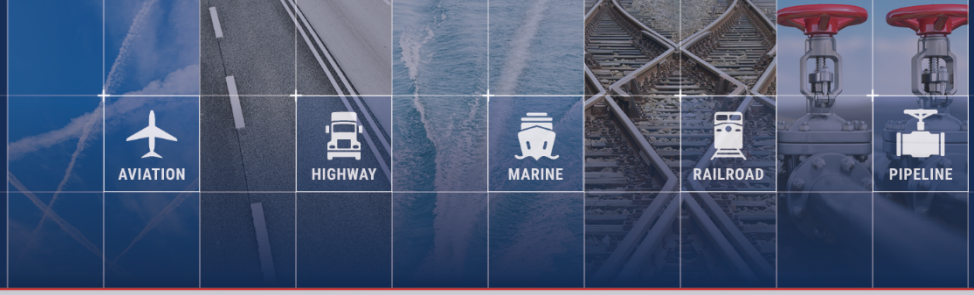

Aviation Investigation Final Report

Location:	Grand Rapids, Michigan	**Accident Number:**	CHI08FA141
Date & Time:	May 29, 2008, 11:01 Local	**Registration:**	N176SH
Aircraft:	Sikorsky S-76A	**Aircraft Damage:**	Destroyed
Defining Event:	Collision during takeoff/land	**Injuries:**	2 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The air ambulance helicopter was departing from a hospital heliport that was located on the 11th story of the hospital during an FAA Part 135 check. Before takeoff, the pilots discussed the construction cranes that were operating on the north side of the hospital and their effect on the approach and departure routes to the pad. The pilot reported that he lifted the helicopter straight up into a vertical takeoff. The torque was about 94 percent and "everything was nominal." The helicopter was about 40 feet in the air when the pilot heard a "pop" and the helicopter started to yaw to the right and vibrate. He attempted to land back on the helicopter pad by using the cyclic and lowering the collective, but the main rotor blades impacted the 32-foot high brick structure located east of the helicopter pad. The helicopter fell straight down impacting the hospital roof. Witnesses observed the helicopter lift off the helipad and then fly backwards until the tail rotor hit a tower on top of the roof. A hospital security video camera showed the helicopter fly backwards as it lifted off the helicopter pad. It showed that the tail rotor appeared to strike an object on one of the towers, and the tail rotor immediately shattered and the helicopter went into a right yaw. A camera that was mounted on one of the towers exhibited impact marks and carbon fibers were found lodged in a crevice of the camera body. Based on the analysis of the accident site, the helicopter traveled about 61 feet straight-line distance rearwards at an angle of about 41-51 degrees relative to the hospital pad. The time from takeoff to impact with the camera was about 11.37 seconds. The inspection of the helicopter revealed no preexisting anomalies that would preclude normal operation.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain tail rotor obstacle clearance from a tower during takeoff.

Findings

Personnel issues	Incorrect action performance - Pilot

Factual Information

History of Flight

Takeoff	Collision during takeoff/land (Defining event)
Post-impact	Fire/smoke (post-impact)

HISTORY OF FLIGHT

On May 29, about 1101 eastern daylight time, a Sikorsky S-76A helicopter, N176SH, operated by Aero Med Spectrum Health, was destroyed by post impact fire after the tail rotor struck a tower while departing from the heliport (MI97) on top of the Spectrum Health Hospital, Grand Rapids, Michigan. The airline transport (ATP) certificated pilot and the ATP certificated Federal Aviation Administration (FAA) inspector received serious injuries. The 14 Code of Federal Regulations Part 91 flight departed the Gerald R. Ford International Airport (GRR), Grand Rapids, Michigan, at 1041. Visual meteorological conditions prevailed at the time of the accident and a company flight plan was filed.

The pilot reported the flight was a FAA Part 135 check, which included an annual Sikorsky proficiency check and a 6-month helicopter instrument proficiency check. The flight departed GRR and flew the FAA-approved Global Positioning System (GPS) "point in space" approach to the termination point just south of the hospital. The flight then proceeded visually to the Spectrum Health Helipad and landed on the north spot. When the helicopter landed, the nose was pointed about 340 degrees. Before takeoff, the pilots discussed the construction cranes that were operating on the north side of the hospital and their effect on the approach and departure routes to the pad. The pilot reported that he lifted the helicopter straight up during the takeoff. The torque was about 94 percent and "everything was nominal." The helicopter was about 40 feet in the air when the pilot heard a "pop", and the helicopter started to yaw to the right and vibrate. The pilot reported that he instinctively added left pedal to counteract the right yaw, and it seemed that he had some tail rotor authority. Then the rate of the right yaw increased rapidly. He attempted to land back on the helicopter pad by using the cyclic and lowering the collective, but the main rotor blades impacted the 32-foot high brick structure located east of the helicopter pad. The helicopter fell straight down impacting the hospital roof.

The FAA inspector, who was sitting in the left seat, reported that the helicopter lifted up normally in a vertical takeoff to about 40 - 50 feet. He stated that the helicopter went straight up. He reported that he was observing the construction cranes and looking out and down during the takeoff. About 40 feet, he heard a "pop" and saw the pilot moving the cyclic. The helicopter started turning right and descending, and then the main rotor blades hit the building. The helicopter went straight down and impacted hard onto the roof. He exited the helicopter by screwing the copilot's pedals all the way aft and "shimmying" out the copilot's chin bubble

on his back. He helped the pilot get out of the helicopter through the chin bubble, and they got behind a heating duct on the roof until the fire fighters arrived. A fire had started during the initial impact, and soon after the pilots exited the helicopter, it was consumed by fire.

A hospital nurse reported that she heard the helicopter and went to the window to watch it takeoff. She saw the helicopter as it lifted off the pad and as it flew backwards toward the brick hospital structure and the radio towers on top of the structure. She saw the helicopter's tail rotor hit a tower.

A witness observed the accident from a 7th floor window across the street from the helicopter pad. He reported that the helicopter's tail rotor clipped the radio tower about mid-span and the tail rotor immediately disintegrated.

A hospital security video camera, which was located near the top of the brick structure and overlooked the helicopter landing pads, recorded a portion of the accident flight. It showed the helicopter as it came in for landing from the south and landed on about a 340-degree heading on the north landing spot. The helicopter stayed on the deck for about 3 minutes before it departed. The video showed the helicopter as it lifted off the north landing spot and as it flew backwards toward the brick structure while the nose of the helicopter remained pointing to the northwest. It showed the helicopter as it went out of view of the video recorder as it continued to climb. Since it was a sunny day, the shadow of the helicopter and the towers on top of the brick structure were visible on the helicopter pad below. The shadow of the helicopter's tail rotor appeared to strike an object on one of the towers. The tail rotor immediately shattered and the helicopter went into a right yaw. The helicopter came back into the view of the video recorder as the main rotor blades impacted the brick structure. The video recording stopped and did not record the helicopter hitting the hospital roof.

A camera that was mounted on one of the towers was removed for inspection. The camera body and its support frame exhibited impact marks. Carbon fibers were found lodged in a crevice of the camera body. The support structure that supported the camera exhibited impact marks.

PERSONNEL INFORMATION

The pilot was a 61-year-old airline transport pilot with single-engine and multi-engine airplane land and helicopter ratings. He held instrument ratings in airplanes and helicopters. He held a second-class medical certificate issued on March 18, 2008. He had about 7,260 total flight hours, which included about 6,760 hours flown in helicopters. He flew about 25.8 hours in the make and model in the last 90 days. His most recent training was at Flight Safety International on May 4, 2008. His most recent Part 135 airman competency/proficiency check was successfully accomplished on November 1, 2007.

The FAA inspector was a 57-year-old airline transport pilot with single-engine and multi-engine airplane land and helicopter ratings. He held instrument ratings in airplanes and helicopters.

He held a second-class medical certificate issued on January 24, 2008. He had about 7,000 total flight hours, which included about 1,200 hours in helicopters. His annual helicopter check, required for participants in the FAA's flight program, was successfully accomplished on July 7, 2007.

AIRCRAFT INFORMATION

The helicopter was a Sikorsky S-76A, serial number 760260, manufactured in 1984. Two Allison 650 shaft horsepower 250-C30S engines powered the helicopter. The helicopter was purchased by Aero Med and configured for emergency medical services (EMS) in 1997. The cockpit was equipped with dual electronic flight information systems (EFIS) and dual digital automatic flight control system (DDAFCS) instruments. It was equipped with instrument flight rules (IFR) capable instrumentation and was certified for IFR flight. The cabin was fitted with a custom EMS interior with two aft facing and two forward facing seats, with a center-mounted stretcher.

Aero Med maintained the aircraft in accordance with an FAA approved aircraft inspection program (AAIP). The computer based program tracked all flight and maintenance actions, and was backed up by corresponding paper logs. An FAA inspection of the maintenance records indicated that the logbooks were current and in order, and that the helicopter was in an airworthy condition for the flight.

According to the aircraft flight logbook, the helicopter had logged 5,195.4 hours and 19,153 cycles of total time prior to the accident flight. The operator reported the mission takeoff fuel load was 1,200 pounds. The gross weight and center of gravity (CG) at takeoff were reported to be 9,762 pounds at 200.3 inches, which were within the CG limits.

METEOROLOGICAL INFORMATION

At 1053, the surface weather observation at GRR, located about 8 nautical miles south of the accident site, was: Winds calm, visibility 10 miles, ceiling broken at 22,000 feet, temperature 18 degrees Celsius (C), dew point -7 degrees C, altimeter 30.25 inches of Mercury.

HELIPORT INFORMATION

The accident site was the Spectrum Health Hospital Heliport, which is situated on top of the 10-story hospital building. It consists of two landing pads, oriented north and south, at an elevation of 880 feet about mean sea level. There is an elevator penthouse approximately 32 feet high located directly to the east of the helipads. On top of the penthouse is a windsock on a 14-foot pole, and a large triangular lattice truss-construction antenna, extending about another 40 feet high, as well as a small Doppler radome and various other small antennae. A TV camera was attached about mid-point on the 40-foot antenna.

Numerous large construction cranes were located within the immediate vicinity (within about

several hundred feet) of the helipad. The three closest cranes were located due west, northwest, and north of the helipad. They extended less than about 50 feet above the helipad.

FLIGHT RECORDERS

The helicopter was not equipped with a cockpit voice recorder (CVR) or flight data recorder (FDR). The FAA did not require the helicopter to be equipped with either a CVR or FDR.

WRECKAGE AND IMPACT INFORMATION

The airframe was largely consumed by fire. The only structure remaining was remnants of the left side cockpit and cabin doors, and a portion of the lower tail cone and vertical pylon. All three landing gear were in the down position. The transmission, engines, tail rotor drive shafts, intermediate gear box, the input and center sections of the tail rotor gearbox remained in their relative positions. The outer housing of the tail rotor gearbox, with the tail rotor hub still attached, was found on the helipad about 12 feet from the vertical pylon. All four main rotor blade spindles remained with the main rotor head. All four main rotor blades were broken into several segments as a result of impact with the penthouse structure. Pieces of the main rotor blades were found in surrounding areas north and northwest of the impact site. Several fragments of the outboard tail rotor blades were found scattered around the accident site, however, with the internal sections missing or burned, they could not be matched to their respective tail rotor blades.

The post crash fire destroyed the majority of the flight control system. All three primary servos remained attached to the main gearbox; however, their aluminum parts were consumed by fire preventing any continuity checks. The upper deck mechanical mixing unit, flight control tubes, and "broom closet" were all destroyed by fire. The stainless steel tail rotor control cables were intact aft of a break at about Station 300. The break was consistent with an overload condition associated with ground impact forces.

The on-site inspection of the engines revealed that there was no leading edge damage to the first stage compressor impellers. There was no visible impact damage to the engine casings. Both engine turbine modules appeared undamaged when viewed externally, and the 4th stage turbine wheels appeared intact when viewed from the exhaust collectors. The post crash fire damaged both engine fuel control units.

TESTS AND RESEARCH

An accident investigation officer from the Grand Rapids Police Department provided the National Transportation Safety Board (NTSB) a report based on the laser measurements taken at the accident site, and his analysis of the security video taken of the accident flight. Based on his analysis, the helicopter traveled a straight-line distance of about 61 feet at an angle of about 41 degrees relative to the helicopter pad as the helicopter traveled backwards to where the tail rotor blades impacted the camera mounted on the tower. The time from takeoff to

impact with the camera was about 11.37 seconds.

According to the Astronomical Applications Department of the U.S. Naval Observatory, at the time of the accident, the sun's azimuth angle was about 109.7 degrees, and the sun's elevation angle was about 50.6 degrees above the horizon. The security video showed the helicopter as it lifted off the pad and yawed to the left on a heading of about 315 degrees while it gained altitude. The shadow of the helicopter on the pad remained nearly stationary, which indicated that the helicopter was climbing rearwards nearly parallel to the sun incidence line of about 51 degrees relative to the helicopter pad.

ADDITIONAL INFORMATION

In September 2008, Aero Med implemented an enhanced safety management system (SMS) program as part of the company's integrated approach to safety. The helicopter pad, MI97, at Spectrum Health Hospital was closed until both helipads were enlarged, and enhanced fire suppression systems were installed for each pad to compliment the original fire suppression system. The 40-foot antenna and Doppler antenna were relocated, and the other antennas and windsock were moved to the east side of the penthouse.

Pilot Information

Certificate:	Airline transport	**Age:**	61,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:**	Yes
Instructor Rating(s):	Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 1, 2008
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	November 1, 2007
Flight Time:	7260 hours (Total, all aircraft), 26 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Check pilot Information

Certificate:		**Age:**	61,Male
Airplane Rating(s):		**Seat Occupied:**	Left
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	March 1, 2008
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 1, 2007
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Sikorsky	**Registration:**	N176SH
Model/Series:	S-76A	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	760260
Landing Gear Type:	Retractable - Tricycle	**Seats:**	8
Date/Type of Last Inspection:	May 1, 2008 AAIP	**Certified Max Gross Wt.:**	10500 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo shaft
Airframe Total Time:	5195 Hrs at time of accident	**Engine Manufacturer:**	Rolls-Royce
ELT:	Installed, not activated	**Engine Model/Series:**	250C30S
Registered Owner:	Spectrum Health Hospitals	**Rated Power:**	650 Horsepower
Operator:	Aero Med Spectrum Health	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	GRR,794 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 22000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.25 inches Hg	**Temperature/Dew Point:**	18°C / -7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Grand Rapids, MI (GRR)	**Type of Flight Plan Filed:**	Company VFR
Destination:		**Type of Clearance:**	None
Departure Time:	10:40 Local	**Type of Airspace:**	

Airport Information

Airport:	Butterworth Hospital Heliport MI97	**Runway Surface Type:**	
Airport Elevation:	746 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	2 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Serious	**Latitude, Longitude:**	42.880832,-85.522781

Administrative Information

Investigator In Charge (IIC):	Silliman, James
Additional Participating Persons:	Glenn Shaw; FAA-Detroit FSDO; Belleville, MI Randy Corbin; Aero Med Spectrum Health; Grand Rapids, MI Christopher Lowenstein; Sikorsky Aircraft Corporation; Stratford, CT Jon-Adam Michael; Rolls-Royce; Indianapolis, IN
Original Publish Date:	December 24, 2008
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=68116