coupling by the Safety Board Materials Laboratory concluded that the nuts most likely had been hand tightened and that cotter pins had not been installed on the bolts. The Safety Board determined that the probable cause was the improper installation of the engine-to-main gear box flex coupling, which resulted in the failure of the flex coupling and a loss of power to the rotor system during takeoff. Contributing to the accident was the mechanic, who removed the engine's flex coupling, failure to follow the operator's maintenance procedures. Also contributing was the Quality Assurance inspector's failure to follow the operator's post-maintenance inspection requirements.[6]

Two accidents were identified as having operational factors involving the pilot's manipulation of the controls.

1. The cause in the first accident narrative above (Bell 412 on July 1, 1991) was the pilot's failure to maintain autorotation rotor rpm prior to touch down.[7]

2. On October 22, 2009, during a practice hovering autorotation the helicopter impacted terrain, which resulted in substantial damage to the tailboom. The left seat check pilot who was giving instruction to the right seat pilot reported that a clear, flat area had been identified for hovering autorotation practice. After being briefed by the check pilot, the right seat pilot brought the helicopter up to a 3- to 5-foot hover. The check pilot stated, "I reminded the pilot that he would retard the throttle. [The] aircraft drifted up to less than 10 feet, [and] before I could correct the altitude deviation the [right seat] pilot aggressively retarded the throttle. The aircraft was allowed to settle to approximately 4 feet before the collective pull was initiated, but I was unable to sufficiently arrest the descent." The Safety Board determined the probable cause as the improper use of the throttle by the pilot receiving instruction, and the check pilot's inadequate supervision and delayed remedial action, which resulted in the collision with terrain.[8]

[5] NTSB accident identification number: LAX05LA025
[6] NTSB accident identification number: WPR10FA112
[7] NTSB accident identification number: DEN91LA095
[8] NTSB accident identification number: WPR10CA028

3. Helicopter Information/Weight & Balance/Performance

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.

3.1 Recent Maintenance

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. Between July 24 and July 26 the engine was removed by Air Methods maintenance personnel, the modules were separated, module 3 was disassembled, the fuel injection manifold replaced, the engine reassembled by Helicopter Services of Nevada maintenance personnel, and then the engine was reinstalled into the helicopter by Air Methods maintenance personnel.

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. Following the post maintenance check flight the battery was replaced, which had been previously identified as a weak battery by the mechanics, and the helicopter was signed off as airworthy.

AVL Hub Interface

Search | Import

New Search

Google Map

Vehicle	Longitude	Latitude	AVLTime	Collective	Heading	Speed	Altitude
N509AM	-111.2313330000	32.3891670000	7/28/2010 12:43:34 AM	False	218	56	4160
N509AM	-111.2441670000	32.3768330000	7/28/2010 12:44:40 AM	False	238	42	5187
N509AM	-111.2626670000	32.3580000000	7/28/2010 12:45:49 AM	False	217	128	5925
N509AM	-111.2626670000	32.3336670000	7/28/2010 12:46:56 AM	False	57	138	5604
N509AM	-111.2271670000	32.3840000000	7/28/2010 12:48:40 AM	False	26	142	2556
N509AM	-111.2185000000	32.4036670000	7/28/2010 12:49:50 AM	False	356	0	2024

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The Air Methods Operations Manual, section B-26 addresses Maintenance Operational Check-Post Maintenance.

"*The Post Maintenance Check shall consist of a face-to-face briefing with the person conducting the post maintenance inspection of the work area. The briefing will include the maintenance task that was performed, any cowlings/panels that were opened/removed and any components/lines that were repositioned or removed in order to facilitate maintenance. The Post Maintenance Check must be performed before the aircraft is returned to service.*

The Post Maintenance Check should include, at a minimum, a thorough pre-flight/visual check for:
• Loose or missing hardware in the area of maintenance.
• Obvious defects in the area of maintenance.
• Tools, loose hardware, rags, or foreign objects left on the aircraft.
• Proper safeties and cotter pins in the area of maintenance.
•The proper servicing of components that may have been affected by the maintenance task."

Section C-7, Maintenance Operational Check, states:

"Maintenance operational check flight will be accomplished any time it is required by the manufacturer or by regulation."

Also stated in section C-7 is FAR Part 91.407(b & c):

> *b. "No pilot may carry any person (other than required crew members) in an aircraft that has been maintained, rebuilt, or altered in a manner that may appreciably have changed its flight characteristics or substantially affected its operation in flight, until a maintenance operational check flight is conducted only by designated pilots in command (who have current FAR Part 135.293 (a)(b) check in the make and model aircraft requiring the MOC or a pilot approved by the company) and logs the flight in the aircraft records."*
>
> *c. "The aircraft does not have to be flown as required in the above paragraph if prior to flight, ground tests, inspections, or both show conclusively that the maintenance, preventative maintenance, rebuilding or alteration has not appreciably changed the flight characteristics or substantially affected the flight operation of the aircraft."*

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 approximately 30-45 minutes to complete. The post maintenance flight test matrix is illustrated in Figure 2.

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. The flight was performed towards the end of the pilot's crew duty day. Normal crew turnover occurs at 1900.

8.3.2 LIST OF TEST SHEETS

N° 0 FLIGHT REPORT
N° 1 VEMD
N° 2 GROUND RUN
N° 3 HOVER FLIGHT
N° 4 MAXIMUM CONTINUOUS POWER CLIMB
N° 5 MAXIMUM TAKEOFF POWER CHECK
N° 6 MAXIMUM CONTINUOUS POWER LEVEL FLIGHT
N °7 AUTOROTATION - 65 kt (120 km/h)

TEST SHEETS TO BE CONDUCTED ACCORDING TO THE MAINTENANCE ACTION OR COMPONENT REPLACED:

TEST SHEETS No → / MAINTENANCE ACTION OR COMPONENTS REPLACED ↓	0	1		2					3		4	5	6		7
		A	B	A	B	C	D	E	A	B			A	B	
ENGINE, FADEC OR MODULE	●	●	●	●	/	/	●	●	●	●	●	●	●	●	/
EBCAU	●	/	/	●	/	/	●	/	/	/	/	/	/	/	/
MGB OR MODULE	●	/	/	●	●	●	●	/	●	●	/	/	●	/	●
MAIN ROTOR HUB	●	/	/	●	●	●	●	/	●	/	/	/	●	/	●
TAIL ROTOR – TAIL ROTOR DRIVE	●	/	/	●	/	●	●	/	/	/	/	/	/	/	/
VEMD	●	●	●	●	/	/	●	/	/	/	/	/	/	●	/

Fig 2 – AS 350 B3 Post maintenance check flight matrix

3.2 Weight and Balance Information

The accident pilot's off call to LifeCom reported "2+55" (2 hours 55 minutes) of fuel, which equates to a fuel load of 90%.[9] 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[10] and cargo capacity (loading

[9] AS350 B3 Flight Manual, section 5.24, Figure 5-24 TAS/CAS in Recommended Cruise (126 knots) and section 5.26, Figure 5-26, Fuel Consumption-Endurance in Recommended Cruise at OAT of 34C, elevation 2,000 feet msl.

[10] The Air Methods spreadsheet calculates fuel weight by averaging the weight between environmental temperatures, 6.8 lb/gal for cold environments, and 6.6 lb/gal for warmer environments, which averages out to be 6.7 lb/gal. Fuel loading is based on 6.7 lbs/gal.

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.

3.3 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.

Section 3.2 contains Engine Flame-Out information[11]. The procedures listed for an engine flame-out in cruise flight are as follows:

1. *Collective pitch….. Reduce (to maintain NR in green arc)*[12]
2. *IAS…………………..Vy*[13]
- *<u>If relight impossible or after tail rotor failure</u>*
3. *Twist grip…………. IDLE detent*
4. *Maneuver the aircraft into the wind on final approach*
- *<u>At height ≈ 70 ft (21 m)</u>*
5. *Cyclic …………….. Flare*
- *<u>At 20/25 ft (6/8 m) and at constant attitude</u>*
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)*

[11] AS 350 B3 Revision 4: May 2007
[12] 375 to 405 rpm normal operating range
[13] Vy= 65 kts – (1 kt/1000 ft)

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. 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 resides in the lowest left portion of the pilot's instrument panel. See figure 3.

Fig 3 - N509AM pilot instrument panel. Location of the NF/NR gauge indicated by the red arrow.

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.

Discussion about autorotation performance with American Eurocopter Chief Test Pilot revealed that in the Chief Test Pilot's experience the heavier the helicopter (at gross weight) the autorotative descent would be faster and that NR would have a tendency to increase at a faster rate, requiring the pilot to use more collective to maintain the NR in limits. A helicopter in a lighter weight condition would experience the opposite situation where Nr would tend to bleed off rapidly if the pilot didn't keep the collective in a lower position. Both situations require good airspeed and NR control to be able to perform a safe autorotative landing at the bottom of the maneuver. Generally, if NR is allowed to decay below 286 rpm (72%), the pilot's control of the rotor disk would be so degraded that recovery of rotor rpm would not be possible. For most helicopters the general rule is that the pilot can control the helicopter with rotor rpm decayed down to 80%, control of the helicopter with Nr below 80% is questionable.

"Helicopter Aerodynamics for Naval Aviators"[14] notes that autorotations are influenced by 5 variables; airspeed, trim, gross weight, upgusts, & rotor RPM (Nr). Gross weight determines rotor RPM at a given collective pitch. At high gross weight, more blade pitch required at a desired RPM. There are tradeoffs for maintaining a high Nr RPM or a low Nr RPM.

Effects of high Nr (rotor RPM):

- Excessive centrifugal loads on the hub
- Excessive propeller region resulting in a higher rate of descent
- Rotational energy to tradeoff in a flare
- Good for high inertia systems which would have difficulty building RPM rapidly in a flare

Effects of low Nr (rotor RPM):

- Higher angle of attack (AOA) therefore a slower rate of descent
- Excessive stall region if RPM gets too low resulting in an increase in rate of descent, less rotational energy to trade off in a flare
- Good for low inertia systems which can build RPM rapidly in a flare
- Rotor blades lose centrifugal stiffness and bend upwards which reduces the effective disk area and increases material stresses
- Blades lose centrifugal force and cone which then reduces the effective disk area and increases the rate of descent.

4. Sequence of Events/History of the Flight

4.1 Background

Air Methods has a maintenance hangar at the Marana Regional Airport, and maintenance that requires special tools, hoists, and shelter is performed there on most of the helicopters that operate in the Air Methods Southern Arizona Operation Area. The accident helicopter (N509AM) was positioned at the Marana Regional Airport on July 24th to undergo engine maintenance related to a fuel coking problem. The accident 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 and on the evening of Tuesday, July 27, the Marana base pilot and the base mechanic performed a 7.5-minute post maintenance check flight.

[14] Helicopter Aerodynamics for Naval Aviators, Aviation Safety Programs, Naval Postgraduate School, Monterey, California, pages 207, 225.

4.2 Accident 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 the Comm Center and reported that LifeNet 12 (N509AM) was off 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 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 proceeds on a course of 112 degrees magnetic for 17 miles directly to the accident location. The helicopter gradually climbs to 3,200 feet by 1339:19, and continues 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.

Fig 4 – Radar track of LifeNet 12 departing Marana and traveling southeast to the accident location.

4.3 Radar Data Review

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[15] 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.

[15] Local terrain elevation is approximately 2,350 ft msl. AGL altitudes converted from mode C msl data.

In the vicinity of the accident location, there was an open area 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 terrain impact, in line with the final flight path trajectory of the helicopter. See figure 5.

Fig 5 – Area surrounding the accident location

4.4 Aircraft Wreckage Information

The wreckage was located on the east side of a north-south running residential road. Running along the length of the west side of the road were residential power and telephone lines suspended from wood telephone poles. On scene examination of the helicopter wreckage revealed that the helicopter descended nearly vertically and impacted the top of a six foot brick wall at the lateral centerline of the fuselage with a very slight left drift. Control continuity was established from the cockpit to the rotor head and tail rotor. All three main rotor blades remained attached to the main rotor hub. One blade was completely burned, another was partially burned, and the third was lightly burned. All three blades exhibited very little rotational movement signatures, very little leading edge damage, and some evidence of blade flapping. The tail rotor was in place on the tail boom and intact; no evidence of leading edge damage, or rotational scoring/damage, and a small amount of flapping was noted at the tail rotor head.

Fig 6 – Main helicopter wreckage.

5. Pilot Information

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. A close friend of the pilot and fellow US Border Patrol pilot related that he knew the accident pilot had learned to fly while he was in high school, and that he flew CH-47 Chinooks, and UH-1 Huey's in Vietnam. The accident pilot completed a full career with the US Border Patrol flying OH-6s, UH-1s, AS350s, Cessna 182s, and Piper Super Cubs (PA-18). The colleague recalled that the pilot had flown AS 350 Bs in the 1980s and was one of the first to receive factory training in the AS 350 B3 around 2002. He estimated that the pilot had at least 3,500 hours in the AS 350 series helicopter, and that the pilot told him (jokingly) that after he accumulated 10,000 total flight hours, he had stopped logging his flights other than those required for currency requirements. During their time together 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 they always practiced full landing autorotations. During a check flight, they would typically practice 6-10 full landing autorotations. Additionally, the pilots themselves would routinely practice power recovery autorotations. Autorotations were something that all the helicopter pilots stayed highly proficient at.

5.1 Pilot Flight Records

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, with 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)[16] 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.

[16] Grading categories: S-satisfactory, U-unsatisfactory, U/S-Retrained, N/A-Not Applicable

Pilot Airman Certificates and Dates of Original Issue[17]

Airman Certificates	Original Date of Issue
Student pilot certificate	December 6, 1967
Private pilot certificate	April 29, 1968
Commercial pilot certificate (ASEL, ASES)	January 25, 1977
Instrument rating	April 9, 1977
Rotorcraft-Helicopter	May 29, 1980

Pilot Flight Times[18]

AIRCRAFT TYPE	TOTAL HOURS	TOTAL LAST 180 DAYS	TOTAL LAST 90 DAYS	TOTAL INSTRUMENT[19]	TOTAL NIGHT
AS350	1,800	69	35	0.0	45[20]
All rotary wing	9,762	69	35	170	3000
All fixed wing	4,500	0	0	190	100
All Aircraft	14,262	69	35	360	3,168

Aircraft Flown[21]

Cessna 150	Cessna 182
Piper PA-28	Piper PA-11
Piper PA-18	OH-6
Piper PA-32	OH-13
CH-47A	UH-1
AS 350	Hughes 500

5.2 Pilot's Schedule

The pilot had been stationed at the Douglas base for about a year. While he was working at the Douglas base, he stayed in the living quarters that are provided for the aircrews. The pilot was scheduled to be off duty from Tuesday July 20 through Monday July 26. However, he did fill in for two night shifts on July 23 and 24. He flew 1.7 hours on the 23rd, and did not fly on the 24th. Tuesday July 27, was his first day back on duty, and he was scheduled for the day shift (0700-1900) for the next 3 days, and then shifted to nights for the remaining days of his scheduled work week. Family members of the pilot stated that on Sunday July 25 and Monday July 26 the pilot kept a normal schedule, rising around 0600 and going to bed around 2100, eating normal meals, and that he did not complain of any tiredness or physical ailments. The morning of July 27, he was up at 0530 and drove to Douglas. The pilot's wife related

[17] Obtained from FAA Pilot Records (Blue Ribbon copy)
[18] Flight information obtained from Air Methods records and personal logbooks.
[19] Combined hood and actual instrument time
[20] Hours for January-July 2010 (total night hours in the AS350 were not available)
[21] Aircraft obtained from the pilots personal logbooks.

that, on the evening of the 27th, she had a telephone conversation with him, which was unremarkable in its content.

5.3 Pilot Training Records

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, 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)"[22] and power recovery autorotations were practiced on each training flight and each competency/proficiency check.

Pilot Training Flight and Competency/Proficiency Checks (last 4 years) [23]

Date	Event	Aircraft Model	Flight Time (hrs)
15 Sep 2006	FAR 135.293 check flight	AS 350 B2	1.0
1 May 2007	FAR 135.293 check flight	AS 350 B	Not recorded
22 Oct 2007	Recurrent training flight	AS 350 B2	1.0
22 Oct 2007	FAR 135.293 check flight	AS 350 B2	0.8
25 Sep 2008	Recurrent training flight	AS 350 B2	0.8
25 Sep 2008	FAR 135.293 check flight	AS 350 B2	0.8
18 Oct 2008	Initial NVG training	AS 350 B3	3.0
19 Oct 2008	Helicopter NVG check flight	AS 350 B3	1.0
27 Feb 2009	Semi-annual training flight	AS 350 B3	1.1
14 Sep 2009	Recurrent training flight	AS 350 B2	1.0
14 Sep 2009	FAR 135.293 check flight	AS 350 B2	0.8
Total			**11.3**

6.0 Company Pilot Training Program

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.

6.1 General and Semi-annual Training

Chapter 1 of the Air Methods Pilot Training Program, titled "General", addresses the overall scope, purpose, and various definitions of training. Semi-Annual Training is addressed in Chapter 1 as follows; "This category of training is required by Air Methods and will be provided to all crewmembers. Semi-annual training is scheduled and due 6 months after the base month. A crewmember may complete semi-annual training grace month early or grace month late." Although this definition of Semi-annual training was included in the training manual, the actual semi-annual training policy was removed in February 2010. FAA regulation requires only that a pilot complete an annual FAR Part 135

[22] The grading categories are: A=exceeds FAA PTS, B=meets FAA PTS, C=requires additional training
[23] Obtained from Air Methods training records.

airman competency check.

6.2 Recurrent 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 3-5 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.

7.0 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.

Oversight program development for Air Methods uses a combination of National Work Program Guidelines and the FAA's Large FAR Part 135 Safety Evaluation Program (SEP) and the Safety Evaluation Assessment Tool (SEAT) processes. This process allows the development of a comprehensive work program based on identified risks. Implementation of the program is accomplished by the CMT members, who travel throughout the carrier's system performing inspections and evaluations. Three of the CMT operations members are remotely sited in South Carolina, Tennessee, and Massachusetts.

The CMT also utilizes inputs from other offices located throughout the U.S. The CMT does not specifically generate work program items for the other offices, however, it does encourage support from the Flight Standards community. "Local" offices have and do incorporate work in their local geographic work programs. During the period FY 2008 through the present there have been a total of 4,631 surveillance activities on the carrier. (This includes operations, airworthiness, and avionics.) Of those activities, 1,487 were accomplished by offices other than the Denver Flight Standards District Office.

There were 56 total surveillance inspections conducted within the Southern Arizona Air Methods Operating Area by the Certificate Management Team (CMT) over the previous 12 months preceding the accident: Florence 9; Douglas 10; Marana 10; Safford 8; Sierra Vista 9; Wilcox 10. There were no action letters issued as a result of surveillance conducted at the above locations. No en route surveillance was conducted as the load carrying capability of the helicopters does not allow for the carriage of an extra passenger. Ground training is observed at Englewood, Colorado. Flight training is observed in conjunction with Certificate Compliance Evaluators and Instructor check rides at locations where availability of aircraft and schedules permit. Those pilots were observed at Modesto and Rialto, California. There were no special safety inspections performed during this period.

8.0 Corrective Actions

The following corrective actions have been taken by Air Methods.

- August 3, 2010, an Air Methods Quality Alert Notice was distributed to all regional maintenance directors, area maintenance managers, and all aircraft model bases of operation, emphasizing that all operational check flights are required to follow manufacturer requirements. “Some Manufactures have specific checks to follow including specific documents/checklists to complete. If a Manufacturer has these requirements; they must be followed, the documents/checklists completed and submitted with the log book entry. The entry must include a reference to the specific checks that were performed. “

- September 15, 2010, a maintenance memo addressing outside vender maintenance was distributed to all field maintenance personnel. The memo states “If a vendor travels to an Air Methods base and intends to “remote” their 145 Repair Station, including signing off the work on a work order, they must bring at least 2 individuals, a technician and an inspector. “ Additionally it states that all such maintenance will be inspected by a company A&P mechanic as soon as the aircraft returns to base.

- September 24, 2010, a maintenance memo addressing maintenance records carried on board aircraft was distributed to all field maintenance personnel. The memo states, “The current aircraft log book, aircraft short term due report and deferred discrepancy log shall remain in the aircraft whenever it is flown. These are the only original maintenance records that may be carried on board an aircraft. If other maintenance records need to be carried with an aircraft, copies must be made. All original maintenance records must be shipped through standard shipping methods.”

Van McKenny
NTSB, Western Pacific Region

E. Attachments

Attachment 1 – Operations Interviews

Attachment 2 – Witness Statements

Attachment 3 – Air Methods Operational Control Center Statements

Attachment 4 – Radar Plots

Attachment 5 – Radar Data Files

Attachment 6 – Air Methods OCC Communications Recordings

Attachment 7 – TRACON Communications Recording

Attachment 8 – Fuel Receipt

Attachment 9 – Air Methods Operations Manual Extracts

Attachment 10 – Pilot's training, flight, and duty records