Aviation Investigation Final Report

Location:	ESSEX JUNCTION, Vermont	**Accident Number:**	IAD99LA024
Date & Time:	December 14, 1998, 16:44 Local	**Registration:**	N8103J
Aircraft:	Bell 47-G5	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot and mechanic departed on a maintenance test flight after completing the installation of an overhauled engine. They performed ground engine runs and two short legs of the test flight. After each leg, the helicopter was shut down and the engine was checked for leaks. The pilot departed on the third leg after official sunset, and after climbing to approximately 1,700 feet, the pilot closed the throttle, then entered autorotation. The mechanic said the engine and rotor rpm decayed simultaneously and then the engine stopped running. During descent, the pilot attempted to restart the engine without success. The autorotation was terminated with a hard landing. Examination of the engine revealed no anomalies and it ran to rated power in a test cell. While operating at full rpm, the throttle was moved rapidly to the flight idle position. The engine exhibited a smooth reduction in rpm to the idle power setting with no interruption. An FAA Helicopter Handbook stated to begin an autorotation, the collective should be placed full down maintain cruise RPM with the throttle. Then decrease the throttle and adjust it to keep the engine RPM 'well above normal idling speed.'

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the pilot's improper entry into the autorotation, which resulted in the loss of power and a low rotor rpm condition. Also causal was the pilot's improper execution of the autorotation which resulted in the hard landing. Factors in the accident were the performance of the autorotation at dusk over rough terrain.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - NONMECHANICAL
Phase of Operation: APPROACH

Findings
1. THROTTLE/POWER LEVER - CLOSED
2. AUTOROTATION - INITIATED - PILOT IN COMMAND
3. (C) CONDITION(S)/STEP(S) IN IMPROPER SEQUENCE - PILOT IN COMMAND
4. (C) ROTOR RPM - LOW - PILOT IN COMMAND

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: HARD LANDING
Phase of Operation: EMERGENCY LANDING

Findings
5. (F) LIGHT CONDITION - DUSK
6. (F) TERRAIN CONDITION - ROUGH/UNEVEN
7. (C) AUTOROTATION - IMPROPER - PILOT IN COMMAND

Factual Information

On December 14, 1998, at 1644 eastern standard time, a Bell 47-G5 helicopter, N8103J, was substantially damaged during a forced landing to a field near Essex Junction, Vermont. The certificated private pilot and certificated airframe and powerplant mechanic passenger were seriously injured. Visual meteorological conditions prevailed for the local maintenance test flight that originated at Essex Junction, approximately 1635. No flight plan was filed for the flight conducted under 14 CFR Part 91.

In a telephone interview, the mechanic said the purpose of the flight was to test fly the helicopter following the installation of the engine. He said:

"We pulled the engine out 6 months ago for overhaul, it was totally rebuilt. They did a wonderful job. It took three days to reinstall. We checked everything out and made sure we put it together perfectly."

The mechanic said they performed a ground run, shut the helicopter down, checked for leaks, and then departed on a test flight. He said they landed, shut down, checked for leaks, then took off and repeated the process. The mechanic said they decided to depart on a third leg of the test flight to perform an autorotation with a powered recovery. He said:

"At 1,700 feet we entered autorotation. The engine RPM and rotor RPM bled off at approximately the same rate until it reached 50 percent, then the engine RPM continued down. At that point we cleaned everything up and tried an engine start, but we just couldn't get it started. We tried to stabilize at 60 to 70 knots. We started to decelerate at 100 feet, but she settled pretty hard."

The mechanic said the pilot entered autorotation by closing the throttle, then lowering the collective. He later said the pilot closed the throttle and lowered the collective simultaneously.

The pilot was not available for interview due to his injuries. In a written statement, the pilot said:

"Landed once in an open field, took off again to homebase. Mechanic suggested to split the needles (roll off the throttle to simulate an engine failure and go into autorotation). When I did, the engine quit running. [It is] not supposed to. I tried to restart but engine would not start. Terrain was a large open field."

A witness reported to the Essex Police that he saw the helicopter make a sharp descent and turn. He said he heard the engine backfire twice and then shut off.

In a written statement, a Federal Aviation Administration (FAA) Aviation Safety Inspector who responded to the scene said the helicopter experienced a "hard impact" and came to rest on its left side. The tail rotor and tail rotor gearbox departed the helicopter during the accident sequence.

Engine power control rigging could not be determined due to impact damage.

A cursory examination of the engine by the FAA inspector revealed that no data plate was installed. The engine was rotated by the engine starter, continuity was established through the powertrain and valvetrain, and the spark plugs produced spark at all terminal leads. There was fuel in the carburetor and compression was verified. The engine was removed from the helicopter for a more detailed examination at a later date.

Weather in Burlington, Vermont, at the time of the accident was calm winds and clear skies. According to the United States Naval Observatory, official sunset in Burlington, Vermont, on the day of the accident was at 1613.

The pilot was issued an FAA third class medical certificate September 1, 1998. He reported 130 hours of total flight experience on that date. On February 3, 1999, the pilot reported 490 hours of flight experience, of which 139 were in rotorcraft. The pilot reported all 139 hours of rotorcraft experience in the Bell 47.

TESTS AND RESEARCH

The engine was examined and a test run was completed at the TEXTRON Lycoming Engine Factory, Williamsport, Pennsylvania, on March 15, 1999.

Examination of the engine revealed that the serial numbers on each crankcase half did not match. Further, it was confirmed that there was no engine data plate installed.

Examination of the cylinders, pistons, and valves by borescope revealed no anomalies. The oil sump was removed to facilitate examination of the drive gears. Examination of the drive gears revealed no anomalies and the sump was re-installed in preparation for the engine test run.

The engine was placed in the test cell and started immediately. The engine ran continuously and met factory performance parameters. At the completion of the test run, the throttle was closed rapidly to the flight idle position and the engine idled smoothly with no interruption. The process was repeated several times.

ADDITIONAL INFORMATION

In a written statement, an FAA Airworthiness Inspector said that both the facility that performed the engine overhaul and the mechanic who installed it in the helicopter were aware that the engine had no data plate installed. He said the mechanic installed the engine for the

owner without making any maintenance record of the installation. The inspector said the overhaul facility advised the owner not to operate the engine in the helicopter until a replacement data plate was obtained from Textron Lycoming. The overhaul facility provided the owner with a copy of Lycoming Service Instruction #13-04 that explained the process for obtaining the new data plate.

According to the FAA Basic Helicopter Handbook, "When the desired position to begin the autorotation has been reached, place the collective pitch stick in the full-down position, maintaining cruising RPM with throttle. Decrease throttle to ensure a clean split of the needles and apply sufficient right pedal to maintain the desired heading. After splitting the needles, readjust the throttle so as to keep engine RPM well above normal idling speed..."

According to FAA Practical Test Standards for a Private/Commercial Pilot Helicopter rating:

"Simulated power failure at altitude shall be given over areas where actual touchdowns can safely be completed in the event of an actual powerplant failure."

According to the United States Army Field Manual 1-301, Aeromedical Training for Flight Personnel:

"Distance estimation and depth perception are easy to recognize when aircrew members use central vision under good illumination. As the light level decreases, their ability to judge distance accurately is degraded and their eyes are more vulnerable to illusions."

According to the Bell Helicopter Model 47G-5 Flight Manual, Emergency Procedures Section under 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."

There is no procedure outlined in the Model 47G-5 Flight Manual for an engine restart in flight.

Pilot Information

Certificate:	Private	**Age:**	57,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 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	September 1, 1998
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	490 hours (Total, all aircraft), 139 hours (Total, this make and model), 490 hours (Pilot In Command, all aircraft), 6 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N8103J
Model/Series:	47-G5 47-G5	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	25001
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	December 14, 1998 Annual	**Certified Max Gross Wt.:**	2600 lbs
Time Since Last Inspection:	1 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6143 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Not installed	**Engine Model/Series:**	VO-435-B1A
Registered Owner:	RONALD R. LAMELL	**Rated Power:**	260 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Dusk
Observation Facility, Elevation:	BTV ,334 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	11:44 Local	**Direction from Accident Site:**	240°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Broken / 3400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	-2°C / -9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(NONE)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	16:30 Local	**Type of Airspace:**	Class G

Airport Information

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

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Serious	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	JOSEPH G MURRAY; PORTLAND , ME ROBERT C OHNMEISS; WILLIAMSPORT , PA
Original Publish Date:	June 22, 2000
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45517