



Aviation Investigation Final Report

Location:	El Segundo, California	Accident Number:	WPR11FA163
Date & Time:	March 13, 2011, 09:30 Local	Registration:	N33602
Aircraft:	Sikorsky S-58ET	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (partial)	Injuries:	1 Serious
Flight Conducted Under:	Part 133: Rotorcraft ext. load		

Analysis

While making the final external load lift from the roof of an office building, the pilot reported that one of the two engines lost power. Witnesses assisting in the operation also reported hearing an engine wind down. The helicopter drifted forward, veered off the side of the roof, and impacted trees and landscaping below. The pilot reported that he had about 400 lbs of fuel on board before the accident flight. The weight of the air scrubber that was being lifted was estimated to be 4,700 lbs; the maximum lifting capability of the helicopter was 5,000 lbs. The pilot reported that he depressed the electrical cargo release switch a couple of times before the helicopter collided with the building and terrain, but he did not attempt to use the manual release because it would have required him to remove his feet from the antitorque pedals to activate a foot lever next to the pedals. During the wreckage examination, the cargo hook was found in the closed position. Postaccident examination of the hook did not reveal any anomalies that would have precluded normal operation; however, due to the extensive impact and fire damage to the electrical system, it could not be determined why the hook did not release the load. Organic debris located on the intake screen of the #1 engine and the lack of such debris on the intake screen of the #2 engine indicated that the #2 engine probably was not operating at the time of the accident. A postaccident examination of both engines revealed no anomalies that would have precluded normal engine operation. Had the pilot been able to release the load, he might have been able to make a successful landing.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A partial loss of engine power and the failure of the external hook to release the load for undetermined reasons.

Findings

Aircraft	(general) - Failure
Not determined	(general) - Unknown/Not determined
Aircraft	Agricultural/external load sys - Malfunction

Factual Information

History of Flight

Maneuvering-hover	Loss of engine power (partial) (Defining event)
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HISTORY OF FLIGHT

On March 13, 2011, about 0930 Pacific daylight time, a Sikorsky S-58ET, N33602, descended and veered off the side of an office building while lifting an external load from the roof in El Segundo, California. The commercial pilot was seriously injured; the helicopter was substantially damaged, and consumed by a post impact fire. The helicopter was registered to Heli Flight, Inc., and operated by Aris Helicopters under the provisions of Title 14 Code of Federal Regulations, Part 133, to conduct rotorcraft external load operations. Visual meteorological conditions prevailed for the flight, and a visual flight plan had not been filed. The flight originated from Riverside, California, at 0829.

The pilot stated that he arrived at the Riverside Municipal Airport in the early morning. He performed his flight planning and conducted a preflight inspection of the helicopter. During the preflight he turned on battery power and performed an electrical functional check of the cargo hook and noted that the helicopter was fueled with 1,200 lbs of fuel; 800 lbs in the forward tank and 400 lbs in the aft tank. In a subsequent statement the pilot reported that the helicopter had 1,450 lbs of fuel on board. Riverside tower recorded that the helicopter departed at 0829. The pilot flew direct to Fullerton, then proceeded to the Raytheon facility. Witnesses reported that the helicopter arrived at Raytheon between 0845 and 0900. The pilot stated that he spent approximately 0.2 hours in the Raytheon parking lot with the rotor turning at flat pitch, then proceeded to perform the heavy equipment lifts. The purpose of the flight was to lift building heating, ventilation, and air conditioning (HVAC) equipment off of the roof of the Raytheon building. Total flight time was approximately 1 hour.

Just prior to the final lift the pilot reported to the ground crew that he had about 400 lbs pounds of fuel; 200 lbs in the forward tank and 220 lbs in the aft tank. While making the final external load lift of an air scrubber from the roof of the office building the pilot reported that an engine "went off line." Witnesses assisting in the operation also reported hearing an engine wind down. Witnesses said the helicopter drifted forward, the long line became taut, the nose of the helicopter pitched down, and the helicopter veered off the side of the roof. The pilot reported that he depressed the cargo release switch a couple of times before the helicopter went over the side of the building. The entire helicopter impacted the side of the building, trees, and landscaping below. The pilot was extracted from the cockpit by the ground crew, and a fuel fed post impact fire ensued. The ground crew stated that immediately after the accident, at least one engine remained operating and both T-handles were pulled (emergency fuel shut off), which successfully shut down the engine/s.

The pilot stated that he did not attempt to depress the manual cargo hook release because the manual release is activated by a foot lever next to the antitorque pedals in the cockpit; he did not want to take his feet off the antitorque pedals.

The component being lifted, an air scrubber, had been out of service for 2-4 years, contained no water, and was estimated by the manufacturer to weigh 4,700 lbs. The helicopter operator stated that the maximum lifting capability of the helicopter was 5,000 pounds.

Aris Helicopters had submitted a lift plan to the Federal Aviation Administration (FAA), which was approved on March 8, 2011.

PERSONNEL INFORMATION

The pilot, age 52, held a commercial pilot certificate for rotorcraft-helicopter, and a certified flight instructor certificate rated in helicopters, issued January 10, 2006. He held a second-class medical certificate with the limitation that he have glasses available for near vision, issued July 21, 2010. Pilot records dated February 4, 2010, show the pilot's total flight time was 7,182 hours, all in helicopters, with 2,673 hours in the Sikorsky S58. The pilot's most recent FAR Part 135.299 airman competency/proficiency check was flown on April 30, 2010, in a SK-58T.

AIRCRAFT INFORMATION

The twin engine helicopter, serial number 58-727, was manufactured in 1974. It was powered by Pratt and Whitney PT6T-3 Twin-Pac, which consisted of two turboshaft power sections attached to a single combining gearbox, with a total capability of producing 1,800 shaft horsepower. During normal operations fuel consumption is approximately 952 lbs/hour (maximum continuous power). The helicopter was equipped with a 6,000 pound capacity Onboard Systems cargo hook installed May 13, 2005. A review of maintenance records showed that a Phase 2 inspection was completed on March 11, 2011, at a helicopter total time of 8,929 hours. The Phase 2 inspection focuses on the cockpit and the angle gearbox compartment (between the engines and main gear box).

The pilot reported that he performed a preflight inspection at 0730 the morning of March 13. He checked the fuel quantity and performed an electrical and mechanical functional check of the cargo hook. The pilot told the Safety Board investigator-in-charge (IIC) on March 23 that the fuel load was 1,200 lbs (800 lbs in the forward tank and 400 lbs in the aft tank). In a written statement provided to the Safety Board IIC by the pilot on August 22, the pilot reported 1,450 lbs (213.2 gal) of fuel on board during his preflight check. Fuel records show that the helicopter was last fueled on March 11 with 97 gal of fuel. Maintenance records show that a 24-month inspection of the cargo hook was performed on March 10, 2010.

According to the S-58T Flight Manual, the left engine (60477), as viewed from the pilot's seat,

is the #1 engine, and the right engine (60474) is the #2 engine.

A 6,000 lb capacity cargo hook manufactured by Onboard Systems was installed (STC #SR00099SE) as a replacement for the Eastern Rotorcraft cargo hook (P/N SP7109). The installation replaced the SP7109 cargo hook that was previously installed as standard equipment. According to the Major Repair and Alteration documentation (FAA Form 337), the only change to the hook installation was a minor modification to the manual release adapter to accommodate the Sikorsky release cable.

According to information provided by Sikorsky, the cargo hook circuit as originally installed, is powered from the Primary 28V DC bus. The Primary bus operates the equipment that is most essential for flight, including the emergency fuel shut off valves (T-handles). Battery power is supplied to the Primary and Primary Start busses. With the battery switch set to the ON position, battery power is supplied only to the Primary Start bus when the battery switch is set to the START position. The monitored bus is never energized from the battery. However, after completing an engine start and the generator switches are turned on, all three busses will be energized regardless of the battery switch position. The monitored bus operates equipment less essential for flight and is automatically de-energized in the event of a partial DC power loss.

WRECKAGE AND IMPACT

The wreckage was located along the southwest face of the east wing of the Raytheon building at 2000 E. El Segundo Blvd, El Segundo, California. Broken tree branches were distributed on the ground and entangled in the wreckage between the tree lined landscape bulkheads and the side of the building. The wreckage consisted of the helicopter nose section containing the PT6T-3 Twin Pack, and the tail section with the tail rotor. The main fuselage, cockpit, and cabin had been consumed by fire, leaving mostly ash and molten metal. Both the forward and aft fuel tanks had been consumed by fire. The external skin of the helicopter's left side, where two fuel lines were attached and ran along the outside of the helicopter, were present. The fuel lines were discolored brown and white ash. The fuel lines that were interior to the cabin/cockpit and the sections that proceeded forward to the engine bay were consumed by fire. The main rotor transmission case, constructed of magnesium, had been consumed by the fire leaving only the mast, bull gear, bevel gears, and rotor head. All four rotor blade butts were attached to the blade grips, and the rotor blades had been severed outboard of the blade to hub attachment. All four blades were accounted for next to the wreckage. Each blade exhibited twisting and longitudinal separation of the trailing edge of the blade from the blade spar. One blade exhibited fire damage. All four tail rotor blades were present on the tail rotor hub and gear box, and pitch change links were observed attached. No evidence of rotational damage was observed on the blades.

The cargo hook trapeze cables were attached to two steel frames, and the 4 cables led to the cargo hook, which remained attached. The cargo hook was observed in the closed position, and the long line steel eye guide was still on the hook (the long line rope material had been

consumed by the fire). The mechanical release cable had been severed and the wires for the electrical release were destroyed by fire. The long line was sheathed in a protective sleeve and remained attached to the air scrubber that was being lifted. The long line was draped over the roof top of the containment house and over the side of the building directly above the helicopter wreckage. The end of the long line that had been closest to the helicopter exhibited expanded, charred, and bubbled nylon-like material consistent with being separated by extreme heat. The left landing gear main mount was located on the roof. The southeast corner of the roof's steel guard rail exhibited impact damage, as evidenced by ripping and curling the upper portion of the rail. Numerous pieces of rotor blade section were observed on the roof, and rotor blade portions were located in the 3rd floor office space directly below the damaged roof rail.

Due to fire damage of the cockpit and cabin area of the helicopter, the cargo hook circuit and positive identification of the electrical bus that energized the cargo hook was not accomplished.

TESTS AND RESEARCH

On March 22, 2011, the helicopter wreckage was examined at the Aircraft Recovery Service facility in Pearblossom, California. The Safety Board IIC oversaw the examination with assistance from technical representatives from the Federal Aviation Administration (FAA), Pratt & Whitney Canada, and Aris Helicopters. No pre-existing anomalies or failures of the airframe were identified during the examination. The PT6T-3 twin pack was removed from the airframe, placed in a crate, and shipped to Pratt & Whitney Canada for further examination.

On April 26-28, 2011, the disassembly and examination of the PT6T-3 twin pack was performed at the Pratt & Whitney facility in Montreal, Canada. The examination was supervised by the Safety Board IIC, and technical representatives from Pratt & Whitney and Aris Helicopters were present. A full set of examination notes is available in the official docket of this investigation. The #2 engine (SN 60474) intake screen exhibited organic dried leaf-like material embedded into the screen, and the #1 engine (SN 60477) intake screen was clear of any organic material or debris. Both engines displayed minimal impact damage and moderate fire and heat damage. Both the left-hand and right-hand power sections displayed very light rotational signatures to the compressor first stage shroud, compressor impeller shroud, and the power turbine shroud. The No. 1 power section compressor turbine shroud displayed light circumferential rubs and scoring due to contact with the adjacent blades. There were no indications of any pre-impact distress or operational dysfunction to any of the engine components, controls, and accessories examined. Functional testing of the fuel nozzles, fuel surge accumulators, minimum pressurizing valves, flow dividers, compressor bleed valves, and power turbine governors was satisfactory, with minor deviations that would not preclude normal engine operation. Fire and impact damage precluded functional testing of the fuel pumps, manual fuel control units, automatic fuel control units, and fuel oil heat exchangers. Disassembly and inspection of these remaining units showed no conditions that would preclude normal engine operation that were not attributable to impact and fire damage.

On June 21, 2011, the cargo hook was examined at the Onboard Systems facility in Vancouver, Washington. The examination was supervised by the Safety Board IIC and technical representatives from Onboard Systems were present. Examination notes are contained in the official docket of this investigation. The cargo hook was manufactured by Onboard Systems, part number 528020-06, SN 494. The entire mechanism was discolored soot gray, and the two halves of the hook casing were warped so that there was an observable gap between the halves. The mechanical (manual) release fitting (attaching the manual release cable to the hook casing) was modified with a guide tube and b-nut. The mechanism was disassembled, all components were accounted for, and there was no evidence of foreign debris or unusual wear. All components were in their proper position and moved in concert as designed. The solenoid that operates the electrical release was dark, sooted, with flakes of carbon on its surface consistent with being exposed to extreme heat, and could not be functionally tested. The solenoid actuator was free, easily rotated, and automatically returned to the normal position by applying hand force. No evidence was identified that would have precluded the normal operation of the hook system.

Onboard Systems demonstrated that the particular hook model that was used on this helicopter would open freely when the solenoid was energized or mechanical release activated. No additional force beyond the hook beam's own weight was required for the hook to open fully.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	52, Male
Airplane Rating(s):	None	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	Helicopter	Toxicology Performed:	Yes
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	July 31, 2010
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	April 30, 2010
Flight Time:	(Estimated) 7182 hours (Total, all aircraft), 2673 hours (Total, this make and model), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Sikorsky	Registration:	N33602
Model/Series:	S-58ET	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	58-727
Landing Gear Type:	Tailwheel	Seats:	11
Date/Type of Last Inspection:	March 7, 2011	Certified Max Gross Wt.:	13000 lbs
Time Since Last Inspection:	2 Hrs	Engines:	2 Turbo shaft
Airframe Total Time:	8934 Hrs at time of accident	Engine Manufacturer:	P&W
ELT:	C91 installed, activated, did not aid in locating accident	Engine Model/Series:	PT6 SERIES
Registered Owner:	HELI FLITE INC	Rated Power:	800 Horsepower
Operator:	Aris Helicopters	Operating Certificate(s) Held:	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KLAX, 125 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	09:53 Local	Direction from Accident Site:	360°
Lowest Cloud Condition:	Few / 10000 ft AGL	Visibility	6 miles
Lowest Ceiling:	Broken / 25000 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	4 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.2 inches Hg	Temperature/Dew Point:	16°C / 10°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Riverside, CA (KRIV)	Type of Flight Plan Filed:	Unknown
Destination:	El Secundo, CA	Type of Clearance:	None
Departure Time:	08:29 Local	Type of Airspace:	

Airport Information

Airport:	Los Angeles Intl KLAX	Runway Surface Type:	
Airport Elevation:	125 ft msl	Runway Surface Condition:	
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious	Latitude, Longitude:	33.912223,-118.389442

Administrative Information

Investigator In Charge (IIC):	McKenny, Van
Additional Participating Persons:	James M Magill; Federal Aviation Administration; El Segundo, CA Doug Hardy; Pratt & Whitney Canada; Montreal Wilfred Alfalla; Sikorsky Helicopters Scott Donley; Aris Helicopters; Riverside, CA
Original Publish Date:	March 28, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=78540

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).