Aviation Investigation Final Report

Location:	SAVANNAH, Tennessee	**Accident Number:**	MIA98GA069
Date & Time:	February 3, 1998, 08:50 Local	**Registration:**	N30TV
Aircraft:	Bell UH-1H	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	4 Fatal, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Public aircraft		

Analysis

Helicopter (hel) was being used to string rope/wires with chief pilot (PIC) in left front seat, copilot in right front seat, & 2 observers behind pilots on either side. Witnesses observed hel approach 150' tall pole with a workman at the top. Workman was to connect a rope to a 17' line from the hel which had 600 lbs of weights attached. Foreman in charge of ground operations was observing on ground between his vehicle & the pole. He was not in radio contact with pilots, although vehicle was radio equipped. Witnesses saw hel approach workman & pole from above with hel's nose facing northwest. Wind was from 110 deg at 9 gusting 19 kts. Observers were watching from sides of hel; right observer was providing suggested flight directions for the copilot, who was on the controls. Hel came to a high hover over the pole; workman attempted to attach the rope. Witnesses said hel descended as it drifted left & forward of pole & workman, then it began to back up & climb. Rotor blades struck pole & workman. Hel then rolled right, descended, & impacted ground on its right side. The hook system that was normally used for this type of operation was on another hel & was not available for this mission. Instead, a 'U' shaped swivel hook with a bolt & nut arrangement was used. The normal hook system would have allowed the workman to quickly hook the rope to the hel within seconds. Video tape showed hel hovering above workman & pole for 1-1/4 min until tape stopped (just before accident). Operation Manual required 2-way radio communication between pilot & ground crew (unless otherwise authorized by Manager of Aviation Services). There was no communication between pilot & ground crew from time hel was overhead until accident occurred.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: failure of the flight crew to maintain sufficient altitude/clearance from the pole and workman.

Related factors were: the gusty wind condition, inadequate communication/coordination between the flight crew and ground personnel, and an improper external system for this type of operation.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: HOVER - OUT OF GROUND EFFECT

Findings
1. (F) WEATHER CONDITION - GUSTS
2. (F) AIR/GROUND COMMUNICATIONS - INADEQUATE
3. (F) CREW/GROUP COORDINATION - INADEQUATE
4. OBJECT - POLE
5. (C) ALTITUDE/CLEARANCE - NOT MAINTAINED - FLIGHTCREW
6. (F) IMPROPER USE OF EQUIPMENT/AIRCRAFT - COMPANY/OPERATOR MANAGEMENT

Occurrence #2: PROPELLER/ROTOR CONTACT TO PERSON
Phase of Operation: HOVER - OUT OF GROUND EFFECT

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

HISTORY OF FLIGHT

On February 3, 1998, about 0850 central standard time, a Bell UH-1H helicopter, N30TV, operated by the Tennessee Valley Authority (TVA), as a Title 14 CFR Part 91 public-use flight, impacted with a pole near Savannah, Tennessee. Visual meteorological conditions prevailed, and no flight plan was filed. The helicopter was destroyed. Two airline transport pilots, one crewmember observer, and one TVA employee working on the pole, were fatally injured. One observer (a helicopter crewmember) received minor injuries. The flight had originated from Muscle Shoals, Alabama, at 0630, en route to Savannah. The flight was conducted to support a rope stringing and wire installation operation which was being conducted by the TVA.

The helicopter departed from the TVA Air Service hangar with a crew of two, TVA's Chief Pilot and an observer. Two additional crew members, another observer, and a contract pilot, had driven to Savannah earlier and were to meet the helicopter in Savannah. After a 30 minute flight, the helicopter landed at the TVA line maintenance facility, and the crew attended a line installation briefing. The two other crew members were there and they also attended the briefing. The briefing lasted about 30 minutes, and the flight departed at 0730.

The helicopter flew about 1.2 hours stringing ropes/wires before it proceeded to the area where the accident occurred. Ground witnesses observed the helicopter approach a pole with a workman at the top, at a height of about 150 feet above the ground. The workman's task was to attach a conductor pull rope to the end of a 17-foot sling and 600 pound weights, with a shackle assembly, which were suspended from the bottom of the helicopter. Ground witnesses saw the helicopter approach the workman and the pole with the nose of the helicopter heading in a northwest direction. The helicopter came to a high hover over the pole, and the workman attempted to attach the rope. The witnesses said the helicopter began to get lower and lower until the workman could no longer reach the line coming from the helicopter. As the helicopter descended it drifted left and forward of the pole and the workman. The ground witnesses said the helicopter started to back up and climb when the main rotor blades struck the pole and the workman. The helicopter then rolled to the right, descended and impacted the ground on its right side.

The Foreman in charge of the ground operation, who was located close to the pole, identified as STR 51, at the time of the accident, said that before the mission started he talked to the workman that was to climb the pole, to make sure "he was comfortable " with hooking the ropes up. The Foreman was told by the workman, "he had done it before, he wasn't concerned." The Foreman said, "...I had my truck parked right next to STR 51 where I could see everything." He said he talked to the pilot-in-command [PIC], "whom [he] thought was flying the helicopter."

The Foreman said that the first rope that had been strung, had been picked up from a nearby field, and it was then brought to his attention that they might have "trouble" flying the next phase, the bottom, without getting "it bucked." It was decided to "...let [the workman] take [the] rope to the top of the pole to hook to the helicopter." The Foreman said he "discussed it" with the PIC and he replied, "Okay." The workman was at the top of the pole when the helicopter came to a hover over him so that he could hook the rope to the helicopter. The Foreman said, "...from where I was standing it looked like he [the workman] was having a hard time getting the rope hooked. I was still standing between the pole and my truck pacing around. I thought I saw [the workman] just stop and start hugging the pole, because the wind from the helicopter was so strong. I saw men in the helicopter leaning out, (spotters) watching what was going on. For some reason I thought they could see what was going on and they were just going to leave. When I looked back up I saw the 600 lbs. weight...bouncing off [the workman's] back and I knew something was wrong for sure." The Forman then ran to his truck and, "...got on the radio to tell [the PIC] he was too close to my man, that he needed to leave so we could regroup. No sooner than I finished I heard a noise, when I looked up the helicopter had hit the top of the pole with their main rotor...."

According to the TVA Aviation Operation Manual, under the heading External Load Operation, the last paragraph on page 26 states: "...external load operations shall not be conducted unless there are two-way radio communications between the pilot and ground crew unless otherwise authorized by the Manger of Aviation Services. Hand or light signals will not be employed except when initially hooking up or releasing load. In case of radio failure, the pilot in command shall terminate operation until the transceiver is repaired or replaced...." During this operation the Foreman said his radio was in his truck, some distance from where he was positioned. There was no evidence found, that from the time the helicopter arrived at the pole, until the accident had occurred, that there was not any radio communication between the ground and the pilot. In addition, examination of the helicopter's radios did not indicate any discrepancies.

The surviving crew member, who was in the helicopter at the time of the accident, confirmed that their mission that day was to pull rope across the Tennessee River. He said that the helicopter approached the pole centerline, from above the pole. Commands were given by the other observer, located on the right side of the helicopter, to the pilot in the right front seat of the helicopter, who was on the controls. The pilot was told by the right side observer, "...to ease the aircraft down and hold position, along with move left and move right commands. These commands were made to move [the] aircraft wire pulling rigging system even with the top of the pole where a linemen from the ground would be located to connect the rope." He further stated that the workman on the pole, "was unscrewing a pin through a swivel in order to insert [the] loop of the rope and reinstall [the] pin." The weights on the rigging "had settled" on the side of the pole with the helicopter, "drifting just past the pole." "A command was given to ease back to bring the rigging back vertical and [the] weights off the pole." The left side observer said he looked away when, "the linemen lost the swivel." When he looked back down, the helicopter had, "drifted to the left and forward of the pole." The workman and

the pole were no longer visible to him from his location in the helicopter.

The surviving crew member described the following events, "...the pilot asked what he needed to do and a command was given to back off and try again...immediately followed with move left command and repeated in about two seconds. Another two seconds past and [the right side observer] yelled left, left, left, left. Immediately following the command I felt and heard both main rotor blades strike the pole. This caused the aircraft to turn 90 degrees to the left and roll hard right."

In addition, after impact the engine was still running. The surviving crew member said, "he moved behind the co-pilot's seat to look for the fuel boost pump cut off switch. The control was not visible...I placed the battery switch in the off position...grabbed the co-pilot's collective control to roll the throttle to flight idle, but it was jammed...I disconnected the battery as I ran around to the opposite side of the aircraft...I moved to where the engine was located and tried to manually move [the] throttle linkage to [the] cut off position, but it was jammed. I went to climb back in the cabin to locate the fuel shut off valve, but [was] told...that the power lines we landed on were hot...I told [them] to shut the power off [and this was done immediately]...I asked [a linemen] to help me back into the aircraft. Once inside I saw the panels covering the fuel valve had been torn off and immediately moved the manual lever to the off position. I then exited the aircraft...the engine shut down in a span of 20 to 30 seconds."

The accident occurred during the hours of daylight approximately 35 degrees, 03 minutes north, and 088 degrees, 02 minutes west.

PERSONNEL INFORMATION

Information on the pilot is contained in this report on page 3, under First Pilot Information. Information on the Second Pilot is contained in this report in Supplement E, Second Pilot Information. The pilot sitting in the left front seat was the pilot-in-command. He was also the Chief Pilot for the TVA. On the accident flight, the Chief Pilot was completing training for the second pilot in aerial line installation operations and procedures associated with the rope/wire stringing operation. In addition, the observer on the right side of the helicopter was to train the left side observer in aerial line installation operations and procedures associated with the rope/wire stringing operation.

METEOROLOGICAL INFORMATION

Meteorological information is contained in this report on page 3, under Weather Information. The reported winds at the Savannah Airport located about 5 miles southeast of the crash were from 110 degrees at 9 knots with gusts to 19 knots. It was determined that the helicopter approached the pole from southwest to northwest. This would have set up a wind condition on the approach to the pole from the helicopter's tail. The helicopter then pointed the nose in a westerly direction as it hovered over the pole which placed the relative wind on

the left side of the helicopter toward the right of the helicopter, and toward the pole, at the same time the helicopter was hovering to the left of the pole.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on both pilots, on February 5-6, 1998, at the Medical Examiner's Office, University of Tennessee, Memphis, Tennessee, by Dr. O.C. Smith.

Toxicological tests were conducted at the Federal Aviation Administration, Research Laboratory, Oklahoma City, Oklahoma, and revealed, "...no ethanol detected" in either pilot.

Drug results for the pilot that was seated in the left front seat indicated that, "...Diphenhydramine detected in the urine...0.013 (ug/g) Diphenhydramine detected in the Blood." Diphenhydramine has been decried by the NTSB Medical Officer, as the over-the-counter medication "Benadryl." Usually this medication is used as a cold and allergy preparation and sleep aid. Diphenhydramine is a sedating antihistamine and has effects including drowsiness and mental impairment. The level detected indicates use of a normal dose about 12 to 24 hours prior to the accident, and the level detected was considered low. Nothing could be determined in regards to the pilot's performance and impairment at the level that was detected.

Drug results for the pilot that was seated in the right front seat indicated, "...8.800 (ug/ml, ug/g) Phenytoin detected in the Blood... Phenytoin detected in Liver Fluids...1.300 (ug/ml, ug/g) Acetaminophen detected in the Blood." It must be noted that the right seat pilot survived the crash and was transported to a hospital where he stayed for many hours receiving medication and treatment before he died.

WRECKAGE AND IMPACT INFORMATION

The helicopter struck a steel utility pole that was 90.67 feet from street level to the top of the pole. The steel utility pole was struck by one of the main rotor blades, 4 inches from the top cap. The second blade strike on the pole was observed 49 inches from the top. The main rotor system, transmission system, pylon section, and complete cargo hook system departed, the helicopter and fell to the ground about 10 feet east of the pole. The airframe also came to rest within 10 feet of the pole, on it's right side, with the nose of the helicopter heading in a westerly direction.

Examination of the helicopter's main rotor system and blade assembly revealed that both of the main rotor blades were destroyed. Both blade roots remained attached to the blade grips. One blade had only the trailing strip remaining on the blade. The other blade had 12 feet of the tip end cut off, and the rest of the blade was attached. Both of the blade tabs were found destroyed. The trunnion and pillow blocks were found torn lose. The yoke was scarred. The static stops displayed compression damage. Both pitch horns were torn from the blade grips. Both drag braces were found bent. The blade grips were scarred. The upper

swashplate was found fractured, and all the control rods were found severed. The pitch change links and damper linkage were found bent and severed. The stabilizer bar assembly had torn from the "A" frame.

The transmission revealed that all 5 mounts were pulled apart, and had torn out of the airframe. The pylon area was found torn out of the airframe. The lift link was found attached to the transmission and the lift beam. The input quill was found damaged. The free wheeling unit was found with impact damage, but functioned properly. The mast, tail rotor quill, and tach drive, all rotated freely. The chip plug was found clean. Except for impact damage no discrepancies were found with the transmission.

The tail rotor system remained attached to the gear boxes and mounts. Both tail rotor blades displayed very little damage. The 42- and 90-degree gear boxes displayed very little damage. The tail rotor oil system was found full and the chip detector plug was clean. No discrepancies were found with the tail rotor system.

Examination of the cockpit and cabin area revealed that the left pilot door had torn apart. The right side pilot door was destroyed. The left pilot's seat was torn from the rail. The right pilot's seat was found pushed through the floor structure.

The landing gear's right forward cross tube fractured at the left hard point attachment fitting. The top of the right skid was gouged 12 inches, just behind the cross tube saddle.

The helicopter was removed from the crash site and taken to the TVA's aviation facilities at Muscle Shoals for further examination. Control continuity was established to all the flight controls.

Witnesses stated that the engine continued to run until the surviving crew member shut off the fuel valve. Examination of the engine revealed that the inlet air ducting and cowling were destroyed. The compressor, G.P. (gas producer) turbine, and power turbine, all showed foreign object damage (FOD). The burner can was dented and displayed impact damage. The exhaust was bent and displayed impact damage. The gearboxes rotated and moved freely. The engine chip detector was found clean. The bleed air line was found broken off. The anti-ice valve was found broken off at the attachment fitting. The fuel lines were found attached, and no fuel had leaked from the fuel system. No discrepancies were found with the engine or any accessories.

ADDITIONAL INFORMATION

According to the TVA, the hook system normally used for this type of operation was a quick, disconnect type of hook, similar to the type that was attached to the helicopter's cargo hook [see photo No. 19]. The hook usually used for this operation was on another helicopter, and was not available for this mission, because the helicopter was at another location, and in use in power restoration work following a major snowstorm. The accident mission had to go

forward with a different system, because boat traffic on the Tennessee River, where the line installation was taking place, was stopped for a period of time, so the operation would not be impeded by boat traffic on the river. For this operation, instead of a quick, disconnect mechanism below the weights, a "U" shaped swivel hook with a bolt and nut arrangement as placed at the end of the line. The quick, disconnect would have allowed the workman on the pole to take the rope with a loop at the end, and slip it over the hook when the helicopter arrived over his location. The entire operation would take seconds. With the system on the mishap helicopter, the workman would first have to remove a bolt from the "U" shaped swivel hook and then slip the loop of the rope into the mechanism, re-screw the bolt, and then signal the pilot that hook-up was completed [see photo No. 17].

One of the witnesses was video taping the operation, and the tape showed the workman on the pole, and the helicopter over him. The elapsed time on the portion of the tape that shows the helicopter over his head, until the tape stopped, just before the accident, was 1 minute 15 seconds. The video tape shows the workman struggling with the hook and bolt, and it slipping out of his hands. It also appears as though the helicopter bumps and strikes the workman once before he is struck by the rotor blades.

The aircraft wreckage was released to Mr. Charles Hofer, Manager, Transmission Line Construction, on behalf of the Tennessee Valley Authority, on February 5, 1998.

Pilot Information

Certificate:	Airline transport	**Age:**	59,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	September 29, 1997
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	12710 hours (Total, all aircraft), 10000 hours (Pilot In Command, all aircraft), 380 hours (Last 90 days, all aircraft), 70 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N30TV
Model/Series:	UH-1H UH-1H	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	73-21853
Landing Gear Type:	Skid	**Seats:**	13
Date/Type of Last Inspection:	November 18, 1997 100 hour	**Certified Max Gross Wt.:**	9650 lbs
Time Since Last Inspection:	35 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	5331 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Not installed	**Engine Model/Series:**	T53L-13B
Registered Owner:	TENNESSEE VALLEY AUTHORITY	**Rated Power:**	1250 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:**	Day
Observation Facility, Elevation:	SNH ,473 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	08:40 Local	**Direction from Accident Site:**	135°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Broken / 2400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots / 19 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	110°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	9°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	MUSCLE SHOALS , AL (MSC)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	06:30 Local	**Type of Airspace:**	Class D

Airport Information

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

Wreckage and Impact Information

Crew Injuries:	3 Fatal, 1 Minor	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	1 Fatal	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal, 1 Minor	**Latitude, Longitude:**	35.220737,-88.229446(est)

Administrative Information

Investigator In Charge (IIC):	Yurman, Alan
Additional Participating Persons:	PAT MATHISON; MEMPHIS , TN DALLES ST JOHN; FT. WORTH , TX CHARLES L HOFER; CHATANOOGA , TN
Original Publish Date:	February 15, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=38406