Aviation Investigation Final Report

Location:	CARROLLTON, Alabama	**Accident Number:**	MIA98FA229
Date & Time:	August 23, 1998, 16:00 Local	**Registration:**	N7162M
Aircraft:	Bell 47G-4A	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 137: Agricultural		

Analysis

The pilot stated he was in cruise flight at about 75 feet over trees after completing a swath run when the engine quit. He started a right turn before he entered autorotation, and did not monitor the engine or rotor rpm. He started a deceleration at about 30 feet and pulled all collective pitch. The helicopter collided with the ground hard, and the main rotor blades collided with the tailboom assembly. Examination of the engine assembly revealed 10 of 22 circlips were installed incorrectly during engine overhaul resulting in the subsequent failure of the number 5 connecting rod.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilots failure to follow written instructions in the flight manual for an engine failure, and the improper use of flight controls (cyclic/collective) during an autorotation resulting in a hard landing, and collision of the main rotor blades with the tailboom assembly. Contributing to the accident was the improper installation of circlips on the counterweight assembly during an engine overhaul. This resulted in a subsequent total failure of the number 5 connecting rod.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: CRUISE

Findings

1. ENG ASSEMBLY,CRANKSHAFT COUNTERWEIGHTS/VIB DAMPER - ASSEMBLY
2. (F) INSTRUCTIONS,WRITTEN/VERBAL - NOT FOLLOWED - OTHER MAINTENANCE PERSONNEL
3. ENGINE ASSEMBLY,CONNECTING ROD - FAILURE,TOTAL

Occurrence #2: FORCED LANDING
Phase of Operation: MANEUVERING - TURN TO LANDING AREA (EMERGENCY)

Occurrence #3: HARD LANDING
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
4. TERRAIN CONDITION - GROUND
5. AUTOROTATION - PERFORMED - PILOT IN COMMAND
6. (C) EMERGENCY PROCEDURE - NOT FOLLOWED - PILOT IN COMMAND
7. (C) FLIGHT CONTROLS - IMPROPER USE OF - PILOT IN COMMAND

Factual Information

HISTORY OF FLIGHT

On August 23, 1998, about 1600 central daylight time, a Bell 47G-4A, N7162M, registered to Southern Helicopters, operating as a 14 CFR Part 137 aerial application flight, experienced a reported total loss of engine power. The helicopter landed hard during a forced landing in the vicinity of Carrolton, Alabama. Visual meteorological conditions prevailed and no flight plan was filed. The helicopter sustained substantial damage. The commercial pilot reported no injuries. The flight originated from a field site location about 5 minutes before the accident.

The pilot stated he had just completed a swath run and was in cruise flight over trees at about 75 feet when the engine quit. He started a right turn before he entered autorotation. He did not monitor his engine or rotor rpm. He started a deceleration at about 30 feet with very little forward airspeed. The helicopter entered a vertical rate of descent. He pulled all collective pitch at about 10 feet. The helicopter collided with the ground hard and the main rotor blades collided with the tailboom assembly.

PERSONNEL INFORMATION

Information pertaining to First Pilot Information is found on page 3 of this report, and in NTSB Form 6120.1/2 Pilot Information.

AIRCRAFT INFORMATION

Review of the engine logbooks revealed the last recorded annual inspection and engine overhaul was conducted on January 20, 1998. The engine had accumulated 246.5 hours since overhaul/ annual inspection. The last recorded 100-hour inspection was conducted on June 9, 1998. The last recorded 50- hour inspection was conducted on July 1, 1998. According to the airframe and powerplant mechanic with inspection authority, the engine was overhauled by himself at his company in Guam named Tropic Helicopters Inc. The company was closed and the engine was shipped to his residence in Alabama, and installed on N7162M.

METEOROLOGICAL INFORMATION

Visual meteorological conditions prevailed at the time of the accident. (For additional information see Weather Information on page 4 of this report).

WRECKAGE AND IMPACT INFORMATION

According to the Pickens County Sheriff Department, Carrollton, Alabama, the wreckage of N7162M was located in a field about 2.9 miles east of highway 17 south and county road 22 in the vicinity of Carrollton, Alabama.

No accident crashsite investigation was conducted by the Federal Aviation Administration (FAA) or the NTSB. The accident was reported to the NTSB on August 25, 1998, by the FAA Birmingham Flight Standards District Office, Birmingham, Alabama, as a reported engine failure which resulted in substantial damage.

On August 26, 1998, the NTSB investigator-in-charge (IIC) was contacted by an insurance adjuster from Carson-Brooks, Inc., Atlanta, Georgia. The adjuster informed the IIC that there appeared to be a bullet hole in the engine crankcase next to the number 4 cylinder. Local law enforcement authorities were notified and the helicopter was transported to an authorized repair facility for analysis by the NTSB, FAA, and law enforcement personnel.

Examination of the helicopter revealed scarring was present on the bottom of the helicopter tail guard assembly from contact with the ground. The helicopter continued forward and collided with the ground in a right skid low attitude. The forward and aft cross tube assemblies were bowed in the middle with evidence of right lateral shift on the saddle straps. The left skid was rotated to the right 90 degrees. The forward and aft legs failed forward and to the right. The right skid was rotated to the right about 30 degrees. The forward and aft legs failed forward and to the right. The aft leg separated from the skid assembly. The right underside fuselage was compressed upward with the floor assembly on the cabin assembly. Minor damage was present on the left underside fuselage of the cabin assembly. The bubble assembly was broken. The left and right fuel tanks were not damaged.

The lower truss type fuselage failed at the jack point at FS80. The upper right truss attach point failed 10 inches outboard of the attach point, and was bowed in to the right at about FS90. The upper left truss attach point was intact. The truss type attach fuselage separated at FS160, FS179, and FS225. The vertical fin, tailrotor extension shaft, and tailrotor guard assembly separated from the truss type fuselage.

Examination of the main rotor system and tailrotor system revealed no evidence of a precrash mechanical failure or malfunction. The yellow main rotor blade collided with the truss type fuselage, tailrotor extension shaft, and the drag brace separated from the main rotor blade. A hole was present on the bottom side of the main rotor blade 20 inches inboard of the blade tip. Chordwise scarring and transfer of blue and white paint was present on the bottom and top of the main rotor blade. No leading edge damage was present. The red main rotor blade collided with the truss type fuselage, and tailrotor extension shaft, and the drag brace separated from the main rotor blade. A hole was present in the bottom and top side of the main rotor blade about 25 inches from the tip. Chordwise scarring and transfer of blue and white paint was present on the bottom and top of the main rotor blade. No leading edge damage was present. The tailrotor blade, serial number 1855, separated 13 inches outboard of the hub assembly. The hub static stop contacted the yoke assembly. The tailrotor blade, serial

number 1851, separated 10 inches outboard of the hub assembly. The hub static stop contacted the yoke assembly.

Examination of the airframe and flight control assembly revealed no evidence of a precrash mechanical failure or malfunction. Continuity of the flight control system was confirmed for pitch, roll, and yaw.

Examination of the main transmission, engine to transmission, and overrunning clutch revealed no evidence of a precrash mechanical failure or malfunction. The number one drive shaft assembly and number two drive shaft assembly separated and were not recovered. The number three drive shaft assembly separated.

Examination of the engine assembly revealed a round hole about 1/2 inch in diameter in the vicinity of the 11 o'clock position on the right side of the helicopter below the number 4 cylinder base (left engine case half). Cracks were present in the crankcase in the near the base of the number 5 cylinder. Disassembly of the engine revealed the number 5 connecting rod assembly was detached. The connecting rod cap was broken in two pieces. Both connecting rod bolts were broken. There was no evidence of heat distress on the number r journal or bearing inserts. Galling was present on the inner diameter, inner bore of the connecting rod yoke, and on the connecting rod cap.

Examination of the number 1 counterweight assembly revealed two of four circlips located in both aft positions were installed with the sharp edge inward. The number 2 counterweight assembly was found with three of four circlips installed with the sharp edge inward. One was located at the forward leading position, and two were located in the aft position. The number 3 counterweight assembly was found with one of four circlips installed with the sharp edge inward, located in the aft trailing position. The number 4 counterweight assembly was found with one of four circlips installed with the sharp edge inward in the aft trailing position. The number 5 counterweight assembly was found with one of four circlips installed with the sharp edge inward in the aft leading position. The number 6 counterweight assembly was found with two of four circlips installed with the sharp edge inward in both aft positions. The circlip located at the aft trailing position was broken in half. One half of the circlip remained in place, and it was installed with the sharp edge inward. The remains of the remaining half was located in the engine accessory compartment. The counterweight roller located at the number 6 trailing position was not located. Ten of 24 circlips were found incorrectly installed.

MEDICAL AND PATHOLOGICAL INFORMATION

Toxicology specimens from the pilot were not requested.

TEST AND RESEARCH

Review of the Bell Helicopter Company 47G-4A Flight Manual, states on page 14,

"ENGINE FAILURE. Execute a normal autorotative descent and establish a level attitude prior to ground contact. At a height of approximately 10 feet apply collective pitch in sufficient quantity to stop descent as ground contact is established."

Textron Lycoming Service Instruction No. 1012F states on page 7of 7, "Install washers, P/N 71907 and circlips, P/N 71906 or LW-14820 on one side of the counterweight and place the counterweight on the proper crankshaft lobe. Insert the proper rollers and secure the assembly by installing washers and circlips on the other side of the counterweight (refer to figure 7). Circlips are inserted with the sharp edge outward (see figure 8)."

Examination of the number 5 connecting rod, connecting rod cap (two pieces), and fragments of the number 5 connecting rod and assembly bolts was conducted by the NTSB Materials Laboratory Division. Scanning electron microscope examination revealed a fatigue crack with micro fissures, indicative of high stress propagation. No gouge or galling damage was found in the fatigue origin area. The fatigue crack extended from the surface to a distance that measured as deep as 0.003 inch, and as wide as 0.18 inch. No heat damage was noted on the bearing shells and the thread crowns of the attachment bolts contained no shear deformation damage or cracking. (For additional information see NTSB Materials Laboratory Factual Report No. 98-172.)

ADDITIONAL INFORMATION

The wreckage of N7162M was released to Mr. Harry D. Brooks, Carson-Brooks Inc., Atlanta, Georgia, on September 9, 1998. The helicopter logbooks were released to Mr. Harold A. Coghlan, FAA Birmingham Flight Standards District Office on September 2, 1998. The number 5 connecting rod, connecting rod cap (two pieces), and fragments of the number 5 connecting rod and assembly bolts were released to Mr. Brooks on October 14, 1998.

Pilot Information

Certificate:	Commercial	**Age:**	55,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	June 30, 1998
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	15000 hours (Total, all aircraft), 1200 hours (Total, this make and model), 75 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N7162M
Model/Series:	47G-4A 47G-4A	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	7569
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	June 9, 1998 Continuous airworthiness	**Certified Max Gross Wt.:**	2950 lbs
Time Since Last Inspection:	89 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	7065 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Not installed	**Engine Model/Series:**	VO-540-B1B3
Registered Owner:	SOUTHERN HELICOPTERS	**Rated Power:**	
Operator:	NELSON E. TUCKER	**Operating Certificate(s) Held:**	
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	TCL ,170 ft msl	**Distance from Accident Site:**	28 Nautical Miles
Observation Time:	15:00 Local	**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Scattered / 4000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	32°C / 19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(NONE)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	15:55 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	33.259483,-88.089294(est)

Administrative Information

Investigator In Charge (IIC):	Smith, Carrol
Additional Participating Persons:	RODGER L HOLMSTROM; BIRMINGHAM , AL EDWARD G ROGALSKI; BELLEVIEW , FL
Original Publish Date:	February 15, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=43783