Aviation Investigation Final Report

Location:	Grand Lake, Louisiana	**Accident Number:**	CEN13FA192
Date & Time:	March 15, 2013, 11:47 Local	**Registration:**	N574EH
Aircraft:	Sikorsky S-76A++	**Aircraft Damage:**	Destroyed
Defining Event:	Aircraft structural failure	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Other work use		

Analysis

The pilot and two mechanics were conducting a post-maintenance check flight of the helicopter's avionics system. After testing the avionics, the pilot allowed the mechanic to fly the helicopter at 1,000 feet above ground level. The mechanic maneuvered the helicopter for about 1 minute and then stated that he was transferring control of the helicopter back to the pilot. Two seconds later, the cockpit voice recorder (CVR) cut off. About 1 minute after the CVR cut off, the pilot made a routine radio call to the tower controller that he was returning to land. Two minutes after this call, the pilot radioed the tower controller and his company's dispatcher, stating that he had a problem and would be landing off-airport immediately. Several ground witnesses noticed the helicopter as it flew toward the accident site, and it was making an unusual noise, described as grinding, screeching, or whistling. The helicopter impacted with a high vertical descent rate and a postcrash fire ensued.

Examination of the helicopter revealed that the main rotor and tail rotor systems had low rotational energy at the time of ground impact. Two of the tail rotor blades (yellow and red) were fractured adjacent to the tail rotor hub. The fracture signatures on the red/yellow tail rotor spar assembly were consistent with the red tail rotor blade spar initially fracturing and the red tail rotor blade departing from the tail rotor.

The resultant imbalance of the tail rotor fractured the tail gearbox (TGB) output housing studs and most likely tripped the CVR g-switch, which cut off the CVR. The yellow tail rotor blade spar fractured due to high centrifugal forces as a result of the imbalance, and the yellow blade departed from the tail rotor; the tail rotor was then rebalanced. The two remaining tail rotor blades continued to provide partial tail rotor anti-torque, and tail rotor drive remained continuous through the TGB. The entirety of the red and yellow blade separation event likely occurred very quickly, with only a momentary bump or vibration at the time of blade separation.

As the TGB output housing began to separate from the center housing, the gears likely began going out of mesh, allowing the output bevel gear to eventually contact the TGB center housing. This condition

likely resulted in the loud, unusual noise reported by witnesses, as well as a drag force on the tail rotor drive system. As the pilot attempted to land, he likely shut the engines down in conjunction with an autorotative landing. Because the tail rotor drive system and main transmission remained mechanically linked, when the engines were shut down, it is likely that main rotor speed (Nr) degraded due to the compromised TGB. As a result, the helicopter developed a high vertical descent rate until ground impact.

The red blade spar fracture signatures were consistent with a fast-growth failure mode. Plausible fast-growth failure modes that were examined included a discrete impact event (e.g. object strike), anomalous operation of the pivot bearing, and a fracture of the pitch horn box (the structure which attaches the pitch horn to the blade and to which the pivot bearings and bumper attaches). With the lack of available evidence because the red blade was not recovered, the specific failure mode could not be determined during the investigation.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

Fracture of the red tail rotor blade spar, which resulted in the separation and departure of the red tail rotor blade from the helicopter and subsequent compromised tail gearbox. The red tail rotor blade was not recovered, thus the cause of the initial fracture could not be determined.

Findings

Aircraft	Tail rotor blade - Failure
Aircraft	Tail rotor gearbox - Damaged/degraded
Aircraft	Descent rate - Attain/maintain not possible

Factual Information

History of Flight

Maneuvering	Aircraft structural failure (Defining event)
Approach	Flight control sys malf/fail
Landing	Loss of control in flight

HISTORY OF FLIGHT

On March 15, 2013, about 1147 central daylight time, a Sikorsky S-76A++ helicopter, N574EH, was destroyed after ground impact near Grand Lake, Louisiana. All three occupants onboard, the pilot and two maintenance personnel, were fatally injured. The helicopter was registered to Era Helicopters LLC and was operating under the provisions of 14 Code of Federal Regulations Part 91 as a post-maintenance check flight of avionics systems. Visual meteorological conditions prevailed for the local flight, which departed from Lake Charles Regional Airport (LCH), Lake Charles, Louisiana at 1119.

At 1120, LCH tower controller instructed the pilot to report inbound to LCH at the completion of the maintenance flight. The pilot acknowledged and advised he would remain on the LCH air traffic control (ATC) frequency. At 1145, the pilot advised LCH ATC that he was about 10 miles to the south of LCH and would be returning for landing.

At 1146:57, the pilot called LCH tower controller and advised he had an emergency and would be immediately landing off the airport. At 11:47:02, the pilot called the Era Helicopters company dispatcher and advised that he had a problem and would be landing immediately. The wreckage of the helicopter was found about 5 miles southeast of the threshold for Runway 33 at LCH. The majority of the helicopter was consumed by a post-crash fire.

Several witnesses noticed the accident helicopter as it flew toward the accident site. The first witness, a helicopter pilot, stated that he observed the accident helicopter in a shallow descent as it passed just east of his house about 600 feet above ground level. He stated that the helicopter was producing an unusual, grinding noise as it passed over his house. After watching the helicopter pass by his house, he walked inside his house to avoid directly viewing a possible crash. As he walked back outside, he noticed smoke plumes to the north of his house.

A second witness, a previous Navy helicopter mechanic, recorded a cell phone video of the helicopter as it passed by his position. He stated the helicopter's rotor system sounded abnormal as it flew by, making a loud, screeching noise. He stated the helicopter appeared to slow down, then the helicopter's tail rose up and it started to spin. He heard a loud boom and saw a plume of smoke.
A third witness stated the helicopter was making a whistling type of noise as it flew toward LCH. At about 100 to 150 feet above the ground, he noticed the helicopter pitch down and then spin for about five revolutions. He stated that he did not hear any noise from the helicopter as it was spinning. After the

helicopter impacted the ground, he noticed flames and smoke.
A map of witness locations and the helicopter's flight path is located in the docket for this investigation.

PERSONNEL INFORMATION

The pilot, age 69, held an airline transport pilot certificate with airplane single-engine land, rotorcraft-helicopter, and instrument helicopter ratings. According to records provided by Era Helicopters, the pilot had accumulated 22,564 hours of total flight experience, with 54 hours in the last ninety days. The pilot had accumulated 850 hours of flight experience in the make and model of the accident helicopter. On February 8-9, 2013, the pilot completed recurrent training in a SK-76 simulator, which included 8 hours of flight time. Dual engine failure/autorotation and tail rotor malfunctions were accomplished during this recurrent training.
On April 2, 2012, the pilot was issued a Class 1 time limited special issuance medical certificate, which required corrective lenses be worn for near vision. During the last examination, the pilot was evaluated for his history of myocardial infarction, angina pectoris and coronary artery disease requiring percutaneous transluminal angioplasty, hypothyroidism, and the use of medication.

AIRCRAFT INFORMATION

The Sikorsky S-76A++ helicopter has a four-bladed, fully articulated main rotor that provides helicopter lift and thrust, and a four-bladed flexible beam tail rotor (spar) that provides main rotor anti-torque and directional control. The helicopter is equipped with two Turbomeca Arriel 1S1 turboshaft engines that are positioned side-by-side behind the main transmission assembly.
The accident helicopter, serial number (S/N) 760369, was manufactured in 1990. Records show the helicopter had accumulated an aircraft total time (ATT) of 6,765.7 hours as of March 15, 2013. The No. 1 engine, S/N 3016, had a time since new (TSN) of 8361.10 hours and a time since overhaul (TSO) of 1475.11 hours as of March 15, 2013. The No. 2 engine, S/N 3508TEC, had a TSN of 6696.80 hours and a TSO of 1287.50 hours as of March 15, 2013.

METEOROLOGICAL INFORMATION

The weather observing station at LCH reported the following conditions at 1153: wind 180 degrees at 13 knots with gusts to 19 knots, visibility 10 miles, clear skies, temperature 23 degrees Celsius, dew point 14 degrees Celsius, altimeter setting 30.05.

FLIGHT RECORDERS

A solid-state cockpit voice recorder (CVR), model L3/Fairchild FA2100-1020, was recovered at the accident site and sent to the NTSB Audio Laboratory for readout. Timing of the accident flight CVR recording was aligned with timing information provided by a time-encoded ATC recording. Other transmissions in the CVR recording were used to validate the alignment of the two recordings.
A summary of the CVR is as follows:

1113: The accident flight recording began, with a sound similar to an engine starting.
1115: The pilot and a mechanic noted that the automatic flight control system (AFCS) test passed with no faults.
1120: The mechanic noted that they needed to do a power check when they returned. The pilot agreed.
1127: The mechanic asked if he could fly after the maintenance checks.
1127-1142: The pilot performed a series of turns, climbs, and descents to check the avionics, flight directors, and autopilot systems. The pilot and mechanic agreed one of the two flight directors may have had a remaining problem.
1142: The pilot asked the mechanic if he wanted to fly the helicopter. The mechanic agreed, and the pilot said he would set the helicopter up for the mechanic on a heading of 150 degrees at an altitude of 1,000 feet. The mechanic noted the helicopter was not like the Cessna 172 he had flown.
1143:00: The pilot said to the mechanic, "it is all yours…do anything you want with it."
1143:06: The mechanic asked if he needed to use the pedals. The pilot said only during power changes.
1143:17: Two high pitched tones, similar to an altitude alert, were recorded.
1143:42: The mechanic said "not quite as touchy as I thought it would be."
1143:45: The pilot said, "oh that's because I've got everything turn on."
1143:55: The pilot said, "What we'll do, we'll take these autopilots off. Take our forced trim off."
1144:04: The mechanic said, "oh yea, there we go; now I'm flying something. Okay."
1144:10: The mechanic said, "Okay, you got her."
1144:12: Two or three snapping sounds were recorded on the intercom. At the same time, the cockpit area microphone recorded a sound similar to the rotor or engine RPM increasing. The two or three snapping sounds, about 0.25 seconds in length, may have been a virtual artifact of the power removal from the CVR and not a physical sound that existed in the helicopter.
1144:13: The CVR recording ended.
For additional information on the CVR, see the Sound Spectrum Study and full transcript of the CVR in the docket for this investigation.

WRECKAGE AND IMPACT INFORMATION

Representatives from the National Transportation Safety Board (NTSB), Federal Aviation Administration (FAA), Sikorsky Aircraft Corporation (SAC), and Era Helicopters were present for the documentation and investigation of the helicopter accident site. Of the four tail rotor blades, two of the tail rotor blades ('yellow' and 'red') were fractured adjacent to the tail rotor hub; at the time of this report, these two tail rotor blades have not been located and recovered.

The helicopter came to rest upright on a southerly heading. The majority of the airframe, including the cockpit, main cabin, and forward portion of the tailboom, was either consumed or heavily heat distressed by the post-crash fire.

Three of the four main rotor blades remained connected to the main rotor hub and the main rotor blade spindles were oriented at about 11 o'clock, 2 o'clock, 5 o'clock, and 8 o'clock positions when viewed from above. The 11 o'clock blade had fractured chordwise outboard of its pitch horn but was found adjacent to the main wreckage about 6 feet away. All four main rotor blades exhibited evidence consistent with low rotational energy at ground impact. The 5 o'clock and 11 o'clock blades exhibited severe chordwise deformation of the spar consistent with exposure to extreme heat. The tip cap for the 5 o'clock blade was found separated from the blade and was found about 12 feet to the east of the main wreckage.

The majority of the main transmission case was consumed by post-crash fire, exposing its internal gears which exhibited evidence of exposure to extreme heat. The main rotor controls were continuous from the three main rotor hydraulic actuators' lower attachment fittings through the swashplate and up to the pitch control rods' connection to the pitch horns. The main rotor controls forward of the hydraulic actuators were consumed by post-crash fire, thus its continuity could not be confirmed.

The two engines were found behind the main transmission and were still covered by the engine cowling. Both engines exhibited evidence of exposure to the post-crash fire. Neither engine's axial compressor showed evidence of foreign object debris ingestion. Additionally, neither engine's free turbine exhibited evidence of blade shedding. The fuel control unit throttle block remained attached to the cable and the pointer was consistent with the shutdown position, but the throttle scale had been consumed by post-crash fire.

The empennage, consisting of the vertical stabilizer and the left and right horizontal stabilizers, was found immediately aft of the main wreckage, and generally aligned with longitudinal axis of the main wreckage. The empennage was found resting on its left side (i.e. the right horizontal stabilizer was pointed almost vertically upward) with the left horizontal stabilizer fractured chordwise adjacent to the vertical stabilizer. The empennage did not exhibit evidence of heat damage apart from the forward end which connected it to the heat-distressed tailboom. The surfaces of the empennage which were not heat damaged did not exhibit evidence of soot deposits.

Only two of the four tail rotor blades (the 'black' and 'blue' blades) were recovered at the accident site. The 'black' blade had fractured from the 'black'/'blue' tail rotor spar while the 'blue' blade remained attached to the spar. The 'blue' and 'black' blade surfaces were mostly intact and did not exhibit signatures of damage associated with high rotational energy. The 'black' and 'blue' pitch change links (PCL) remained attached on both ends to the pitch beam and their respective blade pitch horns.

The 'red' PCL had fractured at the pitch beam-side threads and the remainder of the 'red' PCL was not recovered. The remnant 'red' PCL remained attached to the pitch beam. The 'yellow' PCL remained whole and attached on its outboard end to the pitch beam, but the inboard rod end was observed to be free. The bolt and nut connecting the 'yellow' PCL to its respective blade pitch horn were not recovered.

Disassembly of the pitch beam and outboard retention plate revealed the 'red'/'yellow' tail rotor spar had shifted toward the 'yellow' blade side by evidence of the shifted spar nylon wraps. The elliptical plug of the 'red'/'yellow' spar exhibited crushing damage on the 'red' blade side, with the direction of crushing going toward the 'yellow' blade side.

The intermediate gearbox, tail gearbox (TGB), tail rotor head components, tail rotor blades, rotor brake, and the Nos. 3, 4, and 5 tail rotor drive shafts were retained for further examination.

For additional information on the wreckage, see the Airworthiness Group Chairman's Factual Report in the docket for this investigation.

MEDICAL AND PATHOLOGICAL INFORMATION

On March 16, 2013, an autopsy was performed on the pilot at the Calcasieu Parish Coroner's Office and Forensic Facility. The cause of death was due to blunt force injuries.

The FAA's Civil Aeromedical Institute in Oklahoma City, Oklahoma, performed toxicology tests on the pilot, which was limited by specimens suitable for testing. No ethanol was detected in the muscle or brain. Atorvastatin (Lipitor), a lipid lowering agent used to treat lipid disorders and elevated cholesterol, was detected in the liver. Carvediliol (Coreg), a prescription nonselective ß-adrenergic blocking agent used to treat heart failure and hypertension (high blood pressure), was detected in the muscle and liver. Diltiazem (Cardizem), a prescription calcium ion cellular influx inhibitor used to treat high blood pressure and angina, was detected in the liver.

Review of available FAA medical certificates and supporting documentation indicated the pilot had a remote heart attack treated with angioplasty (opening of coronary arteries with a balloon) and ongoing treatment with medication. On January 25, 2012, a radionuclide stress test was conducted on the pilot and read normal. On March 6, 2013, an exercise stress test/stress echocardiogram was conducted on the pilot and read normal, with normal wall motion and no evidence of ischemia.

TESTS AND RESEARCH

From April 9-11, 2013, the Airworthiness Group, consisting of participants from the NTSB, FAA, SAC, and Era Helicopters, convened to further examine the retained components. The examination revealed signatures consistent with the 'red' tail rotor blade initially separating from the tail rotor assembly, followed by the 'yellow' tail rotor blade separating from the tail rotor assembly due to forces caused by the shift in the center of mass along the span of the 'red'/'yellow' tail rotor blade spar.

The spar fracture located near the root end of the 'red' tail rotor spar was adjacent to the 'red' blade's bumper plate. The area of the 'red' side bumper plate exhibited a slight bowing in the outboard direction (when looking outboard from the pylon-side of the spar). The remnant adhesive layout for the 'red' blade's pivot bearing retainer was observed on the spar fracture.

Examination of the remnant adhesive layout under a scanning electron microscope (SEM) revealed no definitive direction that the layout fibers were pulled. The fracture had a broomstraw appearance, with the broomstraw appearance more prevalent near the central width of the spar. Examination of the fracture under a SEM revealed no evidence consistent with composite matrix rubbing due to delamination.
The opposing spar fracture on the 'yellow' side was located near the edge of the retention plate. The 'red'/'yellow' spar had S/N "A-116-01207" stenciled on the surface of the spar. The spar fracture had an overall blunt and flat appearance.

X-ray examination of the remnant 'red'/'yellow' spar and the 'black'/'blue' spar showed no evidence of "waviness" of the composite filaments in the undamaged areas. The 'black' and the 'blue' tail rotor blades exhibited no evidence of damage consistent with high rotational energy at the time of the accident.

The TGB was examined and contained only traces of oil. No oil sample was submitted with the TGB. The TGB was not drained of oil when it was recovered at the accident site.

The output housing of the TGB, containing the output bevel gear, was separated from the center housing; the mounting hardware for the tail rotor quadrant, spring capsules, and pulleys were holding the output housing to the center housing. Rotation of the input pinion by hand did not engage the output bevel gear. There was no evidence of binding when the input pinion was rotated. Rotation of the output bevel gear by hand revealed no evidence of binding. The pitch change shaft rotated in unison with the

output bevel gear. The TGB exhibited no signatures of damage to its internal bearings. Additionally, the TGB housing exhibited no discoloration of its external paint or internal coatings consistent with heat distress.

The output bevel gear and output housing were removed from the TGB center housing as a single assembly. The splines and threads on the outboard end of the bevel gear exhibited no signatures of damage. The lock washer, large nut, and tapered split cone exhibited no signatures of damage. The top land of the output bevel gear teeth exhibited damage from the tooth heel to about 1/3 of the length of the top land. One of the twelve bolts securing the output bevel gear to the output gear shaft was fractured; the fracture surface exhibited signatures of overload. Small metallic flakes were found throughout the output bevel gear surfaces and the inner diameter of the output gear shaft. The flanges of the output housing that attaches to the center housing were fractured. The flanges remained attached to the center housing with their respective attaching nuts. All observed fracture surfaces of the output housing exhibited signatures consistent with overload.

The nuts securing the input pinion and housing assembly to the center housing remained installed and intact. The input pinion and input housing were removed from the TGB center housing as a single assembly. The top land surface of the input pinion gear teeth exhibited damage from the tooth heel to about one half of the length of the top land. The driving and coasting surfaces of the input pinion gear teeth did not exhibit signatures of abnormal operation or of foreign object damage (FOD) ingestion through the gear mesh. Small metallic flakes were found throughout the surfaces of the input pinion.

The exterior of the center housing exhibited no signatures of cracks or fractures aside from those associated with the fracture of the output housing. Small metallic flakes were found throughout the interior surfaces of the center housing and a trace amount of oil was found inside the housing. On the center housing, impressions of output bevel gear teeth impacting the sealing surface (the inner diameter mating surface) to the output housing were seen from about the 3 o'clock to the 8 o'clock position; the impressions were consistent with impact from a non-rotating output bevel gear. Damage to the center housing with an appearance similar to machining was found adjacent to the sealing surface from about the 7 o'clock to the 12 o'clock position; this damage was consistent with impact from a rotating output bevel gear. Additional static gear tooth impressions were found on the damaged area with the machined appearance.

On September 5, 2013, the 'blue' and 'black' tail rotor blades were brought to the Feather Identification Lab in Washington, District of Columbia (DC), part of the Smithsonian Institution's National Museum of Natural History, to determine if there was evidence of snarge (bird remains) on the blades. Additionally, on September 24, 2013, a specialist from the United States Department of Agriculture (USDA) Wildlife Services in Louisiana examined the tail rotor area of the helicopter wreckage for evidence of snarge. No evidence of bird remains consistent with a bird strike were found on the components.

Because of the relatively low time in service from the 'red'/'yellow' blade assembly's last 1,500 hour spar inspection (5.9 flight hours), the Airworthiness Group examined the S-76 tail rotor 1,500-hour inspection procedures for deficiencies and maintenance actions that could either damage the spar or affect the stresses on the spar. One particular action that was examined concerning the spar inspection is removal of the pivot bearing. Pivot bearing compression screws are used to compress the pivot bearings in order to remove them from the tail rotor blade assembly. Within the pivot bearing replacement

procedures, found in Sikorsky S-76 Maintenance Manual No. SA 4047-76AA-2, exists a caution during the installation of the pivot bearings that states: "Ground support compression screw is not flight hardware. Make sure compression screw is removed before completing maintenance."

On July 23, 2014, the Airworthiness Group, consisting of representatives from the NTSB, FAA, SAC, Bell Helicopter, and Era Helicopters, convened at Bell Helicopter Broussard to perform testing on a scrap tail rotor blade set to determine whether a tail rotor blade could be fully assembled with the compression screw still installed in the pivot bearing and the likelihood of detecting the compression screw. The Airworthiness Group determined that a tail rotor blade could be assembled with the compression screw installed. Additionally, a tail rotor blade assembled with a compression screw left installed in the pivot bearing was visually no different than one without a compression screw left installed in the pivot bearing. However, a tactile inspection of the tail rotor blade revealed a noticeable increase in the force required to pitch and flap a blade with a compression screw still installed in the pivot bearing versus a blade without the compression screw installed.

The Airworthiness Group also performed a tail rotor blade spar "flex check" on a known cracked blade spar and determined that the audible sound made by a cracked spar was relatively quiet. The Airworthiness Group determined that a compression screw within the pivot bearing would increase the stiffness of the pivot bearing and could affect the bending stresses on the spar during blade flapping, though no testing was done to determine what affect this stiffness would have on the pivot bearing in operation.
For additional information on tests and research, see the Airworthiness Group Chairman's Factual Report in the docket for this investigation.

MAINTENANCE HISTORY OF TAIL ROTOR BLADE ASSEMBLY

The 'red'/'yellow' blade assembly, S/N A137-00708X, was manufactured by SAC on June 14, 1984. The spar, part number (P/N) 76101-05017-045 and S/N A116-01207, was manufactured on May 16, 1984. According to maintenance records, all life limited components to blade assembly S/N A137-00708X were original since blade assembly manufacture with the exception of both pitch horns, which were replaced on October 25, 2007 due to the original pitch horns exceeding their life limit of 12,000 hours.

Blade assembly S/N A137-00708X was last removed from a different helicopter (N578EH) on January 7, 2012, with the cause for removal listed as paint erosion and a 1500 hour inspection that was due. Blade assembly S/N A137-00708X was subsequently sent to a Bell Helicopter Broussard, formerly Rotor Blades Inc. (RBI), in Broussard, Louisiana. Work performed on the blade assembly by Bell Helicopter Broussard, under work order no. S76T-137-00708, included replacement of the polyurethane strips, rubber boots, and compliance with the 500-hour and 1500-hour inspections. The airworthiness approval tag (FAA form 8130-3) for blade assembly S/NA137-00708X, signed on March 22, 2012, stated the blade was also refinished and balanced.

According to Era Helicopters, blade assembly S/N A137-00708X was kept in storage at Era Helicopters' facilities in Lake Charles, Louisiana until January 29, 2013, when the blade assembly was installed on the accident helicopter. On January 29, 2013, the ATT was 6,759.8 flight hours and blade assembly S/N A137-00708X had a time since new (TSN) of 14,800.5 flight hours. The accident helicopter accumulated about 5.9 flight hours from the 'red'/'yellow' blade installation onto N574EH until the accident flight.

After blade assembly S/N A137-00708X was installed on the accident helicopter, maintenance records showed that an airworthiness check was performed on March 3, 2013 using the criteria required by the Era S-76 helicopter emergency medical services (HEMS) approved airworthiness inspection program (AAIP). The airworthiness check was directed by an Era Helicopters Fleet Campaign Directive (FCD) No. FCD-000119-2012, which required a maintenance supervisor or lead to perform an airworthiness check of the aircraft with the technician. The S-76 HEMS AAIP airworthiness check requires inspection of the tail rotor blades for cracks, security, and condition, including a tail rotor spar flex check and force-deflection check.

On March 7, 2013, maintenance records showed that an Era technician performed a tail rotor balance 'light on wheels' inspection on the accident helicopter. This tail rotor balance inspection was approved by an Era supervisor on March 9, 2013. On March 10, 2013, a S-76 HEMS AAIP airworthiness check was accomplished as a final maintenance action to approve the helicopter for flight.

HISTORICAL S-76 TAIL ROTOR SPAR FAILURE INFORMATION

On August 19, 1991, a Sikorsky S-76A+ helicopter, S/N 760223, performed a precautionary landing on an offshore platform after the crew experienced a heavy vibration that lasted about 4 seconds. The precautionary landing took place about 15 minutes after the crew experienced the heavy vibrations. Upon landing, two opposing tail rotor blades were found to have departed the tail rotor. The missing tail rotor blades were never recovered. A small central section of the affected spar was found between the retention plates. The affected components were sent to SAC's materials engineering lab for investigation. Lab examination revealed evidence consistent with one of the tail rotor blades fracturing first, and the resultant shift in the center of gravity and imbalance in centrifugal forces led to the opposing blade to eventually fracture as well. The remnant spar did not show evidence of ply waviness consistent with a manufacturing anomaly, rubbing of the plies consistent with spar delamination, or a material defect. The tail gearbox housing exhibited a partially circumferential overload fracture across three of the flanges used to attach the output housing to the center housing. Maintenance records revealed the tail rotor spar had a TSN of 1,571 hours, with 1,507 hours accumulated on the incident helicopter.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	69
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	5-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	April 2, 2012
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 8, 2013
Flight Time:	22565 hours (Total, all aircraft), 850 hours (Total, this make and model), 21571 hours (Pilot In Command, all aircraft), 54 hours (Last 90 days, all aircraft), 19 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Sikorsky	**Registration:**	N574EH
Model/Series:	S-76A++	**Aircraft Category:**	Helicopter
Year of Manufacture:	1990	**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	760369
Landing Gear Type:	Retractable - Tricycle	**Seats:**	14
Date/Type of Last Inspection:	March 10, 2013 AAIP	**Certified Max Gross Wt.:**	10800 lbs
Time Since Last Inspection:	6 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	6760 Hrs at time of accident	**Engine Manufacturer:**	TURBOMECA
ELT:	C91 installed, activated, did not aid in locating accident	**Engine Model/Series:**	ARRIEL 1S1
Registered Owner:	ERA HELICOPTERS LLC	**Rated Power:**	725 Horsepower
Operator:	ERA HELICOPTERS LLC	**Operating Certificate(s) Held:**	Rotorcraft external load (133), On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KLCH,15 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	11:53 Local	**Direction from Accident Site:**	330°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	13 knots / 19 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.04 inches Hg	**Temperature/Dew Point:**	23°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lake Charles, LA (KLCH)	**Type of Flight Plan Filed:**	Unknown
Destination:	Lake Charles, LA (KLCH)	**Type of Clearance:**	VFR
Departure Time:	11:19 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	2 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	30.03861,-93.167503

Administrative Information

Investigator In Charge (IIC):	Folkerts, Michael
Additional Participating Persons:	Jason Adame; Federal Aviation Administration; Baton Rouge, LA Michael Binder; Sikorsky Aircraft Company; Stratford, CT Bryan Larimore; Turbomeca USA; Grand Prairie, TX Val Marshall; Era Helicopters; Lake Charles, LA Harold Barrentine; Bell Helicopter; Fort Worth, TX Kirk Gustafson; Federal Aviation Administration; Boston, MA
Original Publish Date:	January 27, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=86426