Aviation Investigation Final Report

Location:	Emigrant, Montana	**Accident Number:**	SEA01MA163
Date & Time:	August 31, 2001, 09:05 Local	**Registration:**	N186CH
Aircraft:	Kawasaki KV-107-II	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Flight test		

Analysis

The Kawasaki Vertol KV-107 II rotorcraft had departed the helibase on a non-mandatory test flight requested by the pilot-in-command (PIC) to 'tweak' the rotorcraft's engine synchronization system. The test flight was conducted with the bucket and 150 foot long line attached to facilitate the test procedure. Witnesses reported observing the rotorcraft between 300 and 1,000 feet in altitude and beginning a climb when it began to pitch/roll and descend rapidly. Several witnesses reported seeing the bucket horizontal to the rotorcraft and also caught up in one of the rotors. The aircraft impacted on its right side intact with the exception of its rotor blades. Two of the three forward rotor blades were found 600-900 feet from the ground impact site. The third forward rotor blade, which was broken in half, was found with its outboard section at the ground impact site and the inboard half approximately 100 feet away. All three aft rotor blades were found in close proximity to one another and approximately 400 feet distant from the primary ground impact site. All six blades separated from their root sections in about the same place and a post crash fire destroyed much of the rotorcraft. Post crash examination established control continuity from the cockpit area through the control closet and on to all the associated hydraulic actuators as well as the continuity of the entire synchronization drive shafting. Examination and disassembly of all major components revealed no evidence of any fatigue propagation, disconnects, or characteristics of other time dependent failure mechanisms. All hydraulic actuators underwent an X-ray examination and disassembly and there was no evidence of any blockage or jamming within any of the actuators. The engines were examined and disassembled and the gas generator speed range for both was determined to be between 64.3% and 69.7%, or about 10% above ground idle. There was evidence that the long line cable encountered/impacted the nose gear strut, as well as an aft strut, the forward left side of the fuselage, the forward rotor head rain shield and all three forward rotor blades. It could not be determined whether the cable to rotor interaction was an initiating event or the result of a previous occurrence which allowed the cable to become entangled with the forward rotor blades. The PIC had more than 1630 hours of V-107 rotorcraft time of which more than 670 hours were logged as PIC time. The co-pilot had more

than 150 hours of V-107 rotorcraft time none of which was PIC time.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The loss of control during cruise/climb flight for undetermined reasons.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CRUISE

Findings
1. (C) REASON FOR OCCURRENCE UNDETERMINED

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

HISTORY OF FLIGHT

On August 31, 2001, approximately 0905 hours mountain daylight time, a Kawasaki KV-107 II rotorcraft, N186CH, registered to and operated by Columbia Helicopters Leasing, Inc., and being flown by two commercial pilots, was destroyed when it collided with terrain following a loss of control in flight during a cruise/climb phase of operation. The crash site was approximately three miles south of Emigrant, Montana. Both pilots and the onboard mechanic were fatally injured. A post-crash fire destroyed much of the rotorcraft. Visual meteorological conditions existed and no flight plan had been filed. The flight, which was a non-mandatory maintenance check flight following a phase five inspection, was to have been operated under 14CFR91, and originated from the Fridley Helibase staging site approximately eight nautical miles north of the crash site and slightly north of Emigrant, Montana. The rotorcraft was estimated to have departed on the check flight approximately 0845. The aircraft was under contract with US Forest Service and was engaged in firefighting operations in support of the Fridley Fire centered approximately eight nautical miles north and west of Emigrant, Montana.

The rotorcraft departed the Fridley helibase approximately 0845 hours with both pilots and a mechanic aboard. At this time the rotorcraft had been released from the United States Forest Service (USFS) contract and would remain so for the duration of the test flight (refer to Attachment USDA-I). Immediately prior to departure the ground crewman observed the copilot occupying the right seat within the cockpit (refer to Attachment EK-I).

WITNESS DATA

There were seven witnesses located circumferentially around the accident site who observed the rotorcraft immediately prior to or during the crash sequence. The witnesses were located throughout all four quadrants of the compass (N/S/E/W) at distances ranging from less than one-half a mile up to three miles from the crash site (refer to Chart I which shows the approximate location of all seven witnesses).

A synopsis of key observations from each of the witness's statements follows (refer to attached individual witness statements one through seven for additional details):

Witness #1, who was located approximately one-half mile south of the accident site, and was looking north at the rotorcraft, reported that he saw it "dropping," facing south while rotating very slowly to the left; and that the rotorcraft was starting to drop to the left side. The witness believed that the tether and bucket were still below the rotorcraft at the time he observed it and that the rotorcraft was approximately 300 feet above the ridge when he first saw it dropping.

Witness #2, who was located approximately one mile south of the accident site, and was looking north at the rotorcraft, reported that he saw something "spinning" and "dropping fast out of sight."

Witness #3, who was located approximately one and one-half miles east of the accident site, and was looking west at the rotorcraft, reported that he saw it "wobbling" and then it "started down spinning."

Witness #4, who was located approximately three miles north of the accident site, and was looking south at the rotorcraft, reported that he saw "a chopper with [the] water bucket flying erratically." He commented that it seemed that the rotors "were not functioning properly" and that the rotorcraft was "going down fast in a circular pattern." He also reported the rotorcraft as rolling from side to side about 1,000 feet above ground.

Witness #5, who was located approximately two miles northwest of the accident site, and was looking southeast at the rotorcraft, reported that he had a side view of a light colored helicopter, which was "flying northbound" and "pulling a water bucket" and that "all looked fine." He reported further that after about five to six seconds of observation he witnessed the "aft (back) drop down and the forward (front) end rise up and go completely upside down." Additionally, he reported that as the aircraft approached a fully inverted attitude nearly horizontal with the ground he witnessed "the aft rotor blade catch the water bucket's cable and sling it around and round wildly." He then observed the rotorcraft descend inverted in a "left to right turn" with the bucket and cable entangled.

Witness #6, who was located approximately two miles west northwest of the accident site, reported that she observed the helicopter fly over highway 80 towards the Yellowstone River with the "basket hanging below and slightly behind [the] helicopter as it flew." After crossing over the Yellowstone River the helicopter appeared to climb and turn northward roughly paralleling the river. She reported that as the helicopter made this left turn "it seemed to suddenly start a sharp descent," "the nose seemed to dip lower" and "the left hand turn became sharper." The helicopter was observed to "lean steeply to the left" and the basket remained attached by its line and "became parallel to the helicopter as it continued its descent." She reported that the helicopter then turned back to the right and seemed to descend in a clockwise rotation at which point the "rotors appeared to have stopped rotation." The helicopter turned back to the left and rolled slightly on its side at which time "the basket was almost above the helicopter." She observed the helicopter then turn back to the right and level out slightly, during which "there was no rotation of the blades." The helicopter made one last turn to the left before descending from view.

Witness #7, who was located approximately one mile south southwest of the accident site, and was looking generally north at the rotorcraft, reported seeing the helicopter fly over and then turn north while carrying a water bucket. She reported that about one mile north of her location she observed the helicopter "pause and then descend with great speed," and that

while it was descending she observed "one of the propellers and other parts from the top area of the helicopter fly off as it was descending."

PERSONNEL INFORMATION

PILOT-IN-COMMAND:

The pilot-in-command (PIC), who according to the operator would have been assigned the left cockpit seat, held a commercial pilot certificate with helicopter and instrument (helicopter) ratings as well as a type rating in the BV-107 (VFR only limitation). According to the operator, he had accrued approximately 3,889 hours of flight experience, all logged in rotorcraft, and approximately 1,715 hours were logged as PIC time. Additionally, he was reported to have logged approximately 1,631 hours in the Vertol V-107 model rotorcraft of which approximately 671 hours were as PIC. He had been issued a second class medical with no waivers/limitations on September 14, 2000.

CO-PILOT:

The co-pilot, who according to the operator would have been assigned the right cockpit seat, held a commercial pilot certificate with helicopter and instrument (helicopter) ratings and private pilot ratings in both airplane single engine land and instrument (airplane). He was not type rated in the BV-107 rotorcraft. He also held a certified flight instructor certificate with ratings in both helicopter and instrument (helicopter). According to the operator, he had accrued a total of approximately 1,354 hours of flight experience of which approximately 1,076 hours were as PIC and approximately 1,298 hours were logged in rotorcraft. Additionally, he was reported to have logged approximately 154 hours in the Vertol V-107 model rotorcraft, none of which was logged as PIC time. He had been issued a first class medical with no waivers/limitations on January 4, 2001.

CREWMAN:

The crewman, whose location in the rotorcraft could not be determined, held an FAA airframe and powerplant mechanic certificate. According to the operator, he had been engaged in maintenance on the rotorcraft during its preparation for flight testing and, as was customary for the operator, was assigned to assist during the test flight.

AIRCRAFT INFORMATION

N186CH, serial number 4005, was a Kawasaki model KV107-II manufactured derivative of the Boeing-Vertol model BV107 rotorcraft and was built in 1963. According to records maintained by the Federal Aviation Administration (FAA), the rotorcraft was owned by and registered to

Columbia Helicopters Leasing, Inc. as of May 22, 1991. The rotorcraft had a total of approximately 41,559.1 hours of airframe time at the time of the most recent inspection (the day previous to the accident), and had flown for approximately 20 additional minutes on the morning of the accident.

According to the Aircraft Contract Daily Diary for N186CH on August 31, 2001, a morning fire briefing was conducted at 0630 at the incident command post followed by an air operations briefing which was conducted at the Fridley helibase at 0730 hours during which the pilot in command of N186CH indicated that he "...wanted [a] test flight to 'tweak' [the] logic system..." (the logic system is that portion of the electrically operated/mechanically actuated engine synchronization and control system). The diary continued with an entry logged as "0845 - Beginning Hobbs = Yesterday end Hobbs = 1288.7" (refer to Attachment ACDD-I).

The same 0730 entry also contained an entry following "...mechanic installed fuel actuator #2 engine...." There was no engine/airframe logbook entry supporting the installation of the fuel actuator for the #2 engine and the aircraft's status (grease) board located in the maintenance trailer, and which was documented by an FAA inspector, contained no reference to a change or installation of a fuel actuator/control unit.

N186CH had a maximum gross takeoff weight (MTGW) of 20,000 pounds for internal loads and this limit could be extended to 22,000 pounds for external loads. The rotorcraft was equipped with two General Electric CT58-140-1 turboshaft engines.

At the time of the accident, N186CH was equipped and operating with an external bucket used for firefighting operations. The bucket weight was approximately 700 pounds (empty) and the bucket was attached to the rotorcraft's external long line with an approximate 25-foot line. The external long line, from the bucket attach line point to the rotorcraft, was approximately 125 feet in length. The Operator reported that the bucket and long line were used on the accident flight to facilitate the check of the engine control unit, which could be accomplished at greater power settings with the bucket load than without such a load. However, alternative methodologies for providing such load effects were available. The aircraft had departed on the accident flight with 2,400 pounds of Jet A fuel.

N186CH was maintained under a continuous airworthiness program in accordance with the requirements specified in 14 CFR 91.409f(4). The most recent inspection, a phase 5 airframe inspection, was conducted on the rotorcraft on August 30, 2001. A maintenance check flight was not required following the completion of this inspection.

A review of the rotorcraft's maintenance records for the 45 days previous to the accident was conducted and an abbreviated maintenance history was compiled (refer to Attachment MT-I). No significant trends were noted. The number two engine was removed and replaced for overhaul on August 21st and again on August 26th for low torque indications and a hot air leak.

METEOROLOGICAL INFORMATION

Visual clear day meteorological conditions existed at the time of the accident. An aerial photograph taken of the crash site several hours after the accident showed a light column of smoke ascending above the tree line and gradually trailing toward the northeast quadrant (refer to photograph 1). The temperature at the accident site and time of the accident was estimated to be approximately 70 degrees Fahrenheit.

Aviation surface weather observations taken at Cody, Wyoming, and Livingston, Bozeman and West Yellowstone, Montana, for the morning of the accident reported, in part, the following conditions:

Cody (located 85nm east-southeast) reported clear skies, visibility of 10 miles and winds 190 degrees true at 5 knots at 0855.

Livingston (located 22nm north-northeast) reported clear skies, visibility of 10 miles and winds 310 degrees true at 10 knots at 0853.

Bozeman (located 33nm northwest) reported clear skies, visibility of 10 miles and calm winds at 0856.

West Yellowstone (located 42nm south-southwest) reported mostly cloudy skies, visibility 15 miles and winds calm at 0951.

WRECKAGE AND IMPACT INFORMATION

The rotorcraft crashed three nautical miles south of Emigrant, Montana, within the Emigrant Creek drainage and within an area moderately populated with a mix of deciduous and conifer trees. The primary ground impact site of the wreckage (fuselage) was approximately 5,200 feet above mean sea level (MSL) with the aft rotor head at 45 degrees 19.340 minutes north latitude and 110 degrees 44.056 minutes west longitude (refer to Charts I and II).

The rotorcraft was observed at the primary ground impact site resting on its right side and with its longitudinal axis oriented roughly along a north/south magnetic bearing. The cockpit area was located at the southernmost point with the fuselage progressing north through the cabin section to the engine and aft transmission area (refer to photograph 2). The area immediately aft of the cockpit including the control closet (upper fuselage) was observed to have a large tree trunk extending upwards vertically through the wreckage (refer to photograph 3). Aside from the cockpit section of the fuselage including the forward transmission assembly and pylon, the remainder of the rotorcraft had been subjected to a significant post crash fire, which consumed the center (cabin) section and most of the skin structure of the aft section. The magnesium aft transmission case had been completely consumed in the post crash fire

leaving the internal gearing lying in place on the ground. Both turboshaft engines, the mixing box, aft rotor drive shaft and aft rotor head were found lying on the ground consistent with the rotorcraft having come to rest on its right side (refer to photograph 4). All five segments of the synchronization drive shaft extended between the forward transmission head and aft into the mixing box, and although the center section had significant fire damage and melting, all segment couplings were located along the vicinity of the drive shaft axis (refer to photograph 5).

The remains of the bucket, consisting of its steel circumferential retainer attached to the associated cabling was observed a short distance north of the aft rotor head (refer to photograph 6). The 150 foot long cabling, comprised of a braided, multi-strand steel support cable, along with an electric actuation line and two hydraulic operation lines was observed extending back into the primary wreckage area near the aft landing gear struts and progressing along the underside (east) of the fuselage and looped around the nose gear strut (refer to photographs 5 and 7).

Several areas of scrape marks characteristic of the steel braided bucket cable were noted in different locations within the wreckage. Specifically, prominent diagonal cross scrapes were observed along the nose gear strut (oleo) along with less prominent indications on one of the aft landing gear struts (refer to photograph 8). Additional scrape marks matching the cable braid pattern were noted along the forward left side of the fuselage, the aft and upper portion of the left cockpit bubble window, the forward rotor pylon and the forward rotor rain shield (refer to photographs 9 and 10).

The aft rotor head was missing all three rotor blades and each blade was observed to have separated at a location about two to three feet outboard of the blade to hub attach point (refer to photograph 11). Likewise, the forward rotor head was missing all three rotor blades and each blade was observed to have separated at a location about two to three feet outboard of the blade to hub attach point (refer to photograph 12). The remainder of the wreckage was distributed over three general areas as described in the following (refer to Attachment DP-I for individual debris target points and Chart I):

FORWARD ROTOR BLADES

The forward green rotor blade was observed lying on a plateau above the accident site elevation and located bearing 155 degrees magnetic and about 600 feet distant from the primary ground impact site (refer to photograph 1). The blade was continuous from its outboard tip inboard to the separation point approximately 2-3 feet outboard from the hub attach point. The forward yellow rotor blade was observed lying on the same plateau bearing 138 degrees magnetic and about 900 feet distant from the primary ground impact site (refer to photograph 13 and Chart II). The inboard half of the forward red rotor blade was found approximately 100 feet north of the primary impact site (refer to photograph 14). The outboard section of the forward red rotor blade was observed lying on the ground perpendicular to the synchronization shafting. This was the only section of rotor blade to have

been located within the primary ground impact/fire area (refer to photograph 15).

AFT ROTOR BLADES

All three aft rotor blades (red, green and yellow) were located within 150 feet of one another and within an area bearing 052 degrees magnetic and approximately 400 feet distant from the primary ground impact site (refer to Chart II).

LIGHTWEIGHT DEBRIS

The fourth area was a broadly dispersed distribution of small parts consisting of fiberglass, Plexiglas, paint chips, small metal fragments, paneling, and insulation. This material was found within an arc bearing 018 through 027 degrees magnetic from the fuselage impact site and extending approximately 2,300 feet north northeast (refer to Chart II).

TESTS, EXAMINATION AND RESEARCH

The wreckage was transported to the facilities of Columbia Helicopters, Aurora, Oregon, where it was laid out on the floor of a large storage building in preparation for a more detailed examination. The layout was organized into several different areas of the rotorcraft, specifically, rotor blades, bucket and cabling, forward transmission and rotor head, cockpit and control closet, instrumentation, center fuselage control area (synchronization drive shaft and control linkages), aft transmission and rotor head, aft rotor drive shaft and mixing box, and both engines.

The mechanical flight controls (collective pitch, longitudinal/lateral and directional) were examined from the cockpit area through the control closet and out to each rotor head assembly, including the intermediate cabling and walking beam assembly. Although some of the aft control pushrods had been destroyed in the post-crash fire, all the steel pushrod ends were accounted for and there was no evidence of any pre-impact disconnects throughout the system.

Both the forward and aft transmissions were disassembled and examined. Although the aft transmission case had been consumed in the post crash fire there was no evidence of any pre-impact mechanical malfunction or disconnects within either transmission assembly.

All five segments of the synchronization drive shaft were examined and, consistent with the on site observation of all shafting lying in place from forward end to rear end, no disconnects were noted. Portions of the drive shaft had been subjected to the post crash fire but all of the drive shaft couplings were accounted for as found sequentially at the ground impact site. There was no evidence of a disconnect within the mixing box and no evidence of pre-impact disconnect between the mixing box and either of the engine drive shafts. Finally, there was no evidence of any disconnect between the mixing box, the aft rotor head (vertical) drive shaft

and the aft rotor head.

The bucket and cabling was examined and several areas of fire damage were noted. The 5/8-inch diameter cable was comprised of a braided series of multi-strand steel wires. The cable displayed several local areas where the individual wires were abraded down to fresh metal for short distances (refer to photograph 16). A section of the cable was observed to be permanently deformed into a near 90-dgree bend and the braiding was noted to be separated (refer to photograph 17).

The following major components were examined at the facilities of Columbia Helicopters following the accident (refer to Attachment I for additional details):

ROTOR BLADES

The forward red rotor blade was observed fractured in two locations 1) approximately 32 inches and 2) 148 inches from the root end of the blade (refer to photograph 18). Scrape marks characteristic of the steel braided bucket cable were noted at several locations along the leading edge of the blade (refer to photograph 19).

The forward yellow blade was observed fractured at location similar to that of the forward red blade and a third fracture was noted approximately 20 inches from the blade tip (refer to photograph 18).

The forward green blade was observed to display only one fracture located approximately 31 inches from the root end and this blade was in relatively good condition compared to the red and yellow blades previously described (refer to photograph 18).

The aft red blade was observed fractured in two locations 1) approximately 36 inches and 2) 148 inches from the root end of the blade (refer to photograph 20)

The aft yellow blade was observed fractured in three locations with two of the fractures located similar to those of the aft red blade and the third fracture was located approximately 24 inches from the blade tip (refer to photograph 20).

The aft green blade was observed to display only one fracture located approximately 36 inches from the root end (refer to photograph 20).

All three forward blade inboard sections (those blade portions that remained attached to the forward rotor head) displayed extensive scratching and abrasion marks characteristic of the braid pattern from the bucket cable. These marks were not observed on any of the three aft inboard rotor blade sections (refer to photograph 21).

All twelve fractures faces (all six blade separation points) were fractographically examined and all twelve displayed similar characteristics. No fatigue propagation or characteristics of other

time dependent failure mechanisms were observed and all the fractures were consistent with typical overload mechanisms (refer to Attachment II).

FORWARD AND AFT ROTOR HEADS

Numerous fractures and separations of both rotor head attachments and linkages were observed (refer to Attachment II for additional details). All fractures were fractographically examined and all displayed similar characteristics. No fatigue propagation or characteristics of other time dependent failure mechanisms were observed and all the fractures were consistent with typical overload mechanisms.

MECHANICAL FLIGHT AND ROTOR CONTROLS

The fractures observed in the mechanical flight and rotor controls were fractographically examined and no fatigue propagation was observed on any of the fracture surfaces (refer to Attachment II for additional details).

SYNCHRONIZATION SHAFT

All synchronization shaft coupling plates and adapter assemblies were observed intact and there was no fatigue propagation observed on any of the fracture surfaces (refer to Attachment II for additional details).

ENGINE HIGH SPEED OUTPUT SHAFTS

Both the left and right engine output shafts displayed a through fracture and neither fracture showed any fatigue propagation (refer to Attachment II for additional details).

FORWARD TRANSMISSION ASSEMBLY

The primary drive components (gears and bearings) revealed no detectable anomalies and the transmission housing displayed only overload damage (refer to Attachments II and III for additional details).

AFT TRANSMISSION ASSEMBLY & MIXING BOX COMPONENTS

The primary drive components (gears and bearings) revealed no detectable anomalies and the transmission housing was destroyed by fire. The number 1 and number 2 Idler Gear and Clutch assemblies displayed no evidence of "sprag rollover." It could not be determined whether either clutch was coupled at the moment of impact (refer to Attachments II and III for additional details).

AFT (VERTICAL) DRIVE SHAFT ASSEMBLY

Examination of the aft drive shaft assembly revealed no anomalies (refer to Attachment II for additional details).

HYDRAULICS

The forward upper dual boost collective and lateral actuators as well as the aft upper dual boost collective and lateral actuators were examined, along with both hydraulic pumps, the four stick boost actuators (thrust, yaw, roll and pitch) and the yaw and roll extensible links. These components were tested (where possible) and disassembled (the pitch extensible link was too damaged to test). The testing included X-ray examination from multiple angles. No anomalies were noted (refer to Attachment IV). A second examination of these components was accomplished at the materials laboratory of the Naval Depot, Marine Corp Air Station Cherry Point, North Carolina. The second examination results were consistent with those of the first (refer to Attachment V).

ENGINES

Both engines were examined and partially disassembled. Both the number 1 and number 2 engine displayed significant power turbine blade deformation opposite to the direction of rotation (refer to photographs 22 and 23). Significant witness marks were observed on the compressor stage one vane shroud support ring for each engine and the angle was reported as approximately 44 degrees. This angle, along with the estimated 70 degree F. outside air temperature yielded an approximate gas generator speed range between 64.3% and 69.7%, or about 10% above ground idle (refer to Attachment VI).

MEDICAL AND PATHOLOGICAL INFORMATION

Post-mortem examination of the pilot, co-pilot, and mechanic, was conducted at the facilities of the Gallatin County Law Enforcement Center morgue, Bozeman, Montana, on September 1, 2001, (case numbers MO1-142, MO1-143, and MO1-144).

The post mortem of the PIC and mechanic revealed no significant findings. The post mortem of the co-pilot revealed a "...focal 80% atheromatous narrowing of the proximal left anterior descending coronary artery in a 1 cm long segment...." The pathologist reported in his "Summary and Comment" section of the report that "...There was a single severe focus of atheromatous coronary artery disease found in the left anterior descending coronary artery. The significance of this with respect to the crash is unknown, but it is more than would be expected considering the [pilot's] age...."

The FAA's Toxicology Accident and Research Laboratory, Oklahoma City, Oklahoma conducted toxicological evaluation of samples from the pilot, co-pilot and mechanic. The following findings were reported for all three crew (refer to attached Toxicology reports):

	PILOT	CO-PILOT	MECHANIC
Carbon Monoxide:	NONE	UNKNOWN	NOT PERFORMED
Cyanide:	NONE	NONE	NOT PERFORMED
Drugs:	NONE	NONE	DIPHENHYDRAMINE*
Volatiles:	NONE	SEE NOTE 1	SEE NOTE 2

*detected in liver and kidney

NOTE 1:
16(mg/dL, mg/hg) ETHANOL detected in blood
37(mg/dL, mg/hg) ACETALDEHYDE detected in blood
02(mg/dL, mg/hg) N-PROPANOL detected in blood
18(mg/dL, mg/hg) ETHANOL detected in Brain
01(mg/dL, mg/hg) ACETALDEHYDE detected in Brain
01(mg/dL, mg/hg) N-PROPANOL detected in Brain
NO ETHANOL detected in Muscle

NOTE 2:
22(mg/dL, mg/hg) ETHANOL detected in Kidney
04(mg/dL, mg/hg) ACETALDEHYDE detected in Kidney
02(mg/dL, mg/hg) N-PROPANOL detected in Kidney
NO ETHANOL detected in Muscle

ADDITIONAL INFORMATION

On-site examination of the wreckage was conducted on August 31 through September 2, 2001, after which the wreckage was conditionally released for the purpose of transport to the Operator's facility for reconstruction. Verbal release of all wreckage excluding the eight hydraulic servo actuators and three extensible links, associated fluid samples and x-rays was accomplished on October 22, 2001. Written wreckage release was accomplished on November 14, 2001, and is documented on NTSB form 6120.15 (attached).

Pilot Information

Certificate:	Commercial	**Age:**	37,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 None	**Last FAA Medical Exam:**	September 14, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 19, 2001
Flight Time:	3889 hours (Total, all aircraft), 1631 hours (Total, this make and model), 1715 hours (Pilot In Command, all aircraft), 64 hours (Last 90 days, all aircraft), 57 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Commercial; Flight instructor; Private	**Age:**	28,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	January 4, 2001
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 6, 2001
Flight Time:	1354 hours (Total, all aircraft), 154 hours (Total, this make and model), 1076 hours (Pilot In Command, all aircraft), 103 hours (Last 90 days, all aircraft), 67 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Other flight crew Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Co-pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	28,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 None	**Last FAA Medical Exam:**	January 4, 2001
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 6, 2001
Flight Time:	1354 hours (Total, all aircraft), 154 hours (Total, this make and model), 1076 hours (Pilot In Command, all aircraft), 103 hours (Last 90 days, all aircraft), 67 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Kawasaki	**Registration:**	N186CH
Model/Series:	KV-107-II	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	4005
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	August 30, 2001 Continuous airworthiness	**Certified Max Gross Wt.:**	22000 lbs
Time Since Last Inspection:	0.3 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	41559 Hrs at time of accident	**Engine Manufacturer:**	General Electric
ELT:	Installed	**Engine Model/Series:**	CT 58-140-1
Registered Owner:	Columbia Helicopters Leasing, Inc.	**Rated Power:**	1500 Horsepower
Operator:	Columbia Helicopters, Inc.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	CHIL

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LVM,4656 ft msl	**Distance from Accident Site:**	25 Nautical Miles
Observation Time:	08:53 Local	**Direction from Accident Site:**	13°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	290°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	16°C / 5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Emigrant, MT	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	08:45 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	3 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	3 Fatal	**Latitude, Longitude:**	45.323333,-110.731666

Administrative Information

Investigator In Charge (IIC):	McCreary, Steven
Additional Participating Persons:	Cathryn M Kurtz; FAA Flight Standards District Office; Hillsboro, OR D. Shaw Siglin; Boeing, Global Rotorcraft Customer Support; Philadelphia, PA George Warren; Columbia Helicopters, Inc.; Portland, OR Gordon Gissel; GE Aircraft Engines; Lynn, MA
Original Publish Date:	February 21, 2003
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=53170