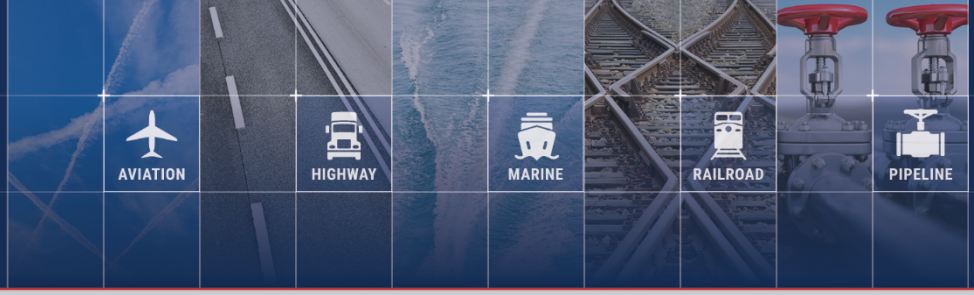

Aviation Investigation Final Report

Location:	THORNE BAY, Alaska	**Accident Number:**	ANC93FA061
Date & Time:	May 8, 1993, 09:30 Local	**Registration:**	N314CR
Aircraft:	BELL 214B1	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Minor
Flight Conducted Under:	Part 133: Rotorcraft ext. load		

Analysis

THE HELICOPTER WAS BEING USED TO MOVE LOGS IN A LONG-LINE LIFT OPERATION. THE PILOT REPORTED THAT AS HE INCREASED COLLECTIVE TO LIFT A LOG, HE HEARD A LOUD NOISE, WHICH WAS FOLLOWED BY A LOSS OF POWER. AN AUTOROTATION WAS MADE TO A LANDING ON ROUGH, DOWNHILL TERRAIN, DOWNSLOPE FROM WHERE THE LOG WAS BEING LIFTED. A TEARDOWN OF THE ENGINE REVEALED EVIDENCE OF FOREIGN OBJECT DAMAGE AT THE 6TH AND 7TH STAGES OF THE N1 (GAS PRODUCER) COMPRESSOR. SELF-LOCKING NUTS (PN STD3064-4) WERE MISSING FROM 2 COMPRESSOR CASE BOLTS (PN MS9566-36), WHICH WERE LOCATED OVER A BLEED PORT, LEADING TO THE 6TH STAGE OF THE GAS PRODUCER. METALLURGICAL EXAM REVEALED NUT FRAGMENTS OF A CHEMICAL COMPOSITION, CONSISTENT WITH THE MATERIAL SPECIFIED IN STD3064-4 NUTS. THE ENGINE HAD BEEN IN OPERATION ABOUT 283 HOURS, AFTER BEING REASSEMBLED WITH A NEW COMPRESSOR SECTION.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: FOREIGN OBJECT DAMAGE TO THE COMPRESSOR ASSEMBLY, PROBABLY DUE TO LOOSE NUTS FROM THE COMPRESSOR CASE AFTER IMPROPER MAINTENANCE (INSTALLATION) BY MAINTENANCE PERSONNEL.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: HOVER

Findings
1. (C) COMPRESSOR ASSEMBLY - OTHER
2. (C) COMPRESSOR ASSEMBLY - FOREIGN OBJECT DAMAGE
3. (C) MAINTENANCE - IMPROPER - OTHER MAINTENANCE PERSONNEL

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

Findings
4. AUTOROTATION - PERFORMED - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: LANDING

Findings
5. TERRAIN CONDITION - DOWNHILL
6. TERRAIN CONDITION - ROUGH/UNEVEN

Factual Information

HISTORY OF FLIGHT

On May 8, 1993, at approximately 0930 Alaska daylight time, a Bell 214B1 helicopter, operated by Chet Rasberry, Inc., of Apple Valley, CA, d.b.a. CRI Helicopters, experienced a complete loss of engine power and collided with terrain while conducting aerologging operations near Thorne Bay, Prince of Wales Island, Alaska. The helicopter was on a local company VFR flight plan and was being operated under 14 CFR Part 133 in visual meteorological conditions. The commercial helicopter pilot and copilot received minor injuries and the aircraft was substantially damaged.

The helicopter had been operating for 30 minutes in its second on hour cycle, lifting logs with a 150 foot long line from a 4000 foot elevation and transporting them to a log landing about 1/2 mile down slope at the 1500 foot level. The helicopter had lifted a log when witnesses reported that the helicopter engine exhaust emitted a brief 5 foot flame with a "whoosh" sound before autorotating and impacting on a 30 degree slope studded with felled and bucked timer. The main and tail rotors struck stumps and the hillside, destroying the blades and substantially damaging the fuselage.

The T55-08D turboshaft engine was removed and an examination was conducted by an NTSB team including a powerplant investigator, and other team members from industry. The teardown of the engine revealed that the gas-producer compressor (N1) section and the power turbine (N2) had seized with metal debris and blade parts.

The 6th stage N1 stators were damaged and all 7th stage turbine blades had separated, with extensive foreign object damage aft of the point. Thermal damage was evident in the area of the first rotor of the power turbine as well.

The disassembly examination revealed that two self-locking nuts (PN STD3064-4) were missing from two compressor case bolts (PN MS9566-36) which were located beneath the 6th stage N1 bleed band the nut end(s) of the bolts in a cavity over an open bleed port leading to the 6th stage of the gas producer. Metallurgical examination revealed nut fragments of a chemical composition consistent with the material specified in PN STD 3064-4 nuts. (See attached Powerplant Group Chairman's report and the manufacturer's report of teardown).

INJURIES TO PERSONS

The commercial pilot-in-command and commercial copilot received minor injuries.

DAMAGE TO AIRCRAFT

The helicopter was substantially damaged. Refer to wreckage information.

PERSONNEL INFORMATION

Captain Robin G. Kennedy and copilot Ford W. Chapman were interviewed by NTSB and FAA investigators on the day following the accident. (May 9, 1993 at Ketchikan, Alaska). Captain Kennedy told investigators that he had 7800 hours of pilot time in rotorcraft. He said that the aircraft had been operating normally before experiencing total engine failure.

The captain was asked about the weight of logs carried. He said that he never carried logs in excess of 7000 pounds, and that 7000 pounds was his "target weight". Records found in the wreckage indicated that 17 of the 60 lifts made on the day of the accident were recorded to be exactly 7000 pounds.

The captain told investigators that the company had told him not to exceed 7000 pound per turn. he indicated that he was not aware that the maximum allowable weight was approximately 5600 pounds with operating fuel at the beginning of his cycle, ranging to 6900 pounds with minimum fuel remaining.

Investigators were told by CFR management on May 9, 1993, that Captain Kennedy had been "promoted" to a position of head of pilot training following the accident on May 8, 1993.

On December 16, 1993, Mr. Kennedy contacted the NTSB from a location in Washington state. He said that he was no long working for CRI and wished to revise earlier statements made to investigators. (Refer to record of telephone call.)

Medical records indicated that Captain Kennedy weighed 188 pounds.

Mr. Chapman told investigators that he had worked for CRI Helicopters, Inc., for nine days before the accident. He said that he had no turbine experience before employment with CRI and his total helicopter experience consisted of approximately 100 hours of Robinson 22 flight time.

Mr. Chapman described his training as copilot on the Bell 214B1 to be "on-the-job-training." He said that he had not studied any lesson plans, manuals or taken any tests in conjunction with his assignment as copilot, nine days prior to the accident.

Mr. Chapman said that "7000 pound logs were the heaviest we carried." Investigators asked Mr. Chapman if he had discussed the maximum weight of logs carried, on any occasion after the accident. Mr. Chapman said, "yes, me and Robin had a meeting with Chet in his office."

Medical records indicated Mr. Chapman weighed 240 pounds. The standard weight and balance used by CRI computed their weight as 170 pounds for each pilot. (See weight and

balance record for N314CR).

AIRCRAFT INFORMATION

Bell 214B1, SN 28055, was operated in normal category, with a maximum gross weight limitation of 16000 pounds with external load. The cargo belly hook had an operating limitation of 8000 pounds.

WRECKAGE AND IMPACT INFORMATION

The helicopter completed an autorotation from approximately the 4000 foot elevation, beginning at an altitude of approximately 175 foot above ground level, abeam a 50 degree easterly slope, and impacting at approximately the 3000 foot level.

The aircraft's advancing main rotor blade contacted a stump and the ground in the helicopters four o'clock quadrant, prior to autorotative touchdown on a 30 degree up slope.

Both main rotor blades of composite material shattered with ground and log contact. Damage to the hull consisted of compartment crushing below the floor and a breaking of the tail cone at the hull and an upward realignment of the tail cone of approximately 15 degrees. Damage was seen to the tail rotor and the tail rotor drive shaft in the tunnel where rotational signatures and torsional stoppage fractures existed.

The helicopter rested on a heading of 200 degrees magnetic and 30 degrees nose up and 45 degrees right roll.

TESTS AND RESEARCH

Refer to Powerplant Group Chairman's Factual Report of Investigation and the Corrective Action Evaluation Team (CAET) report of disassembly and examination of T55-08D engine, SN LE31938 at the Textron-Lycoming facility.

The weighing records of SN 28055, dated 10/4/90, showed that the helicopter had an empty weight of 8234.1 pounds (See weight record) and an operating weight of 10,389.6 pounds at the start of each cycle, without external load. The maximum external load that could be carried within the helicopter's certified load limit at the start of cycle was 5610.4 pounds, increasing to 6910.4 pounds at minimum fuel.

The Bell 214B1 helicopter was operated as an external load, aerologging helicopter under 14 CFR Part 133. The flight crew told investigators that at the beginning of each "cycle" lasting approximately one hour and ten minutes, the helicopter was fueled to approximately 1500 pounds of fuel. At the end of each cycle, the refueling amount was approximately 1200 to 1300 pounds. The crew members told investigators that according to company policy and their operating manual, they did not lift logs in excess of 7000 pounds.

The on-scene investigation revealed that the weight of a number of the logs being transported exceeded the aircraft gross weight limitations by approximately 1000 pounds, or approximately 20 percent. A review of available logging records of the helicopter at various southeast Alaska logging locations during the past 52 weeks indicated logs were carried in excess of 2000 pounds beyond the aircraft's gross weight limits.

The electronic load cell was removed from N314CR by investigators at the accident site and sent, by the FAA FSDO-05 Juneau office to Onboard Systems, Inc., in care of the FAA Northwest Mountain Regional Branch 260. An FAA representative from Hillsboro FSDO (Oregon) witnessed the unwrapping, examination and testing of the unit. In a discussion with Onboard Systems general manager, Mr. Mark Lemmon on 6/14/93, the NTSB learned that the electronic load cell had been found to be within 2 percent accuracy throughout it's range of operation.

Calculations by the NTSB, FAA Flight Standards and Bell Helicopter team members found, using the weight and balance document in the accident aircraft, that the helicopter could lift a log or logs weighing 5610.4 pounds with 1500 pounds of fuel, ranging up to 6910.4 pounds with 200 pounds of fuel. (See interview of Bob Rice, witness and helicopter mechanic for CFR.) A review of logging records indicated that the average cycle consisted of 24 turns and was approximately 71 minutes in duration. During those periods the aircraft burned approximately 18.6 pounds of jet fuel per minute and thus could carry loads weighing 56 pounds heavier for each 3 minutes of fuel expended on each turn.

Logging records showed that the accident pilots and other company pilots routinely exceeded the 16000 pound gross weight limit of the helicopter, by over 1000 pounds static load. Investigators made no calculations of dynamic loads such as those found as the loads are pulled or swing in transit.

Notes made by the copilot and found in the wreckage on the day of the accident showed that during 60 individual turns, the 16000 pound maximum gross weight of the helicopter was exceeded 32 times, routinely by 1000 pounds (20 percent) per turn.

In an interview of the ground crewman who hooked logs to the helicopter's longline, (log hooker) the FAA learned that logs estimated to be 7000 pounds in weight by that ground crewman were regularly lifted. (See transcript of interview with CRI employee David Trainor.) That ground crewman stated that logs of 7500 pounds were lifted on occasion. he stated that he estimated the weights of logs by measuring (scaling) the logs after felling and applying factors of pounds per board foot content. Mr. Trainor said that after scaling the logs with a measuring tape, he applied factors of six pounds per board foot for spruce (Sitka Spruce) and eight pounds per board foot to hemlock (White Hemlock). Mr. Robert Simmons, a forest engineer from the U.S. Forest Service, Ketchikan, advised the FAA and NTSB that the USFS had obtained core samples of both Sitka Spruce and White Hemlock from trees felled the previous day at the accident site. Mr. John Glick, a U.S. Forest Service Certified Scaler, measured the

samples which resulted in a measurement of 57 pounds per cubic foot of White Hemlock, or 9.1 pounds per board foot and 55.7 pounds per cubic foot of Sitka Spruce or 7.8 pounds per board foot.

NTSB investigators calculated the scaling and weight application used by the ground crewman interviewed to be approximately 30 percent underestimated for Sitka Spruce and 14 percent underestimated for Hemlock.

Individual daily logging records found in company records showed that logs as heavy as 8200 pounds had been successfully lifted by CRI pilots previously flying Bell 214B1 helicopters.

While the FAA-approved operator's manual indicated weights could be carried to 8000 pounds, this FAA-Approved amount actually exceeded the helicopter type-certificated load capacity (with minimum fuel) by 1100 pounds. (See attachment page 3-3 of CRI External Load Operations Manual, October 25, 1992, and FAA- Approved February 10, 1993).

ADDITIONAL INFORMATION

The engine had been in operation approximately 283 hours since reassembly with a new compressor section. The compressor rotor had been repaired at the Textron-Lycoming, Stratford, Connecticut, plant and shipped to the operator for reassembly. Records indicate that the rebuilt compressor section was assembled in the case at the CRI maintenance facility at Apple Valley on February 1, 1993 and shipped to Ketchikan for "final assembly and hot end (power turbine N2) installation." Records do not indicate at which point the compressor section cross-case bolts were actually installed.

Examination of FAA surveillance records of CRI aerologging activity in past 2 years indicated that no on-site inspections of operations where logging, carriage of logs, field maintenance or operations of helicopters under 14 CFR Part 133 were ongoing. Program Tracking Record System (PTRS) records indicated that surveillance of CRI activities in Alaska had been carried out by members of FAA Flight Standards Juneau District Office (FSDO-05) during ramp inspections of helicopters engaged in operations under 14 CFR Part 135 (air taxi) during ramp checks at Juneau, Wrangell, Petersburg and Ketchikan.

The company president told investigators, in response to their questions, that pilot's were not paid bonuses. Mr. Rasberry said, on May 3, and May 9, 1993 that pilots were paid according to the type of aircraft flown. Records found in CRI files included "Aircraft Daily Operations Reports" included a sheet which stated "Scale weight (-) minus 20% equals actual weight. Actual weight divided by 10 pounds equals number of board feet. Rate of pay (x) times 1,000 board feet divided by flight hours equals flight hr. rate in dollars."

WRECKAGE RELEASE

The wreckage of the helicopter was released to CRI Helicopters, Inc., Somerset Aviation, Inc.,

insurer on 9/23/93.

ADDITIONAL PERSONS

In addition to those additional persons listed, the following individuals participated in the investigation:

Robert Kolvig, FAA IIC, FSDO-05 Juneau, AK Ned Horne, FAA Airworthiness Inspector, FSDO-05 Juneau, AK Richard R. Glodowski, Special Agent, U.S. Forest Service Larry Heady, Enforcement Officer, U.S. Forest Service Phillip A. Hensley, Textron-Lycoming, Stratford, CT. Henry F. Giannini, Textron-Lycoming, Stratford, CT. David Knobloch, CRI, Inc., representative, Stratford, CT. Martin Slade, Textron-Lycoming, Stratford, CT. James Bailey, Special Agent, Dept of Ag IG, San Francisco. Dave Dixon, Special Agent, Dept of Ag IG, San Francisco.

Current computer datablocks allow for four additional persons participating in the investigation.

Pilot Information

Certificate:	Commercial	**Age:**	34,Male
Airplane Rating(s):		**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	February 15, 1993
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	7860 hours (Total, all aircraft), 800 hours (Total, this make and model), 72 hours (Pilot In Command, all aircraft), 180 hours (Last 90 days, all aircraft), 75 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	BELL	**Registration:**	N314CR
Model/Series:	214B1 214B1	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	28055
Landing Gear Type:	Skid	**Seats:**	7
Date/Type of Last Inspection:	May 6, 1993 AAIP	**Certified Max Gross Wt.:**	16000 lbs
Time Since Last Inspection:	9 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	5647 Hrs	**Engine Manufacturer:**	LYCOMING
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	T55-08D
Registered Owner:	CRI HELICOPTERS, INC	**Rated Power:**	2050 Horsepower
Operator:	CHET RASBERRY	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	CRI HELICOPTERS, INC	**Operator Designator Code:**	EEYA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 4000 ft AGL	**Visibility**	20 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	20°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:		**Type of Flight Plan Filed:**	Company VFR
Destination:		**Type of Clearance:**	None
Departure Time:	00:00 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:	2 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor	**Latitude, Longitude:**	55.68024,-132.190841(est)

Administrative Information

Investigator In Charge (IIC):	Herlihy, Douglas
Additional Participating Persons:	JOHN YOUNG; WASHINGTON , DC DAVID C DOSKER; FT WORTH , TX BEN R BURDETTE; HURST , TX PAUL BENJUNAS; STRATFORD , CT
Original Publish Date:	September 30, 1994
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=2300