



# National Transportation Safety Board Aviation Accident Factual Report

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<b>Location:</b>	High Island 573, GM	<b>Accident Number:</b>	FTW04FA029
<b>Date &amp; Time:</b>	12/01/2003, 0821 CST	<b>Registration:</b>	N457PH
<b>Aircraft:</b>	Bell 407	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>		<b>Injuries:</b>	1 Fatal
<b>Flight Conducted Under:</b>	Part 135: Air Taxi & Commuter - Non-scheduled		

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## HISTORY OF FLIGHT

On December 1, 2003, at 0821 central standard time, a Bell 407 single-engine helicopter, N457PH, registered to and operated by Petroleum Helicopters Inc. (PHI), of Lafayette, Louisiana, was destroyed when it impacted water following a loss of power while operating over open ocean water in the Gulf of Mexico in the vicinity of offshore platform High Island 560 (HI 560). The commercial pilot, who was the sole occupant, sustained fatal injuries. Visual meteorological conditions prevailed and a flight plan was not filed for the Title 14 Code of Federal Regulations Part 135 on-demand air taxi cargo flight. The flight departed from offshore platform, High Island 573, at 0814, and was en route to offshore platform High Island 264 when the accident occurred. The call sign for the flight was "El Paso 63."

The following is a chronology of the helicopter's flight activity on the morning of the accident:

0700 - Departed offshore platform, High Island 264A, with no passengers.

0702 - Landed on High Island 264C and picked up 5 passengers.

0705 - Departed High Island 264C

0723 - Landed on High Island 573 and dropped off 2 passengers.

0725 - Departed High Island 573 with 3 passengers.

0737 - Landed on High Island 582 and dropped off 3 passengers.

0739 - Departed High Island 582 with no passengers.

0754 - Landed on High Island 573 and shut down. The shut down was due to a wait for cargo.

0814 - Departed High Island 573 with cargo (5, ten-pound safety valves which were placed in the baggage department).

0821 - A "Mayday" call received was on company operating frequency 122.82mhz. The call was digitally recorded by the operator's communications center: "Mayday, Mayday, Mayday," and then a short pause, following by, "El Paso six-three, Mayday, Mayday, Mayday."

No further radio transmissions were received and response from the communications center was unanswered. Approximately 1150, the pilot's body was found floating and recovered by a rescue vessel. Three days later, the submerged helicopter wreckage was recovered from approximately 240 feet of water.

#### PERSONNEL INFORMATION

The pilot held a valid commercial pilot certificate with rotorcraft and instrument helicopter ratings. His most recent second-class medical certificate was issued on November 13, 2003, with the limitation to wear corrective lenses. The pilot had accumulated over 14,000 hours of flight time in his career as a pilot, 10,700 hours of which were as pilot-in-command (PIC) of single-engine turbine helicopters while employed by PHI. He had accumulated 844 hours in the Bell 407 as PIC. Most of the pilot's flight time was accumulated flying offshore in the Gulf of Mexico. The pilot's most recent airman proficiency check was successfully completed on December 11, 2002. The pilot had 151 hours in the Bell 407 in the previous 90 days before the accident and 52 hours in the previous 30 days.

#### AIRCRAFT INFORMATION

The helicopter, serial number 53147, was manufactured in March of 1997, received its initial airworthiness certificate on May 23, 1997, and was delivered to the operator on May 30, 1997. At the time of the accident, the aircraft had accumulated a total time of 4600.1 hours. The engine, a Rolls Royce model 250-C47B, serial number CAE-847043, had accumulated a total time of 4647.2 hours. Research of the airframe records showed the last major inspection accomplished was the 300-hour/3-month inspection at 4576.55 total airframe time on November 11, 2003. All of the life limited components were within limits and verified. Part numbers and serial numbers of actual installed components was verified. The last inspection of the aircraft was accomplished on November 11, 2003 (daily inspection). In addition, the 600-hour Lead The Fleet (LTF) inspection was accomplished on November 11, 2003, and the 25/50 LTF inspection was accomplished on November 11, 2003. The last major component change was the 1800-hour rotor brake overhaul accomplished on November 11, 2003 at 4537.05 total airframe hours. Airworthiness Directive research showed that all directives were accomplished prior to their required due date.

Engine records research showed the last major engine inspection was the 150-hour inspection accomplished at 4520.2 total airframe time. In addition, the 300-hour inspection was accomplished at 4528.55 total airframe time. The 2000-hour inspection was accomplished at 3489.0 total airframe time. The 100-hour Hydro-Mechanical Unit (HMU) inspection was

accomplished at 4557.0 total airframe hours. The bleed valve was overhauled and replaced at 4378.55 airframe total time. Critical turbine component cycles (comprised of 4 turbine wheels) as of December 1, 2003, were: 1st stage wheel - 1,826 cycles; 2nd stage wheel - 1,826 cycles; 3rd stage wheel - 1,882 cycles; 4th stage wheel - 4,818 cycles. According to records, the turbine assembly p/n-23063354, s/n-CAT44419, had 3,940.5 hours of operation, and 890.1 hours remaining until the next overhaul.

## WRECKAGE AND IMPACT INFORMATION

Recovery: When the helicopter was raised by the recovery crew and placed on the barge, it was washed with fresh water. The general condition of the wreckage as it lay in-situ on the ocean floor was documented by divers as follows: All 4 main rotor blades were found attached to their respective grips and displayed minimal damage. The main rotor mast was not damaged and the main rotor pitch change links and horns were all attached and not damaged. The tail boom was attached to the fuselage and the tail rotor hub and blade assembly was intact. Several holes and dents were noted on the engine exhaust stack. Straps were attached around the main rotor mast, pitch change links, pitch change horns, and under the bottom of the fuselage to raise the wreckage to the surface. As the wreckage was brought to the surface and placed on the barge, it was noted that the main rotor pitch change links and pitch change horns were bent. The skid mounted floats were attached to the skids, not deployed, and the float inflation bottles were found fully charged. When the helicopter was removed from the barge and placed on the truck for transport, the four main rotor blades were removed from their respective grips, the skid assembly was removed, and the float bottles were discharged. The Electronic Control Unit (ECU) and HMU canon plugs were disconnected and washed with fresh water and covered with plastic. The ECU was preserved and shipped to Goodrich, West Hartford, Connecticut, for data retrieval.

An examination of the airframe and engine was conducted at the PHI facility, located in Lafayette, Louisiana, on December 5-7, 2003.

Airframe/ Main Fuselage: The fuselage was collapsed from impact forces, and the roof structure was fractured laterally in three different locations; in front of the forward transmission support legs, the aft passenger bulkhead, and behind the aft firewall. Associated with the aft roof fracture was a complete fracture of the aft fuselage, which was held together with mangled wires. The floor structure was also found fractured in three locations and a portion of the floor was missing on the pilot's side just ahead of the forward seat-frame support. The vertical tunnel was found fractured and deformed consistent with overload forces, and the nose exhibited significant crushing. All doors were missing except the latch portion of the right passenger door. The pilot's seat pan and seat structure were deformed downward. Several punctures were observed protruding through the bottom of the seat pan, and their respective imprints corresponded to several items under the seat pan (cyclic centering support, sensor for cyclic metering, and a heater hose T-connection). The pilot's left seat belt attachment fitting was found fractured at the hinge connection on the forward bulkhead. The seat buckle was found still buckled with the shoulder harness straps attached.

**Landing Gear:** The skid landing gear was mostly intact with all four saddles attached to corresponding skids and crosstubes, however, both crosstubes were spread consistent with high vertical loads at impact with the water. Both float steps were fractured and were missing except the forward section of the left step. Flattening of the crosstubes was more prevalent on the forward crosstube and on the right side of both crosstubes, which was consistent with airframe damage being more severe on the forward right side of the helicopter. The float bags had not deployed, and were secure in their skid mounted enclosures.

**Tailboom & Tail Rotor:** The tail boom was mostly intact with the exception that the right horizontal stabilizer was fractured in an upward direction. The bottoms of the right and left stabilizer endplates were bent inboard near the stabilizer attach points. Tail boom skin was deformed in two locations on its bottom right side consistent with water impact. The bottom of the vertical fin was bent left at the bottom of the support cast, and upward crushing of the fin honeycomb structure. The tail rotor driveshafts were found disconnected on either side of the oil cooler driveshaft consistent with impact forces. Drive continuity in the tail rotor drive system was established and all hangar bearings rotated freely. The tail rotor blades were found attached and secure in the hub. Free pitch change movement in the tail rotor hub was observed and transmitted forward through the control tube to the fracture at the aft portion of the fuselage.

**Flight Controls:** Numerous separations in the fixed flight controls were observed at locations associated with airframe deformations, fractures, and damage. The throttle cable was fractured consistent with impact forces. Control continuity was established from the collective and cyclic to the main rotor hub assembly. The collective was fractured at its base, and the collective jack-shaft was fractured away from its mount on the pilot seat bulkhead. The pilot's cyclic stick also was fractured at its base and was missing. The tail rotor pedal assembly was missing, as was the honeycomb floor structure where the pedals were attached.

**Drive System:** Salt water corrosion damage was observed on the transmission case that resulted in corrosion by-products being present in the internal transmission gear systems. As a result, the transmission would not turn prior to disassembly and cleaning. After disassembly, no distress was noted on any of the internal gears. Once the transmission was cleaned of corrosion by-products, the components were able to be rotated by hand. When the chip detectors were removed from the transmission, oil residue and corrosion was observed on the detector ends, but no metal chips were noted. The freewheeling unit was not disassembled but rotated in the freewheeling direction and the spraggs engaged in the drive direction.

**Main Rotor Blades and Hub Assembly:** Initial photos taken during recovery showed that the main rotor blades remained attached to the main rotor hub assembly, and two of the blades exhibited downward bending. The Green blade (s/n A-176) had a downward bend approximately 71-inches outboard from the blade bolt hole. The Red blade (s/n A-192) had a downward bend about 72-inches outboard from the blade bolt hole. Both the Orange blade (s/n A-74) and the Blue blade (s/n A-295) exhibited trailing edge root closure damage and some minor delaminations on their blade skins. The lack of leading edge damage was consistent with a relatively lower rotor RPM at impact. The Blue and Orange yoke arms on the main rotor hub assembly exhibited significant delaminations and fractures in the flexures. The Red

flexure arm also exhibited delaminations and fractures on the bottom outboard surfaces. The Green flexure arms, on both the leading edge and trailing edge inboard surfaces near the lead/lag bearing, exhibited yoke fractures on the top surface of the yoke. Each of the four outboard elastomeric bearings on the adapter showed delaminations. Additionally, contact by all four sets of the upstops and downstops were observed on the pitch horn contact plate. All four main rotor hub flapping elastomeric bearings exhibited movement when the swashplate was manipulated by hand.

**Servos/Hydraulic Pump:** All servos were bench tested for functionality at an operating pressure of 1,000 pounds per square inch (psi). The left lateral, right lateral, and collective servos appeared to function within the manufacturer's tolerance. The hydraulic pump was tested at 4,300 rpm with an input pressure of 12 psi. The pump showed an output pressure of 1,000 psi (+or- 25 psi) at a flow rate of 2.0 gallons per minute (gpm). No anomalies were noted. The manufacturer's requirements for this same type pump in a new/overhauled condition are 1,000 psi output pressure with a minimum flow rate of 2.85 gpm.

**Fuel System:** The airframe fuel filter was examined and the canister was full of a mixture of water, fuel, and mud. The filter element did not exhibit significant particulates between the fuel filter element folds. The main fuel tank was compromised, consistent with impact forces.

**Engine:** After recovery, visual inspection showed heavy salt-water corrosion. N1 and N2 were found locked and would not rotate. All rigid and flexible oil and fuel lines were intact and all fittings were found to be tight. All engine controls, HMU, ECU, and CEFA were found intact and attached. The fuel nozzle inlet line contained approximately two teaspoons of fuel and the fuel filter was free of debris. Mechanical rotation exit damage was found inside the exhaust collector at the 4-o'clock to 7-o'clock position. Exit damage was also found on the exhaust stack near the forward left side. The NTSB IIC determined, and parties concurred, that the engine assembly required a complete teardown examination.

**Engine Teardown Examination:** Visible turbine wheel blade exit damage was observed to the exhaust collector. The compressor was free to rotate when separated from the turbine, and the gearbox was free to rotate when the compressor was removed. All gears and bearings were found intact in the gearbox, and the spur adapter gear shaft and retaining ring were in place. Disassembly of the gas producer (N1) revealed no unusual conditions to the wheels. Slight rub marks were observed on the turbine to compressor coupling approximately 2.5-inches from the turbine end. The containment ring was found with two tangs broken. Disassembly of the power turbine assembly (N2) revealed the 3rd stage wheel was missing all airfoils. Five of the airfoils had about 1/2-inch from the blade root remaining, and all other airfoils were sheared down to the wheel hub. The 3rd stage wheel hub was intact. The 4th stage nozzle had all vanes intact, and the leading edges and trailing edges of the vanes had sustained impact damage. The trailing edges also had approximately 1/4-inches of material missing around the entire circumference. Heavy damage to the 3rd stage tip path was noted with the tip path extended outward with pieces of material missing. The 4th stage wheel had approximately 3/4 of the blade tips missing for 360-degrees, with one blade missing.

Hydro-mechanical Unit (HMU) / Electronic Control Unit (ECU): No anomalies were noted during examination/testing/download of the HMU and ECU, at the Goodrich facility. Incident recorder (IR) data from the ECU showed that a Np hard fault occurred between records #9 and #10. No prior history faults were recorded on the IR maintenance page.

After examinations of the airframe (fuel system, rotor systems, flight control systems, drive systems, electronic control systems), no anomalies were found other than within the power turbine assembly.

#### TESTS AND RESEARCH

Metallurgical examinations by the NTSB and Rolls Royce revealed evidence that the 3rd stage turbine wheel airfoil(s) had failed. A root cause of the failure was not determined, and further testing was conducted at Rolls Royce. As a result of some of the dynamic test results, Rolls Royce issued several Commercial Engine Bulletins (CEBs) regarding inspection of in-service turbine assemblies. Additionally, Bell Helicopter issued an Alert Service Bulletin (ASB), which introduced flight manual revisions to avoid power turbine RPM (Np) steady state operation between 68% and 97%.

#### MEDICAL AND PATHOLOGICAL

An autopsy of the pilot was conducted at Jefferson County Morgue, Beaumont, Texas, on December 2, 2003. The cause of death was listed as, "multiple injuries including basal skull fractures, ruptured heart, and transected aorta. Toxicological tests, conducted at the Civil Aeromedical Institute, Oklahoma, City, Oklahoma, were negative.

#### ADDITIONAL INFORMATION

The wreckage was released to the owner's representative.

## Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	61, Male
<b>Airplane Rating(s):</b>	None	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	Seatbelt, Shoulder harness
<b>Instrument Rating(s):</b>	Helicopter	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 With Waivers/Limitations	<b>Last FAA Medical Exam:</b>	11/01/2003
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	12/01/2002
<b>Flight Time:</b>	14191 hours (Total, all aircraft), 844 hours (Total, this make and model), 11631 hours (Pilot In Command, all aircraft), 151 hours (Last 90 days, all aircraft), 52 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Bell	<b>Registration:</b>	N457PH
<b>Model/Series:</b>	407	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	No
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	53147
<b>Landing Gear Type:</b>	Skid	<b>Seats:</b>	7
<b>Date/Type of Last Inspection:</b>	11/01/2003, AAIP	<b>Certified Max Gross Wt.:</b>	5250 lbs
<b>Time Since Last Inspection:</b>	22 Hours	<b>Engines:</b>	1 Turbo Shaft
<b>Airframe Total Time:</b>	4577 Hours at time of accident	<b>Engine Manufacturer:</b>	Allison
<b>ELT:</b>	Installed, not activated	<b>Engine Model/Series:</b>	250-C47B
<b>Registered Owner:</b>	PETROLEUM HELICOPTERS INC	<b>Rated Power:</b>	710 hp
<b>Operator:</b>	PETROLEUM HELICOPTERS INC	<b>Operating Certificate(s) Held:</b>	On-demand Air Taxi (135)
<b>Operator Does Business As:</b>		<b>Operator Designator Code:</b>	HEEA

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:		Distance from Accident Site:	
Observation Time:		Direction from Accident Site:	
Lowest Cloud Condition:	Clear	Visibility	15 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	14 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	60°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.32 inches Hg	Temperature/Dew Point:	21 °C / 11 °C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	High Island 573, GM (NONE)	Type of Flight Plan Filed:	Company VFR
Destination:	High Island 264, GM (NONE)	Type of Clearance:	Unknown
Departure Time:	0814 CST	Type of Airspace:	

## Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	28.000278, -93.918889

## Administrative Information

Investigator In Charge (IIC):	Alexander Lemishko
Additional Participating Persons:	Tom R Stunda; FAA; Houston, TX Mark Stuntzner; Bell Helicopter; Hurst, TX Bob Ketchum; Rolls Royce; Indianapolis, IN Glenn Cornett; PHI; Lafayette, LA
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at <a href="mailto:pubinquiry@ntsb.gov">pubinquiry@ntsb.gov</a> , or at 800-877-6799. Dockets released after this date are available at <a href="http://dms.nts.gov/pubdms/">http://dms.nts.gov/pubdms/</a> .