Aviation Investigation Final Report

Location:	Pottsville, Pennsylvania	**Accident Number:**	NYC08FA198
Date & Time:	May 30, 2008, 20:50 Local	**Registration:**	N238AM
Aircraft:	Eurocopter Deutschland EC 135 P2+	**Aircraft Damage:**	Substantial
Defining Event:	Collision with terr/obj (non-CFIT)	**Injuries:**	3 Minor
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

After taking off on a helicopter emergency medical service mission, the twin-engine helicopter climbed approximately 75 feet. The pilot lowered the nose, but the helicopter would not climb or accelerate normally. The pilot saw 125 percent on one of his gauges, but was not sure which gauge it was as he was looking outside. A "gong" sounded, similar to what the pilot had heard when doing "max takeoffs," but he did not hear an engine-out horn or see any warning lights. The pilot also noticed that one torque indication was declining to "near zero" percent, and the helicopter began to yaw. The pilot was able to correct the yawing moment with anti-torque inputs, and remembered lowering the collective and "pulling pitch" before the helicopter impacted the ground in a level attitude. The No. 1 engine was running as the pilot exited the helicopter, but the No. 2 engine was not. Examinations at the accident site revealed that the helicopter, after lifting off from the heliport, flew out of ground effect over down-sloping terrain, settled, then struck a parked semi-trailer about 80 feet below the heliport. No preimpact mechanical anomalies of the helicopter, engines, or engine switches were found. As part of the pre-takeoff confirmation check, the pilot was required to ensure that both main engine switches were in the FLIGHT position; however, onboard recorded data revealed that the No. 2 main engine switch was in the IDLE position during the takeoff.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot’s failure to ensure that both engine switches were in the FLIGHT position for takeoff.

Findings

Aircraft	(general) - Incorrect use/operation
Environmental issues	Sloped/uneven terrain - Not specified
Personnel issues	Lack of action - Pilot

Factual Information

History of Flight

Takeoff	Miscellaneous/other
Takeoff	Collision with terr/obj (non-CFIT) (Defining event)

HISTORY OF FLIGHT

On May 30, 2008, at 2050 eastern daylight time, a Eurocopter Deutschland EC135 P2+, N238AM, operated by Air Methods Corporation as "MedEvac 7" incurred substantial damage during an emergency landing after takeoff from Mazzuca Heliport (PS95), Pottsville, Pennsylvania. The certificated airline transport pilot, flight nurse, and flight paramedic received minor injuries. Visual meteorological conditions prevailed, and a company visual flight rules (VFR) flight plan was filed for the air medical flight, which was responding to a motor vehicle accident in Wayne Township, Pennsylvania. The air medical flight was conducted under Title 14 Code of Federal Regulations Part 91.

According to the pilot, after liftoff from PS95 he climbed to approximately 75 feet above ground level. As he lowered the nose of the twin-engine helicopter to transition to forward flight, he realized that something was "wrong" and the helicopter would neither climb, nor accelerate normally. He saw 125 percent on one of his gauges, but was not sure which gauge it was as he was "looking outside" the helicopter at the time. He looked at the first limit indicator (FLI) gauge and observed that one of the needles was "falling to zero." A "gong was going off," similar to what he had heard when doing "max takeoffs;" however, he did not hear any "engine out horn," nor see any warning lights.

The pilot noticed that one "torque" was moving down to near "zero percent," and the helicopter started to yaw. He was able to correct the yawing moment with the anti-torque pedals, and the cyclic and collective controls "seemed to function correctly."

The pilot recalled "lowering the collective" and "pulling pitch" before the helicopter impacted the ground in a level attitude, and that the helicopter "spun to the right" before coming to rest on its left side.

As he exited the helicopter, the pilot noticed that the left engine was operating, but the right engine was not. The pilot went back to the helicopter and helped the other crewmembers egress, and could not "get the switch off to stop the engine." He recalled that after the impact, he tried to "put the engine to idle," but the "seatbelts were locked," preventing him from reaching the switch panel. The left engine was eventually shut down by the fire department by flooding it with water.

PERSONNEL INFORMATION

According to Federal Aviation Administration (FAA) and pilot records, the pilot held an airline transport pilot certificate with multiple ratings, including rotorcraft helicopter. He had accumulated 7,000 total hours of flight experience, 6,100 hours in rotorcraft, and 125 hours in the accident helicopter make and model.

AIRCRAFT INFORMATION

The helicopter was configured for emergency medical service operations. It was powered by two Pratt & Whitney PW2062B2 engines; each controlled by an Electronic Engine Control (EEC) unit. It was equipped with a dual hydraulic system, and a dual electrical system. The rigid main rotor system was of a 4-bladed, all-composite, bearingless design, and its anti-torque system utilized a fenstron. It was certificated for single pilot operations.

According to FAA and operator records, the helicopter was manufactured in 2007. The helicopter's most recent continuous airworthiness inspection was completed on May 29, 2008, and at the time of the accident, it had accumulated 162 total hours of operation.

METEOROLOGICAL INFORMATION

A weather observation taken about 4 minutes after the accident, at Reading Regional Airport (RDG), Reading, Pennsylvania, located approximately 22 nautical miles southeast of the accident site, recorded the wind as 210 degrees at 7 knots, visibility 10 miles, clear skies, temperature 23 degrees C, dew point 15 degrees C, and an altimeter setting of 29.97 inches of mercury.

AIRPORT INFORMATION

According to the Airport Facility Directory, PS95 was a private use, unattended heliport, located 810 feet above sea level, 2 miles southeast of Pottsville, Pennsylvania. The sole helipad at PS95 was asphalt and measured 25 feet wide by 25 feet long.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site and wreckage by an FAA inspector revealed that the helicopter, after lifting off from the heliport, had traveled approximately 100 feet forward before striking a semi-trailer, which was parked at an adjacent commercial loading dock approximately 80 feet in elevation below the heliport.

The fuselage displayed varying degrees of impact damage and the left landing skid had spread and collapsed in an upward direction.

The tail boom was wrapped around the aft portion of the fuselage, and the vertical fin with its

integrated tail rotor, had come to rest next to the belly of the helicopter. Two complete circumferential breaks were evident. One break was discovered to be just aft of the fuselage and the other break just forward of the vertical fin.

All four main rotor blades were broken. One blade was severed approximately 1 foot outboard of the main rotor hub, and one blade was severed approximately 3 feet outboard of the main rotor hub. The two other blades were severed at the main rotor hub.

During the on-site examination of the wreckage by the FAA, no preimpact mechanical malfunctions of the flight controls, main rotor, tail rotor, or drive systems were discovered.

Engine Examinations

External examination of the engines on-site revealed that the left engine exhibited rotational damage but the right engine did not.

At the request of the NTSB investigator in charge, both engines were removed from the wreckage and shipped to Pratt & Whitney Canada Corporation's manufacturing facility for examination.

Examination of the left engine revealed that the drive shaft and mating spline were damaged which was indicative of a sudden stoppage of the engine.

Examination of the right engine did not reveal any anomalies.

Recorded Data

Download of the Data Collection Unit (DCU) revealed that at the time of the accident, the left engine was operating in the high power range with its main engine switch in the FLIGHT position, and that the right engine was operating with its main engine switch set in the IDLE position. The DCU data also revealed that the left engine torque had peaked at 151 percent.

Download of the Vehicle and Engine Multifunction Display (VEMD) and the Caution Advisory Display (CAD) indicated that the helicopter had been in that configuration for approximately 1.5 minutes prior to ground impact.

SURVIVAL FACTORS

The helicopter was equipped with crash resistant fuel cells. The fuselage and seats were of an energy absorbing design. Both the flight paramedic and flight nurse were wearing flight helmets; however, the pilot was not.

TESTS AND RESEARCH

Published Guidance

According to the operator's EC135 Pre-Takeoff Confirmation Check, the pilot was supposed to assure that the main engine switches were in the FLIGHT position, the "Systems" were checked, and that the "Torques Respond," prior to takeoff."

Review of the helicopter manufacturers EC135 P2+ Flight Manual revealed that during the takeoff, the pilot is required to first enter a hover, then check that the rotor speed (Nr) and power turbine (N2) indications are within parameters, the FLI needles are matched at the same parameters, and that all warning, CAD, and VEMD indications are checked.

No data indicative of a hover check being performed was discovered during review of the downloaded data. According to the helicopter manufacturer, if a hover check had been performed, five independent cockpit indications would have been presented to the accident pilot:

- The N2 indication needle of the engine would have been at idle, indicating approximately 74 percent.
- The N2 indication needle of the engine in flight mode would have indicated approximately 100 to 103 percent.
- There would have been a split between the FLI needles.
- There would have been an IDLE caution on the CAD in the system column for the engine at idle.
- There would have been an IDLE caution in the upper portion of the FLI screen.

Other Single Engine Takeoff Events

In August of 2008, the NTSB was notified of two other single engine takeoff events that occurred with different operators.

The first event occurred on June 17, 2008, when a pilot attempted to take off in another EC-135P2. During the takeoff, the audio warning was heard, and an NR droop was confirmed. The pilot set the helicopter down and realized that the No. 2 main engine switch was in the idle position, but he did not observe any other warnings or cautions. He then placed the No. 2 main engine switch in the flight position. All parameters were normal and helicopter was flown. During subsequent ground checks, it was discovered that an engine exceedance had occurred. The helicopter was taken out of service and the No. 1 engine was removed due to overtorque and temperature exceedances.

On August 6, 2008, another EC-135P2 accomplished a single engine takeoff when the pilot was preparing to reposition the aircraft to a refueling pad. While going through the start sequence, he noted that the sun glare was very intense. However, he didn't recall any other distractions. After a normal run up, he reviewed the start check list and the pre-takeoff check list placarded

on the instrument panel. When he picked the aircraft up to hover, he noted a minor instability which he attributed to the wind coming over the hangar. The pilot's attention, as he came to a hover, was mainly focused on the close proximity to the hangar and the parked fuel truck on his right side. He immediately started a rearward rotation to the right. As he was 90 degrees into the turn, while concentrating on the location of the fuel truck, he then noticed the split in the FLI and noted the No. 2 main engine switch was at idle. He immediately reduced power and landed the aircraft. The helicopter was taken out of service and the No. 1 engine was removed due to an over torque exceedance.

As a result of this accident and the additional events, the parties were requested to provide documentation of inadvertent single engine takeoffs.

Review of the proprietary information provided by the parties revealed that approximately 40 inadvertent single engine takeoff events had occurred since 2002, involving multiple operators. The majority occurred during training, after a power check, or during a helicopter emergency medical service (HEMS) mission.

Review of the proprietary information by NTSB investigators also revealed the existence of three possible occurrences of single engine takeoffs when the main engine switches were thought to have moved out of the selected position. During the course of the investigation, an event was reported by an operator of a main engine switch on an EC135 P2+ with approximately 3,870 hours in service moving out of the detent. According to the operator, during the before takeoff check to verify that the main engine switches were physically in the FLIGHT position, the No. 2 main engine switch easily came out of the FLIGHT position. The pilot then placed the No. 2 main engine switch back into the FLIGHT position, and conducted the test again with the same result. The flight was aborted, the helicopter was shut down, and maintenance personnel were called. Maintenance personnel discovered that the No. 2 main engine switch (with minimal effort), would easily move out of the FLIGHT position.

20VE Switch Panel

The engine switches were located in the EC135 P2+ on the 20VE switch panel. As a result of the reported instances of engine switch problems, on September 18, 2008, the 20VE switch panel from the accident helicopter and a 20VE switch panel from a high time exemplar provided by another HEMS operator.

Examination of the 20VE switch panels revealed that they were divided into two subpanel sections – engine control switches and DC power control switches. The engine control switches were located in the upper subpanel. The DC power control switches were located in the lower subpanel

There were five switches on the engine control subpanel, with two switches for each engine – the main engine switch, and the FADEC (EEC) control switch. The FADEC control switch was a two-position, ON/OFF switch. The main engine switch was a three-position

(OFF/IDLE/FLIGHT) switch, with a detent and safety guard. To move the switch from IDLE to FLIGHT, the pilot would push up on the switch. However, to move the switch from FLIGHT to IDLE, the switch had to be pulled out and over a detent. A spring-loaded switch guard would close when the switch was not being manipulated. The switch guard was located to the left of the switch and would prevent accidental movement of the switch from the IDLE to the OFF position. In order to move the switch from IDLE to OFF, the switch guard had to be swung open.

The fifth switch on the engine control subpanel was the training selector switch, which separated the Engine 1 and Engine 2 switches. The switch had two positions, OFF and ARM. The switch also had a safety guard, which was positioned on top of the switch and had to be lifted in order to move the switch from OFF to ARM.

Testing and physical examination of the accident helicopter's 20VE switch panel revealed that it was functional. Both engine switches would lock properly in the FLIGHT position, and the switches had to be pulled out of their respective detents before moving them to IDLE.

Testing and physical examination of the exemplar 20VE switch panel revealed that it was functional, but the No. 1 and 2 main engine switches exhibited visible signs of wear. When each main engine switch was placed into the FLIGHT position, the switch could be moved to the IDLE position without pulling the switch out, and during further examination under magnification, excessive wear of the detent faces was visible.

ADDITIONAL INFORMATION

As a result of the accident, the parties to the investigation took the following actions to improve safety:

Eurocopter

On July 15, 2008, Eurocopter published an Alert Service Information Letter (ASIL), regarding unintended single engine takeoffs in the EC135 to help pilots avoid such a situation by explaining some cockpit indications, helping them to identify a single engine situation before the takeoff and by reminding them to follow the existing flight manual procedures. The ASIL also contained information regarding suggested procedures in the event that an inadvertent single engine takeoff has occurred.

On February 8, 2010, Eurocopter published Alert Service Bulletin EC135-31A-045 regarding inspection of the ENG CONTROL switches for wear every 400 flight hours, and installation of dual switch locks to assure proper positioning of the ENG CONTROL switches. Additionally, starting with aircraft serial number 0870, the dual switch locks were installed as standard equipment.

Eurocopter also developed a monitoring system which will be included in new production

EC135s to automatically monitor the position of the engine switches on the 20VE switch panel to detect if only one switch was in the FLIGHT position, and the collective lever was disengaged. If this configuration was detected, a pulse tone would sound for 5 seconds and simultaneously "CHECK ENG" would begin flashing on the warning display. This system will also be available for retrofit in previously manufactured EC135s.

Air Methods

On June 17, 2008, Air Methods Distributed a memorandum to all company pilots that emphasized the need to accomplish a "Before Takeoff Check" to include verifying engine throttles, engine control levers, power control levers, or switches are in the full open or fly position before every takeoff and to verify that both torque meters respond correctly as collective pitch pull is initiated. The information was then added to their Before Takeoff Checklist.

A “Before Takeoff Confirmation Checklist” decal was also affixed to each instrument panel in plain view of the pilot. It included essential items to be confirmed by the pilot prior to each start and takeoff. Air Methods also modified its Operations Manual to require that the pilot verbally challenge and respond to each item on the confirmation checklist to ensure that each item was complete, and added a requirement for the pilot to utilize all safety equipment issued, furnished, or installed in the aircraft for all flights including flight helmets.

On August 18, 2008, Air Methods distributed a Quality Alert Notice (QAN 17-08), to all of its maintenance personnel advising them that at each airworthiness check they should ensure that there are no abnormalities in the operation of the switching unit installed in the aircraft and if the switches were rough, ratcheting or did not lock properly, to ground the aircraft and notify the Regional Maintenance Director immediately.

Pilot Information

Certificate:	Airline transport; Flight instructor	**Age:**	54,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	January 18, 2008
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	October 31, 2007
Flight Time:	7000 hours (Total, all aircraft), 125 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Eurocopter Deutschland	**Registration:**	N238AM
Model/Series:	EC 135 P2+	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0565
Landing Gear Type:	High skid	**Seats:**	4
Date/Type of Last Inspection:	May 29, 2008 AAIP	**Certified Max Gross Wt.:**	6415 lbs
Time Since Last Inspection:	12 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	162 Hrs at time of accident	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	C91A installed, not activated	**Engine Model/Series:**	PW206B2
Registered Owner:	Wilmington Trust Co Trustee	**Rated Power:**	447 Horsepower
Operator:	Air Methods Corporation	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Lehigh Valley Medevac	**Operator Designator Code:**	QMLA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Dusk
Observation Facility, Elevation:	RDG,344 ft msl	**Distance from Accident Site:**	22 Nautical Miles
Observation Time:	20:54 Local	**Direction from Accident Site:**	160°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	23°C / 15°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Pottsville, PA (PS95)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Wayne Township, PA	**Type of Clearance:**	None
Departure Time:	20:50 Local	**Type of Airspace:**	

Airport Information

Airport:	Mazzuca Heliport PS95	**Runway Surface Type:**	
Airport Elevation:	810 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	3 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Minor	**Latitude, Longitude:**	40.686111,-76.210281

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Ronald A Forsyth; FAA/FSDO; New Cumberland, PA Axel Rokohl; BFU; Germany Jerome Projetti; BEA; France Andre Turenne; TSBC; Canada Lindsay Cunningham; American Eurocopter; Grand Prairie, TX Douglas R Hardy; Pratt & Whitney Canada Corporation; Canada Chris Meinhardt; Air Methods Corporation; Englewood, CO
Original Publish Date:	October 21, 2010
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=68132

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