

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE



FATAL AVIATION
ACCIDENT HISTORY

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**LEARNING
EXPERIENCES**

Section One

**FATAL
AIRTANKER
MISHAPS**

The afternoon of July 21, 1979 found this contract airtanker, a Boeing B-17G (B-17), and her two-person flight crew dropping retardant on fires in the Two Creek Drainage Basin of the Superior Ranger District, Montana. The Superior Ranger District is part of the West Zone Dispatch Office area located in St. Regis, Montana.

Their initial dispatch to this fire occurred at 1411 hours Mountain Daylight Time (MDT). They proceeded to make one flight consisting of four retardant drops. A United States Department of Agriculture Forest Service leadplane pilot supervised the airtanker while it made two of those successful drops on the fire. The leadplane was released and returned to the Missoula Aerial Fire Depot at 1545 MDT.

At 1604 MDT, the B-17 airtanker was dispatched to a different fire on the Lolo National Forest. A leadplane was not available on this second fire to provide supervision. A leadplane was not required since this airtanker Captain was a certified Initial Attack Pilot and as such, was authorized to make retardant drops without supervision of a leadplane.

The first series of drops by the airtanker on this second fire were commenced at about 1625 MDT. They completed four drops without the assistance of a leadplane. Several individuals, including the pilot of a Twin Otter on a smokejumper mission, observed these drops.

The airtanker returned to the airtanker base (ATB) at 1655 MDT. The airtanker was re-loaded with 1,800 gallons of retardant, serviced with 380 gallons of fuel, and filled with 15 to 17 gallons of oil in preparation for another run on the fire. This airtanker was dispatched a second time to that same fire at 1739 MDT. Their departure time from the airport was recorded as 1748 MDT. Their flight from the airport back to the fire took about 15 minutes.

Upon returning to the fire, the airtanker made a high pass over the fire and then an approach for a second pass. The fire was located near the top of a mountainous ridge on an even slope that provided an easy target for a retardant drop. Once the pass had been made, no retardant had been dropped. Immediately after the airtanker passed over the drop target, it made a steep left turn and impacted a densely timbered hillside.

Many people witnessed this final flight path ending when the airtanker impacted terrain at 1810 MDT. Search and rescue efforts located the mishap site quickly and within 20 minutes, smokejumpers, including an Emergency Medical Technician (EMT), arrived on scene. The Captain and Copilot were killed upon impact.

The mishap site was located approximately ten miles southwest of Superior, Montana and 45 miles west of Missoula, Montana.

Many of the witnesses who observed this airtanker's flight patterns on this series of drops unanimously agreed they were unorthodox and dangerous. The airtanker had narrowly missed a spur ridge following a left turn up a gulch after its first retardant run. The safe, recommended flight pattern on this fire over this terrain, later selected by a leadplane and used several times by another airtanker, was down drainage to the north until sufficient altitude could be gained, then a right turn, back track pattern back to the fire area. The mishap airtanker's drops were on target and effective, in spite of their varying patterns.

Witnesses did not observe retardant being dropped during the final pass over the drop zone, although one person stated that a pink cloud of what was believed to be retardant was observed dropping from the airtanker about one quarter of a mile before the impact point. No physical evidence of retardant stains on trees or the ground supporting this sighting could be located during an air search. There was no indication that the retardant load had been deliberately jettisoned by the pilots when they recognized the hazardous situation they had flown into.

Terrain features were very steep and tree covered throughout the area. Tree heights were estimated to average 80 feet.

The airtanker made initial contact with the trees about 150 yards before impacting the ground. The final approach heading was about 130 degrees. Witness marks on the trees indicated the descent angle was 20 degrees at an extremely steep left bank of 60 to 65 degrees. Ground impact occurred on the west side of the drainage at the 5,200-foot level on a 40-degree slope.

Ground impact occurred in an estimated 5 to 10 degree nose low attitude and approximately a 40-degree left bank. On site wreckage examination revealed the flaps were set at about 15 degrees. There was no indication that any of the four engines had been feathered as all appeared to have been under power upon impact. The steep left bank was beginning to shallow; this can probably be attributed to the tree strikes and the B-17's aileron reversal tendency during stalls.

The general weather in the fire area included good visibility and temperatures in the high 80 degrees Fahrenheit with scattered clouds and light wind. The sun angle and terrain shadows should not have presented a hazard for the crew.

The investigation team determined that during the sequence of events, the airtanker's flight path during the left turn was taking it too close to the mountainside. This required more bank angle and gravity forces to increase the rate of turn and hold altitude in order to clear the mountainside. Unfortunately, as bank angles and load factors increased, induced drag, which predominates at low speeds, also increased dramatically. These factors would have required significant increases in power to maintain flight and preclude stalling.

The airtanker's situation, already critical because of its low airspeed, low altitude, and the turning space restriction, was compounded by the additional bank angle and increased load factor. The fringe of a stall was entered and aggravated by the addition of aileron and elevator input to increase the rate of turn. Power was insufficient to maintain flight and a few seconds later the airtanker completely stalled when performance demands could not be maintained. Close proximity to the ground precluded the use of normal stall recovery techniques, and the airtanker descended into the trees.

The Captain and Copilot were both qualified and approved for the mission. The Captain had flown this airtanker 88.6 hours since April 6, 1979 and the Copilot had been his copilot for 83.9 of those hours since May 23, 1979. The Captain and Copilot successfully flew retardant drop assignments in this airtanker in a variety of fire conditions and terrain in three different regions since April 6, 1979. During this contract season, either a leadplane or an air attack aircraft on 84 percent of their missions, had supervised this crew.

The investigation team determined that the Captain occupied the left seat and the Copilot occupied the right seat at the time of the mishap.

The Captain had accumulated 2,089 hours of total flight time as the Pilot in Command (PIC), including 699 hours in multi-engine aircraft. He had 649 hours in the B-17 and 539 hours low-level flight time (under 500 feet) as of July 21, 1979.

The Copilot's experience consisted of 899.6 PIC hours with 109 hours in multi-engine aircraft. He had 85.3 hours in the B-17 and 86 hours low-level flight time as of July 21, 1979.

The day of the mishap was both pilots' first day back on the job after one day off spent on the ground.

Analysis of pathology reports tended to support the theory that the Copilot was flying the aircraft at the time of impact. However, no conclusive evidence suggested which pilot initiated the fatal left turn. Toxicology reports indicated alcohol in the Copilot's stomach (.085 percent) and blood (.072 percent), but not in his urine. The medical examiner estimated that this alcohol level could have been caused by the consumption of two to four beers within 45 minutes prior to the mishap.



Boeing B-17G (B-17) wreckage location.

December 2, 1980 was a clear day. Airtankers "T1" and "T2," both Douglas Commercial (DC) DC-4's, departed the Hemet-Ryan Airport in California at 1322 hours Pacific Standard Time (PST) and 1323 PST respectively. Both airtankers had been recently released by the Forest Service from southern California fire assignments and were headed for their home base in Tucson, Arizona. No flight plan had been filed with the Federal Aviation Administration (FAA), although the crews intended to file one in flight.

While enroute, the crew of T1 engaged in taking in-flight photographs of T2 at an altitude of approximately 9,500 feet. T1 was flying in formation with T2 at his four to five o'clock position. The pilot of T1 stated over the radio that they were going to cross over to the other side of T2 to take more photographs. T2 gave permission and said that he would hold steady. The repositioning path T1 flew was a 45 degree overtaking angle from the four to five o'clock position toward the 10 to 11 o'clock position of T2. The vertical separation between the two airtankers was insufficient and a mid-air collision occurred.

The vertical fin of T1 struck the right wing flap of T2. T1's fin and rudder were sheared off by that impact. The retardant tanks of T2 compressed the top aft end of the fuselage of T1. The number two propeller of T2 severed the fuselage of T1 approximately 10 feet in front of its horizontal stabilizer. T1's tail section was separated from the rest of the airtanker at that time, rendering it out of control. The pilot of T2 radioed Palm Springs Approach Control at 1350 PST, declared an emergency, and apprised them of the collision. T2 landed at the Palm Springs Airport at 1356 PST. The Captain and Copilot of T2 were not injured.

After T1 experienced the tail separation, they lost altitude rapidly. T1 dropped debris for about a mile and a half until it cut through two power lines and then struck the earth nose first. There was a post-mishap fire. The Captain and Copilot were fatally injured.

The tail section of T1 was found approximately two and a half miles from the main wreckage site. The power company observed a power surge at 1343 PST, which was presumably caused by the fuselage of T1 breaking power lines at the mishap site.

T2's damage consisted of damage to the right wing flap, scrapes and punctures to the retardant tank, damage to the right wheel compartment, badly "chewed up" propeller blades on the number two engine, a hole in the left wing, a dented left horizontal stabilizer on the tail, and various other damage.

Turbulence and wind were not believed to be a factor contributing to this mid-air collision.

T1, a DC-4, was manufactured in 1944 and licensed as transport category. They were operating under a current Forest Service contract. The Captain's pilot application, dated April 12, 1978, showed that his qualifications and experience met minimum requirements for the Forest Service contract. His flight time was listed as 3,000 hours as the PIC of which 1,400 hours were in multi-engine aircraft. He had accumulated 2,500 hours in aerial dispensing operations and 1,375 hours of multi-engine time in aircraft over 12,500 pounds maximum certificated gross weight (MCGW). He had a total time of 26 hours in the DC-4.

T1's Copilot's pilot application, dated April 21, 1980, showed that his qualifications and experience met minimum requirements for the Forest Service contract. His flight time was listed as 1,500 hours as the PIC of which 735 hours were in multi-engine aircraft, 730 of those hours were in multi-engine aircraft over 12,500 pounds MCGW. He had a total time of 0 hours in the DC-4 at that time.

T2, a DC-4 or C-54 G, was manufactured in 1945 and licensed as standard category. They were operating under a current Office of Aircraft Services (OAS) contract.

T2's Captain pilot application, dated May 4, 1980, showed that his qualifications and experience met the minimum contract requirements. His flight time was listed as 16,000 hours as the PIC of which 12,000 hours were in multi-engine aircraft.

T2's Copilot pilot application, dated January 25, 1980, showed that his qualifications and experience met minimum requirements for the contract. His flight time was listed as 2,970 hours as the PIC of which 2,077 hours were in this category and class.

The investigation concluded that whomever was actually flying T1 permitted the airtanker to collide with T2, resulting in the loss of the tail of T1, and the subsequent total loss of T1.

QUALITY PHOTO NOT AVAILABLE

The Fairchild C-119 airtanker was dispatched from Goleta, California at 0857 hours Pacific Daylight Time (PDT), July 8, 1981, heading for a fire burning on the Los Padres National Forest. The airtanker arrived at the fire location and was given direction for the drop by the Incident Commander (IC). The IC instructed the airtanker pilots to keep the drop high because of steep terrain and snags. They were also instructed to drop only one-half the retardant, saving the remainder for another run. The airtanker pilots acknowledged the instructions.

The airtanker pilots notified the IC that they were on final approach. As the airtanker approached the intended drop area, the IC noted from the sound of the engines that they were “revved up.” He also heard cracking and popping sounds. When the airtanker came into his sight, the IC and another person noticed that the drop doors on the airtanker were not open and that the landing gear was retracted.

The IC had worked with this airtanker and its crewmembers on several previous occasions. The IC noted that the airtanker was lower than he had expected, traveling at an air speed higher than he had observed on previous drops, and that the airtanker was in a descending attitude. The IC and one other person observed the airtanker continue past the intended drop site and then suddenly drop vertically approximately 50 to 100 feet. At that moment, the left wing tip (approximately half of the total left wing span) flexed downward, snapped off, and began cartwheeling along behind the airtanker. The airtanker began to roll left, its nose began to drop, it began to strike trees, and then it struck ground at 0927 PDT.

The Captain and Copilot were fatally injured upon impact. The aircraft was totally destroyed.

Ground investigation confirmed the loss of the left wing prior to impact. Portions of the left wing, left flap, left inboard aileron, and approximately 20 feet of intact left wing tip were recovered between 50 to 800 feet in front of the impact point.

The terrain consisted of vegetation including Jeffrey pine, Pinon pine, and brush ranging from ten to 80 feet in height. The slope gradient of the land surface ranged from 40 to 80 percent. Elevation at the top of the mountain was 6,500 to 6,750 feet. The mishap was located at the 5,250-foot level. The temperature was 70 degrees Fahrenheit and winds were approximately five miles per hour (mph) from the north-northeast.

At the time of the Captain’s Forest Service inspection on June 15, 1981, he had accumulated 7,000 hours of total flight time, 250 hours of this total time was as Copilot. He was rated for multi-engine aircraft of over 12,500 pounds MCGW and he reported 5,000 hours in this aircraft category. Time in typical terrain (mountainous) was reported as 5,000 hours.

At the time of the Copilot’s Forest Service inspection on April 21, 1981, he reported his total flight time as 996 hours. 804 of those hours were flown as a Copilot. He had 400 hours in typical terrain.

The Fairchild C-119 airtanker started contract performance on June 15, 1981, with an accumulated airframe time of 4,874.4 hours. From that date until July 7, 1981, the airframe had accumulated an additional 40.44 hours of flight time. The maximum amount of flight time on any single day during the 23 previous days of contract use was three hours and 52 minutes on June 26, 1981.

The airtanker’s maintenance schedule was up to date. This airtanker had a malfunction of the number one engine at an airport on June 15, 1981. The number one engine was replaced and the airtanker returned to service on June 18, 1981. On June 26, 1981, this airtanker encountered severe turbulence in Arizona, which had “ripped” the helmet from the pilot’s head and strew equipment around inside the airtanker. The Captain and Copilot reportedly later inspected the airtanker for visible damage and “jumped up and down on the wing and everything seemed all right.” The weight of this airtanker was estimated to be 69,240 pounds at the time the mishap occurred.

Investigation by the National Transportation Safety Board (NTSB) and Forest Service teams showed definite pre-mishap cracks in the inner left wing aileron bell crank control assembly. The possibility of a

bell crank failure could have induced aileron flutter, which in turn could have contributed to wing destruction causing the wing to separate from the airtanker.

After this mishap, all C119s under contract in this Region were grounded so airworthiness inspections could be conducted. Three aircraft were inspected and a total of 14 parts in aileron control systems were found cracked or to have had excessive wear. Three of five bell cranks were found to have cracks. An Airworthiness Directive (AD) was then issued by the FAA pertaining to prevention of possible wing failure due to loads induced by “free aileron” on this type of aircraft.



Aerial view of Fairchild C-119 main wreckage.

March 5, 1983 found the airtanker, a Douglas B-26 on contract to the Forest Service, dropping retardant onto fires on the Cherokee National Forest in Tennessee. The morning before, this airtanker and single pilot contained 3.0 hours of flying. The airtanker had then landed in Knoxville, Tennessee at Tyson Field and refueled with 400 gallons of 100 octane avgas. The airtanker then departed for its regularly assigned base at Asheville, North Carolina.

At about 1620 hours Eastern Standard Time (EST), a Forest Service leadplane was dispatched to a fire near Hubbard's Fork, Kentucky. This leadplane arrived at the fire at 1700 EST and shortly thereafter another airtanker from Tyson Field arrived. The fire was in a "blowup situation" and it was necessary for this airtanker to drop its complete load on one pass over this fire. This airtanker made his retardant drop without incident and returned to Tyson Field. The late developing fire necessitated a call for additional firefighting aircraft.

The Douglas B-26 airtanker was dispatched from Asheville, North Carolina ATB at 1715 EST and arrived on scene at approximately 1745 EST. The airtanker pilot contacted the Forest Service leadplane who was circling overhead, coordinating firefighting efforts. The airtanker orbited at 3,000 to 3,500 feet mean sea level (MSL) while the leadplane made a dry run on the fire to evaluate the conditions, type of drop to be made, and to identify any safety hazards. The two pilots discussed the fire situation and behavior characteristics and decided what strategy would be used on the retardant drops.

The airtanker's first retardant drop on this fire was made utilizing two doors in trail configuration and was completed without incident. The second pass was again made in standard airtanker-leadplane configuration (leadplane in front) with a two-door trail drop. According to the leadplane pilot, their strategy had been to save the last two available doors for any hot spots or blowups that might occur on the fire. After the second retardant drop, the airtanker initiated a very wide left hand pattern approximately one and one half miles behind the leadplane.

As the airtanker was flying the left hand pattern, he and the leadplane pilot discussed strategy to be used on the final drop. The airtanker was then about one mile ahead of the leadplane and was flying at minimum terrain clearance level. The wind shifted, the "blown-up" area of the fire was visible, and the fire-line became obvious to both pilots. The last run was to be completed without following the leadplane. The airtanker pilot commented to the leadplane pilot, "Well, I can see it real good from here and I think I can hit it from a left hand turn." The leadplane pilot assumed the airtanker was going to make a dry run in order to get a better look at the fire before making the last drop.

Just after the airtanker had leveled his wings from the turn, the leadplane pilot observed what appeared to be pieces of metal coming loose from the airtanker as it impacted tree tops on the ridgeline. After initial impact with the trees, the airtanker continued down a hill approximately 1,600 feet to the final impact area. The mishap occurred at approximately 1800 EST. The pilot was fatally injured.

Witnesses on the ground reported the airtanker had struck trees near the top of a 1,800-foot ridgeline and plummeted into a ravine 1,600 feet from the initial impact point. They also reported about how low the aircraft had been at the beginning of the run and that the engines were running smoothly and even increased in power just prior to the time of impact.

This Douglas B-26 was manufactured as a United States Air Force World War II medium bomber in 1944 and was later converted for use in fighting wildland fires in its civilian version under a Special Airworthiness Certificate. It was licensed in the "Restricted" category. All AD's and service bulletins had been complied with as of January 22, 1983, the date of its last 100-hour inspection. There were no significant discrepancies discovered.

A flight plan was not filed and flight following was provided by the London Forest Service Dispatch Office.

The post mishap position of the propeller blades in respect to pitch angle and the propeller blades impact configuration suggested that the engines were producing power at the time of impact. Examination of the airframe structure and the cockpit configuration failed to produce any evidence to support a control system or structural malfunction. All of the instruments were destroyed, but the fuel selectors, engine magneto switches, propeller controls, and the throttle level positions were all set at normal operating positions.

The pilot possessed an Airline Transport Pilot Certificate (ATP) and had in excess of 4,100 hours of total flight time. He was type rated in the B-26 and had accumulated 733 hours in this aircraft in more than the four years he had been working as an airtanker pilot.

He reportedly was a very qualified and skillful pilot. It was noted that on numerous occasions other leadplane pilots and the aircraft owner had counseled the pilot about getting too low on his retardant drops. He had been proud of his airtanker abilities/performance and he frequently exhibited an overzealous attitude while performing firefighting operations.

Evidence in this mishap also suggested that he flew too low, below the 150 foot authorized drop height. This maneuver placed the aircraft in a position of insufficient height above the ground, consequently disallowing sufficient altitude to safely maneuver the aircraft.

The pilot was not wearing contract required personal protective equipment (PPE). His cause of death was listed as head injuries.

The weather was typical for the spring season. A frontal passage had occurred during the preceding 48 hours and was producing gusty surface winds from 12 to 20 knots with rapid clearing and a temperature of approximately 70 degrees Fahrenheit. The aviation weather forecasts had predicted these conditions along with an advisory of moderate to severe turbulence over the mountains.

At the approximate time of the mishap, the Flight Service Station (FSS) reported a ceiling of 15,000 feet with scattered clouds at 9,000 feet and a visibility of seven miles. All aviation operations conducted on March 5th were performed under Visual Flight Rules (VFR). The leadplane pilot and the two other airtanker pilots all reported that weather conditions were good at the time they made their retardant drops. All pilots reported clear to scattered sky conditions, visibility in excess of five miles, and light to moderate turbulence due to gusty winds.

There were visibility restrictions in certain locations due to smoke from the fire, but ground observers stated that they could see the aircraft when it struck the treetops. Visual Meteorological Conditions (VMC) prevailed at the fire scene.

After studying the factual information gathered in the course of the investigation, the investigation team concluded that the mishap of the airtanker was due to an undetermined cause. After careful review of the facts and circumstances of this mishap, they had two hypotheses.

Hypothesis A: The pilot allowed the aircraft to descend below the authorized drop height of 150 feet, thereby placing the aircraft in a position of insufficient height above the ground, consequently disallowing sufficient altitude to safely maneuver the airtanker.

Hypothesis B: The pilot encountered a wind shear effect or similar phenomenon and could not control the airtanker sink rate or didn't notice anything unusual until it was too late to recover and lost control of the aircraft. The team was unable to verify the existence or nonexistence of a wind shear phenomenon.

QUALITY PHOTO NOT AVAILABLE

This OAS contracted and carded Fairchild C-119G (3E) airtanker was flying under the operational control of the Forest Service on a Forest Service fire on September 16, 1987 when the mishap occurred. It had been dispatched to a fire about six miles west of Castle Crags State Park, California at 1705 PDT and departed the Siskiyou County Airport (Montague, California) shortly thereafter.

The C-119G airtanker, another airtanker of the same kind, a leadplane, and an air attack arrived at the fire at the same time. Two more airtankers followed shortly thereafter. The leadplane identified the target, the approach and departure routes, indicated the target was at an elevation of 4,500 feet, that the ridge on final approach was to be crossed at 6,600 feet, advised there was no wind, there was good visibility, and that there was no turbulence except a "1.5g bump" going across the head of the fire.

The leadplane directed one of the C-119 airtankers to drop first. That airtanker aborted their first run because of excess speed. On the second pass, it crossed the ridge at a different point, permitting a somewhat longer final approach. That drop was a successful one. The run was made through a saddle then down a creek to the fire some two miles down stream with a planned exit down stream into a larger canyon.

The leadplane then directed the mishap C-119G airtanker to drop next. The mishap airtanker used the same approach as the first airtanker. The mishap airtanker reached the uphill side of the fire when the crew reported trouble maintaining proper speed and dropped their retardant on the fire. At about the time the pilot dropped the retardant, a structural failure occurred and the right wing separated from the airframe along with the tip of the left wing and the tail booms. The fuselage with both engines and most of the left wing attached encountered terrain impact and burned as a unit. The time was 1730 PDT.

The Aviation Manager at the Redding Airport sent another leadplane to relieve the leadplane already on scene and asked the Dispatch Office to recall the remaining airtankers. The Dispatch Office then recalled the relief leadplane and directed the on-scene leadplane to drop the remaining airtankers.

The on-scene leadplane directed the other C-119G to drop, using the same pattern as the previous two airtankers. This airtanker again aborted the first run because of excess speed. While this airtanker was recovering altitude to try again, the on scene leadplane directed another airtanker, a DC-4, to drop. The DC-4 used the same pattern and successfully dropped retardant on the burning wreckage of the mishap airtanker, which was about one half of a mile past the fire. The C-119G had just gone around and then made a successful drop on its second pass. The fourth airtanker at this fire was also a C-119. The on scene leadplane and the remaining three airtankers then returned to the airport.

Both pilots and an Airframe and Powerplant (A&P) Mechanic on board were killed.

The Captain was qualified in the C-119 as an Initial Attack airtanker pilot and had been properly approved by OAS in the Alaska Region. He had limited experience in airtanker work in the typical terrain of the mishap. He had accumulated 12,943.1 hours of total flight time, 12,143.4 of these hours were logged as the PIC. 1,286.6 hours were recorded as the PIC time in type, 515 hours as the PIC in low-level operations, 3,501.6 hours as the PIC in aircraft over 12,500 pounds MCGW, 85.4 hours as the PIC of Airtanker/Dispensing Operations, and five hours as the PIC in initial attack at the time of his qualification inspection on April 16, 1987.

The Copilot was a qualified airtanker Copilot, and had been properly approved by the OAS in the Alaska Region. He had 1,652 hours of total flight time. He reported 1,205 hours as the PIC in airplane, 0 hours as the PIC time in type, 60 hours as the PIC in low-level operations, 0 hours of time as the PIC in aircraft over 12,500 pounds MCGW, and 0 hours time as the PIC in airtanker/dispensing operations on April 22, 1987.

The A&P Mechanic was serving his first season with this company and was apparently on board because the airtanker had been dispatched from the Siskiyou County Airport with instructions to land at the Redding Airport. Neither the Contracting Officer Representative (COR) nor the Contracting Officer (CO) had approved him to accompany the flight crew on airtanker flights. The CO would probably have approved this had a request been made.

The leadplane pilot was qualified. The direction and coordination of the four airtankers dropping on the fire was in accordance with standard procedures.

The Fairchild C-119G (3E) airtanker was approved under an OAS contract in the Alaska Region on May 25, 1987. It was ramp-checked by Forest Service Inspectors prior to service on fires in the Pacific Southwest Region.

There was no evidence of any unresolved mechanical problem with the airtanker immediately prior to the mishap. The airtanker was within maximum take-off weight. There was no reason to suspect that the center-of-gravity limits had been exceeded. The maximum zero fuel weight was most likely exceeded by several thousand pounds.

The retardant load had been dropped immediately prior to the mishap. At the time of impact, there were approximately 1,075 gallons of fuel on board, the landing gear and flaps were retracted or almost retracted, and the engines were running, but not developing significant power. The airtanker had almost certainly been substantially exceeding normal drop speed at the time the retardant was dropped. There was no evidence of failure of any wing structure component by reason of fatigue, cracks, corrosion, divergent control surface flutter, casting defects, or other deficiencies. All fractures were tensile or shear failures.

The visibility conditions in the fire area were excellent. The air was smooth except for a “bump” passing by the fire. Terrain features associated with the retardant drop run on the fire were typical for this geographical area in northern California. The route chosen for the drop run required the airtankers to descend 2,000 feet within about two miles to make an effective drop on the fire. A ground crew was working this fire and although there were near misses, no one on the ground was injured.

The Captain of the third C-119G airtanker, who had been the first to attempt a drop, stated that after the aborted run he went around and made a longer run on the fire. All of the C-119G Captains stated that this (fire zone) was a hole and that slowing down to the correct speed was risky and dangerous. They all stated that they had done just that.

The mishap investigation team concluded that the airtanker was subjected to excessive aerodynamic loads, which led to a catastrophic structural failure of the wings due to excessive speed and probable excessive pitch-up at or immediately after dropping the retardant.



Fairchild C-119G (3E) main wreckage.

On September 29, 1990, a civilian general aviation Cessna 172 encountered a mishap during search and rescue training over the Hood Canal District of the Olympic National Forest in Washington. The wreckage was located on the east side of Wynoochee Lake. A post-mishap fire began to burn. The Forest was informed of the fire the morning of September 30th. The District covered initial attack of this fire, which began to burn vigorously around 1130 PDT. Between 1130 PDT and 1230 PDT, two 20 person fire crews, a helicopter with a bucket, an air space closure, and an airtanker retardant drop were ordered.

A leadplane and a Lockheed Neptune P2V-7 airtanker were then dispatched from the Wenatchee ATB with estimated times of arrival (ETA's) over the fire of 1330 PDT and 1340 PDT respectively. The leadplane did arrive at the fire at 1330 PDT and contacted the Incident Commander (IC). The IC told him to contact Mr. X for drop instructions. The airtanker crew, leadplane pilot, and Mr. X discussed drop locations.

The leadplane made one run from the north to the south over the determined drop location, a pattern that was decided as unacceptable. The leadplane then made two more runs and he and the airtanker crew agreed on a run from the south to the north. The leadplane informed Mr. X and the airtanker crew that the drop would and should be high because of terrain considerations. The leadplane pilot said he wanted the airtanker to drop half their retardant load, single door trail with three tenths of a second delay, so that if they missed due to the high drop, they would be able to make another run. The airtanker made the run and dropped the retardant on target. The airtanker then immediately impacted a ridge before the retardant dropped completely hit the ground.

The airtanker impacted a log landing area with the mid section of its fuselage. The tank doors were not closed. One tank door was buried vertically upon initial impact. The airtanker began breaking up. The outer right wing and jet engine were torn off upon hitting a stump piling area on the edge of the log landing. The airtanker continued across the log landing and the tail section separated. This section came to rest approximately 250 feet down slope from where the airtanker initially impacted terrain. The cockpit and remaining fuselage continued down the slope, became inverted, and pointed back up towards the impact point. The remainder of the right wing, right reciprocating engine, and the left wing with both engines separated continued down slope from the cockpit fuselage.

Both airtanker pilots suffered fatal injuries. The time was about 1359 PDT.

The terrain the retardant drop was requested on was wooded and mountainous. The ground was hard with an 80 percent slope. The obstacle struck before principal impact was a "log landing."

A review of the activities of both the Captain and Copilot conducted for the previous 36-hour period prior to the mishap revealed an established normal daily routine for both individuals.

The Captain had accumulated 14,723 hours of total flight time. 11,618 of these hours were as the PIC, 1,312 hours as the PIC in type, 5,669 hours plus as the PIC in aircraft over 12,500 pounds MCGW, and 1,868 hours plus as the PIC of Airtanker/Dispensing Operations by the day of the mishap. The Copilot had 46 hours dual instruction in make and model. He had accumulated 3,090 hours of total flight time, 2,600 of those hours as the PIC by the day of the mishap.

Wreckage investigation revealed that the airtanker's two reciprocating engines were operating at or near full power. The jet engines (jet assist) were running, but were not at full power. Jet engine indications concluded they were at 40 percent or idle. Jet engine actuating rods when operating at 100 percent power are measured at 13 inches. Both of this airtankers' jet engine actuating rods were measured post-mishap at 7.5 inches. The varicam system was found to be within normal operating range.

The nose gear was found in the retracted position, which indicated the airtanker crew had started the landing gear up. On this model Lockheed, the P2V, the nose gear would have come up first, followed by the main landing gear. The investigation team concluded the airtanker crew had used the landing gear to keep from building up too much speed when dropping down from a 2,400-foot saddle to the drop site at approximately 1,800 feet.

In addition, the crew had the flaps fully extended, the flapjack screw follower was found to be two to three inches from the end of travel, which would have been normal for making the retardant drop. Flaps would have allowed for a more stable lower airspeed while the crew used power when they approached the target drop zone for the retardant drop.

The probable cause of this mishap was that the pilot maneuvered the airtanker in a manner that he was extremely low and slow, with landing gear and flaps extended, and did not use additional jet engine thrust available to clear the ridge. The pilot had misjudged the short steep canyon and was not able to recover sufficient airspeed to exit the drop pattern safely. The pilot had dropped one half of their retardant on the target and did not jettison the other half of the load to avoid hitting the ridge.



Lockheed P2V-7 airtanker after impact and beginning to break up.

Black and white photo taken by "Daily World."

October 16, 1991 was a repositioning day for the Lockheed P-3A 'Orion' airtanker under contract to the Forest Service. The airtanker had been dispatched from its base in Santa Barbara, California to Missoula, Montana to support fire suppression efforts involving a number of large fires in the Northern Region.

The Captain and Copilot departed in VFR conditions at 1605 PDT. Their departure was reported to the National Incident Coordination Center (NICC) in Boise, Idaho with an ETA of 1950 MDT. They departed Santa Barbara with their normal fuel load of approximately 20,000 pounds and topped off oxygen tanks.

While still in the area controlled by the Oakland FAA Air Route Traffic Control Center (ARTCC), the crew requested and received an Instrument Flight Rules (IFR) clearance. They were assigned an altitude of 23,000 feet. The Orion proceeded uneventfully and was handed off to the Approach Controller at Missoula (MSO). MSO Approach did not have, at that time, terminal radar equipment that covered their entire area of responsibility. At first contact with MSO Approach, the Orion was 26 miles southeast of the Missoula International Airport and descending to 12,000 feet. At approximately this time, the crew reported to the Forest Service Aviation Coordinator at MSO that they were 15 minutes from the airport. This message was then relayed to the NICC.

In the course of several exchanges between the Orion and the MSO Approach Controller, it was disclosed and confirmed that the Orion's flight crew did not have the approach plate (or chart) depicting the published approach procedure for the Victor Omnidirectional Range-Distance Measuring Equipment (VOR-DME) Bravo (B) approach, which was the approach in use for aircraft arriving from the south. Clearance was nevertheless offered and accepted and the controller provided the information as the Orion crew began to execute the VOR-DME B approach.

At this time, the cloud bases at the MSO Airport were at about 7,900 feet and other aircraft making instrument approaches there were descending through 8,000 feet, canceling their IFR flight plans and making visual approaches to the airport for landing. Since the Orion's crew was able to monitor these radio communications/transmissions on the same frequency, they were probably counting on doing the same.

At this time, there were very strong winds and moderate to severe turbulence reported at altitudes above 8,000 feet that increased with altitude in the MSO area. In addition to turbulence, the Orion crew contended with effects of flying at high altitudes, using oxygen in an unheated and un-pressurized aircraft for more than two hours.

At some point in the initial phase of the approach, some confusion as to what heading to fly apparently occurred and the airtanker turned back toward the south, away from MSO. By this time the controller had authorized descent to 8,600 feet on an approximate heading of 200 degrees magnetic.

MSO Approach received notification by Salt Lake City ARTCC (Center) that this airtanker was west of the course consistent with the approach procedure and subsequent notification that the airtanker had disappeared off Center's radar screen. Repeated attempts to contact the Orion crew failed and MSO Approach notified the County Sheriff's office, the Forest Service, and other agencies that the aircraft was missing and presumed down. Search and rescue attempts were not able to detect an Emergency Locator Transmitter (ELT) signal. The mishap site was located the following day. The Orion crew had died instantly of multiple massive injuries.

The Orion flight crew was current and qualified in this aircraft and for the mission. The Captain had accumulated 8,868 hours of total flight time, 8,106 hours as the PIC, 129 hours PIC time in type, 5,138 hours as the PIC in low level (below 500' above ground level (AGL)), and 2,825 hours as the PIC in typical terrain (mountainous). His instrument time on the date of contract inspection, May 31, 1991, contained 231 hours of actual and hood time combined.

The Copilot had accumulated 3,087 hours total flight time, 2,288 hours as the PIC. His instrument time consisted of 174 hours of combined actual and hood. He declared 180 hours as the PIC in the Type 1 "Low

Level” environment, and 180 hours as the PIC in typical terrain (mountainous) on the date of his contract inspection, April 29, 1991.

Some of the findings of the investigation team are noted here; however, this is not a complete list of findings.

The airtanker was airworthy with no evidence of malfunctions. The airtanker did not have an exhausted fuel supply. There was a post mishap fire that burned itself out quickly.

The crew had been subjected to the environmental stress of operating the majority of the flight at flight level 23,000 feet in an un-pressurized and unheated cockpit with outside temperatures below –20 degrees Centigrade while wearing oxygen masks.

Terminal weather at MSO was VMC. Weather affecting the initial and intermediate segments of instrument approaches into MSO was Instrument Meteorological Conditions (IMC). There was reportedly strong westerly winds and considerable turbulence between 8,000 to 15,000 feet, precipitation in the form of snow, and mountain top obscuration around the MSO airport.

The MSO Airport is located in a valley surrounded by mountainous terrain with high rims. The National Weather Service (NWS) reported 100-knot winds at 12,000 feet. The elevation of the mishap site was approximately 8,500 feet MSL.

The airspace under the control of MSO Approach Control was a non-radar environment. Therefore, the controller on duty had to rely on the airtanker crew informing him of their position and altitude during the approach phase of their flight.

MSO Approach Control issued and the Orion crew accepted an instrument approach clearance for the VOR-DME B approach with mutual understanding that the Orion crew did not have the published VOR-DME B approach procedure on board.

Approach transmitted only sufficient information to enable the Orion crew to position the airtanker onto the initial stages of the approach. Further instructions to complete the approach were to follow. The VOR-DME B approach instructions issued to the Orion crew by the controller, though technically correct, would have been difficult to follow given the position of the airtanker at first contact with Approach.

The Orion crew transmitted a query to Approach Control concerning the final approach heading and the reply transmitted back to them could not have adequately fulfilled the intent of the question or aided the crew in their attempt to position the airtanker on a portion of the published procedure.

A significant interval of time elapsed after the warning from Center that the airtanker could possibly be outside protected airspace before Approach issued a climb clearance. The Orion crew deviated from the clearance instructions issued by the Approach Controller. Protected airspace provided in the instrument approach procedures diminished rapidly if deviated from.

Federal Aviation Regulations (FARs) and the “7110.65 Controllers Handbook” do not prohibit Air Traffic Controllers from providing an instrument approach clearance to pilots who do not have the published approach charts. FARs and provisions of the Forest Service Airtanker Contract required that aircrews have all enroute and letdown charts appropriate for their flight.

The VOR navaid on which the VOR DME-B approach is predicated was checked for proper operations and was operating to specifications satisfactorily the day following the mishap.

The winds and turbulence in the Missoula area and the Orion crew’s inability to refer to the appropriate published approach chart compounded the level of difficulty during the approach sequence.

The aircraft impacted terrain during this instrument approach.



Lockheed P-3A Orion main wreckage site.

This Douglas DC-7B airtanker had been operating from Stockton ATB, California and had made several drops of retardant on the southeast edge of a fire on the El Dorado National Forest.

Their first mission on October 1, 1992, had begun at 0833 PDT. Their fourth mission had them departing the ATB at 1156 PDT. Their departure was immediately followed by a Lockheed SP2H enroute to the same fire. The DC-7B arrived in the fire vicinity at an elevation of about 6,500 feet MSL at 1220 PDT. Air attack briefed the DC-7B's two-person flight crew for their retardant drop. Air attack was flying at approximately 7,500 feet MSL. The planned drop was to be made from north to south about one mile west of the upper dam on the reservoir. It was to be the airtanker's first drop in this particular location. The visibility was good, in excess of ten miles, and turbulence was reported as mild, but bumpy. The area over the lake to the east of the drop pattern was experiencing reduced visibility due to smoke.

According to occupants of the second airtanker, the DC-7B made a turn around the fire and was descending northbound for a drop out of a right hand pattern when the DC-7B Captain indicated that he wanted to depart the pattern as he had a problem with an engine. He suggested the second airtanker perform the intended drop while he worked with his engine problem. The second airtanker then received attention from air attack and began a circle to fly a pattern similar to the pattern the DC-7B had flown.

Shortly thereafter, air attack asked the DC-7B if he needed to abort (drop) his load of retardant. That Captain replied that he might have to if he couldn't solve his engine problem. All communications were normal. Air attack was operating without leadplane assistance as the leadplane had departed the scene for fuel a few minutes before, instructing air attack to perform drops on the west side of the reservoir. Another leadplane was about six minutes out.

The mishap airtanker was reported to be descending at about 6,000 feet MSL heading in a north-northwesterly direction after departing the drop pattern, with no visible signs of engine problems and no indication of concern present in his radio transmissions. The DC-7B continued northbound toward gently rising terrain about two miles from the intended drop site and was next observed heading in an easterly direction and low to the ground. The airtanker was reported to be in a sharply pitched up attitude prior to dropping its retardant. Air attack reported that he observed the retardant start and stop, but did not know if a full load had been dropped. He said the load was continuous. The DC-7B was then reported to fall off on the right wing as it descended steeply toward the ground. During this sequence, the Captain transmitted on the radio, "We're going in, we're going in."

It was at this point that tree strikes occurred which removed the horizontal stabilizers and elevators from the tail of the airtanker. This entire sequence took place within the span of about 60 seconds. The airtanker then went behind a ridge and white smoke was observed rising from the site. Air attack declared a mayday and flew immediately to the site, taking approximately one minute to arrive on scene.

The airtanker had impacted the ground in steep terrain at an elevation of approximately 5,100 feet MSL. Some of the wreckage was deposited in a creek bottom and the remainder was located on an adjacent south-facing slope. Both the Captain and Copilot were fatally injured. The aircraft was totally destroyed. The time was noted as 1225 PDT. A post-mishap fire consumed 20 acres before it was contained.

From a distance, several witnesses observed the airtanker pitch up sharply, very close to the ground and observed retardant being released from the airtanker prior to it going out of sight behind a ridge.

The Captain was properly certificated and initial attack qualified to perform retardant missions on fires. He operated the airtanker within established flight and duty limitations. He completed two mandatory days off on September 22nd and 29th. On May 13, 1992, the Captain possessed 8,225 hours total flight time, 6,850 of this time was as the PIC. In the previous 12 months, he had flown 17.5 hours as the PIC, 15 hours of which were in the previous 60 days. He had accumulated 1,106 hours in type, 500 hours in fire surveillance, 2,100 hours of low level flight (below 500 feet AGL), 1,106 hours as the PIC in aircraft over 12,500 pounds MCGW, 1,000 hours as the PIC in airtanker/dispensing operations, 5,200 hours as the PIC in multi-engine aircraft, and 1,500 hours in typical terrain (mountainous).

On May 13, 1992, the Copilot reported a total flight time of 2,445 hours, 2,315 hours of which were as the PIC. He had 0 hours in airtanker/dispensing operations, 199 hours as the PIC in multi-engine land aircraft, five hours of PIC time in the previous 12 months, 0 hours of PIC time in the previous six months, 120 hours in fire surveillance operations, 0 hours as the PIC in low level flight, 0 PIC hours in aircraft over 12,500 MCGW, and 368 hours in typical terrain. He was qualified as an airtanker Copilot. His most recent day off was September 29th.

The airtanker was properly inspected, properly carded, and was carrying 2,672 gallons of GTS-R retardant at the time of the mishap. Information from the investigation revealed that no propellers were feathered and all were turning at the time of impact. At least one or more engines were determined to be producing significant power.

The weather was clear. Light turbulence and good visibility were reported in the area of the drop zone. Air attack reported good visibility over the mishap site as well. Two ground personnel in the area reported smoke drifting in from the spot fire being worked and that horizontal visibility was poor in smoke. Therefore, localized smoke near ridges may have restricted horizontal visibility.

The terrain was moderately steep, logged over in the previous ten years, and populated with a mixed and uneven aged stand of Alder, Red Fir, Cedar, Sugar Pine, and Manzanita trees. Terrain was a factor in the mishap.

The investigation team determined that the DC-7B impacted Ponderosa Pine trees at approximately 5,400 feet MSL prior to ground impact. Ground impact occurred approximately 1,500 feet from the first point of vegetation impact. Major portions of both horizontal stabilizers, both elevators, and some retardant tank gating system components were found between the initial impact point and the actual wreckage location at 4,900 feet MSL.

The causal factor of this mishap was the pilot's preoccupation, inattention, or possible distraction while operating the airtanker in close proximity to terrain. Contributing factors included: 1) Cockpit/Crew Management, 2) The pilots failed to recognize the severity of the situation and were reluctant to abort their retardant load, and 3) The fuselage struck vegetation.



Overview of main Douglas DC-7B mishap site.

The Lolo National Forest in Montana had a large fire incident occurring on July 29, 1994. Many resources were being utilized including smokejumpers, airtankers, and leadplanes. We join the scenario well into the retardant dropping stage.

Smokejumpers on the fire had requested drops straight down the hill. The leadplane (with a leadplane trainee and instructor on board) thought that a run straight down the hill would require the airtankers to descend too steeply and did not approve that pattern. Instead, airtankers were flying a counterclockwise pattern and were making their runs more or less parallel to the hillside, from southeast to northwest, and then maneuvering out over the valley.

The leadplane was communicating with the ground crew on the radio “smokejumper net” and with the airtankers and a helicopter in the area on an aviation very high frequency amplitude modulation (VHF-AM) frequency. The leadplane needed to depart the fire to return to Missoula for fuel and informed the ground crew that another leadplane pilot would be relieving them in the same aircraft after refueling.

While the leadplane was refueling, the fire became quite active and several spot fires occurred on a small finger ridge 200 yards northwest of the main fire. When the leadplane had left, the smokejumpers understood that one of the airtankers, a Lockheed P2V-7 Neptune, would be returning to the fire with another load. They had a particular spot fire that was troublesome and they wanted that retardant dropped on it.

Meanwhile, after refueling, the leadplane was appropriately diverted to another group of fires. There were no other leadplanes available in Missoula. The airtanker Captain was advised that a leadplane would not be able to assist with his drop and he agreed, before takeoff from Missoula, to make the drop without leadplane assistance. The Captain was both qualified and approved to fly the drop without a leadplane.

Once the Lockheed P2V-7 Neptune arrived over the fire, they flew in a high counterclockwise pattern, as before. After some radio congestion and a frequency change, the flight crew was able to contact the smokejumpers on the ground. The airtanker crew identified which spot fire the smokejumpers wanted the drop on and agreed to make the run. The smokejumper requested the airtanker to make a half-load drop downhill (southwest). The airtanker departed from the orbit and flew northeasterly, entering the drainage.

About one mile from the fire and about 1,000 feet over a point between the creek and the ridge to the north leading up to a peak, the airtanker was seen to drop part of its retardant load over a patch of sparse timber. The airtanker then turned somewhat to the right toward the ridge southeast of the creek. Before reaching that ridge it turned left again to parallel the creek and started climbing up, what, from their viewpoint, would have been the right side of the drainage, at an altitude below the tops of the ridges on both sides and in front of them.

As they approached the upper end of the drainage the Captain began a left 180-degree turn, still at an altitude below the ridges around him. At some point during his maneuvering he radioed the smokejumper to ask “Is anyone down there?” The smokejumper replied to the negative and the Captain called “Turning final.” Part way around the turn and perhaps ten seconds later, the Captain called “Tanker – is going in.” He repeated it twice, rolled wings level flying toward the ridge, pulled up hard, and impacted terrain about 350 feet below the ridge top.

A helicopter was at the mishap scene immediately and once there, reported the mishap to dispatch. He advised them there was little likelihood of survivors and that the post-crash fire had ignited a rapidly growing wildland fire. Two airtankers and a leadplane were dispatched to the site and two loads of retardant were dropped on the wreckage location within 30 minutes of the mishap. Airtanker operations at the ATB were then shut down.

Both the Captain and the Copilot survived the initial impact, exited the airtanker, and then died at the mishap site as a result of thermal injuries. Immediate post-mishap actions needed to address the possible rescue of the airtanker crew were rapid and appropriate.

The District Fire Management Officer (FMO) and a search and rescue specialist from the County Sheriff's Office flew to the mishap site in a helicopter about 90 minutes after the mishap. They decided that the state of the wildland fire ignited by the crash, the weather, fuels, and terrain in the area together with difficult access and lack of potential safety zones precluded staffing the fire and, when balanced against the unlikelihood of survivors, precluded ground search and rescue operations as well.

An alternative decision to attempt immediate access to the site would have placed personnel at unacceptable risk and the aircrew still would not have survived. The low suppression priority of the post-crash fire established by the Ranger District on July 29th and maintained through July 30th by the incident management team resulted in no direct suppression actions on the mishap site fire through July 30th, other than the two retardant drops immediately following the mishap. Fire suppression actions on the post-crash fire on July 31st and August 1st were appropriately aggressive.

Visibility on the original fire had been good and smoke was reportedly not a problem. The air was smooth with no "sinkers," but there was some convection from ground heating. Density altitude from the target fire vicinity was high enough to materially effect aircraft performance. There was nothing remarkable about the fire that the retardant drops were being made on.

The airtanker was airworthy at the time of takeoff on the mishap flight and the fuel on board at takeoff was adequate for the planned flight. The airtanker was configured for best climb performance prior to the mishap. The airtanker had part of the retardant load on board at time of ground impact. Presence of a leadplane on scene for the planned drop would probably have averted the mishap.

The investigation team determined this following sequence of events leading up to the impact point. The Captain presumably elected to fly a flight path northeast into the drainage as requested by the smokejumpers. As the Captain began the flight path and programmed his tank doors for the requested half-load drop, something went wrong and part of the retardant was dropped. The problem could have been: 1. The airtanker tank and gating system malfunctioned as it was being programmed and one or more doors opened without command (Most probable). 2. The Captain inadvertently touched the drop switch on his control yoke after selecting and arming the three doors required for a half-load drop and dropped one or more doors (Moderately probable). 3. The Captain saw that the planned drop pattern would require a hard climb and dropped part of the retardant load to enhance climb performance (Least probable).

Regardless, the flight crew was distracted during the retardant drop and were further into the drainage at a lower altitude than anticipated when the Captain regained situational awareness. He applied full power to gain airspeed and then began a climbing left turn starting along the right side of the drainage. About one-third of the way around the turn and after calling "turning final" he recognized that there was insufficient room within the drainage to complete the run, rolled wings level, flew toward the ridge and pitched up. The airtanker failed to climb high enough to clear the ridge and impacted approximately 350 to 400 feet below the ridge top. As stated, part of the retardant load was still aboard.

The Captain was worn down and fatigued. Both pilots were qualified and approved for the mission.

On January 21, 1994, the date of his contract inspection, the Captain was highly experienced with 5,118 hours total flight time, 2,292 hours of typical terrain (mountainous), 2,650 plus hours as the PIC Airtanker/Dispensing Operations, and 2,202 hours time in type.

The Copilot had 4,500 hours total flight time, 1,500 hours as the PIC in typical terrain (mountainous), 0 hours as the PIC Airtanker/Dispensing Operations, and 0 PIC hours in type on April 5, 1994, the date of his contract inspection. These pilots had crewed the airtanker together long enough to presumably develop reasonable cockpit duty coordination (Crew Resource Management (CRM)).



This photo of the Lockheed P2V-7 Neptune was taken the day after the mishap, July 30, 1994.

This particular Lockheed C-130A had a history dating back to December of 1957 when she was delivered to the US Air Force. In April of 1959, she was modified and became a C-130A-II to perform electronic reconnaissance missions. In September of 1964, she was de-modified and reconfigured as a "near standard C-130A" and transferred to the US Air National Guard. In August of 1986, the aircraft was transferred to the Davis-Monthan Air Force Base in Tucson, Arizona for storage. In June of 1988, the airtanker was removed from storage. In June of 1990, she underwent modifications to become a restricted category firefighting aircraft, which was approved per an FAA Form 337. A Restricted Category Special Airworthiness Certificate, which authorized aerial dispensing of fire retardant, was issued in May of 1990.

This Lockheed C-130A received an eddy current inspection, which had been completed in April of 1991. All parts tested met the inspection standard. She endured an entire progressive inspection cycle on April 22, 1994. She was returned to service following that inspection. This inspection program was an FAA approved and authorized airplane inspection program (AAIP). On July 17, 1994, the operator completed a "Day Off Inspection" (seven day check), which included the mechanics initialed item No. 20 b, "Check dry bay area for leaks, fuel press. On." The records of subsequent checks were kept onboard the airtanker.

The California Division of Forestry (CDF) requested an airtanker to respond to a fire burning near the Tehachapi Mountains on August 13, 1994. This particular civilian model Lockheed C-130A, on lease to the Forest Service as a public use aircraft, responded to the call from the Hemet-Ryan Airport in California at 1310 PDT.

Forest Service Dispatchers gave the C-130A's three-person flight crew information that included magnetic direction to the fire and distance from the departure airport, along with the latitude and longitude of the fire's location. The airtanker operator reported that the flight crew was familiar with the area, the airtanker was equipped with a global positioning system (GPS), and a company flight plan had been filed for the operation. The flight was conducted under VFR in VMC, and they were flight following on frequency 124.55 with the "High Desert Terminal Radar Approach Control (TRACON)" (Joshua/Ontario Approach Control (Approach)).

All communications had been routine with no indication of any in-flight problems. The flight crew had been responding to radio calls without delay or difficulty until after 1330 PDT. It was at that time the pilot had reported to Approach that he intended to "go straight for the next 42 miles" when he was asked to say his destination. The assigned mission was to respond to a reported fire in the mountains. Air traffic control communication tapes revealed two unidentifiable transmissions: one of an unintelligible squeal, followed by a brief expletive at 1331 PDT.

Witnesses in the vicinity of the San Gabriel Mountains reported seeing the airtanker in level flight, on a west-northwesterly heading, when they saw a bright orange flash occur near a wing root. The first flash was reportedly followed about one second later by a much larger, darker orange fireball accompanied by black smoke. At that time, witnesses stated that the right main wing separated from the airtanker and the airtanker began to roll. Both the separated right wing and remaining fuselage impacted on the north face of a ridge in the vicinity of a canyon at about the 6,500-foot level of a mountain.

Witnesses stated that the ground impact of the main wing and fuselage resulted in an additional fireball and explosion with a column of black smoke, causing several small brush fires. At least one witness stated that the smoke from the ground fire rose vertically in an undisturbed column.

The mishap site was located along an imaginary line connecting the Hemet-Ryan Airport and Tehachapi, California in steep mountainous terrain, near Pearblossom, California. Firefighting helicopters responded to the mishap site, dumping water directly on the wreckage and surrounding area. In spite of those efforts, the wreckage continued to smolder for over 24 hours. All three crewmembers were fatally injured and the airtanker was destroyed.

The Captain, Copilot, and Flight Engineer were rated in the aircraft and had current flight experience in the Lockheed C-130A. According to FAA inspectors, at the time of the mishap, the flight was being operated in accordance with applicable FARs.

The investigation team gathered what they could from the remains of the wreckage. A total of six center wing pieces, five pieces of the upper wing surface, and one piece of stringer were found approximately 1,000 feet in advance of the separated main wing. Numerous pieces of one inch thick yellow Styrofoam, a green interior wing panel, and a torn portion of a fuel cell liner were also found in the same general area. None of this debris had been involved in the resulting ground fire. The Styrofoam material was reported to have been located beneath the auxiliary fuel cell. Portions of the Styrofoam exhibited evidence of surface charring. Light sooting of the wing pieces was consistent with normal service.

A crush on the separated right wing components indicated a near level attitude at impact. The identification was made by serial numbered components recorded as being located on the right side of the airtanker. Examination of the debris showed the outline of a burned and melted main wing structure extending from the right wing tip to a section inboard of the number three engine nacelle. The ground fire had melted or consumed all fracture surfaces on the inboard portion.

A tear down inspection of the number three and four engines showed no evidence of rotational scarring. Although the supporting structure was fractured or consumed by fire, the engines still maintained their relative positions on the right wing. The persistent odor of ammonia was detected in and about the number three engine.

Both the number three and four propellers and hubs were found separated from the engines. The number three propeller was found in the feathered position while the number four propeller was found in reverse. There was no bending, twisting, or leading edge damage on any blade from either the number three or four hubs. Two blades from the number three hub had been consumed by fire up to the blade root.

The number one and two engines were recovered and both exhibited evidence of rotational scarring. Both engines were displaced from their position relative to the left wing. Crush damage on the engine cases indicated a near 90-degree terrain impact angle on both engines. The number one and two propellers and hubs were separated from the engines. None of the number one or two propeller components were recovered.

The main fuselage and remaining left wing impacted a rising terrain finger. The impact resulted in major structural collapse and disintegration and was accompanied by a post crash fire. The cockpit area was identified, but efforts to access the interior portion were unsuccessful. Attempts at an aerial recovery of the cockpit were also unsuccessful and resulted in disintegration of the structure.

Investigators estimated that at the time of the mishap, the airtanker was within weight and balance limitations and had sufficient fuel to complete the planned flight. The airtanker's encoding altimeter was indicating 7,800 feet MSL.

Examination of a section of the center wing section, which was found early in the debris path, submitted to the Materials Directorate at Wright-Patterson Air Force Base for analysis disclosed no evidence of a lightning strike. None of the fuel probes from the airtanker were identified or recovered.

The investigation team covered more research into the history of this Lockheed C-130A and others like her. The US Air Force reported that the fuel systems in C-130A aircraft had experienced fuel leaks due to O-ring failure. The Air Force did not track the rate of O-ring failures associated with the fuel system. Lockheed engineers confirmed that report, saying that while O-ring failure was a relatively rare event, it did occur. According to the Air Force, there had been no known C-130A mishaps in which an external fuel leak was determined to be the probable cause.

According to Lockheed, failures that had occurred were the result of fuel line flexing or thermal expansion. They reported that a failure was more likely to occur in a fuel line coupling as opposed to a fuel valve,

although the possibility existed for both. They stated that an O-ring failure could range from seeping or dripping, and occurring over time, up to a failure that would result in a sudden high-pressure spray. They expressed the opinion that prolonged storage could result in the O-rings drying out or shrinking. They also acknowledged that the flight profile of aerial firefighting resulted in wing flexing.

A review of maintenance procedures, followed by both the Air Force and the contracted operator and confirmed by Lockheed, revealed that O-rings were an on-condition item and not life limited. Lockheed did report that once O-rings were removed, they were not to be reused. A review of maintenance records of the accident airtanker did not identify any reported fuel leaks or the removal or replacement of any fuel line, coupling, or valve. According to the contract operator's records, an inspection of the fuel system was completed on April 22, 1994. The contract operator reported that an item on the preflight inspection of the airtanker specified checking the dry bay for fuel odor.

The fuel system of the C-130A is pressurized to 15 to 17 per square inch (psi) for the lines that transfer fuel from the main fuel tanks to the engine. Cross-feed lines that transfer fuel from the main tanks in the opposite wing are pressurized to 15 to 17 psi when utilized. The fuel valves in the C-130A operate on a 28-volt direct current (dc) single-phase circuit. The valve motors are powered only when the valves are in transit to open or close; however, the cannon plugs are powered whenever dc power is energized. The external cannon plugs on the valves are not shielded. The electrical wiring is open within the corresponding wing section and is in proximity to the fuel system. Lockheed reported that there had been some history of insulation chaffing or cracking, but did not report any known incidents or mishaps in which an electrical short had contributed to a fuel-fed fire.

US Air Force T.O. 1C-130A-1 stated that external fuel leaks presented a fire hazard if the leak was in the proximity of an engine. If a leak occurred, it was recommended that an emergency be declared and that the aircraft land at the nearest airfield with sufficient runway to complete the landing roll without use of reverse thrust. Lockheed reported that with sufficient fuel leaking in the dry bay, it would be possible for fuel to drain through the engine pylon and into the engine nacelle. The hot section of the number three engine is located below the number three dry bay. The tattletale drain for the dry bay exited out of the lower engine nacelle forward of the hot section.

According to a publication of the US Air Force Systems Command at Wright-Patterson Air Force Base in Ohio, the fuel used in the airtanker, Jet-A1, had a flash point of 40 degrees Celsius (100 degrees Fahrenheit).

Lockheed reported that in 1978, a C-130A experienced an in-flight fire and explosion, which resulted in a wing separation due to a lightning strike on a fuel probe. According to a readout from the Bureau of Land Management's (BLM) Automatic Lightning Detection System (ALDS), there was lightning activity in the area of the mishap site at the time of the mishap. Witnesses both on the ground and in the air near the site reported that the airtanker was clear of clouds and that there was no visible electrical activity at the time of the in-flight explosion.

This information was gathered from the NTSB report LAX94FA323.

QUALITY PHOTO NOT AVAILABLE

On the morning of June 21, 1995, eight airtankers, eight helicopters, an air attack aircraft, and a leadplane were operating on a fire 28 miles easterly from the Ramona Airport in California. The weather was clear and warm, but typically hazy at the airport and toward the fire area.

A few minutes before 1100 PDT, another leadplane arrived at the fire flown by a pilot receiving a leadplane pilot check ride who was accompanied by an instructor pilot. This leadplane was to relieve the leadplane already on the fire, who had been leading airtankers for about three hours.

At the time of the leadplane swap, two of the eight airtankers were on the ground at the Ramona Airport and the other six were in a single orbit at 6,000 feet MSL east of the fire, loaded and waiting for instructions. The leadplanes were flying a smaller orbit several miles south and west of the airtanker orbit, over the area of the fire the airtankers had been working, while one briefed the other. When the relief pilot was satisfied that he understood the situation, he released the original leadplane to return to the airport.

About three or four minutes later, the relief leadplane, a Forest Service owned and operated Beechcraft Baron B-58P, received instructions to stop airtanker operations over the fire. All of the airtankers were to return to base still loaded. One airtanker was directed to a different airport while the other five, along with the relief leadplane, were directed to the Ramona Airport. The inbound airtankers turned out of their orbit one by one as they came around to a westerly heading to the airport, strung out in trail one or two miles apart. They gradually descended.

As the relief leadplane headed toward the airport, his course converged slightly on the airtanker string's course and he noted they were initially about one half mile abeam and to the left of the third airtanker in line. The relief leadplane pilot radioed the airtanker pilots to caution them that they were all bound for the airport together and should look out for one another. This transmission was on the air tactical AM 122.925 frequency. All five airtankers acknowledged this transmission.

As the airtankers and relief leadplane proceeded toward the airport, the relief leadplane heard the original leadplane, also a Forest Service owned Baron, call the ATB for a fuel truck to meet him, first by mistake on the AM 123.975, the helicopter tactical frequency in use on the fire, then on AM 122.925, the frequency guarded by the ATB. The relief leadplane radioed the original leadplane on 122.925, indicating that he would need fuel too, but the original leadplane pilot did not acknowledge that transmission.

Upon reaching a point about eight to ten miles out, and again at two miles out, the airtankers and the relief leadplane pilot presumably reported their positions and intentions to land on the airport's published Common Traffic Advisory Frequency (CTAF). Witnesses could not confirm that all airtankers and both leadplanes had made both of these calls.

As the first airtanker in line, a Douglas C-54G, neared the airport at or very near pattern altitude (1,000 feet AGL/2,400 feet MSL), they radioed on CTAF that they were two miles out on the initial approach. Somewhere about this time, the crew of this airtanker lowered their flaps to the approach setting, which may have caused the airtanker to "balloon up" momentarily if the elevator trim had not already been corrected.

A few seconds later, the relief leadplane pilot, still to the left of the third airtanker about one quarter mile, and slightly behind and above, noticed a smaller white aircraft in close proximity to the first airtanker. This smaller white aircraft was somewhat above, to the left of, behind, and on about the same course of that airtanker. The pilot of the second airtanker in line, following behind the first airtanker by about one mile or so, did not see this smaller white aircraft, although he was closer to the first airtanker than the relief leadplane.

A few seconds after the first airtanker reported two miles out, this "smaller white aircraft" (which was later identified as the original Baron leadplane), struck the first airtanker's vertical fin and rudder from above, converging from the left and in a descent. The collision occurred about 1,000 to 1,500 feet above a large department store on Main Street, one and one half miles from the airport at approximately 1108 PDT.

The Baron initially broke off part of the airtanker's vertical fin and rudder, collapsed the rest, and then the Baron rolled off. The tails of both aircraft separated. The airtanker may have first pitched up but then pitched down violently and rolled to the left, eventually striking the ground approximately vertically and about one mile from the end of Runway 27 at Ramona Airport. The Baron rolled inverted and descended in a flat spin, impacting the ground a little east of the airtanker. The tails of both aircraft fell widely separated and landed without substantial further damage a few hundred feet east of the impact points of the two aircraft.

The airtanker impacted the ground next to a residence and close to another, disintegrated, and began to burn violently. The Baron struck the ground inverted, more or less intact, and began to burn immediately. The Captain and Copilot of the airtanker and the pilot of the original leadplane were fatally injured on impact.

A teenager in one of the residences and another teenager behind the same building escaped without injury. The other residence was unoccupied. Both residences and other items on the properties were consumed by fire. Two post-mishap grass fires were ignited.

The airtanker that had been second in line flew over the mishap site less than 30 seconds later, made an overhead approach and immediately landed at Ramona. The remaining three airtankers were diverted to an alternate ATB. All air operations at the Ramona ATB were suspended.

The mishap investigation team researched all available pilot records. They noted that the leadplane pilot was qualified in the Baron and for the leadplane mission. He had flown 13.8 hours of leadplane duty on fires during the two previous days and slightly over three hours on the fire the day of the mishap. This amount of flying, demanding, and stressful mission of a leadplane pilot, while not unusual, could be expected to produce some degree of cumulative fatigue. The leadplane pilot was wearing his required PPE.

The Captain of the airtanker was qualified and properly approved as a DC-4 initial attack rated airtanker pilot. He had more than 750 hours as the PIC in the DC-4 and many season's experience in Southern California as an airtanker pilot in this region. The Copilot was qualified and properly approved as a DC-4 airtanker Copilot. She had little experience in the DC-4 or in airtanker operations. They were not wearing contract required PPE clothing.

Weather was well above VFR minimums; however, existing haze and/or smog could have handicapped detection of other aircraft in the vicinity of the airport.

This fire had started on June 19th, two days before the mishap. Containment was not expected until June 24th. Substantial airtanker and other aircraft operations from the airport in support of this fire had been occurring and were expected to continue. However, the air activity was not considered a "sustained operation" and consequently an FAA temporary control tower or other aircraft control capability had not been obtained. The Ramona Airport has a considerable volume of general aviation traffic, including student pilots and foreign nationalities with limited command of the English language.

Having presumably left the fire three or four minutes before the airtankers, the original leadplane should have made his approach and landed well ahead of the first airtanker. The reason for this delay could not be determined. The mishap leadplane was flying an approach to an overhead pattern at the airport at the time of the collision. He would have been experiencing a heavy cockpit workload just prior to the collision in watching for conflicting traffic, adjusting speed, configuring his aircraft for the approach, and going through checklists. Some of these tasks would have diverted him from scanning outside the aircraft.

The mishap airtanker crew was flying an approach to the same overhead pattern to the airport as the leadplane at the time of the collision. Both aircraft were close to the same altitude, between 1,000 to 1,500 feet AGL, just prior to the collision. The Captain would have been experiencing a heavy cockpit workload just prior to the collision accomplishing tasks as well as delegating tasks to and closely supervising his inexperienced Copilot.

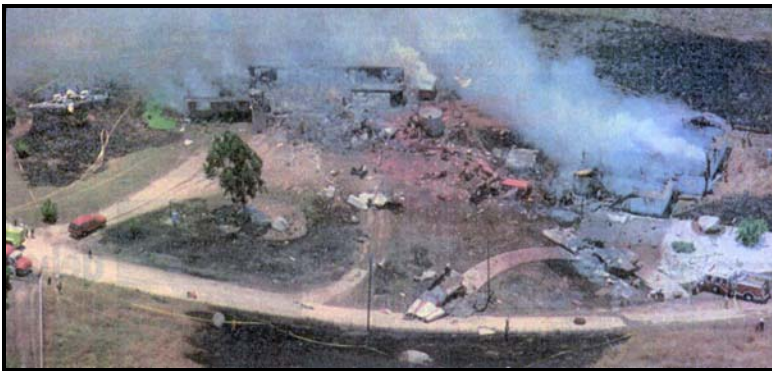
The overhead pattern for Runway 27, when approaching from the east, required an aircraft to fly over or parallel to and to the right (north) of the runway in the direction of landing at pattern altitude of 1,000 feet AGL, then turn left into the standard landing pattern. This pattern was well known to airtanker pilots and other fire aircraft pilots as they had consistently used it. The overhead pattern at the airport was not a published procedure or documented by any other means for the benefit of general aviation pilots not accustomed to operations at the Ramona Airport. All of the airtanker pilots had been briefed in pre-work meetings to fly the overhead approach at this airport 500 feet above the 1,000 foot pattern altitude for light aircraft before descending into the regular left hand pattern as then previously, but no longer, recommended in the FAA Airman's Information Manual (AIM).

When the leadplane drew near the airtanker, the airtanker would have been below, ahead of, and to the leadplane's right. Consequently, the leadplane pilot, sitting on the left side of the Baron in level flight, would not have been able to see the airtanker that was first in line. The Baron, approaching as described, would not have been readily visible to the crew of the first in line airtanker.

The Baron collided with the airtanker from behind, above, to the left, descending, and on a converging heading, initially striking the airtanker's vertical fin and rudder with the bottom of the leadplane's fuselage. The leadplane may have pitched up and rolled one way or the other immediately before or after initial contact. Further damage to both aircraft during the brief period of contact resulted in separation of the aircrafts tails, rendering both aircraft uncontrollable. Ground impacts of both the aircraft were not survivable.

The Forest Service investigation team determined the cause of this mid-air collision to be the failure of each pilot to detect each other's aircraft visually or to react to each other's position reports in time to avoid the collision. Contributing factors cited were: 1) The failure to obtain an FAA portable control tower or other air traffic control capability at Ramona when substantial fire aircraft operations began, 2) Ordering five airtankers and a leadplane to return to Ramona from the same fire at the same time, 3) The original leadplane pilot's unaccountable delay in returning to Ramona, and 4) The inadequate procedure for pilots broadcasting position reports on the CTAF with no assurance anyone was hearing them, especially at a busy uncontrolled field and at a time when a number of aircraft were converging on the same approach to land.

The NTSB investigation report for this mid-air collision is numbered LAX95GA219A/B.



The wreckage of the leadplane is in the upper left hand corner of this photo, the airtanker near the center. Burning are the two residences. The tail sections of both aircraft are not pictured here.

Photo by Scott Linnett of the San Diego Union Tribune.

June 27, 1998 found the Gila National Forest experiencing fires requiring the services of air resources. A Neptune P2V-7 (US Navy version Lockheed SP-2H) airtanker was dispatched for extended aerial attack from the ATB in Albuquerque, New Mexico to the fire complex in the morning hours of that date. The Captain, flying as the PIC and pilot in control, and the Copilot were the only two people on board.

The airtanker returned to the ATB after two missions on the fire. The airtanker was dispatched again that same afternoon. The airtanker crew departed the ATB and flew to another fire on the Gila with the Captain again as the pilot in control. Aerial operations on the fire were under the control of an Air Tactical Group Supervisor (ATGS) aircraft and a leadplane. The airtanker made one drop on the northwest side of this fire.

While in flight back to the ATB, the Captain requested permission from the leadplane to allow assuming the duties of pilot at the controls (left seat) on the remaining mission. Permission was granted and the change occurred as the airtanker was reloaded with retardant at the ATB.

With the Copilot now in the left seat, the airtanker returned to the fire and dropped retardant on its southern flank with leadplane assistance and without a dry run. The airtanker then returned to the ATB once more. During this time, the leadplane departed the fire to begin a rest break, as required by Forest Service Southwest Region policy.

After reloading, the airtanker, with the Copilot still at the controls and in the left seat, returned to the fire. Under the supervision of the ATGS, they completed a dry run on the southern flank of the fire, the same pattern as the previous leadplane assisted the drop run. Due to terrain considerations, a right turn flight pattern was being used for airtanker drops on the south side of the fire.

The airtanker then began the drop run and began to transition from the base leg to the final leg in a sharp right bank turn. While in this turn, the right wing struck the top of a Ponderosa Pine tree about 55 feet above ground level, shearing off a part of the right flap. The airtanker continued at a downward angle with the right propeller striking a second tree about 45 feet above ground level, shattering the propeller. The right wing then hit a third tree about eight feet above ground. The airtanker flew into the ground nose down and in a right bank. During this mishap sequence, the configuration of the airtanker was full flaps, gear up, with both jet assists at flight idle, and both reciprocating engines running, the normal configuration for this phase of flight.

Ground firefighting engines and crews were on scene for an immediate attempt to rescue. A small post-mishap fire began and two airtanker drops were conducted so that the ground crew could work. Both pilots were fatally injured upon impact.

On April 27, 1998, the date he was issued an Interagency Pilot Approval, the Captain possessed 7,775 hours of total flight time. Broken down into categories, it was determined that on that date he had 7,475 hours as the PIC in all aircraft, 325 hours of these hours were as the PIC in the P2V. 2,960 hours were logged as the PIC of Airtanker/Dispensing Operations. He was not a Certified Flight Instructor (CFI). He was Initial Attack qualified and 1998 was the 30th year this Captain was carded for fire missions.

On April 27, 1998, the date he was issued an Interagency Pilot Approval, the Copilot possessed 8,337 hours total flight time. He listed 7,740 hours as the PIC in all aircraft; 291.3 hours of these hours were as the PIC in the P2V. 17.7 hours were logged as the PIC of "low level" operations (<500 feet AGL). In addition, 17.7 hours were listed as the PIC of Airtanker/Dispensing Operations. He was in training for initial attack qualifications and 1998 was the 5th year this Copilot was carded for fire missions.

Both pilots had the previous day off.

Forest Service policy, at the time of this mishap, did not require flight instruction to be given by a CFI. The Forest Service had no specific low altitude (500 feet AGL and below) experience requirements for contract or agency pilots.

During the investigation process, the ATGS stated that he observed the airtanker making a descending right base to final turn that took the airtanker over a set of power lines west of the fire area. This was the same flight pattern used by the other airtankers. The investigation team determined the stated power line was to the west of the drop area about .14 miles (756 feet) from the first tree struck during the mishap sequence. The power line reached 90 feet high.

After the airtanker passed over the power lines, the ATGS observed it continue the descending right turn and noticed that the airtanker crew did not level the wings. The airtanker's right wing struck a tree at approximately 55 feet above the ground, taking off a piece of the right wing flap.

Weather in the area consisted of winds out of the southwest at five to ten mph, and according to witness accounts, visibility was not a factor. Official sunset was at 2024 MDT, the same time the mishap occurred.

The general terrain in the drop area was slightly descending and the terrain around the drop area had rising terrain to the northwest. The Ponderosa Pine forest canopy was generally uniform at a height of about 60 feet.

The investigation team discovered that the airtanker was scheduled to return to their original ATB at the end of this last mission, but that the airtanker crew would not have had sufficient fuel to get there.

The post-mishap toxicological report for the pilot flying the airtanker at the time of the mishap, the Copilot, revealed a presence of two antihistamines, Brompheniramine and Chlorpheniramine. At any detectable tissue level, the most common adverse reactions of these medications may include drowsiness, sedation, dizziness, faintness, and disturbed coordination.

The probable cause of this mishap was stated as: While in a right bank descending turn, the right wing struck the top of a Ponderosa Pine tree. Contributing factors included: 1) The toxicological report for the pilot flying the airtanker revealed a presence of Brompheniramine and Chlorpheniramine, both antihistamines. At any detectable tissue level, the most common adverse reactions of these medications may include drowsiness, sedation, dizziness, faintness, and disturbed coordination, 2) The pilot flying was inexperienced in low level flight, and 3) The airtanker was in too steep of a turn and at too low of an airspeed to maintain altitude. The airtanker struck trees resulting in a loss of control of the airtanker.



Main wreckage location of the Neptune P2V-7, Navy version Lockheed SP-2H.

This C-130A aircraft, on contract to the Forest Service, was manufactured in 1957 by Lockheed and placed into service for the US Air Force in 1957.

In 1988, the aircraft became a civilian asset operated by a Forest Service contractor and was put into service as an airtanker.

On June 17, 2002 at about 1429 MDT, this C-130A airtanker took off from the Minden, Nevada ATB to drop retardant on a fire burning on the Humboldt-Toiyabe National Forest.

A company flight plan had been filed for this mission, which took place in VMC.

At about 1445 PDT, the airtanker had initiated a retardant delivery run. During the delivery, the airtanker experienced an in-flight structural failure as its wings separated from the fuselage near the wing roots. As a result, the remaining fuselage collided with terrain.

A fire ignited on the ground in the area of the separated wings. An additional fire ignited on the ground by the remaining airtanker debris. The mishap location was adjacent to the small community of Walker, California. The fires were quickly suppressed before spreading into the community.

The Captain, Copilot, and Flight Engineer were fatally injured.

A videotape of the mishap sequence filmed by an on scene news reporter aided the mishap investigation teams from the NTSB and Forest Service.

Recorded winds at the Reno-Tahoe Airport, located about 30 miles northwest of the mishap site, were 190 degrees at 15 knots with gusts to 21 knots.

Examination of the airtanker maintenance records indicated that the airtanker had a total of 21,747.91 flight hours at the time of the mishap.

The investigation process was ongoing at the time this booklet was written. The NTSB file number for this mishap is LAX02GA201.



C-130A airtanker as its wings separated from the fuselage near the wing roots.



C-130A airtanker after its wings separated from the fuselage.

Photos taken from videotape filmed by KOLO-TV, Reno, Nevada.

On July 18, 2002, three airtankers, a helicopter, and a leadplane were dispatched to a fire burning in the Arapahoe/Roosevelt National Forest, not far from Estes Park, Colorado. One of the airtankers was a 57-year-old Consolidated Vultee PB4Y-2 Privateer procured by the Forest Service on a contract. The PB4Y-2 had flown seven previous missions on this fire the same day.

The PB4Y-2 airtanker was loaded with approximately 2,000 gallons of fire retardant and 550 gallons of fuel. At 1815 MDT, the PB4Y-2 departed the ATB at Broomfield, Colorado and joined up with the leadplane on a retardant run as another airtanker observed from behind and above. The pilots of the second airtanker observed “the left wing tip” of the PB4Y-2 “coming up,” “there was some asymmetry of the airplane.” The left wing separated from the airtanker near the fuselage and airtanker control was lost.

Shortly after wing separation, fire erupted at the fuselage/wing separation point. The fire continued to burn and upon impact with the ground, ignited a spot fire.

The post mishap fire partially consumed portions of the wreckage. The spot fire was contained the same day. The mishap was located in mountainous terrain six miles southwest of Estes Park, Colorado. The PB4Y-2 was destroyed.

Both pilots of the PB4Y-2 airtanker were fatally injured.

An amateur photographer captured several digital photos of the mishap sequence, which aided the NTSB and Forest Service mishap investigators.

The Captain of the second airtanker said, (sic) the third airtanker had just completed his drop “and (PB4Y-2) had observed the drop and was preparing to drop. All communication between (PB4Y-2) and (the leadplane) was normal. I fell behind (the PB4Y-2) on downwind and base. I looked away momentarily and I again focused on (the PB4Y-2). I noticed his left wing was falling. The aircraft was in a 15 to 20 degree bank. I next saw fire near the fuselage as the wing failed inboard of the number two engine. The aircraft pitched nose down in a huge fireball and plunged into the ground vertically starting an immediate large fire.”

The Copilot of the second airtanker said this airtanker was in his base turn for the drop and in a “smooth 15 to 20-degree bank turn,” when the left wing separated from the airtanker. “The aircraft then went into a rotation and impacted the ground.” This Copilot said that operations were normal and the weather in the area consisted of “the smoothest, least turbulent conditions of the day.”

The leadplane pilot stated that the conditions were perfect for a tanker drop. There was no turbulence and no smoke in that area. He had been working with the third airtanker and then instructed the PB4Y-2 that they would be extending the drop just made. The PB4Y-2 responded to the positive and said that he was on downwind for the drop. The leadplane pilot told him that he was at his eight o’clock and the airtanker pilot stated he had him in sight.

The leadplane pilot then told the PB4Y-2 pilot that he would come up on his left side and continue downwind with him until he was ready to turn back. The airtanker pilot responded, “I think I’m going to use this nice big valley to turn around in.” The leadplane pilot told him that sounded like a good idea. They flew approximately 15 seconds before the airtanker began a gentle turn to final. They continued in the turn from downwind to final without squaring off for a base, which is normal on airtanker runs.

The leadplane pilot said that after he turned on final, he told the Captain of the PB4Y-2 that his attack run would require a pitch over which was approximately one half mile ahead. The leadplane pilot said after he finished that transmission, the Captain of the second airtanker called him and said that the left wing had just come off of the PB4Y-2 and the airplane had gone in.

Weather and terrain did not appear to be factors in the mishap.

The investigation process was ongoing at the time this booklet was written. The NTSB file number for this mishap is DEN02GA074.



PB4Y-2 airtanker upon wing separation.

Photo taken by amateur photographer, name unknown.



PB4Y-2 main wreckage.



PB4Y-2 separated left wing.

LEARNING EXPERIENCES

Section Two

FATAL HELICOPTER MISHAPS

This mishap occurred in the Stikine Area of the Tongass National Forest in the Alaska Region. The United States Department of Agriculture Forest Service exclusive-use Bell 47-G3B-1 was being utilized at a spike camp for project crew transportation.

The helicopter was available July 16, 1976 and was dispatched from Petersburg to Big John Bay to deliver mail and move crews. This was completed and the helicopter then went to Rowan Bay on Kuiu Island to remain overnight. On Saturday the 17th, the helicopter was used to move crews to remote work sites in the morning and returned them in the afternoon to the Rowan Bay Camp.

At about 1715 hours Alaska Daylight Time (ADT), July 17th, the helicopter departed from the Rowan Bay Camp headed for the Big John Bay Camp with a final destination of Petersburg. A Forest Service employee was on board, desiring to go to Petersburg on his day off. At about 1730 ADT, the helicopter landed at the Big John Bay Camp, the pilot loaded two empty propane bottles onto the external racks, and secured the bottles with a bungee cord. At about 1750 ADT, the helicopter again took off with one passenger enroute to Petersburg. At a point five miles from Petersburg in Duncan Pass, the helicopter encountered the mishap.

The helicopter was not missed until Monday, July 19th, when it could not be located for work. A search was then initiated and the wreckage was located. According to a stopped watch found at the wreckage location, the estimated time of the mishap was 1804 ADT, July 17th.

Upon investigation of the wreckage, it was determined that initial impact into a large snag occurred about 25 feet above the ground. However, there was lack of tree and branch breakage near the major wreckage. The helicopter was believed to be on a true course of 095 degrees at the point of impact. After contacting the snag, the helicopter slid down it, scarring it heavily, and came to rest inverted at its base. A fire erupted, burning the cockpit and engine areas. The main rotor mast was broken and the main rotor was separated from the helicopter. The broken piece of mast was not found. The tail rotor blades were separated from the gearbox and the tail rotor gearbox was separated from the helicopter. The tail rotor blade was found 411 feet from the fuselage of the helicopter.

The pilot and passenger died instantly of injuries sustained in the mishap.

Dispatching of this helicopter was conducted from Petersburg, but flight following was done by the Rowan Bay Camp Cook. While at Rowan Bay, the helicopter's movements were monitored closely by Rowan Bay and loosely by the Dispatcher in Petersburg. Past policy had been for the pilot to check in with the Petersburg Dispatcher upon arrival at the airport and not with Rowan Bay.

The Emergency Locator Transmitter (ELT) was activated and appeared to be operating normally. No aircraft in the area had been monitoring 121.5, the frequency to detect the ELT signal.

The Forest Service National Helicopter Manager inspected both the helicopter and pilot on May 17, 1976. The pilot received a Forest Service Pilot Card that day.

The pilot had accumulated 3,500 hours total flight time, 400 hours in make and model, 150 hours in last 60 days, and 550 hours mountain flying time prior to the day of his initial inspection.

The pilot had flown a total of 4.2 hours the day of the mishap and had been on duty for 11 hours. He spent between 1330 ADT and 1445 ADT taking a nap at the Rowan Bay Camp.

Deficiencies were found on the helicopter during its inspection on May 17, 1976. These deficiencies were soon corrected and the helicopter became available under the contract on May 23, 1976. The helicopter had been unavailable on June 7, 1976 because of an inoperative generator. It was again unavailable July 7th and 8th because of an inoperative magneto. Between July 9th and 13th it had been unavailable while waiting for a main rotor blade replacement. It was again unavailable July 14th and 15th because of a supercharger problem.

The tail rotor blade had a mandatory change time of 600 hours. At the time of the mishap, the blades had been installed on this helicopter for a total of 622 hours.

Weather at the time of the mishap was estimated at 1,500 feet overcast, better than five miles visibility, and gusty winds to 20 knots from the south. There were rain showers of varying intensity in the area.

Further analysis of tail rotor blade Serial #A-376016 A-376008, which had been found 411 feet from the fuselage of the helicopter, revealed that this blade had a separation fracture at the grip area. Initial National Transportation Safety Board (NTSB) reports indicated that the separation was caused by fatigue failure of the tail rotor blade material. This caused severe vibration, separating the tail rotor gearbox and remaining blade from the helicopter. This then caused the loss of control of the helicopter, which resulted in the mishap.



Bell 47-G3B-1 wreckage.

Black and white photo.

The evening of July 24, 1977 was clear with half-moon light conditions. The temperature was 70 degrees Fahrenheit. Night helicopter operations were taking place on the fire burning in the Angeles National Forest in southern California. The terrain was mountainous and the helispot elevation was 5,000 feet. Three helicopters were operating with pilots using Night Vision Goggles (NVG) from the Mill Creek Heliport. The local County Fire Department (County FD) was operating their Bell 205 A-1 and the Forest Service was using two contract helicopters.

An unscheduled night briefing for helicopter operations began at approximately 2040 hours Pacific Daylight Time (PDT) at the helibase. The Forest Service contract helicopter pilots attended this briefing. The County FD helicopter pilots did not attend, but the Fire Department Air Officer did. This discussion included the location of potential hazards (power lines, telephone lines, etc.), the size of the helibase, the need for separation of helicopters, and landing and takeoff procedures. These procedures could be summarized to say that one helicopter was to land at a time and that the pilots would be responsible for spacing the helicopters.

It was at this briefing that the South Zone Helicopter Specialist expressed concern that the helibase would be marginal for operating all three helicopters scheduled to be on the night mission. The Forest Liaison with the County FD was contacted and informed that only two helicopters would work out of the helibase. The liaison indicated the County FD helicopter would operate from an alternate helibase.

It was at this time the County FD Air Officer arrived at the briefing and discussed possible hazards. A discussion ensued between the County FD Air Officer and the South Zone Air Unit Helicopter Program Management Officer concerning the feasibility of working all three helicopters at the one helibase. It was then decided to work the two Forest Service contract helicopters and the County FD helicopter out of the same helibase.

The primary reason for not operating the County FD helicopter out of the alternate helibase was inadequate water supply. Procedures were discussed for placement of helicopters and service vehicles. At 2137 PDT, the County FD Air Officer briefed the County FD pilots on the procedures and other points brought out during the briefing and subsequent discussion. This briefing took place over the radio in one minute and 15 seconds.

Night water dropping operations commenced at 2155 PDT. The two Forest Service contract helicopters were first and second to lift-off. All of the pilots experienced difficulty contacting ground forces to receive directions for priority water-drop targets.

At 2200 PDT, the County FD helicopter lifted off the helibase to go on a drop run. A short time later, the County FD helicopter returned and entered what witnesses described as a normal downwind traffic pattern at an estimated three quarters of a mile west of the heliport. The Forest Service contract Bell 212 returned from its fourth water drop and entered a downwind traffic pattern over the highway.

Both pilots in the Forest Service Bell 212 stated they saw the County FD helicopter approximately one half mile ahead and outside of their traffic pattern on downwind to the helispot. The Forest Service pilot stated that the County FD pilot was making an approach that was steeper than his own previous three approaches.

The Forest Service pilots stated they called turning final over the traffic frequency and that they heard the County FD pilot call turning final. It is not known if the County FD pilots heard the Forest Service pilots call final.

Ground witnesses observed the County FD helicopter during its downwind, base, and final legs during their approach. However, relative positions of both helicopters at the time of impact and witness statements substantiate that the County FD helicopter was making a shallow to normal approach of approximately 15 to 20 degrees.

A mid-air collision occurred on final approach, approximately 75 yards from the Mill Creek Heliport. The time was about 2230 PDT.

The Forest Service pilot stated the first hit was loud, but felt light. The second hit was much louder. He described the impact like something gnawing in the rear. He said his helicopter pitched nose down and started spinning to the right. He estimated the helicopter turned a full 360 degrees and an additional 180 degrees before the first ground impact.

The Forest Service pilot chopped the throttles after the full 360-degree turn and lowered the collective. He managed to hold a flat pitch attitude in spite of an estimated 45-degree nose low position. The helicopter leveled somewhat, still spinning, and impacted the ground at the heliport in a slightly nose low attitude. It bounced about 10 to 12 feet and came to rest on a heading of 010 degrees.

The exact impact point of the County FD helicopter on the ground could not be established. Traces of impact evidence were destroyed as rescue activity kicked up the dirt. The helicopter probably hit the ground and bounced downhill approximately ten feet, coming to rest in a left tilted upright position. The engine continued to run in spite of rescue personnel's efforts to shut it down. Estimates of time indicated it was 40 to 45 minutes before the engine finally quit from fuel starvation.

There were a number of individuals involved in this mid-air collision.

There were two pilots in each helicopter.

In March of 1977, County Fire Department Pilot #1 had 8,300 hours total flight time, 4,800 plus hours in the Bell 204/205/206. In April of 1977, County Fire Department Pilot #2 had 7,155 hours total flight time, 5,000 hours in the Bell 204B/205A-1. County FD Pilot #2 was approved by the Forest Service as a check pilot for NVG training. It was undetermined which County FD pilot was actually flying the Bell 205. One of these pilots was critically injured and the other was fatally injured. The deceased pilot had made a daylight reconnaissance flight, the injured pilot had not. Both pilots in the County FD helicopter made a night reconnaissance flight prior to their first landing.

The Forest Service contract pilots in the Bell 212 sustained very minor injuries. Forest Service Pilot #1 had 4,500 hours total flight time, 250 of which were in this make and model. He had been approved for night vision missions on July 1, 1977. Forest Service Pilot #2 had 4,700 hours total flight time, 550 of which were in this make and model. He was approved for night vision missions on June 17, 1977.

Three of the four pilots' helmets came off during the course of the mishap. All four pilots were qualified and current for NVG operations.

Sometime before entering the traffic pattern, the County FD pilots radioed the Forest Service contract Bell 212 pilots stating they would like to follow them on the next water drop. Because of this, the Bell 212 pilots understood the County FD pilots intended to follow the Bell 212 to land. The County FD helicopter was making a wider traffic pattern than the Forest Service contract helicopter. The Forest Service pilot's last visual contact of the County FD helicopter was as the Forest Service Bell 212 was turning base leg. At that time, he estimated the County FD helicopter's position to be one half mile to the left of his own helicopter at approximately the same altitude and generally eastbound.

Three witnesses stated that on final approach, both helicopters were descending; the upper helicopter (Forest Service) was descending more steeply than the other one (County FD). The two helicopters came together in this relative position.

Ground personnel could not visually distinguish one helicopter from another in flight after dark. Nonetheless, witnesses stated that County FD pilots had been consistently making standard landing patterns terminating in final approaches described as shallow to normal. The last landing pattern flown by the Forest Service mishap contract helicopter was slightly different than previous ones in that their downwind

leg was about 200 feet higher and the final approach was a steep one. The Forest Service mishap pilots expressed concern about power lines in the vicinity of the landing pattern and gave this as the reason for their steep final approaches. This approach was not found to be outside of safety limits.

The fire command system was undergoing a shift change from a Class II to a Class I fire team at the time of the mishap. The night operations briefing was not conducted in accordance with the Helicopter Night Flying Operations Guidelines.

The mishap investigation revealed that navigation lights on all three helicopters were observed “on” during the night operation. It was found that air traffic separation and sequencing procedures were not clearly defined. The South Zone Forest Service Helicopter Management Officer had reservations about the procedures of flying three helicopters out of one helibase at night. The Helicopter Manager and the County FD Air Officer agreed it was feasible to operate three helicopters out of the helibase that night. Neither of these two personnel were a part of the formal Forest Service organization at the time. Their agreement to fly three helicopters out of the one helibase was accepted and implemented by the Helibase Manager, whose authority it was to authorize such activity.

Both Forest Service Forest and Air Net frequencies were overloaded with radio traffic. This interfered with communications between helicopters and the helibase. Because of the problems in making radio contact with personnel on the fire lines, the pilots and the Helibase Manager could not determine the locations for priority water drops.

The Helibase Manager had been contemplating shutting down air operations until effective communications could be established with ground forces. The County FD helicopter did not have Forest Service Forest Net capabilities. During the fatal landing pattern, helibase personnel did not hear either the Forest Service or County FD helicopters announce turning final on the Air Net frequency. Prior to this, all incoming helicopters had been heard to make that report on Air Net. Both helicopters were operating on aircraft VHF frequency 118.95. After the mishap, the transmitter selector switches on both helicopters were found to be in that position.

There were at least two pairs of signal wands in use on the helibase. A Forest Service employee gave County FD ground personnel a pair of wands though they had not specifically requested them. These second pair of wands was obtained without approval of the Helibase Manager. The Deck Manager knew County FD personnel had them.

Under Forest Service procedures, it is the Deck Manager’s job to assign pads for arriving aircraft. By the Deck Manager’s testimony, on at least one occasion, the County FD pilots had landed on the north pad even though he had been signaled to land on the south pad. It was the understanding of the County FD Air Officer that the north pad was the only one to be used for water filling. It was impossible for the Deck Manager to visually identify any one helicopter from the others in the dark. The Deck Manager’s authority and responsibilities were not clearly understood in regard to the County FD helicopter pilots and ground crew.

The Helicopter Night Flying Operations Guidelines had not been adopted as mandatory by either agency. As a result, the briefing did not include all pilots or all ground personnel. Crash/rescue procedures were not discussed. The Air Traffic Boss position was not filled as called for in a multi-aircraft night operation. Check points were not assigned to assure air traffic separation. Uniform flight patterns had not been established.

There was not a formal agreement between the two agencies, the Forest Service and County FD, regarding operational procedures for fire suppression.

No evidence was found of mechanical failure in either helicopter. There was no evidence of NVG failure. All NVGs were examined and determined that the objective lenses were all on “infinity” setting, as opposed to close-up for instrument viewing.

The investigation team concluded that the County FD helicopter did not see the Forest Service mishap helicopter during their final approach. This was considered probable because of limited 40-degree vision when wearing night vision goggles.



Forest Service contract helicopter on helibase, post-mishap.



Final resting place of the County Fire Department helicopter (near center of photo) in relation to the helibase and to the Forest Service contract helicopter (in top right hand corner) post-mishap.

Photos in black and white.

In the Alaska Region, a Hiller Model 12J3 (Soloy Turbine conversion of Hiller 12E) was being used to support a Forest Service survey crew on Prince of Wales Island on the Ketchikan Area of the Tongass National Forest.

On July 28, 1977, the day of the mishap, the helicopter did not fly in the morning due to low weather conditions. At 1030 ADT, a five-person crew had hiked into the work site. The weather improved in the afternoon, which permitted flight to begin.

At 1707 ADT, the helicopter left the spike camp for the first of three flights to pick up the survey crew. On the second pickup and return to the spike camp, the helicopter went out of control and impacted terrain 2,690 feet from the point of takeoff. The angle of descent prior to impact was relatively steep (approximately 45 to 55 degrees) as indicated by tree strikes. After impact with the ground, the helicopter pivoted forward and over, and came to rest in an inverted nose low attitude. The passenger, who was seated in the right seat, was killed instantly. The center seat passenger was seriously injured. The pilot sustained head injuries and suffered from shock and loss of memory.

The mishap occurred at about 1715 ADT. The helicopter was being flight followed at the time. Search and rescue procedures were initiated promptly and another helicopter arrived over the mishap site at 1745 ADT. Additional personnel and a doctor were dispatched to the mishap site and the victims were subsequently evacuated to Ketchikan.

The weather was estimated as 1,500 feet broken clouds with 20 miles visibility and light winds. The weather reported at the Ketchikan Airport (approximately 35 miles away) during the same period was a ceiling of 2,000 feet, winds at 11 knots, temperature at 58 degrees Fahrenheit and dew point at 53 degrees Fahrenheit.

The investigation of the mishap revealed that the helicopter was being operated within all Federal Aviation Administration (FAA) and Forest Service guidelines. All maintenance inspections were current. All applicable Airworthiness Directives were current and complied with. All time limited components were within prescribed limits. The helicopter was within its allowable gross weight and had adequate fuel on board.

At the time of his Forest Service Inspection on April 21, 1977, the pilot had a total Pilot in Command (PIC) time of 1,445.2 hours. His time in the Hiller Model 12J3 was 290.3 hours. He had flown only .4 hours in the last 60 days.

The engine, fuel control, and governor were disassembled for further investigation. There were no unusual results discovered. All systems were inspected at the mishap scene. The only apparent failure of a component, not thought to be impact related, was of the cyclic control isolation link. The rod end of this isolation link that attached to the cyclic control bell cranks, which are mounted to the transmission, appeared to have fatigue failure. This was later confirmed by microscopic examination at the NTSB laboratory. A failure of this type would have most probably resulted in loss of cyclic control.



Hiller Model 12J3 wreckage.



Black and white photographs.

The Selway Ranger District in the Nez Perce National Forest in Idaho (Intermountain Region) were using a contract Bell 206BIII to conduct helitorch operations on August 22, 1984.

There were a number of Forest Service employees taking part in the helitorch job:

The Helitack Foreman on site began employment with the Forest Service in 1973 and began working with helicopters in 1975. He had intermittent experience with the helitorch beginning in 1979. His most recent helitorch experience was in April and May of 1984. He was qualified as the Division Boss, Air Service Manager – Heliport I, and Tanker Boss.

The Assistant Helitack Foreman had eight years in the Forest Service, all served on the Nez Perce. His training record indicated he was well versed in Forest Service helicopter activities. He had received helitorch training in 1979, and was involved in several helitorch wildlife burn projects from 1979 through 1984. He was continuing his qualifications to operate the helitorch. He was qualified as Air Service Manager – Heliport I and Sector Boss.

The Forest Service had seasonally employed the Helitack Crew Member acting as the Marshaller since 1974, working a variety of Forest Service fire and aviation jobs. He had several seasons as a crewmember on a helitack crew, but only one day of previous helitorch operating experience. He had never marshaled a helitorch operation prior to the day of the mishap. He had marshaled on other projects with the pilot and helicopter being used on this day.

The Forest had obtained a Technical Advisor for this project. This Supervisory Forestry Technician began working for the Forest Service in 1965. He encompassed a wide background in fire and aviation management and had accumulated a lot of experience with helitorch operations. He guided the set-up of the heliport and worked with the rest of the crew on repairing and making sure the helitorches were working properly.

The contractor's pilot was properly carded for the Bell 206B. He was approved for: reconnaissance, fire suppression, sling loads, animal counting, snow landings, rescue, helitorch, and long line missions. He had accumulated 1,000 hours in Bell 206A and Bell 206B helicopters. He stated he was first approved for helitorch flying in 1980. He had read a lot of information concerning helitorch flying and had discussed its handling and operations with many people. His first actual helitorch flight took place August 21, 1984.

On August 21, 1984, eight barrels of jellied gasoline were flown using one of two torches located at the Round Top Mountain Heliport. The pilot experienced numerous problems with intermittent ignition or pumping with the torch. In addition, the support crew experienced three or four cable entanglements on this day and began placing a person at the torch to alleviate these cable entanglements.

The heliport was located on an east-west running ridgeline covered with grass and widely scattered trees and brush. The grass provided excellent dust abatement and there were no trees or brush within 100 to 125 feet of the mishap site. Approach and departure routes were available throughout 360 degrees.

While the helicopter was flying with this first torch, the crew was maintaining the second helitorch. They tightened up loose electric connections and determined that the cables were of proper length, the same as the first helitorch. Because the jelling time of the mix was taking so long, the crew decided to pre-mix four extra barrels so that they would be properly jelled in time for use.

On the morning of August 22nd, the second helitorch was placed perpendicular to the landing pad at the heliport; it was to be the active helitorch this day. The four pre-mixed barrels were placed beside the active helitorch and the inactive helitorch was located beside the last barrel in the row of four. Locating the extra barrels so close to the operating area was to minimize the amount of time and effort needed to replenish the torch. A decision was made to keep the Assistant Helitack Foreman close to the active helitorch during its lift-off to alleviate any cable entanglements.

At 1117 PDT, the helitorch suspension cables became entangled about the torch itself. The Assistant Foreman was correcting the entanglement when the helicopter started a right hand spin while hovering over the helitorch. The Assistant Foreman attempted to move away. The helicopter spun approximately 180 degrees. The tail rotor fatally struck the Assistant Foreman.

When the strike occurred, the Marshall was approximately 20 feet in front of the helicopter. The Helitack Foreman and the Technical Advisor were standing behind a one and a half ton stake truck, watching activities through the windshield of the truck.

During investigation interviews, the Technical Advisor explained that he had always placed the drip torch at the side of the helicopter so the pilot could observe it easier through the pilot's door. This was opposed to putting it in front of the helicopter, requiring the pilot to observe it through the chin bubble. He stated that on prior jobs the only time it had been put in front of the helicopter in this Region was when a Hughes 500 was utilized for the job. He stated that cable entanglements were a very common occurrence and he felt that the cables would become entangled whether the torch was placed in front or to the side of the helicopter.

In his mind, the pilot had questioned the reason for putting the helitorch to the side of the helicopter instead of the front. He did not ask anyone present about his concern because he thought they all had plentiful helitorch experience.

Further investigation showed that the pilot, helicopter, and crew had not trained as a unit with the mishap helitorch. The Regional Helicopter Program Officer had made efforts on several occasions to get the torch, pilot, helicopter, and crew together to accomplish training, but these efforts failed because of the inability to get the helitorch to the same location as the crew. The helitorch was funded out of another District and was stored there until it was requested for use.

The helitorch wiring did not meet contract specifications due to helicopter circuit breaker problems. Auxiliary wiring was installed. This wiring was connected to the primary buss in the battery box, through a switch mounted on the cyclic control, to a circuit breaker, then out to the cargo hook. This wiring was taped to the fuselage exterior and to the cyclic with duct tape. The helicopter met all other contract specifications.

An overall operations and safety briefing was conducted and attended by all personnel involved in this project on the morning of August 21st. A helicopter helitorch specific safety briefing was conducted at the heliport just prior to actual operations on August 21st.

Reportedly, the primary cause of this mishap was that the helitorch cables became entangled about itself. The asymmetric center of gravity which caused the helicopter to roll right and yaw right would not have occurred if the cables had not become entangled as they did.

There were several contributing factors that added to the severity of this mishap: 1) The fatally injured Assistant Foreman was underneath the helicopter and moving about the helitorch attempting to untangle the cables before the helicopter was in a stable hover, 2) There were extra barrels of jellied gasoline and other miscellaneous equipment in the immediate operating area. They provided stumbling blocks for the Assistant Foreman during his attempt to escape the area and provided a psychological deterrent to the pilot, 3) Communications, visual and verbal, between the pilot and signalman, were inadequate. The pilot could not fully assess the extent of cable tangles, and 4) Placing the helitorch at the side of and perpendicular to the helicopter promoted the probability of a cable entanglement because of the multiple movements required to get the helicopter centered over the helitorch, particularly in gusting wind conditions.



Bell 206BIII post-mishap photograph.

A properly carded Forest Service contracted Aerospatiale Alouette III (SA316B) was working on fire missions in the Pacific Northwest Region. More specifically, the helicopter and the pilot (who was the sole occupant of the helicopter) were in the Okanogan National Forest, just west of Winthrop, Washington.

On August 8, 1985, a Safecom had been submitted pertaining to this helicopter and the loss of the longline hook. The crew wrote that neither they nor the pilot could explain how it could have happened.

On August 9, 1985, this helicopter departed North Cascades Smokejumper Base (NCSB) with a longline load, external basket cargo, and internal cargo and flew to Helispot 1 (H-1). He landed and some cargo was off-loaded. Some other cargo was taken out of the baskets and put into the cargo net.

The helicopter then departed H-1 for the fire line with a longline external load in support of fire activities. Over the radio, the pilot advised the ground person that they would need to physically disconnect the load because there was no remote hook. The load was successfully placed on the ground. The external load delivered was well within the aircraft's weight-carrying ability.

The helicopter then departed the fire line and flew past H-1 to return to NCSB. The helicopter had a 100 foot 3/8 inch diameter un-weighted steel cable weighing just over 25 pounds (the longline) attached to the cargo hook at this time. Personnel on H-1 observed the helicopter, passing in an easterly direction abeam H-1, descending down drainage. They observed the helicopter to be flying faster than normal for an empty longline and the cable was trailing perhaps 80 degrees back from vertical. They heard unusual noises shortly after the helicopter passed from their view. The noise was estimated to last four to seven seconds.

It was reported that the helicopter was on fire prior to ground impact. There was no success when radio contact with the helicopter was attempted. Personnel at H-1 and other observers spotted smoke. Another helicopter was diverted from dropping water on the fire line to the new smoke, where he made one drop. This helicopter then flew to H-1, picked up two helitack crewmembers and flew back to the smoke, where spotting the wreckage of the helicopter confirmed the mishap. The pilot was fatally injured in the mishap.

The terrain consisted of a canyon bottom at 4,000 feet, 30 percent down slope. The area was mountainous and wooded. It was an overcast day with little wind, 74 degrees Fahrenheit. Weather was not a factor in the mishap.

The investigation revealed that the pilot was properly carded for Forest Service missions on May 28, 1985. He did not, however, meet Forest Service contract requirements for flight experience in make, model, and series at the time of initial carding. He possessed 8,900 hours total flight time, 872 total hours as the PIC, 75 hours as the PIC in this make and model of helicopter, and 75 hours as the PIC in make and model in this typical terrain.

At the time of this mishap, the Forest Service Helicopter Operations Handbook did not specifically address longline operations without a remote hook. It did, however, state "The general requirements for the remote hook guard requirements for the remote hook guard are to: ... (4) provide adequate weight to ensure good flight handling of the remote hook and lead line."

The FAA approved the company's Rotorcraft Load Combination Flight Manual for class A, B, and C Load Combinations on May 20, 1983. It stated in Section II under Airspeed Limitations: (a) Airspeed will be governed by the flight characteristics of the load and each load which differs substantially from any the pilot has previously carried will be tested for hovering, slow flight, and maximum airspeed characteristics, in that order.

The 100-foot longline weighed just over 25 pounds and carried no weight on the bottom end at the time of the mishap.

It was determined that on June 13, 1985 the engine had 887 hours since overhaul. This determination was based on an overhaul on December 12, 1977. Power checks were exceeding Forest Service requirements of ten hours between checks.

The investigative engine tear down analysis took place on September 12, 1985. It revealed strong evidence that an engine failure occurred prior to the helicopter entering the trees.

The investigation team determined the helicopter began to shed parts 750 feet prior to impacting the ground. The longline cable became entangled in the tail rotor and main rotor systems ultimately causing the helicopter to collide with the terrain.

The investigation team believed the probable cause of this mishap was an engine failure. It was also deemed probable the pilot was flying too fast with an unweighted cable at the time of engine failure and the subsequent maneuvering caused the cable entanglement with the rotor systems. The loss of the tail rotor system may have contributed to the severity of the mishap.



SA316B engine wreckage.



Tail rotor system with entangled cable was found 250 feet south of the main wreckage. All 100 feet of the cable was intact and found at this point.

On March 6, 1987, the Forest Service was using a chartered Bell 206BII Jet Ranger in the Alaska Region to transport a project work crew of three.

The Chatham Area Tongass National Forest, Forest Aviation Officer (FAO) was at the airport to see the flight off. He secured the equipment and passengers, checked the doors were securely closed, and then cleared the pilot to start the helicopter. A formal safety briefing was not given; apparently because the individuals had flown many helicopter flights as passengers and knew the procedures.

All three Forest Service passengers were wearing white SPH-4 flight helmets and green Nomex flight suits. The pilot was wearing a headset, shirt, and Levi trousers. Each person was wearing a jacket. Though a personal inflatable flotation device was available for each individual, no one had donned one.

The helicopter departed the airport at 0922 hours Alaska Standard Time (AST) and headed for a work site in Freshwater Bay on Chichagof Island. The FAO returned to the dispatch office to monitor the radio and flight follow the helicopter. The pilot called with a radio check-in and the FAO responded with an "off" time of 0922 AST.

Regular radio communications took place between the FAO and the pilot throughout the morning and mid-afternoon. At 1130 AST, the helicopter was reported to be in the Kennel Creek Area and at 1226 AST the helicopter reported to be operating in the Freshwater Bay Area. The pilot stated that he had fueled up the helicopter at the Kennel Creek fuel tank. The pilot had added 15 gallons there, bringing his total fuel on board to 49 gallons. The helicopter was left running at low revolutions per minute (rpm) during the refueling.

The helicopter flew through to Peril Strait following the Kadashan Drainage. At 1310 AST, the pilot checked in at False Island and requested a flight plan extension to 1400 AST, as they would need to follow the water route to Sitka due to weather. They proceeded across the strait, watching for the opposite shoreline (about three miles). They reached the shore near the peninsula and followed the shoreline northeast. One passenger was very familiar with the land features and constantly updated everyone about their exact location. No one on board seemed concerned about their situation in spite of the reduced visibility from snow and fog and the low 200 to 500 foot ceilings. Winds were northerly at 20 to 30 knots.

At Sergius Narrows, the helicopter crossed from the north shore of Baranof Island to the south shore of Chichagof Island. The passenger who was sitting in the left front seat had been monitoring the fuel quantity; they had 15 gallons (36 minutes) of fuel remaining at this point. The airport was 25 to 27 miles away.

While crossing Sergius Narrows at 175 to 200 feet above the water and without warning, the engine quit. The pilot immediately entered an autorotation and attempted to restart the engine. The auto ignition system was inoperative and turned off. The pilot had determined this during his preflight. A right turn of approximately 150 degrees toward an island was made and the airspeed was reduced to 10 to 20 miles per hour (mph) before impacting the water northwest of Rapids Island. The pilot and two of the passengers saw the red engine-out light and a yellow low-rotor-rpm light on the annunciator panel.

Impact with the water was very hard, nose high, and in a right bank (approximately 10 degrees) attitude. The helicopter was equipped with inflated pontoon-type rubber floats. Initial impact on the right rear float had sufficient force to bend the cross tube upward. The left, forward rolling action that followed failed the left float, left chin bubble, and right windshield. The helicopter rolled inverted and the cabin was engulfed in water immediately. This occurred so rapidly that the pilot and three passengers barely escaped drowning.

All four survived the mishap, although difficulty was experienced in exiting the inverted helicopter cabin under water. All four climbed onto the belly of the inverted helicopter, which was floating, suspended by the remaining right side float. The pilot had one pocketknife and a butane cigarette lighter in his pocket and had managed to grab his inflatable life jacket as he exited the helicopter. The three Forest Service

employees did not have any survival gear on them. Their personal gear, stowed in the cargo compartment, could not be retrieved.

They discussed the seriousness of their situation. Standing in water on the bottom of the helicopter, growing rapidly numb from the cold water, and believing they were being carried out to sea by an outgoing eight-knot tide, it was evident that none would survive very long. The time was 1330 AST. All agreed their best alternative was to swim to shore. The current was moving them close, approximately 100 feet, to Rapids Island. The pilot said, "We better swim for it."

The pilot and one passenger let themselves into the water and started for shore. Another passenger jumped in next. The last removed his coat and dropped it over the float, stood up on the float, dove in, and swam as hard as he could to overcome the current. The others wore their coats. The last passenger to get off the helicopter reached shore ahead of the others and looked down current. He saw one passenger struggling in the water past the island. The float that had broken off was floating near his position so they all hollered at him to swim for the float. He was last seen, believed holding onto the float, drifting with the current. By 1345 AST, all but this one passenger had made it to the shore of Rapids Island.

There had been no emergency radio transmission from the helicopter to alert anyone about any difficulty. Consequently, they were suspected of having landed someplace to wait for better weather. Because he could hear that the dispatcher could not raise the helicopter on the radio, the skipper of the Forest Service Marine Vessel (M/V) Sitka Ranger boat had asked Dispatch if they wanted him to remain in the area. He was told they didn't suspect any trouble and to continue returning to port.

At 1400 AST, when the helicopter did not land at the airport on schedule, Dispatch began overdue aircraft procedures. At 1515 AST, the skipper of the M/V Sitka Ranger radioed to Sitka Dispatch that the wreckage of the helicopter had been located upside down in the vicinity of Little Island. This information prompted an official search to begin.

At 1535 AST, the United States Coast Guard (USCG) dispatched a helicopter with rescue personnel to the site. Upon diving into the floating helicopter, they found it to be empty and began searching the surrounding area.

On shore, one passenger was near total exhaustion. He was fully conscious of the trouble he was in and knew he had to get over the hill to where the other two were sheltering in a root wad. The other two encouraged him at that point, and he finally made it. He suggested that he try to get a fire going and for the other two to collect some firewood while they were still able to do so.

It took considerable effort to dry out the lighter before it would work. He placed the lighter under his armpit for 15 to 20 minutes, trying to warm it up and dry it out. He cut slivers of wood with the knife and finally got the butane lighter to light and stay lit. It was 1600 AST before he felt they had a fire that they could keep going, two and a half hours after swimming to shore. They all felt they would survive the night, if not rescued, since they had a fire.

The survivors took turns watching for signs of a search on the beach. At about 1500 AST, the pilot and one passenger thought they heard a helicopter, but the sound weakened and disappeared. About 1600 AST, they heard a helicopter again, getting closer. Then they heard another one and the survivor on the beach hollered for everyone to get down to the beach to be seen. The USCG helicopter flew by but didn't see them. The owner of the mishap helicopter had another helicopter in the area searching and it seemed to be coming toward them. A survivor waved the yellow life vest but the helicopter never saw them, turned away, and headed for another bay. The USCG helicopter flew by again at about 1630 AST, heading directly at the survivor on the beach.

The survivor by the fire had placed some material on the fire that was putting up a lot of smoke. The USCG had seen the smoke but the passenger on the beach didn't know that and kept chasing after the helicopter, waving. He thought they may have been seen but wasn't taking any chances. The USCG put a diver in the water to swim to shore and check the survivors. The diver made the survivors stay by the fire

and warm up, since they were all experiencing hypothermia. The time was 1700 AST. The search for the missing passenger continued for at least four days. He was never located.

The investigation team discovered that the pilot had been approved for Forest Service use on April 21, 1986. He had flown a total of 50.7 hours in the previous 90 days. He was an exceptionally well qualified pilot with over 14,000 hours total flight time. 3,100 plus hours were as the PIC in this make and model of helicopter.

The helicopter had been flown a total of 52.4 hours since June 16, 1986. The helicopter had been in extensive major maintenance for approximately eight months. It had just been signed off March 5, 1987, the day before the mishap. The mishap pilot flew a maintenance test flight of .3 hours on that date. A flight lasting .6 hours in duration took place the day of the mishap before the Forest Service passengers boarded the helicopter. The helicopter was not operating on any Rental Agreement or Call-When-Needed (CWN) contract.

Post mishap inspection of the helicopter revealed that the fuel shut-off valve was in the open position. The cannon plug from the airframe fuel filter bypass indicator was corroded. The fuel tank was ruptured upon impacting the water. The fuel boost pump punctured a hole through the top of the bladder. Salt water was found inside the airframe fuel filter. The filter bowl and the filter were very dirty. The filter allegedly had been changed during the annual inspection. Salt water was found in the fuel line from the airframe filter to the high-pressure pump. The high-pressure filter was removed from the engine and disassembled on 'the bench.' A drop of water was found in the filter bowl and was considered too far upstream to have trickled in while the helicopter was submerged. No water was found in the fuel control unit and governor connecting lines.

The finger stringer was removed from the fuel control unit and a small piece of dirt was found on the outside of the screen. This is an inside-to-outside flow filter. Dirt should not have been on the outside. There was no damage to the governor shaft, the hot section, or the compressor section.

Only one lamp removed from the annunciator panel showed failure while burning. That lamp was the low rotor rpm bulb. The engine out bulb and cover were missing.

Fuel samples taken at the fuel site where the pilot had refueled the helicopter with 15 gallons of fuel before the return flight, were found clean and clear. The fuel on board the helicopter should have been sufficient to reach the airport if they had averaged about 90 mph. The engine de-ice switch was found in the "off" position. The engine auto-igniter system was inoperative; the switch was off.

The National Weather Service (NWS) in Sitka reported the weather at 0950 AST as scattered clouds at 2,500 feet, estimated ceiling at 6,000 feet overcast (OVC), with another OVC layer at 15,000 feet. Surface visibility was 15 miles. Breaks in the overcast were visible. Wind was 160 at eight knots. Temperature was 37 degrees Fahrenheit and dew point was 28 degrees Fahrenheit.

Another pilot in a fixed wing aircraft passing through the area at approximately 1130 AST was forced to land and taxi on the water because of bad weather: snow showers, low ceilings, and poor visibility.

Weather during the return trip at 1300 AST was reported as intermittent ceilings at 200 to 500 feet with reduced visibility of one half of a mile in snow. There were occasional heavy snow showers and fog. Winds were northerly at 20 to 30 knots.

Possible probable causes were determined as: 1) Mechanical failure of the fuel control and governor, 2) Snow ingestion and blockage of the particle separator, 3) Fuel contamination – as per the small drop of water found in the fuel drained from the filter bowl and the very dirty airframe fuel filter.



The wreckage discovered by the M/V Sitka Ranger boat.



Post-mishap Bell 206BII Jet Ranger being moved into the hangar.

On May 31, 1988, a Forest Service job contract pilot and his employee transported their helicopter, a UH-1B, by trailer to Warm Springs, Oregon. They positioned the helicopter to begin aerial application of insecticides, Thuricide 32L insecticide (B.T.), for suppression of Western Spruce Budworms. This helicopter was one of ten aerial application and seven observation/marker aircraft subcontracted to spray 195,000 acres of Oregon, Warm Springs Indian Reservation, and national forest land in the Warm Springs Unit.

On June 4, 1988, a Forest Service Aviation Safety Inspector called the FAA Flight Standards District Office (FSDO) in Hillsboro, Oregon. He requested an FAA inspection of this UH-1B spray helicopter due to concerns he had about its airworthiness. The FAA declined to inspect the helicopter as it was to be flown on a government project. Forest Service personnel characterized the spray operation as a "Service Contract" project. Consequently, any aircraft involved were not inspected or carded by a Forest Service Aviation Safety Inspector as required for aircraft services obtained by an "Aircraft Contract."

On June 6, 1988, the pilot aborted his first attempted spray mission after experiencing engine surges in flight. A total time of .2 hours was recorded for that flight. The Project Team Leader's daily accomplishment report for this date contained the comment "engine problems, keep ship from applying." The contractor's employee later reported that a Rotary Wing Application Specialist, the Project Team Leader, and a Forest Service Manager were aware of the engine problems.

The Spruce Budworm job contract was started up early in the Visual Meteorological Conditions (VMC) day of June 14, 1988. Forest Service daily flight records showed the pilot, the only occupant of the mishap helicopter, departed the grass/dirt Old Mill Airstrip on the Warm Springs Indian Reservation at 0515 PDT. He was loaded with 250 gallons of B.T. for aerial application. As the helicopter left the airstrip, it was observed to be having difficulties gaining altitude. Nonetheless, the first load was sprayed and the helicopter returned to the heliport at 0607 PDT.

After refueling and reloading with 250 more gallons of B.T., the pilot took off on his second aerial application flight of the day. The Forest Service Team Leader, who was supervising the spray operation of this helicopter from a communications vehicle at the airstrip, later said that he heard the pilot broadcast a distress call at 0642 PDT over the very high frequency (VHF) radio. Radio traffic on other radios in the vehicle masked part of the distress call, but he distinctly heard part of the transmission including "...power, going down, going down." A search was initiated.

The wreckage was located at 1008 PDT. The mishap took place en route to the aerial application area five nautical miles (nm) southwest of the loading site. The pilot was fatally injured. The aircraft was totally destroyed. There was not a post mishap fire.

The NTSB investigated this mishap. Their file number is SEA88FA109.

Upon questioning by the investigation team, the company employee and several other witnesses reported seeing flames shooting out the helicopter engine exhaust extending at least three to 15 feet during engine start in the days since the helicopter arrived in Warm Springs. An Airframe and Powerplant Mechanic (A&P) of another company said the mishap helicopter had starting problems. He said that the engine would not accelerate to flight idle speed within the maximum starter engage time of 40 seconds, which he described as a 'hang start.'

The mechanic said the pilot had energized the starter as long as two minutes in attempts to start the engine. He reported that after the pilot was unsuccessful on several occasions in starting the engine using the normal approved procedure, he began placing the governor in the emergency position for starts to get the engine to accelerate to flight idle speed.

The pilot held an FAA Commercial Pilot Certificate issued on December 8, 1977 with Airplane Single Engine-Land and Rotorcraft-Helicopter ratings. He held a Second Class Airman's Medical Certificate that was issued on May 21, 1988 with no limitations. His logbook contained an entry, dated Jan. 8, 1988, for

completion of his Biennial Flight Review (BFR). According to his logbooks, he had accumulated 9,274 hours total flight time of which 4,701 hours were flown in helicopters, 681 hours in the UH-1B helicopter, 680 hours as the PIC. The pilot did not possess an A&P mechanic's license.

The mishap helicopter was a United States (US) Army UH-1B helicopter manufactured by the Bell Helicopter Company under a military contract. This particular helicopter was operated by the military until it was retired from the active fleet and sold as surplus. A civil certification of the helicopter was affected by a commercial helicopter pilot training operator with maintenance staff for routine maintenance and inspection of company aircraft. This maintenance facility did not hold an FAA aircraft manufacturing or repair station certification. This company applied for and was awarded an FAA Aircraft Type Certificate (TC) on April 6, 1984 for "Bell UH-1B" helicopters.

The mishap helicopter was assigned a serial number. The origin of this serial number could not be determined for the certifying FAA office. The helicopter was type certificated in the utility helicopter restricted category in accordance with 14 Code of Federal Regulation (CFR) 21.25 (a) (2) for the special purpose of external cargo operations.

The FAA issued a restricted category airworthiness certificate for this aircraft on February 15, 1984. The certificate listed the serial number and the model as a 204-UH-1B, Bell Helicopter. A review of the specifications of the Bell 204 and military UH-1B helicopters revealed significant differences in structure, systems and operating limitations of the two types of helicopters. Purposes listed on the certificate were agriculture and pest control, aerial surveying, forest wildlife conservation, patrolling, search and rescue, and external cargo operations.

According to personnel at the FAA Helicopter Directorate, any modification of the helicopter from the manufacturer's type certificate, including installation of special purpose equipment, must be documented by FAA Form 337. The modification must be inspected and approved by an FAA Airworthiness Inspector. The airworthiness certificate must conform to the restrictions listed on the Manufacturer's Aircraft TC.

There was not an FAA Form 337 filed for installation of the aerial spray equipment on this helicopter. There was no record that this helicopter had been inspected and approved by the FAA. There was no record the FAA office that issued the restricted category airworthiness certificate had inspected the helicopter for the additional purposes listed on the airworthiness certificate that were not listed on the TC.

The TC listed required equipment for operation of the helicopter. Included on this list were the Military Operators Manual for the UH-1B and the aircraft check list. Neither document was aboard when the mishap occurred. The TC required the helicopter be maintained in accordance with military standards. The engine maintenance manual outlining engine servicing, maintenance, and required checks was not listed on the TC.

According to entries in the maintenance records, other numbered military technical publications and inspection checklists designated for use on other UH-1 series military aircraft were used by company personnel to accomplish required maintenance on the helicopter.

Since new, the helicopter had been flown a total of 7,109 hours. The last recorded annual inspection was completed on May 4, 1988 at 7,105.4 hours. The maintenance records indicated the helicopter had been involved in a hard landing as a result of engine hot section failure on April 25, 1986, at 6,850.3 hours total time. The landing gear skids and transmission were changed after the helicopter returned to service on July 9, 1986. The engine was removed again on March 9, 1987, at 6,960.8 hours.

The engine in the helicopter when the mishap occurred was installed on March 9, 1987. There was no record that a baseline Turbine Engine Analysis Check (TEAC) was accomplished as required by the aforementioned military maintenance manual after the engine was installed to determine maximum N1 (speed of gas producer (compressor) in rpm) limits. There was no record that the pilot was performing a daily Health Indicator Test Check (HIT) check to monitor engine performance as required by that technical

manual. The maximum allowable N1 speeds entered on the Go-No-Go placard posted by the N1 indicator was dated December 16, 1974. It could not be determined how the pilot computed hand written load charts found in the helicopter without current TEAC N1 topping information.

According to personnel at the FAA Helicopter Airworthiness Certification Branch, four FAA Airworthiness Directive's (AD's) had been issued for civil certified UH-1B helicopters. There was no record of compliance with those AD's in the helicopter logbooks. The president of the TC holder reported the company has not established a system for distributing AD's, factory service bulletins, or changes to military technical manuals to aircraft operators. The TC stated that a report, dated October 10, 1983, listing Army Modification Work Orders and Technical Bulletins was available from the TC holder and must be complied with. The president of the TC holder was not familiar with the report and could not provide a copy when it was requested.

The maintenance records indicated the helicopter was weighed on May 3, 1988. A hand written calculation of weight and balance after installation of the spray equipment was in the helicopter records. According to those calculations, the helicopter basic weight was 5,633.2 pounds and the center of gravity (cg) was 129.9 inches aft of the datum. The pilot weight was determined to be 180 pounds. Standard fuel load for this helicopter was 800 pounds. The helicopter was serviced to 800 pounds of fuel before the helicopter took off on the mishap flight.

Forest Service records indicated the helicopter was loaded with 250 gallons of insecticide weighing 2,375 pounds. The gross weight at take off was computed to be 8,988.2 pounds. The maximum allowable gross take off weight listed in the TC and military manuals was 8,500 pounds. The cg range at maximum gross weight was listed as 125 to 136 inches aft of datum. The helicopter's cg was computed to be 118 inches aft of datum at takeoff and when the mishap occurred.

An A&P mechanic from another company later stated that the pilot had requested his assistance in changing an engine governor after experiencing rpm fluctuations in flight on June 6, 1988. He said the pilot reported the engine N2 (speed of power turbine in rpm) rpm surged to 7,000 rpm, dropped to 6,000 rpm, and stabilized at 6,500 RPM. According to the Military Operations Handbook, normal operating rpm at maximum gross weight is 6,600 rpm and maximum N2 rpm is 6,750 RPM. A special inspection of the helicopter's power train would have been required when the maximum allowable N2 rpm was exceeded. There was no record in the helicopter logbook of an over-speed inspection being accomplished. The A&P stated he had changed the N2 governor. However, the helicopter logbook was not available and he did not make an entry of the changed governor.

At 0620 PDT, the morning of the mishap, weather at the airstrip consisted of clear skies, temperature 49 degrees Fahrenheit, 81 percent relative humidity, and winds out of the northwest at three to five mph. Density altitude at the mishap site was computed to be approximately 3,420 feet. Elevation at the mishap site was 3,300 feet mean seal level (MSL). There was 15 miles of visibility.

The helicopter initially impacted and broke a large evergreen tree 60 feet above the ground on a heading of 055 degrees magnetic. It then traveled approximately 134 feet, breaking several more trees during the impact sequence, and came to rest on the ground in an upright, nose up attitude with the nose jammed into a broken tree. The tail boom and main rotor system separated from the main fuselage. The fuselage split circumferentially through the aft cargo compartment. The roof above the cockpit and aft cabin was collapsed down to the level of the pilot seat back. The engine compartment separated from the aft fuselage. The engine air intake filtration system was damaged and the inlet section was open to the atmosphere. The main power shaft was disconnected at both ends with only minor damage to the spines.

There was no evidence of main or tail rotor impact with trees in the impact area and no significant leading edge damage to any of the rotor blades. The drive shafts exhibited no torsional damage. The engine power turbine blades were free to turn clockwise, but locked up when turned counterclockwise. There was visible damage to the inlet stators and front stages of compressor blades.

A fuel sample from the helicopter and service vehicle was visually examined and tested for water. The sample was clear with no evidence of water or other contamination.

The transmission input quill was rotated to check operation of the free wheeling clutch assembly, which operated normally. The clutch was removed, disassembled, and examined, revealing normal internal lubrication: no scoring, discoloration, or damage.

The engine was disassembled and examined at Textron Lycoming, its manufacturer. The power turbine section contained soot and a buildup of carbon deposits on the fuel nozzles, but no evidence of blade rub, deformation, or damage indicating over-temperature operation.

Examination of the compressor revealed all but three axial stage compressor blades had separated above the blade platform. Two small pieces of wood and two small pieces of metal identified as aluminum (#6010) that is used in fabricating the particle separator were found in the compressor. Examination of the compressor blades revealed high cycle fatigue in all stages of the compressor.

The governor that was removed from the mishap aircraft, a governor that had been installed before the mishap, and subsequently removed, and the fuel control unit were tested. According to the report, the tests revealed deviations from normal specifications in both function and rigging.

The helicopter had been above maximum certified gross takeoff weight and exceeded the forward center of gravity limit at the time of takeoff.



Wreckage of UH-1B as viewed opposite the direction of impact.
Black and white photocopy.

The repeater site in the Cloud Peak Wilderness Area on the Buffalo District in the Bighorn National Forest in Wyoming was located at 10,205 feet MSL. It was above the timberline among sharp granite boulders of irregular sizes and shapes.

August 19, 1988 was a clear day with a temperature of approximately 65 degrees Fahrenheit and winds out of the east at three to seven mph. An Aerospatiale SA315B (Lama) was busy transporting a Helitack Crewmember, two Communications Technicians, and cargo, which included four repeater batteries strapped to the floor to the repeater site.

While flying reconnaissance for a proper landing site at 10,000 feet MSL and 100 feet above the terrain, the helicopter began to spin violently to the left. The pilot was unable to control the rotation and the helicopter began to descend toward the rocks below. The helicopter descended 400 feet rapidly and rotated four to six times before the tail rotor guard struck the rocks. The helicopter continued to rotate another 90 degrees before impacting on an easterly heading at a nearly level and upright orientation with considerable forward velocity.

The dynamic forces generated by the weight of the passenger in the left front seat on impact caused his seat belt to fail. This seat belt failed on the outboard side of the left front seat at approximately six inches from the attachment point. The failed seat belt released the left front seat passenger from the restraint system. He was subsequently thrown from the helicopter feet first and was propelled into the rotating main rotor blades.

The main rotor system was still under power after the fuselage impacted the rocks. The rotors contacted the rocks above the impact site and caused the helicopter to attempt to continue to rotate in a counterclockwise direction. The fuselage turned upon itself and came to rest heading to the west and nearly inverted on a 65 percent south sloping aspect of a rocky peak.

One survivor called for help on his handheld radio and directed the rescue helicopter to their location.

Personnel on the helicopter were qualified as follows:

The pilot was properly inspected and approved for SA315B helicopters. He had approximately 150 hours of PIC time in the previous 60 days. 350 hours of his 2,350 hours total flight time were in the SA-315/316 helicopter. The pilot occupied the right front seat and was wearing the prescribed personal protective equipment (PPE). He survived the mishap, but sustained injuries.

The Helitack Crewmember on board the helicopter was fully qualified as such. He was on the helicopter to load and unload the passengers at the destination. His seat failed. He was seated in the left rear seat. He was wearing PPE. He survived the mishap, but sustained injuries.

The passenger in the right rear seat was the Communication Unit Leader on the fire. He was being flown to the repeater site to change the batteries in the repeater radio. He appeared uninjured at the time of the mishap, but was sent to the medical facility for observation. He was wearing PPE. He survived the mishap, but sustained injuries.

The passenger in the left front seat was a Bureau of Land Management (BLM) Radio Technician Trainee. The Communications Unit Leader had requested him for fire situation training purposes. He was wearing PPE. He was fatally injured when he was thrown from the helicopter during the mishap sequence.

The mechanic assigned to this helicopter was an employee of one company on loan to another as a temporary mechanic replacement. He was fully qualified to maintain the helicopter and was not on board the helicopter at the time of the mishap.

The SA-315B involved in this mishap was manufactured in June of 1975. The total time on the airframe was 8,212.1 hours. Total time on the engine was 2,609.3 hours with 4,962 cycles recorded. An FAA

Extension Certificate for 250 hours was issued for the engine, extending the time before overhaul (TBO) to 2,750 hours. The next scheduled maintenance was to check the main gearbox chip plug and filter at the airframe time of 8,216 hours. The next scheduled inspections were a 25-hour inspection at 8,226.0 hours and a 100-hour inspection at 8,276.7 hours. There were no open maintenance discrepancies being carried forward or deferred at the time of the mishap.

Examination of the wreckage revealed that the tail rotor drive shaft was broken at the shaft location where the drive train attached to the fuselage. A fatigue crack in the intermediate coupling shaft was discovered. Examination of the company's overhaul and maintenance records showed that an approved FAA Repair Station installed the shaft in June of 1988 after overhaul. The failed part had 1,224 hours since overhaul at the time of the failure with a time limit of 1,800 hours between overhaul.

The NTSB analysis of the break revealed a fatigue fracture propagating from a point weakened by chrome plating, in the radius where the crack began. An Aerospatiale Service Bulletin (Number 01.14) mandated that shafts with chrome in the radius be removed from service beginning in 1979 and was the subject of the 17th Airworthiness Directive for the SA 315 B helicopter. The mishap shaft was checked and approved as having no chrome in 1985. The Service Bulletin was complied with on May 1, 1985, as bulletin number 01.47, an identical bulletin associated with the SA316 helicopter.

The investigation team found the seat harness of the fatally injured individual with the buckle closed and belt failure in the webbing. The examination of the seat belts by the NTSB Materials Laboratory revealed that they were substituted at the factory for the standard inertial reel belts in the mishap helicopter. The tests of the seat belts found none met the requirement of Technical Standard Order (TSO) C-22, the standard for aircraft seat belts. Analysis of the seat belt fabric indicated deterioration from exposure to ultra-violet radiation.

The helicopter was determined to have been loaded within limits specified by the flight manual for the density altitude of the mishap site.

The probable cause of this mishap was determined to be the loss of power to the anti-torque (tail) rotor. This forced the helicopter into an uncontrollable spin to the left and impact with large granite boulders.

The loss of power to the tail rotor was caused by the failure of the intermediate coupling shaft assembly, due to a fatigue crack at the coupling flange. Contributing to the failure was improper compliance with the manufacturer's mandatory service bulletin number 01.14.

The probable cause of the fatal injury was the failure of the passenger restraint system, which allowed the passenger to be thrown from the helicopter upon impact.



SA315B tail rotor failure was caused by the failure of the intermediate coupling shaft assembly, due to a fatigue crack at the coupling flange.

At approximately 1500 PDT on July 26, 1991, a Bell 206 LI departed from the Bald Mountain Helitack Base enroute to a small holdover lightning fire in California. This fire was located north of Alpine Lake in the Pacific Southwest Region, Stanislaus National Forest. On board the helicopter were the pilot, helitack crewmembers, and initial attack response equipment. After landing the crew in a meadow near the fire, the pilot had the water bucket hooked on and commenced dropping water from a nearby lake onto the fire.

Approximately one and a half hours after arriving at the fire, the pilot had made 12 bucket drops. The pilot was then told to longline two pillow tanks of water to the fire. The pilot left the water bucket at the meadow helispot, picked up a helitack crewmember, and returned to the helibase for the needed equipment and to refuel. On the way, the pilot was asked what length longline he would need and he indicated the 100-foot line would be enough.

After refueling and loading two 100-gallon pillow tanks, a 100-foot longline, and the remote hook, nets and associated equipment, the pilot and the crewmember returned to the valley. The equipment was unloaded and readied for filling and pickup. The pilot flew back to the meadow helispot near the fire, picked up two more helitack crewmembers, and returned them to the helibase. On this trip, the pilot circled the fire and the person on the ground indicated where he wanted the tanks placed: a small opening enlarged by falling a large lodge pole pine. The opening was quite close to the fire line on the north side and the intent was to hook a hose to the pillow tanks and gravity-feed water to the fire. The pilot radioed the valley that the 100-foot longline would be okay.

The tanks were filled from an engine at the valley and helitack crewmembers prepared the longline load. While most of the engine crew had been shuttled to the fire by another helicopter, a Foreman had remained with the engine. The Foreman operated the engine and monitored the tank gauge to insure that only 75 or 80 gallons were put into each tank, as directed. Helitack crewmembers verified that the pillow tank was about six or seven inches high when filled, which, according to their training, would correspond to 75 gallons.

At liftoff, the helicopter gross weight was within established limits for the density altitude at the load landing spot. The load calculation for this flight was completed after the helicopter took off and was not reviewed or signed by the pilot.

The pilot took off and lifted out the first pillow tank about 1700 PDT. The pickup and departure appeared normal. He circled over the meadow helispot. His approach was apparently slow and his descent fairly steep as he brought the load in over the lower trees on the northeast side of the opening. During the flight the pilot had commented by radio, "It's really squirrely up here today." And, on short final, "Don't get under this load." The person on the ground, preparing to direct the setting down of the pillow tank, did not hear the first comment, but answered, "okay" to the second.

As the helicopter came to a hover, the load hit the ground somewhat harder than normal and a few feet north of the spot previously indicated to the pilot. The pilot disconnected the remote hook electrically and the helicopter rose slightly and moved forward a few feet. The helicopter skids were about 16 feet higher than the top of a 90-foot tree on the pilot's right at the point where the load touched the ground. The plane of the main rotor overlapped the treetop by approximately two feet. There was a 106-foot snag-top tree about 40 feet in front of the helicopter.

While still in a hover, the helicopter began to wobble and tilt, first to the right and then to the left, and then began to descend vertically. The witnesses observed that the engine and/or rotor noise changed noticeably. The pilot keyed his mike and in a distressed voice called out, "Get out of the way!"

The helicopter continued to descend and the main rotor hit the 90-foot tree about four feet from the top. Further strikes occurred progressively down the tree. As the helicopter descended to about 50 feet up the tree and turned to the right, the main rotor began disintegrating and cut off the tail boom.

At approximately 40 feet, the helicopter pitched nose-down and free fell to the ground on top of the pillow tank and longline. The impact was relatively hard. The helicopter ended upright and at least 45 degrees nose down. The main rotor blades were at a high pitch or angle of attack during all of the tree strikes.

Two crewmembers from the engine were on scene immediately. They noticed the helicopter engine was still running at flight idle and a moderate amount of fuel was leaking out. The cabin floor was pushed upward by the force of impact. The pilot had been fatally injured.

The pilot was qualified and properly approved for the Bell 206LI and for longline missions using a remote hook. On the date of his Office of Aircraft Services (OAS) interagency inspection, he had 12,200 hours of helicopter PIC time. All these hours were in weight class less than 6,000 pounds. It was determined that he was not fatigued or unusually stressed at the time of the mishap mission. He did not become incapacitated during the flight.

The helicopter was properly inspected and approved. There were no known mechanical defects that would affect flying performance on the day of the mishap. All damage and defects found in the wreckage examination and component analysis resulted from the helicopter's impact with the tree strike and the ground. Fuel on board the helicopter and in the contractor's fuel truck was not contaminated.

The fire area and mishap site were in the head of a large, wide, relatively flat drainage with higher ground on three sides. The spot chosen and improved for landing the longline loads was adequate in size, but some of the surrounding trees were significantly taller than estimated by personnel on the ground (90 to 100 feet tall). The mishap site was in an area characterized by fairly dense stands of large, tall lodge pole pine, and other smaller trees interspersed with small and large meadows and natural openings, at an elevation of about 7,600 feet MSL.

The day was clear and sunny and there was little smoke obscuration near the fire. At the load touchdown point, the helicopter was in direct sunlight but the ground was in deep shadow. Winds at ground level were southerly at zero to six mph. Winds were somewhat stronger at treetop level. There was indirect evidence of 180-degree wind shifts several times per hour, turbulence, and possibly wind shear at tree lines. A thunderstorm had passed through the area earlier and buildups were visible about 20 miles away. Temperature was reported at 20 degrees Centigrade.

In developing a probable cause to this mishap, the investigation team stated that the flight profile of the final approach to land the load in the opening was conducive to the helicopter entering into a main rotor vortex ring state that was aggravated by a shift in direction or down draft in the wind. This could have caused a descent beyond the pilot's capability to arrest in the vertical space available to perform an escape maneuver. They deemed the mishap was caused by the strike of the main rotor blade near the top of a tree.



View of Bell 206LI from center of opening. Tree felled prior to mishap to enlarge opening.

July 12, 1994 was a hot day on the Gila National Forest in the Southwestern Region. The temperature was determined to be 90 degrees Fahrenheit at the helispot at 9,520 feet.

At about 1500 MDT, an initial attack helicopter, a Bell 206LIII, arrived over a newly reported lightning fire. The fire was located in rough mountainous terrain at an altitude above 8,500 feet and a few miles from a large project fire. The pilot and four-person helitack crew sized up the fire from above and radioed this information to the Silver City, New Mexico Dispatch Center. The pilot then made a high and low level reconnaissance over the 9,520-foot helispot, which was less than a quarter of a mile from the fire. The helispot was located at the south end of a steep northwest-southeast oriented ridgeline. An approach to the helispot was initiated in a west-northwest direction and the pilot attempted a landing.

Upon completing the approach, the helicopter came to a 10 to 20 foot hover over the helispot. This hover was followed immediately by a pronounced flaring of the helicopter to a nose high attitude. The helicopter then started to turn to the right and slide backward. The right turn rapidly became a spinning motion. It was reported that occupants of the helicopter heard a loud crack like noise after one or two full turns. The helicopter was soon one hundred yards immediately east of the helispot, adjacent to the original approach path, over a measured 70 percent slope that was thickly populated with pine and fir trees, oak brush, rocks, and other vegetation.

The helicopter continued to spin, descending almost vertically with the fuselage reasonably level until the rotor system severed two medium sized trees 10 to 12 feet above the ground. The nose of the helicopter impacted the ground sharply with the tail rotor pointing away from the slope. After initial impact, the helicopter slid approximately 70 feet, coming to rest against a large tree. The wreckage was positioned on a measured heading of 040 degrees from the intended landing spot at a distance of 350 feet.

There were five occupants on board the helicopter. At the point of impact, one passenger was thrown from his right rear seat, tearing loose from his seat belt. He fell into a prominent "gully" in the ground immediately below the helicopter impact point. He survived and remembers seeing the helicopter pass over him as he lay in the gully. He then ran from the scene, climbing frantically uphill around the south side of a prominent large rock dominating the immediate landscape.

The four remaining occupants remained inside the helicopter as it slid down the steep hillside. Of these four, one survived. This passenger remembers unbuckling his seat belt, exiting the helicopter to the south, and climbing up the hill, south of the big rock. There was no immediate fire.

Personnel involved in the mishap included:

The pilot, who was carded in April of 1994, had a total of 4,270 hours flying helicopters, all in the Bell 206LIII. 3,100 of these hours were in mountainous terrain. He had flown 29.1 hours between July 7th and July 12th. He had been working an average of 14 hours each day for those five days. He was seated in the right front seat and was fatally injured.

The helitack crewmember, the left front seat passenger, had nine years of fire experience. He was fatally injured. The left rear facing seat passenger, an Administratively Determined (AD) Firefighter, was fatally injured. The AD Firefighter seated in the left side last aft seat in the rear compartment had four years of firefighting experience and survived the mishap. The other survivor was seated in the rear compartment, right seat aft. He was also an AD Firefighter. There was loose cargo between the seats of the very aft row of firefighters.

After both survivors climbed to the top of the ridgeline, one used his shirt tied to a stick as a signal to rescuers. Both reported popping sounds after leaving the helicopter, but did not observe wreckage smoke until later. There was a post-mishap fire. Both survivors were rescued.

Both surviving crewmembers reported that the approach was made in relatively stable conditions until they were immediately over the intended landing spot. One surviving crewmember reported that he felt the

approach was made downwind. During prior flights, another pilot had observed this pilot making downwind approaches. Other pilots had previously counseled the mishap pilot against accepting heavier loads than he should have and for flying after dark.

A five-gallon cubitainer of water, a Dolmar container with one and a half gallons of gasoline, and two and a half quarts of oil were carried unsecured on the floor of the main passenger compartment.

One load calculation had been prepared for July 12th for an altitude of 8,500 feet and 28 degrees Centigrade. Reconstructed load calculations for the actual elevation, temperature, and operating conditions exceeded the performance limitations of the helicopter. The calculated weight of the helicopter at the time of the mishap was 3,750 pounds, which included the 'as equipped' weight of 2,440 pounds, plus the weight of the pilot, a fuel load of 265 pounds, and a manifested payload of 875 pounds.

The allowable payloads for the flight were computed using the interagency helicopter load calculation method. Using a pressure altitude of 9,520 feet and 32 degrees Centigrade, the maximum gross weight to hover in ground effect (HIGE) was 3,580 pounds (allowable payload of 525 pounds), and a maximum gross weight to hover out of ground effect (HOG E) at 3,515 pounds (allowable payload of 460 pounds).

However, normal initial attack loading of this helicopter was indeed, four firefighters. Although the pilot's name was found on the carbon copy of the helicopter load calculation, it was not on the original copy.

Interviewed helitack crewmembers stated that if conditions at the intended landing site were determined to be unsuitable, it was normal procedure to land at the nearest suitable site and shuttle personnel. It is believed that this helicopter may have been overloaded for actual conditions encountered at the initial attack landing site.

Shoulder harness restraints were built into this Bell 206LIII, but were not used by rear seat occupants. Shoulder harness restraint in the rear passenger compartment was not a requirement of this contract.

The pilot wore a flight helmet; all other occupants wore hardhats with chinstraps. All occupants wore all other required PPE.

Post mishap engine teardown analysis indicated that the engine and tail rotor drive were functioning at the time of the mishap. The helicopter was operating with all the doors removed. The helicopter had been properly carded and properly maintained.

The NTSB and parties to their investigation team determined mission oriented personnel influenced the pilot to perform tasks that were unsafe. The actual probable cause(s) were not listed on the report. The NTSB report number: FTW94FA232.



Wreckage distribution of Bell 206LIII.

**Arrow: (a) Slope below impact point (b) tail boom
(c) final resting point.**



**Engine transmission, blade grips, and mast.
Note tree which stopped the helicopter as it slid downhill.**

Engine transmission, blade grips, and mast of Bell 206LIII.

On September 23, 1994, a Boeing Vertol CH-47D (Chinook) helicopter belonging to the United States Army in the state of Washington was working diligently on firefighting activities on the Payette National Forest in the Intermountain Region near McCall, Idaho. It was daylight, the visibility was three miles and winds were variable at five to eight knots. It was a day.

At 1745 MDT, the Chinook was setting up for a mission to transport Forest Service fire crews. Fire suppression bucket work was to follow the transport mission. The helicopter departed the helibase with a bucket externally attached. The helicopter crew's intention was to leave the bucket at the helispot, transport three Forest Service fire crews, then retrieve the bucket and proceed fire suppression activities.

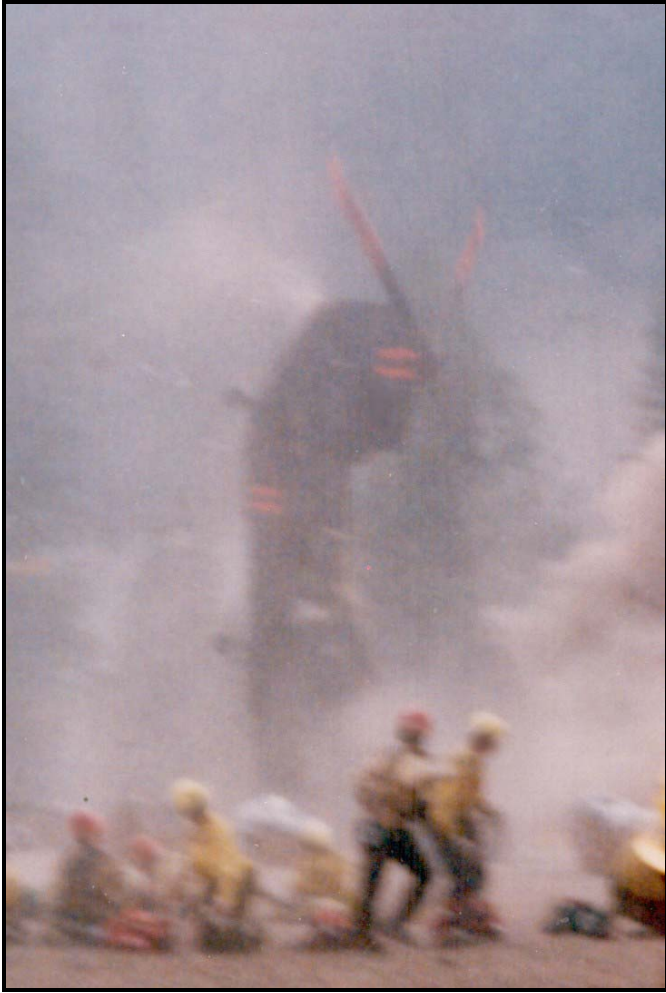
Upon arrival at the Davis Ranch helispot, the US Army pilot sat the external load (bucket) on the ground and moved the helicopter to the right of it to land. After touching down and still "light" on the wheels, the tail of the helicopter rose slightly in the air with the front landing gear still on the ground. Immediately following, the tail rapidly went over the top of the helicopter. The helicopter came to rest upside down and laying on the top right side. The back of the helicopter was located where the nose was during the attempted landing. During the mishap sequence, a front rotor blade impacted the left side of the fuselage, entered the passenger compartment, struck, and fatally injured a US Army Reserve flight engineer.

Of the many firefighters on the ground waiting for transport, none reported injuries. They had been located 150 to 200 feet away from the helicopter landing zone and quickly evacuated the area during the mishap sequence.

Of the five occupants on board the Chinook, one flight engineer was fatally injured and another received serious injuries. Two pilots and a National Park Service (NPS) Helicopter Manager received minor injuries. The helicopter was totally destroyed.

The Captain had a total time in all aircraft of 8,100 hours. 7,110 of these were as the PIC hours. He had 1,537 hours in rotorcraft. The Copilot had a total time in all aircraft of 6,500 hours, 3,000 of which were as the PIC.

The Military Aviation Safety Center conducted this mishap investigation.



Chinook helicopter during mishap sequence.

Photo taken by a firefighter awaiting transport.

The day was October 29, 1996 and the Bell 47 Soloy grass seeding job contract for the Forest Service was well underway on the Fish Lake National Forest, south of Fillmore, Utah. This helicopter and pilot had already completed 20 missions of spreading grass seed and had refueled two to three times. At the time of the mishap, the bucket had just been reloaded for its 21st flight of the day.

As per job contract expectations, this job contractor supplied the personnel to accomplish the reloading of the seeding bucket. On this 21st reload, the contractor's two ground personnel performed reloading of seed into the seed bucket as they had done all day. After loading the seed, one ground crewmember moved to the front of the helicopter and behind a large rock. The other ground crewmember moved to the right of the helicopter, near the stack of seed bags. He then turned his back to the helicopter with his head down to avoid rotor wash from the helicopter as it lifted off.

Three Forest Service personnel were located 50 yards downhill from the helicopter loading area. As per the stipulations of the job contract, they were not involved in the operation except for the delivery of seed bags to the contractor's ground crew. The Contracting Officers Representative (COR) was on site to provide contract administration. The Forest Service Manual (FSM) 5700 specifically required Forest Service personnel to limit involvement in aviation job contracts.

The 21st reload took place at around 1547 hours Mountain Standard Time (MST). The pilot, flying from the left seat, lifted the helicopter to a hover. One Forest Service employee observed the attachment cable over the right skid while the helicopter was coming to a hover. The Forest Service witnesses observed the helicopter lift off and noted that the bucket suddenly spilled to the side, seed was being dropped from the tilted bucket from the top left side. The Forest Service personnel observed that the pilot was having problems controlling the helicopter and it seemed to be swinging out of control. The pilot, attempting to control the unbalanced lateral cg, continued to add power. The helicopter gained altitude and moved forward until it impacted the hillside in front and to the right of the landing/departure area. The helicopter then rolled down into scrub oak trees.

The helicopter impacted nose down and slightly on its right side. The mishap site was on a near 45 percent slope with several rock outcroppings and heavy loose rock. The initial contact appeared to be with the main rotor system and cockpit simultaneously. It was then observed to roll over while sliding down the hill and came to rest in an upright position against a small tree. There was not a post crash fire. The pilot survived the mishap, but was seriously injured. The helicopter was destroyed.

The district was notified of the mishap and an ambulance and law enforcement were requested. The pilot remained buckled into his seat and crewmembers extricated him from the wreckage. He was given first aid. Emergency Medical Technician's (EMT's) arrived, rendered advanced emergency treatment, and transported him to the hospital. He later succumbed to his injuries.

The pilot was the owner of the company. At the time he was issued an OAS card, he had accumulated helicopter flight hours of 8,000 plus as the PIC. He had a total PIC time of 5,000 plus hours in the Soloy 47.

The pilot was not wearing a Nomex flight suit, but was wearing a snowmobile suit and gloves. He was not wearing a helmet on this job contract, nor was he required to. The Forest Service personnel observing at the contract site had asked the pilot to wear his helmet. The pilot had said that it gave him a headache and it was uncomfortable to look down at the bucket with it on. According to the Office of the Medical Examiner, his cause of death was craniocerebral injuries.

The mishap investigation determined that a formal system of lifting procedures, including critical pre-departure checks by ground personnel, were not apparent during the performance of this job contract. A formal written safety plan was not written and was not required. The owner/operator had sole authority to determine the operating site. Other than the divided reloading duties of the ground crew, there were no formal arrangements regarding organization or management of the operating base.

The only communications the pilot had with his ground crew were visual signals. There were no helicopter operations communications with Dispatch during the entire reseeding project. The Forest Service COR monitoring the seeding project provided radio contact between the operating location and Dispatch.

There was no evidence found to indicate structural failure prior to impact with terrain.

It was determined that the pilot was unable to control the helicopter and flew into ascending terrain. The helicopter had exceeded its lateral cg limitations due to the external load; the cable hooked over the landing skid. The contractor's procedures for loading and clearing the helicopter for departure were inadequate. Agency policy did not provide for aviation management or oversight of job contracts.



Bell 47 Soloy wreckage resting in oak brush.

Black and white photo.

In the evening hours of July 5, 1997, the Sierra National Forest Helitack/Rappel Crew were ordered to an incident on the San Bernardino National Forest in the Pacific Southwest Region. In the morning, July 6, 1997, the crew left their base.

The Assistant Helicopter Manager and two of the crewmembers accompanied the pilot in the Bell 206LI. The remaining three crewmembers drove in their crew truck. The company fuel truck departed for the San Bernardino as well.

The fire was burning in front country hills ranging in elevations from 1,600 to 3,600 feet MSL. This fire was reported to be the third fire in the past 20 years on this particular site. Terrain was relatively steep, rocky, and covered with flashy fuels. Drainages were deep and winding, heavier fuels were found there. Access was poor. There were a few roads except to the very lowest of slopes.

The helicopter arrived at the Patton Helibase at 0900 PDT local after approximately two hours of flight time. The pilot then flew a total of six reconnaissance (recon) and cargo flights between 1000 PDT and 1600 PDT, totaling two hours 41 minutes of flight time. He refueled with 47 gallons from another fuel truck already at the helibase in the morning and 39 gallons from his own fuel truck at 1430 PDT.

Just before 1630 PDT, while the pilot was loading passengers for another recon flight, his mission was changed to water dropping. The pilot refueled again, putting 14 gallons in from his own truck. He then departed with a Bambi bucket and about 250 pounds of fuel.

Operating conditions for water dropping in the vicinity were not especially difficult or hazardous. However, the terrain was steep, broken, and almost entirely lacking suitable emergency landing spots.

The weather at this time was reported as VMC. It was daylight, the visibility was ten statute miles or more, the temperature was 94 degrees Fahrenheit, and wind was from the south at eight knots. No gusts were reported; however, winds were increasing somewhat with the normal afternoon thermal effect. There was haze and smoke, but it wasn't smoky enough to seriously limit aviation operations. Smog and haze at the lower elevations restricted visibility to a minor extent. Density altitudes in the fire area were not significantly limiting helicopter payloads.

Another helicopter pilot and the Bell 206LI pilot filled from a water source about four miles west of the canyon. The other pilot dropped first, working the south side of the spot and dropping on the contour along the east side of the canyon, down canyon into the southerly wind.

The Bell 206LI helicopter was carrying a 140-gallon bambi water bucket attached directly to the belly hook by its 12-foot suspension lines and control head. The bucket cinch strap was not tightened to an intermediate position, so the bucket was capable of being filled to its full capacity. When he was finished filling, he was carrying about 1,100 pounds on his hook. He was capable of carrying about 1,250 pounds allowing for fuel burn off.

As the other pilot flew west after his drop to dip another load, he saw the Bell 206LI loaded and inbound to drop in the same area. Before the other pilot passed over the ridge west of Sand Canyon (about 1705 PDT), he heard someone say, "...flame-out..." over the radio frequency. It sounded to him like the Bell 206LI pilot. He radioed "...are you all right?..." He heard "...flameout - going down..." The other pilot immediately turned back across the canyon to try to locate the Bell 206LI. While circling the spot fire drop area, he saw a column of dust further down the canyon and began flying that way. An Air Attack Supervisor also saw the dust. Each called in a "Mayday."

After initial impact, the mishap helicopter moved downhill a few feet to the top of a steep bank or cliff, fell to the bottom of the cliff, and slid or rolled about 20 feet further down the slope before coming to rest. The pattern of damage appeared to indicate the right side of the helicopter, and perhaps the top as well, struck the ground during its movement after initial impact. There was no fire. The tail rotor assembly broke away from the tail boom early in the sequence and was found under the nose. The tail boom broke off close to

the fuselage and ended up lying fairly intact down the slope below the main wreckage. The bambi bucket control head was still attached to the belly hook on the helicopter after the mishap sequence ended.

The Bell 206LI pilot was found still strapped in and slumped out of the right side of his helicopter. His living space had been severely compromised by significant structural collapse and crushing. His seat pan had crushed. He was fatally injured.

The investigation process determined that at the beginning of the mishap sequence, the pilot was either about to drop his load of water or had just done so on the spot fire on the east side of the canyon. He would have been perhaps 100 feet above the ground, part way up the canyon side. The investigation team determined that he experienced a loss of engine power and began an autorotation down the canyon, looking for an opening in the bottom to land in. During this autorotation, the pilot radioed twice that he had a flameout.

The pilot was able to maintain autorotative flight for one third of a nautical mile down the canyon before he struck a steep, rocky slope approximately 120 feet above the bottom of the canyon. The initial impact appeared to have been extremely hard, with the helicopter parallel to the slope or tail-down. The pattern of the main rotor and tail rotor damage suggested that the main rotor was rotating quite slowly and not producing enough lift to keep the helicopter flying at the time of initial impact.

The pilot had taken the previous two days off duty. On the day of the mishap, he had flown 6.8 hours. He had close to 10,000 hours flying as the PIC, more than 4,000 hours of experience in mountainous terrain, and 2,900 hours as the PIC in Bell 206 series helicopters. The pilot had been wearing all required PPE and had exhibited a safety-sensitive and professional attitude.

The helicopter was inspected and approved under the contract on April 8, 1997. It had been flown 34.9 hours on the contract since inspection and approval. Power checks indicated satisfactory engine performance. There had been no mechanical incidents or shortcomings since the beginning of the contract period. On the first flight of the day on July 4th, the engine would not start on the first attempt. This also occurred on July 6th, the day of the mishap.

The company fuel truck had been inspected and approved on April 8th. Fuel samples taken after the mishap from tank and filter exhibited no visual contamination indication.

The Forest Service investigation team researched the possibility of “oxygen depletion,” causing an engine failure. An engine manufacturer (Allison 250 engine) combustion engineer was contacted. It was reported the oxygen in the atmosphere would have to have been 95 percent depleted to cause the engine to fail. About the only place that this condition, 95 percent depletion, could exist is very near to flame. Given the reported conditions over this fire at the time of the engine failure, it is very unlikely that oxygen depletion occurred.

The NTSB conducted the factual investigation, case number LAX97GA235. They reported that the fuel on board might have been critically low at the time of mishap. However, fuel gauges at takeoff indicated fuel enough for more than one hour of flight. They found that an interruption of the fuel flow occurred, causing the beginning of the mishap sequence.

The Forest Service investigation team also determined that the direct or proximate cause of the mishap was the helicopter engine’s loss of power.

At the time the Forest Service report was written, the investigation team had been unable to determine why the engine lost power. Given the fact that the engine test revealed no discrepancy that would have caused the power loss, they also concluded that an interruption of the fuel flow occurred. The team concluded that at the time of the mishap the helicopter was low on fuel. The cause was unknown.



Close-up of Bell 206LI mishap site. Tail rotor actually found under nose and moved to permit access to cockpit.

On June 24, 1998, the Tennessee State Governor's Drug Task Force was conducting drug interdiction operations in a mountainous area of the Cherokee National Forest in the Southern Region. A Tennessee Army National Guard (TANG) OH-58A (Kiowa) helicopter and pilot were being used to support ground crews in these operations. Since the operations were taking place on National Forest System lands, a Forest Service Law Enforcement Officer (LEO) was participating as a member of the task force. He was on board the helicopter.

The Drug Task Force was made up of several cooperating agencies for the purpose of locating and eradicating marijuana being illegally cultivated in the state of Tennessee. The TANG provided support to the task force in the form of aircraft and personnel. When the task force operated on Forest Service System Lands, the Forest Service participated as a full member of the task force, providing personnel and other resources to aid in marijuana eradication efforts.

During the afternoon of June 24th, the Task Force's operations primarily consisted of using the helicopter with an on board observer to locate illegal marijuana cultivation sites. They were then to direct ground crews to the cultivation sites so they could be eradicated. At approximately 1430 hours Eastern Daylight Time (EDT), the LEO had boarded the helicopter as the observer for the operation. At approximately 1637 EDT the helicopter departed the Tri-Cities Airport after refueling the helicopter. Before departing, the pilot received a weather advisory for fast moving severe thunderstorm activity in the area for the next several hours. At approximately 1732 EDT, the NWS issued a thunderstorm warning for two counties, Washington and Sullivan.

The helicopter returned to the site of a located marijuana garden to guide the ground crew in. Operations proceeded normally. At approximately 1745 EDT, the pilot told the ground crew he had to leave the area due to deteriorating weather conditions. Ground personnel reported that a storm had moved into the area and it was raining by the time the helicopter actually departed the area. The helicopter left the sight of the ground crew heading in a northeasterly direction and did not turn while still within sight. Thirty to forty-five seconds later, the ground crew heard another radio transmission, "Oh shit," from the helicopter. Ground personnel reported that the weather had become severe immediately after the helicopter departed and lasted for 15 minutes. It was reported that trees up to three inches in diameter were bent horizontal by the wind event.

No further communication was heard from the helicopter and attempts to re-establish radio contact with it were unsuccessful. At approximately 1830 EDT, the Tennessee Highway Patrol initiated a search and rescue operation to locate the missing helicopter. When initial attempts failed to locate the helicopter, personnel and units from many cooperating law enforcement agencies and other sources joined the search and rescue operation. The search and rescue operation continued until June 27th, when at approximately 1630 EDT, the helicopter wreckage was located in a creek drainage.

Both occupants were killed as a result of the mishap. Their cause of death was massive trauma, which had occurred during the mishap sequence.

Aviation operations were under the direct control of the TANG. The mishap helicopter was owned and operated by the TANG. The comparable civilian model of this helicopter is the Bell Model 206, Jet Ranger. The Kiowa helicopter was painted non-reflective dark green with no high visibility markings. This made it very difficult to find during search and rescue operations, even when very close to the wreckage. The dense dark green canopy and the helicopter's paint scheme masked the wreckage and contributed to the length of the search. The helicopter was properly maintained by military standards.

The pilot was a Tennessee Army National Guard Captain. At the time of the mishap, he occupied the right front seat of the helicopter. He was rated to operate this helicopter and had accumulated approximately 4,135 total flight hours of experience. Of that time, approximately 1,295 hours were in rotor wing aircraft and 600 hours were in the OH-58A. He possessed an Air Transport Pilot (ATP) fixed wing aircraft pilot certificate. His flight medical certificate was current with an expiration date of November 1998.

The pilot and helicopter in this mishap did not have a current approval for use in Forest Service aviation operations as required by FSM 5712 and FSM 5713. However, the pilot and helicopter did meet Forest Service requirements for approval of military pilots and aircraft.

The Forest Service LEO was trained and certified. He was assigned to work with the Governor's Drug Task Force. He occupied the left front seat of the helicopter. His LEO qualifications were current and he had authority to enforce laws related to the production, possession, and/or trafficking of controlled substances on National Forest System Lands. He was also a trained and qualified Forest Service Project Helicopter Manager. He was not wearing any Nomex PPE. He was wearing a flight helmet.

The mishap area was steep mountainous terrain at approximately 2,600 feet MSL. Foliage coverage was a continuous canopy of deciduous trees with dense undergrowth and reproduction. The wreckage was located in a drainage about .8 miles east of the site where the helicopter was last seen by ground crews. The helicopter had contacted trees on the northeast side of the drainage, losing the main rotor. The rest of the helicopter continued airborne to impact the southwest side of the drainage at approximately 3,100 feet MSL. The top of the ridge was 3,850 feet in that area. The wreckage rolled approximately 70 feet down the steep sloping terrain where it came to rest against a tree about five inches in diameter in an inverted position.

The LEO was ejected from the wreckage at the point of impact and was found about 15 feet up slope of the helicopter. The pilot remained in the wreckage. The ELT had been destroyed on impact and did not function to aid in the search.

Essentially, the helicopter remained intact with the tail boom attached, but twisted upright. The nose of the helicopter was destroyed back to the pilot cyclic control on the right side and back to the left seat on the left side. The main rotor was found on the opposite side of the drainage 100 feet northeast and below the main wreckage site. The blades were attached to the rotor head and the mast was severed just below the trunion.

The helicopter sustained massive impact damage as the result of sudden terrain and vegetation impact. The main rotor head and blades were found separated from the main fuselage wreckage that suggested an in-flight separation. The main rotor mast was found fractured approximately one eighth of an inch below the main rotor splines. The fracture surface that remained with the main rotor head exhibited areas of typical overstress and a smooth flat surface that appeared highly polished.

Metallurgical analysis indicated that the end of the shaft had a fracture surface with two areas of differing appearance. The smooth flat area showed no fracture information when viewed with a binocular microscope. The flatness and 90-degree fracture angle to the surface raised concerns of fatigue as being possible in this area. The other half of the rotor head end fracture had obvious smearing marks, with a center of rotation about a point. Also noted was twisting of the shaft between the two spline sections.

The transmission end of the fracture essentially matched the upper fracture surface, except for one large bump and the scratches sustained as the result of terrain impact. The tail rotor drive system showed signs of extensive impact damage with no significant indication of rotational damage. Engine external and internal examination found no indication of pre-existing defects. The compressor stator vanes were found contaminated with metal debris and covered with dirt deposits, which suggested that the engine attempted to run while ingesting dirt and metal contamination.

The splined turbine shaft sheared as the result of torsional and compression overstress. The gas producer and power turbine rotors showed signs of molten metal deposits consistent with foreign object contamination. The extensive Kaflex drive shaft damage, internal engine damage, pylon isolation mount scarring, and internal transmission gear scarring suggested excessive transmission displacement.

The massive fuselage damage was considered terrain impact related damage. The suspected main rotor mast separation occurred as the result of sudden vegetation contact not as an in-flight separation. The possible fatigue found in the main rotor mast fracture surface might have weakened the mast structure.

The United States Army Safety Center conducted the factual investigation.



OH-58A Kiowa fuselage wreckage.

July 30th, 2002 found this Aerospatiale AS315B (Lama) flying bucket support on a fire southeast of Estes Park, Colorado in the Arapaho/Roosevelt National Forest under a CWN contract with the Forest Service.

The helicopter had been refueled and departed from the staging area near Estes Park to apply water along the fire's boundary at approximately 1840 hours Mountain Daylight Time (MDT). VMC prevailed.

At approximately 1845 MDT, witnesses heard a "high pitched whining and a rrr-rrr sound, followed by "whoop, whoop, whoop" sounds. They saw a "bluish/purplish" colored flame coming from the exhaust stack of the helicopter's engine.

Witnesses heard the pilot give a warning over the radio, "Helicopter going down." They heard a high-pitched whine and saw the main rotor blades turning slowly as the helicopter descended.

The helicopter lost engine power and impacted wooded, relatively level terrain at an elevation of 8,500 feet. A post impact fire ensued and was quickly extinguished. The fire caused additional damage to the helicopter.

The pilot, the sole occupant of the helicopter, was fatally injured upon impact. He had been wearing personal protective equipment and was restrained by a four-point harness seatbelt.

The NTSB, FAA, and Forest Service were continuing their investigation into this mishap at the time this booklet was printed. The NTSB file number is DEN02GA085.



Aerospatiale AS315B wreckage.

LEARNING EXPERIENCES

Section Three

OTHER FATAL MISHAPS

October 17, 1974 was a fairly typical weather day in the Ketchikan Area of the Tongass National Forest in Alaska. There was reportedly a 2,000 to 3,000 solid overcast layer of clouds around Thorne Bay (TRB), Prince of Wales Island. It was flat calm except for occasional winds to two knots from the southeast. There were scattered fog patches and the temperature was 45 to 50 degrees Fahrenheit.

A Forest Service contracted DeHavilland DHC-II (Beaver) on floats was descending into TRB as a helicopter was taking off. Another pilot of the same company, also in a Beaver, landed shortly after the Forest Service Beaver, on a separate mission. The second pilot had made a short, low altitude flight, landed short, and taxied through the fog bank at the mouth of TRB. The pilots had a brief discussion. There was turbulence near the mountains approaching Thorne Bay. There was a dense fog cover near TRB; however, part of the bay was open.

The Forest Service Beaver departed TRB at 0850 hours Alaska Daylight Time (ADT) in a southerly direction with a pilot and six Forest Service personnel on board beginning a Visual Flight Rules (VFR) personnel transport mission. The Beaver, on step, made a turn to the left in the vicinity of a rock island and lifted off in an easterly direction. Shortly after taking off, the aircraft entered into a fog bank and within one minute had struck a tree, which detached 18 inches off the right wing tip. After striking four more trees, the aircraft plummeted nose down to the ground, flipped, and twisted over onto its right side. The aircraft came to rest pointing back toward its point of liftoff.

At the point of impact, the treetops were at 300 feet in elevation, the highest point in the flight path. The ground was steep and littered with downed timber. The mishap site was about 200 yards from the beach. Sometime after hitting the first tree, probably at the time of ground impact, two rear seated occupants were thrown free of the aircraft. The impact caused severe traumatic injuries to the persons on board, which resulted in the deaths of the front seat occupants. The three occupants in the second row also received severe traumatic injuries, which resulted in their deaths.

The two occupants who had been thrown free of the aircraft during the mishap sequence were seriously injured. One of these occupants struggled over rough terrain to the beach to wave his orange float vest in order to obtain help. Two aircraft flew past, but did not see him. A third aircraft spotted him and landed at about 1140 ADT. This was the first outside communication notifying anyone that something had occurred. There had been little or no flight following of the flight from the Forest Service or the contractor. The Forest Service was not certain as to who was on the aircraft until one of the injured passengers was brought back to Ketchikan.

The then recent expansions of the Tongass National Forest, use of a growing communications system which was not yet adequate, and the use of "seat fare" tickets and the operational control policy associated with that method of procurement all contributed to the slow response time to the mishap.

One of the fatally injured passengers had a personal portable radio in his briefcase and another had a locator beacon in his. Neither of the survivors was aware of these items. All aircraft occupants had been wearing their seatbelts; the front seat passenger was also wearing a shoulder harness.

The switches were off and were probably turned off by the pilot after hitting the first tree. There was no fire. While the aircraft was damaged beyond repair, the fuselage remained relatively intact.

The pilot had limited instrument and night flying experience. There was not a necessity to take off into the fog bank. The aircraft was not overloaded and the engine was apparently operating normally using climb power, or greater, when it encountered the tree.

The probable cause of this mishap was determined to be pilot error. His error occurred when he lost visual contact with the ground and became disoriented after entering the fog bank.

QUALITY PHOTO NOT AVAILABLE

June 11, 1979 was a beautiful day in the Selway-Bitterroot Wilderness Area of northeast Idaho. The weather in the area was reported as generally clear with a thin layer of overcast clouds at 25,000 feet above ground level. The visibility was between 30 to 40 miles and the wind speed was four knots. The temperature was 70 degrees Fahrenheit, dew point 45 degrees Fahrenheit. Summer season preparations were under way on the Nez Perce National Forest.

A Forest Service owned and operated Douglas Commercial (DC)-3 C-47 and its two person crew started their day dispatched from the Grangeville, Idaho Airport to transport personnel and gear to the Moose Creek Ranger Station up the Selway River, a distance of about 60 miles. On board the aircraft were 11 Forest Service employees (which included the pilot and copilot), one volunteer, 3,100 pounds of cargo, and two canines. Some of the passengers were going to be taking part in training so that they could provide guidance and direction to wilderness users and other passengers were enroute to check the new water system installed at the Ranger Station.

The aircraft had been configured for smokejumper missions and consequently all of the passengers were sitting on the port side of the aircraft facing the cargo on the other side. The cargo was held in place with retaining straps.

The pilot radioed upon take off at 0928 hours Pacific Daylight Time (PDT). The pilots began to fly the normal route, over the river, and to the Ranger Station. Their next radio check-in would be due in 20 minutes, about 0950 PDT.

When the Nez Perce National Forest Dispatch Office could not contact the DC-3 and determined her to be late for arrival at the Ranger Station, a search aircraft was dispatched from the Grangeville Airport. The time then was 1030 PDT. This search aircraft picked up the Emergency Locator Transmitter (ELT) signal emanating from the DC-3. A second fixed-wing aircraft and a helicopter were then dispatched to assist the search. The DC-3 was visually located at 1200 PDT.

While the search was in progress, an aircraft with 14 rescue-trained smokejumpers was dispatched from the Northern Region, Regional Fire Center in Missoula, Montana. This group included seven certified Emergency Medical Technician's (EMT's). All 14 jumped to the mishap site soon after it was located.

The aircraft was found in the Selway River, approximately ten miles downriver from the Ranger Station. It had broken up and sections of the wreckage were scattered approximately six miles downstream by a rapid current. The location was a steep, timbered, rocky-river canyon at an elevation of 2,000 feet mean sea level (MSL). Three passengers survived the mishap; however, one of these survivors succumbed to his injuries before he could be transported to the hospital. Search, rescue, and recovery efforts continued until July 14, 1979, when all victims were accounted for.

The DC-3 had apparently developed engine problems during their flight. Two observers, one a private airplane pilot, watched the aircraft take off at the Grangeville Airport. These observers reported black smoke coming from the right engine for a short period during takeoff. The smoke stopped as the aircraft circled the airport. Both observers felt the smoke was not excessive or unusual, but rather the result of a "too-rich" fuel mixture.

There were also indications that the DC-3's left engine experienced problems during its flight. The survivors reported that just prior to shutting down and feathering the left engine, the pilot made an announcement to the passengers that he had made a decision to return to the Grangeville Airport.

The aircraft was observed experiencing engine trouble a few miles before the mishap site. Several visitors who were rafting and backpacking in the wilderness area observed the aircraft as it proceeded on its flight path up the river. At least three people took photos of it during the interval between the time that vapor trailed from the right engine until it was approaching the impact point. From those accounts and from those photographs, it was known that the right engine burned and fell off the wing about three miles before impact.

The aircraft continued approximately three and one half miles upstream in a narrow canyon in powerless glide after the right engine fell off.

The pilots evidently attempted to land in the river. During this maneuver, the aircraft hit a tree and nosed into the river. Upon impact, the aircraft broke up. All major sections were located and retrieved. Minor pieces had scattered along several miles of the river. A checkpoint was established downstream early in the recovery process so that no aircraft wreckage or victim passed that point. The river was reportedly at a high water stage.

The mishap investigation team determined many different events occurred during the DC-3's mishap sequence.

It was determined that the left engine failed (or was shut down) in flight, about 20 minutes after takeoff from the airport. Presumably this was the result of rising temperature of nose case components and lubricating oil and low oil pressure. The left propeller was apparently feathered immediately after the engine failed (or was shut down) in flight.

The right engine "blew a jug" on cylinder number eight and burst into flame within perhaps 10 to 30 seconds from the time the left engine stopped. The right engine separated from the wing with an explosive sound within perhaps 10 to 30 seconds from the time it burst into flame.

The time span from the failure of the left engine through impact was probably three to four minutes. The coincidence of the two engines failing within less than one minute of each other during flight was extraordinary with a probability of occurrence greater than one million to one.

During the powerless glide, perhaps altering its glide path and flight attitude immediately before impact, the aircraft struck a tree with its left wing about 100 to 200 feet before impact into the river. Based upon survivors' statements and the damage to the wreckage, it was estimated that the aircraft's attitude upon impact was downward (perhaps 15 to 20 degrees) and the left wing was low (perhaps 15 to 20 degrees).

The investigation team examined all aircraft maintenance records. They determined this aircraft had a 100-hour inspection on September 19, 1978. Inspection of the number one engine (left or port side) had been deferred since it was scheduled for replacement. On May 30, 1979, the "preseason inspection" was completed on the airframe and right engine only. The time on the number two engine (right or starboard side) was 1,069.6 hours at that time. The logbook stated that the left engine had been replaced that same day. Actual time on the left engine at the time of the mishap was 8.5 hours. Actual time on the right engine at the time of the mishap was 1,078 hours.

The contractor who installed the left engine and nose case assembly stated that he was not shown any serviceable tags or certification for the engine when it was delivered to him for installation.

The origin of the right engine is unknown. It was received for overhaul with a total time of approximately 8,000 hours. It was overhauled to zero hours on Feb. 6, 1973. It was installed on this aircraft at airframe time of 11,340 hours, 25 minutes.

Engine teardown analysis concluded the following causes for the engines failures:

Left engine:

1. Crankshaft to propeller shaft oil transfer pipe left out upon assembly of engine and nose case.
2. Overheating of oil and nose case gear as evidenced by discoloration of gears and metallic analysis.

Right engine:

1. Cylinder number eight parted at lower skirt in a pre-existing crack.

2. Both bronze and steel washers were found on the cylinder hold-down studs. Studs were broken and nuts were loose and missing.
3. Examination of the studs holding cylinder number eight in place showed four studs were broken and missing. One stud had a missing nut and two studs had loose nuts. All seven of the studs above were adjacent in the upper left quadrant of the flange, which holds the cylinder to the engine main case.

In the metallurgical report that accompanied the teardown analysis, three studs holding cylinder number eight in place showed marks of fatigue failure to varying degrees and one yielded under tensile stress. The cylinder flange showed fatigue marks around one of the studs.

Both emergency fluid shutoff valves had been pulled, which stopped fuel and oil flow from passing through the firewalls in the nacelles.

The investigation team conducted background checks on the pilot and co-pilot, including their previous 24-hour history. These profiles showed no behavior or other problems that would have had a negative impact on any flight.

The Captain was an Air Transport Pilot (ATP), Certified Flight Instructor (CFI), and an Airframe and Powerplant (A&P) Mechanic. He was exceptionally qualified for the Captain's position and highly respected for his ability as a pilot. His records indicated he had an accumulated total flight time in excess of 10,585 hours (time recorded in 1973). 10,000 of those hours were in multi-engine aircraft.

The co-pilot had a commercial certificate and was a CFI. He was considered very well qualified for the DC-3 co-pilot's position. He had accumulated more than 9,000 hours of total flight time (time recorded in 1977).



DC-3 RIGHT engine trailed about 100 feet of flame.

Witness photo.



The tail section in the river where it had come to rest in slower water. This scene was downstream of the mishap site.

A Forest Service owned Aero Commander 500B piloted by a Forest Service employed pilot departed Ogden, Utah on August 4, 1980 for a flight to Salmon, Idaho. Upon arriving at the Salmon Airport, the aircraft was refueled and remained at the airstrip until approximately 1500 hours Mountain Daylight Time (MDT) on August 5th. It was at that time the Aero Commander, the pilot, and one passenger prepared to depart the Salmon Airport enroute to McCall, Idaho with a final destination of Ogden, Utah. The aircraft took off at approximately 1515 MDT for McCall, and was not heard from thereafter.

The original flight plan was filed with the Intermountain Region, Regional Office Dispatcher for the flight from Ogden-Boise-Salmon-Ogden. The final flight plan was changed to fly Salmon-McCall-Ogden. It was filed with the Salmon and McCall Dispatchers; however, this change was not passed on to the Regional Dispatcher. Over the course of the two days, August 4th and 5th, flight plans for this aircraft and pilot had been modified.

At approximately 1815 MDT, August 5th, a telephone search of remote mountain airstrips was initiated in an attempt to locate the aircraft. An air rescue search was initiated at 2000 MDT. At approximately 2315 MDT, an infrared scan of the expected flight corridor of the mishap aircraft was conducted, with negative results. At approximately 1120 MDT on August 6th, the downed aircraft was located from the air in the mountains of the Salmon National Forest, seven miles southwest of the town of Salmon. EMT's, smokejumpers from the McCall Smokejumper Base, and a helicopter were dispatched to the scene at 1132 MDT.

The pilot was fatally injured upon impact. The passenger survived with serious injuries.

The overlap in dispatch operations/areas contributed significantly to the delay in initiating search and rescue operations. The mishap was determined to have occurred at about 1530 MDT, August 5, 1980.

In the course of the mishap investigation, weather information was reviewed. Statements by other pilots that were flying in and out of Salmon indicated wind turbulence in the area above 6,000 feet at the time of the mishap to be moderate to severe, with updrafts and downdrafts in excess of 1,500 feet per minute. A station, eight miles northeast of the mishap site, at 4,300 feet in elevation, reported wind out of the northwest at ten miles per hour (mph). The temperature was 77 degrees Fahrenheit, the dew point 35 degrees Fahrenheit. It was reportedly VFR conditions.

The post mishap aircraft inspection revealed that even though required, this aircraft was not equipped with a shoulder harness for each of the front seat occupants. Tests in an independent laboratory, the coroner, and witnesses all stated that the seat belts were not secured when the two occupants were extricated. It was found that the seat belts had failed to sustain impact loading.

The condition of the wreckage indicated a strong vertical pancake impact.

Engine teardown analysis of the two engines did not reveal any malfunctions. It was apparent from observations that both engines were running at the time of impact. From examination of the propellers, it was concluded that both propellers were operating in their low pitch regime at the time of impact. No pre-impact discrepancies were noted on either propeller. The aircraft was flown 387.75 pounds under the maximum gross weight of 6,750 pounds.

Aiding in the delay for rescue, the ELT was in the armed position, but did not signal upon impact. Judging by the position of the aircraft wreckage, the investigators determined it would not have activated when a forward gravity force was exerted upon it.

The pilot's records were examined in detail. Examination of his previous 24-hour history examination indicated that he was properly rested and physically in condition to perform this flying mission. The recruitment, evaluation, and selection process used in the employment of the pilot met all legal requirements. However, the process did not produce a candidate who was properly qualified to safely perform the fixed wing flying duties of the specific position without extensive additional training after appointment.

The pilot held certificates as a commercial pilot for fixed wing and helicopter aircraft as well as helicopter flight instructor. Previous Forest Service employment on June 5, 1980, the pilot had not flown a fixed wing, multi-engine airplane since 1973. Total flight time as of August 5, 1980 (the day of the mishap), was as follows: helicopter total time 5,664 hours, airplane single engine land (ASEL) 1,500 hours, and airplane multi-engine land (AMEL) 960 hours. His all aircraft accumulated total time was 8,124 hours.

The pilot had no previous history of flying AMEL airplanes in mountainous terrain. The pilot had not flown any night hours or under Instrument Flight Rules (IFR) during the previous six months in a fixed wing, multi-engine airplane.

His Forest Service training consisted of three cross-country passenger transport trips during which another pilot gave the mishap pilot verbal instruction concerning emergencies and mountain flying techniques. These flights covered 9.4 hours flying time during which one landing was made at a backcountry airstrip. On June 26, 1980, the pilot was authorized to perform personnel transport, low level reconnaissance, back country operations, and fire reconnaissance. That same day, the two pilots flew together again for a pilot proficiency check during daylight hours. Three instrument approaches were made in simulated IFR conditions. The flight lasted 1.6 hours. After this flight, the mishap pilot was authorized to perform VFR day, VFR night, IFR day, and IFR night operations.

Causal factors cited in the investigation report were as follows:

- There was no evidence of an overall established Aviation Safety Plan for the region that would address issues involved in this mishap.
- The pilot testing and certification procedures and documentation review met the minimal stated requirements of the Forest Service Manual (FSM), but were grossly inadequate to meet the intent and the needs of this pilot for proficiency.
- The recruitment, evaluation, and selection process used in the employment of the pilot met all legal requirements; however, it did not produce a candidate who was properly qualified to safely perform the fixed wing flying duties of the specific position without extensive additional training after appointment.
- The pilot's total flight time and the lack of current time in fixed wing aircraft.
- The pilot had no previous history of flying AMEL aircraft in mountainous terrain.
- Confusion in flight plan filing and follow up procedures contributed significantly to the delay in initiating search and rescue (contributing factor).
- The altitude at which the aircraft entered the canyon was 1,500 feet lower than local pilots generally did.
- Flight path from take off to impact does not appear to be consistent with safe practices for the given situation.
- Wind turbulence above 6,000 feet was reported by other pilots in the air to be moderate to severe, with updrafts and downdrafts in excess of 1,500 feet per minute.



General view of Aero Commander wreckage.

On Friday, May 8, 1981, this Forest Service owned and operated Beechcraft Model 58P (Baron) aircraft underwent a routine 50-hour inspection by a contractor in Redding, California. The aircraft was returned to the Forest Service late that same afternoon and remained in a locked Forest Service hangar facility until the morning of May 11, 1981.

It was on May 11, 1981 that this aircraft and a Forest Service pilot were to transport three Forest Service personnel to conduct a pre-season inspection of a contract airtanker located in Chico, California. The flight commenced at 0838 PDT with a takeoff from south to north out of the Redding Municipal Airport.

Shortly after takeoff, the pilot requested permission from the airport tower to return and land. Permission was immediately cleared to land on any runway. Based on eyewitness accounts, the aircraft swung to the left, passed over a Forest Service hangar, and then collided onto the roof of the southeastern corner of the fire cache building. The mishap occurred at 0846 PDT.

Though there were approximately 50 people in the fire cache at the time of the mishap, all escaped without injury. The four occupants of the Baron were fatally injured.

The aircraft burst into flames upon impact and ignited a fire in the southwest end of the building. The building and its contents were totally destroyed. The building was equipped with a sprinkler system. The sprinkler system supply line was ruptured by the impact of the aircraft.

The pilot of the aircraft who took off just prior to the mishap aircraft did not notice any debris on the taxiway. The pilot of the first aircraft to take off following the mishap aircraft reported debris in the run up area adjacent to the runway takeoff position. The pilot of the second plane to follow the mishap aircraft noted debris on the right side of the taxiway. This pilot retrieved the debris and turned it over to Federal Aviation Administration (FAA) tower personnel. This debris was identified as an exhaust stack identical to one from a Baron.

The mishap investigation team reviewed the pilot's records. He had held a Class I, Commercial Pilot Certificate. His ratings included: ASEL and Airplane Single Engine Sea (ASES), AMEL, rotorcraft-helicopter, instrument airplane, and instrument helicopter. His first class medical certificate was issued May 1, 1981, with no limitations. Flight training records showed only limited review of emergency procedures during his two latest proficiency checks. He had logged a total of 228.3 hours in the Baron, 12 hours single-engine fixed wing, 1,475.2 hours in multi-engine fixed wing, and 6,478 hours helicopter time. His total flight time in all aircraft added up to 7,965.2 hours.

The surface weather observation taken by the National Weather Service (NWS) at 0845 PDT on May 11, 1981 was as follows: clear visibility for 60 miles, temperature 64 degrees Fahrenheit, dew point 34 degrees Fahrenheit, wind from 350 at 17 knots, and altimeter setting 29.96 inches of mercury.

The impact fire destroyed much of the physical evidence. Of the components examined at the scene and teardown analysis, there was no evidence of any mechanical failure other than the exhaust stack dropping off the left engine prior to take off.

During the 50-hour inspection previously noted, based on a manufacturer's special service bulletin requirement to inspect turbochargers for unusual wear, both exhaust stacks had been removed. The contract mechanic thought he had found a scrubbing problem in the left engine turbocharger. A Forest Service mechanic was called and he also examined the turbocharger. The engine cowling was in place during examination and viewing access was through the cowl flap opening. The Forest Service mechanic determined there was not a problem. The inspection concluded and the aircraft was released to the Forest Service.

The aircraft had been fueled to 120 gallons total (60 gallons per side) on May 7, 1981. Several other aircraft were filled from the same fuel source. There was no indication of any problem with the fuel.

Subsequent inspection of other Forest Service owned turbocharged Baron aircraft revealed improperly installed clamps, which secure the exhaust stack to the turbocharger.

The investigation revealed no evidence or probability of contamination of the cabin by noxious or toxic fumes or gases.

There was no evidence that an extreme emergency or panic situation existed at the time the pilot radioed to the tower that he was going to return and land.

It was determined that the pilot lost control of the aircraft while reacting to the situation which had caused him to indicate to the tower that he was returning to land. The aircraft then stalled and impacted inverted into the fire cache warehouse at the Redding Airport.

On May 16, 1981, the Forest Service issued notification to all Regions recommending preflight inspection of exhaust stacks on all Barons.

On June 3, 1981, the Beechcraft Aircraft Corporation issued a Safety Communiqué recommending preflight inspection of exhaust stack installations on all Model 58P and Model 58TC Beechcraft aircraft.



Southeast end of warehouse showing the initial post mishap fire.

Black and white photo.

The Rocky Mountain Region reported thunderstorm activity with heavy lightning in the Big Horn National Forest, Wyoming on September 6, 1983 and again the afternoon of September 8th. Air patrol missions on this Forest were routinely conducted after lightning storms, therefore, an air patrol was ordered for Friday, September 9th.

On Friday morning, the pilot of a Forest Service contracted Cessna T210 obtained a weather briefing and filed an FAA flight plan. At 1127 MDT, the aircraft departed the Sheridan, Wyoming Airport for air patrol of the northern part of the Forest with the pilot and a Forest Service observer on board.

The pilot radioed his position at the Tayler Mine Fire, a manned spot fire where the weather was reported to be sunny with scattered clouds at 1,200 feet. The pilot communicated that they were proceeding north toward the manned Smith Creek Fire, a distance of approximately 14 miles, where the winds were reported at ten miles per hour out of the south. Clouds/fog covered the tops of ridges in the vicinity and the temperature was 56 degrees Fahrenheit. General terrain in the fire area was mountainous, with some peaks reaching 7,200 feet.

At approximately 1150 MDT, the Forest Service fire crew at the Smith Creek Fire heard an aircraft engine south of their location, in the canyon. They did not see the aircraft, but heard its engine for approximately 30 seconds at high revolutions per minute (rpm) and very loud. Then they heard the 'cracking' sound of a crash. The fire crew radioed the Tongue Ranger District in Sheridan, Wyoming to determine if that Ranger District or any other was in radio contact with the aircraft. The Ranger Districts could not get a radio response from the aircraft. The Smith Creek Fire crew radioed that they were leaving their location to search the area.

At approximately 1210 MDT, the fire crew located the aircraft about one half of a mile south of the Smith Creek Fire, seven miles west of Dayton, Wyoming. The immediate vicinity of the mishap was a steep box canyon approximately 1,200 feet to 1,300 feet wide at the mishap elevation of 7,200 feet MSL. The wreckage was located on a steep slope with spruce and fir timber types of nine to 12 inches diameter breast height (dbh). The fire crew reported heavy fog in the treetops and variable winds from the south at the time they heard the aircraft and at the mishap site. The crew reported that both aircraft occupants were fatally injured. There was no fire at the wreckage site.

The mishap investigation team determined that the Cessna 210 was properly configured and carded for Forest Service use and that it had been properly maintained.

It was determined the aircraft engine was running at maximum power just prior to impact. The mishap sequence began when the right wing contacted a 10-inch dbh tree at about 25 feet above the ground. The aircraft had been in a steep right bank with the nose pointing down.

The aircraft, spinning in a clockwise direction, nose vertically down, struck trees, and the propeller sliced the tree several times throwing pieces 9 to 11 inches in diameter.

The first ground contact occurred when one propeller blade was deposited approximately 14 inches into the ground. The aircraft bounced up about six feet while still rotating to the right. The cabin doors flew off. The left front seat back was thrown out. The shoulder harnesses of the pilot and observer had not been used. The pilot was thrown partially out of the door, and parts and debris from inside the cabin were flung out and scattered.

The aircraft then twisted around and between two trees, breaking off the empennage then slid to the ground coming to a stop in a nearly vertical position. The ELT did not activate upon impact.

The Forest Service observer was qualified and experienced for fire reconnaissance flights.

The pilot was authorized and qualified for the flight. He had accumulated 3,944 hours of total flight time and 750 hours as the PIC in Cessna 206's. He had 301 hours of actual instrument time; one of those hours

was in the last 90 days. He had a pilot safety briefing. When this pilot was carded, an actual flight check ride was not given.

The probable cause of this mishap was the pilot failing to maintain altitude and airspeed, causing the airplane to stall and enter a spin. The pilot attempted to turn out of the canyon, which was too narrow to accommodate the required radius of turn without stalling the aircraft. The low cloud ceiling did not allow a climb out of the canyon under visual flight conditions. The pilot entered the canyon under conditions that made a safe exit difficult or impossible.



Cessna T210 main wreckage.

Two pilots of one company departed Silver City, New Mexico, Turner-Ridgeport Airport in two different aircraft at about 0530 MDT on July 23, 1984. They were both headed for Albuquerque, New Mexico (ABQ) to perform Forest Service Forest Pest Management (FPM) survey flights.

Both aircraft arrived ABQ, taxied in, and serviced their respective aircraft. One of the aircraft, a Cessna T337G, received 32 gallons of fuel while the second aircraft received 31 gallons. The pilot of the second aircraft witnessed the fueling operation and said it had been done correctly.

Both pilots then waited for their passengers to arrive for the survey flights and conversed together in the waiting room, reportedly discussing the aircraft and their characteristics.

At approximately 0745 MDT, the Cessna T337G's passenger arrived, and the pilot and passenger left the facility at about 0755 MDT. The ABQ control tower cleared the aircraft for takeoff at 0811 MDT on Runway 12. The aircraft departed the ABQ runway approximately one minute later and switched to the Stage 3 departure frequency for a southbound departure, Alamogordo, New Mexico.

The FPM survey was conducted from north to south. Communications were initiated with Lincoln National Forest Dispatch. The last radio communication from the Cessna T337G was received at 1052 MDT and was recorded by the Cibola National Forest. The time of the mishap is unknown. Search activities were initiated at 1545 MDT.

When the wreckage was found, it was determined that the pilot and passenger were fatally injured.

The mishap investigation team analyzed the wreckage and mishap site. They determined that the aircraft appeared to be approaching a ridge in a right bank on a heading of about 300 degrees. Initial impact in the mishap sequence occurred when the left wing struck a large snag. The right wing tip then clipped some small branches, depositing minor debris from the wing tip. In a descent path of about 15 to 20 degrees, the right wing impacted a large tree at approximately wing station 110. The leading edge was crushed back to near the rear wing spar, causing separation of the outer eight to nine feet of the right wing. There was significant damage in the vicinity of the wing attachment to the fuselage section.

Normally, the wing, tail booms, and horizontal stabilizer would have formed a rectangular shaped structure. With the wing impact, sufficient skew of the structure caused separation of the left boom and left vertical stabilizer as a single unit. This section, and the right wing section, was located along the flight path about 135 feet before the main wreckage location. Although there was additional attachment separation of the right boom and the horizontal stabilizer, there was physical linkage of these sections by control system cables, which are routed through the right boom. The left boom did not have these cables. The tree indentation in the wing, and the breakage of the trees indicated the aircraft had been in a right bank of about 40 degrees.

With the loss of the right wing, it appeared the aircraft rolled clockwise to the inverted position by the time it impacted the tree at the location of the main wreckage. Impact with the tree was at about 30 feet above ground level. The aircraft subsequently slid down the tree to the ground.

The impact force on the propeller caused a bending moment on the front portion of the engine crankshaft resulting in a fracture of the shaft between the propeller mounting flange and the engine case allowing the front propeller to end up well out in front and to the right of the projected flight path beyond the main wreckage location. The crankshaft fracture surface showed about 50 percent of the circumference had a rough textured 45-degree-shear plane indicative of failure under tension. The remainder of the fracture face was a relatively polished surface indicating a compressive shearing force. The forward end of the crankshaft was hollow and at the point of fracture was like a thick walled pipe. The portion remaining with the engine was distorted into a slight oval shape. Additional markings on the engine and the propeller hub flange showed additional impact between these two portions after fracture of the crankshaft.

Impact of the engine with the tree occurred on the right front (#5) cylinder. Due to the aircraft being inverted upon separation from the engine mounts, the engine was deflected well to the right of the flight path.

One blade of the rear propeller had a significant rearward bend. This impact applied a sufficient rearward bending moment to fracture the crankshaft between the engine and the propeller mounting flange. Cause of separation was not only shown by the fracture face, but in additional circumferential cracks in the fillet of the propeller mounting flange.

Post-mishap analysis of the aircraft turbochargers indicated that the front engine turbocharger had been inoperative for some period of time prior to the mishap. Comments by engine analysts indicated this condition had probably existed for some hours. Although the aircraft was capable of flight in this condition, cockpit instruments and aircraft performance give positive indications of turbocharger malfunction. Teardown analysis of the aircraft engines indicated no evidence of mechanical failure.

Both propellers were found in the feathered position. The design of the propellers was such that they would automatically feather when detached from the engines. Both propellers were found separated from the engines. The aircraft had plenty of fuel.

The front end of the aircraft's engine crankshaft was submitted to a metallurgical laboratory for examination as to the cause of failure. It was determined the failure was caused by overstress under a bending moment or load. This failure occurred at impact and there was no evidence of cracking prior to the catastrophic failure.

The terrain of this mishap site was steep and mountainous. Peak elevations in the area were in the range of 10,000 to 12,000 feet. Elevation at the mishap site was approximately 9,500 feet.

A look into the pilot's personnel records was warranted. As of July 12, 1984, the pilot had logged 1,659.9 total flight hours, 1,511.4 of those as the PIC. He had 12.7 hours in the Cessna T337 aircraft. Based on his logbook, his hours flown in mountainous terrain were estimated at 30 hours. The pilot indicated this hour count to the check pilot upon his agency check ride. The Forest Service Handbook (FSH) and the Forest Service contract required a pilot to have a minimum of 200 hours experience of flying in typical terrain. However, this was the pilot's initial carding by the Forest Service. He did have sufficient total flight time to meet Forest Service requirements for this mission.

The agency check ride given to this pilot was approximately 18 minutes in duration. This check ride included discussions on mountain flying techniques including winds, turbulence, canyon flying, and density altitude. It also included a discussion about Forest Service operating rules and procedures including the 500-foot minimum altitude limit applying to the highest prevailing terrain in the immediate area, focus on flying the aircraft, and the pilot's authority in the aircraft. The check ride did not encompass demonstration of emergency procedures nor was instrument currency documented. The pilot became approved for reconnaissance, Federal Aviation Regulation (FAR) Part 135 instrument flight, passenger transport, and night flying post check ride. There is no written record that the pilot received a safety briefing following initial approval. All officials who had hired and carded this pilot said he was a very sharp and professional individual.

The weather given from a neighboring district indicated the temperature in the mishap area was probably in the 70 to 75 degrees Fahrenheit. Winds were undetermined. Calculations concluded that at 9,500 feet and 75 degrees Fahrenheit, the density altitude was approximately 12,000 feet. A few lightning strikes were recorded in the surrounding area.

The cause of the mishap was undetermined. The nonfunctional front engine turbocharger diminished aircraft performance at the high-density altitude coupled with the pilot's limited experience with low-level flight in mountainous terrain was documented as contributing factors.



Cessna T337G main wreckage at impact point.

Redmond Dispatch in California received a request for a passenger transport flight on July 14, 1988, at 0830 PDT. The request was forwarded to the pilot at approximately 0915 PDT. The aircraft, a DeHavilland DHC-6 300 (Twin Otter) under contract to the Forest Service, was then off loaded of all smokejumper gear, swept out, and the passenger seats installed.

At approximately 1100 PDT, the pilot (a Forest Service employee) started the aircraft and began taxiing out to head to John Day, Oregon to pick up his passengers. Redmond Dispatch asked him to hold and shut down for a possible change in plans. The pilot taxied back to the ramp area and shut down. He telephoned dispatch from the "loft." The dispatcher had solved the additional request problem and the pilot was cleared to takeoff. At this time, the pilot was the only person on board the Twin Otter. During this period of time, approximately five to ten communication transmissions with Redmond Dispatch took place and were normal.

At 1135 PDT, the pilot checked in with John Day Dispatch and transmitted his expected time of arrival would be 1215 PDT. There were no further transmissions from this pilot. The last transponder blip recorded at Seattle Air Route Traffic Control Center (SEA ARTCC) was at 1140 PDT.

The approximate time of impact was between 1140 PDT and 1142 PDT. The pilot was fatally injured. The aircraft was completely destroyed.

The initial point of aircraft impact occurred when the right wing contacted three trees at the 5,000-foot level of a mountain. This impact separated the wing into three sections before the aircraft "exited" over the mountain edge. The final impact site was on this ridgeline with the aircraft coming to final rest in a steep canyon to the east. There was a high mountain further east on the flight path that also needed to be crossed before a descent to John Day, Oregon could be commenced.

The pilot was properly certified to fly the aircraft. It was determined that he held an ATP, AMEL with DC-3, DH-C4, CW-46, L-TCB ratings, commercial privileges, ASEL, Rotorwing-Helicopter G-TBM, and B-B17's. He was a CFI in airplane multi-engine (AME). His total time in this make/model was 1,755.7 hours. His total time in multi-engine fixed wing aircraft was calculated at 9,856 hours. Of these hours, 119.2 were as the PIC in the previous 90 days. His single engine fixed wing time totaled about 3,700 hours. This pilot had recently had two aircraft incidents.

The pilot's known medical records over the previous few years were reviewed. These records indicated the pilot had been having medical problems, some of which he did not want brought to the attention of the Medical Doctor (MD) designated by the FAA to do flight physicals. In addition, he did not tell his supervisor that he was having medical problems. It was noted that he had complaints of chronic muscular neck pains, back problems, falling asleep, allergy problems, numbness in the top of his feet, feeling tired and run down, and pain in his legs.

On the day of the mishap, the pilot awoke at 0545 PDT and ate a good breakfast. He was known to have a habit of snacking on his lunch about mid morning. It was noted that this consumption schedule could contribute to drowsiness.

The aircraft did not contain an automatic pilot. No failures of the aircraft structure, electronic, hydraulic, and other systems were found.

There was no indication of disability during the pilot's last radio communication, five minutes prior to the mishap. His flight tract showed a moment of brief recovery of altitude and then a gradual descent of about 400 feet per minute. He was off course to the right for about five minutes before impacting with trees on the ridgeline at 5,800 feet of altitude. This flight tract strongly supported a very high probability of sleep-induced unconsciousness.

The most probable cause of this mishap was determined to be the pilot's acute in-flight incapacitation due to sleep.



DeHavilland DHC-6 300 (Twin Otter) final impact site.

The pilot and aircraft, a Beechcraft 200 (King Air) under contract to the Forest Service, departed the Redding, California Airtanker Base (ATB) at 1357 PDT on September 11, 1988 on a mission to transport two firefighters to Jackson, Wyoming.

The pilot delivered the passengers to the Jackson Hole Airport (JAC, an uncontrolled airport) at approximately 2127 MDT. The pilot then stepped into operations for a short break before returning to his aircraft for a solo return flight to California.

September 11, 1988 was reportedly a very dark night with a 2,000-foot overcast ceiling and no visible horizon. Visual Meteorological Conditions (VMC) prevailed. Winds were calm with no reportable gusts, altimeter 30.26 inches of mercury, density altitude 6,000 feet, temperature 36 degrees Fahrenheit, dew point at 34 degrees Fahrenheit, and visibility ten statute miles. The pilot filed an IFR flight plan. He received his IFR flight clearance through the Salt Lake City (SLC) ARTCC.

A student pilot and his friend witnessed what happened after the King Air pilot taxied away from operations. They reported they were walking on the ramp when they saw this King Air taxi toward the north end of the runway. They walked across the taxiway to an unpaved area near the runway to watch the aircraft takeoff. The student pilot said the aircraft came to a stop on a taxiway perpendicular to the runway. He wasn't sure if the pilot did a run up or not since he wasn't familiar with this type of aircraft. The aircraft taxied onto the runway and started the takeoff roll. The aircraft flew past his position in, what appeared to be, a normal departure, but did not immediately retract the landing gear.

As the aircraft climbed, it banked toward the east and the witness turned his attention away. His attention was drawn back to the King Air when he heard a change in engine sounds. Both witnesses sighted the navigation lights of the aircraft and estimated the aircraft to be south and east of the airport at a location where an aircraft would have been turning left from crosswind to downwind. The aircraft was observed to be in a rapid descent with engine sounds described as "racing."

The aircraft then climbed back to approximately the same altitude. The student pilot's companion made the comment, "Isn't he flying kind of funny?" The aircraft then flew in an easterly heading for a short time. The witnesses began talking again, but their attention was drawn back to the King Air once more. This time they observed the aircraft northeast of the airport when it began to do the same strange maneuvers again. The aircraft appeared to bank left and suddenly lose altitude very rapidly, gain altitude very rapidly, then lose altitude very rapidly again. This time the aircraft went out of sight. The student pilot told his friend it must have crashed. They immediately ran back to the ramp and reported the mishap to airport security.

The wreckage was located at 0630 MDT the following morning. The condition of the aircraft wreckage was consistent with a high speed, nearly vertical impact. The aircraft mishap site was in a wilderness area consisting of flat, rocky terrain covered with sagebrush on the southwest side of a butte. The airport could be seen from the mishap site at a distance of about two miles.

The majority of the wreckage was located around or within an impact crater ten feet in diameter. The engines were buried seven feet below the surface of the ground. The remaining wreckage debris was scattered over an area of 50 feet. All parts and components of the aircraft were accounted for in and around the mishap site. There was a strong odor of jet fuel present in the wreckage. There was no evidence of any fire. Ground scars at the mishap site showed signs of vertical impact only, with no movement of the aircraft in any horizontal direction. Landing gear was in the retracted position.

The pilot was fatally injured.

The National Transportation Safety Board (NTSB) mishap investigation team interviewed witnesses during the investigation process. From these witnesses they determined the flight path and attitude of the aircraft during its short flight following take off from JAC. They also determined that all other flight time occurring this day with passengers on board were normal or uneventful.

The NTSB discovered that the mishap pilot had been on continuous flight duty from about 1400 PDT until the time of the mishap, 2157 MDT, which equaled approximately eight hours. A witness stated the pilot seemed to be tired and hungry.

The pilot's log book showed the following flight hour parameters: 4,400 hours total flight time in all aircraft, 62 hours in the make and model, 2,250 hours ASE, 2,150 hours AME, 516 hours of night flying, 755 hours of actual instrument time, and 50 hours of simulated instrument time. He had recorded 21 hours in rotorcraft of which 1.5 hours were as the PIC/solo. It was noted that he did not possess a helicopter rating and his logbook did not contain an instructor's endorsement for solo flight. His PIC in all aircraft combined were as follows: 4,150 hours total as PIC time, 44 hours in make and model, 2,150 hours in Airplane-Single Engine (ASE), 2,000 hours AME, 500 hours of night flying, and 700 hours of actual instrument time. He maintained an airplane CFI certificate and had instructed 250 hours total, broken down as follows: 200 hours ASE, 50 hours AME, 10 hours night, 25 hours actual IFR, and 25 hours simulated IFR.

It was determined he had seven hours of night flying time in this make and model, ten hours of actual instrument time in this make and model, and five hours of simulated instrument time in this make and model.

The operator in a continuous airworthiness maintenance program had maintained this particular King Air. No discrepancies were noted in the maintenance records. The fuel was deemed not contaminated. An investigator determined the weight and balance figures were all within limits.

The NTSB determined the probable cause(s) of this mishap to be the Pilot in Command's uncontrolled altitude, poor planning/decision, improper use of flight controls, and spatial disorientation. Contributing factors cited were the dark night light condition and fatigue due to this pilot's flight schedule.

Questions:

QUALITY PHOTO NOT AVAILABLE

On August 11, 1988, South Zone requested leadplane coverage for their fire mishap on the Sequoia National Forest beginning the following day. They requested two leadplanes, one to begin at 0800 PDT at Porterville, California and the other to begin at 1000 PDT at Lancaster, California. On the evening of August 11th, two Forest Service leadplane pilots agreed which of them would fill the Porterville order and which would fill the Lancaster order.

The morning of August 12th, one Forest Service owned Beechcraft Baron 58P departed Ontario, California for Lancaster at 0933 PDT and landed there at 0953 PDT. After a briefing regarding fire tactics, this pilot relieved the leadplane currently working Lancaster at 1500 PDT. The relieved pilot left the fire at 1505 PDT.

The Baron then took over leadplane responsibility and was working with one airtanker on Division A, where it had already dropped half its load. The other half load was to be dropped farther down the hill. The runs were generally southwest to northeast over heavily wooded rugged mountain terrain. During this time a helitack crewmember standing four and one half miles to the southeast, was videotaping the airtanker's second drop.

After leading the airtanker on its second retardant run, the leadplane executed a steep pull-up left climbing turn. This is the point at which the mishap occurred.

The aircraft burned when it impacted the ground and was found in a nearly vertical nose-down attitude. The time was 1540 PDT.

Videotape filmed from four and one half miles to the southwest was a tremendous source of investigative information. The video showed the airtanker approaching the target, releasing the retardant, and starting a slight climb. Initially, the leadplane did not appear in the video. However, the leadplane's flight path was observed and reported by the airtanker crew as entering a steep left pull up and climbing turn of approximately 180 degrees, placing it in a position to watch the drop. The airtanker made the drop and was climbing straight ahead as the leadplane entered the video from the right, passing about one half mile west of the airtanker and about 120 to 130 feet higher in altitude.

The Baron's altitude was later calculated at 500 feet above the terrain by a NTSB computer. The leadplane appeared on the video to be in a left bank in excess of 60 degrees and in a slight descent as it passed the left wing of the airtanker. The indicated airspeed of the Baron was later calculated to be 93 knots by the NTSB. The airtanker airspeed was calculated to be 152 knots. Smoke from the fire was rising almost vertically in most of the fire area. Consequently, ground speeds would be very close to the indicated airspeeds.

The video showed the leadplane reach a 90-degree angular point with the airtanker tail. The leadplane then suddenly entered a very rapid roll to the left, a "split S" entry into a very quick counter-clockwise spin. It completed at least two full turns (720-degree roll) within four seconds before impacting the ground in a near vertical, nose-down descent. There was insufficient altitude to complete a recovery. The pilot was killed instantly during the mishap sequence and the aircraft was destroyed. There was a post-crash fire.

The airtanker pilot stated that there was very little turbulence over the fire mishap. However, analysis of smoke plumes over the fire on the videotape indicated the possibility of turbulence and/or wind shear in the vicinity of the drop zone. The leadplane had made one "lead" to a drop area upslope from the position of the second run; therefore, the possibility of wake turbulence existed.

The terrain southwest of the drop zone was rapidly rising. Terrain to the northeast of the drop zone was a large open valley.

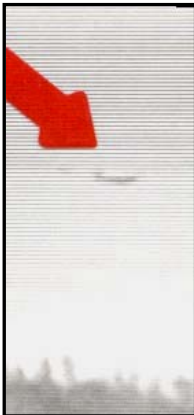
The leadplane pilot was fully qualified and current in accordance with Forest Service standards in the Baron. He was designated to act as a leadplane pilot and Airtanker Coordinator 1 with no restrictions on July 28, 1987. Since January 1, 1988, the pilot had accumulated 203.4 hours of flight time in six different types of aircraft. He had flown 145.5 hours in the Baron and 89 of these hours were flown as a leadplane

pilot. He held ATP, AMEL, Commercial, ASEL & ASES, and Rotorcraft – helicopter and instrument – helicopter ratings.

The Beechcraft Baron Pilot’s Handbook indicated that at a bank angle of 60 degrees and a calculated gross weight of 5,526 pounds, the Baron 58P would stall at 114 knots. It should be noted that this calculation was based on a level turn, which would have required two “g’s” to maintain altitude in a 60-degree bank. The leadplane was noted to be in a slight descent prior to the stall and could not have been in a level sustained two “g” maneuver.

The aircraft was airworthy in accordance with FAA and Forest Service maintenance standards. Analysis of the left propeller indicated that the left engine was developing little or no power upon impact. Analysis of the right propeller indicated that the right engine was developing substantial power upon impact. Neither engine offered any evidence of mechanical damage at any time prior to the mishap. Engine teardown analysis could not conclusively determine if there had been an engine malfunction power loss prior to impact. All major aircraft components were accounted for at the mishap site.

The cause of this mishap was narrowed down to one of two possibilities. Either the aircraft experienced a left engine (critical engine) malfunction while in a very steep left bank (in excess of 60 degrees) which resulted in a stall/spin or the pilot maneuvered the aircraft into an attitude (steep left bank with slow airspeed) that resulted in a stall/spin.



Arrow points to the leadplane as it passes the vertical stabilizer of the airtanker then rolled inverted and entered a counter-clockwise nose down (splits) spin.

Photo taken from video monitor screen.



Baron wreckage looking southwest. On the left is the left engine, upside down. Right of the left engine is the nacelle (air scoop is open, in flight position) indicating the air conditioner was on. Tail section with cables hanging over tree limb.

On June 21, 1991, a fire was burning on private land within the Cibola National Forest approximately 40 nautical miles west of the Albuquerque, New Mexico Airport (ABQ). A Cibola Dispatcher requested leadplane coverage following initial airtanker activity on the fire.

At 1434 MDT, a Forest Service owned and operated Beechcraft Baron B58P departed ABQ enroute to this fire. During the next four hours and nine minutes the pilot actively participated in suppression actions on this fire burning in relatively gentle rim rock and mesa terrain at an elevation of about 8,000 feet. An ATGS in a Cessna 340 assisted him in the workload. Throughout his time over this fire, the Baron pilot supplied information and provided direction for ground suppression personnel that were dealing with shifting wind conditions and reduced visibility.

Using airtankers from Alamogordo, New Mexico, this leadplane directed 17 retardant delivery runs prior to the mishap, delivering 18,900 gallons of retardant to the fire line.

The only witness to the mishap was a Captain of an airtanker. He and fire personnel indicated that the mishap pilot was attempting to provide retardant in an arroyo on the east end of the fire, which was obscured by a low layer of smoke. These personnel indicated that the mishap pilot felt retardant could be placed in this area. It would have to be delivered through the smoke immediately above the fire, but would not obscure or interfere with flight visibility. This drop was to be made at 8,100 feet using two doors at a time, sequenced to provide continuous 2,000 gallons coverage of a full retardant load from an airtanker.

Timing of the drop would be important to ensure penetration to the exact location of the fire, which could not be seen, burning in the bottom of the arroyo. Timing was also important as the leadplane had been out over four hours and the Baron pilot would need to return to ABQ for fuel as soon as this drop was completed.

The Baron joined up with the airtanker on downwind and proceeded to provide direction as the two aircraft descended into the drop pass on a heading of 100 degrees. The airtanker was 50 yards behind the leadplane on the pass. The leadplane pilot wagged his wings to mark the point of release and immediately entered a sharply pitched left bank in order to be in a position to observe the drop. The airtanker pilot noticed the Baron had a pitch angle of about 30 degrees and that the bank angle increased throughout the turn until the aircraft went "through the vertical" and crashed inverted, immediately north of the retardant line just delivered.

The airtanker pilot said that the Baron pilot had just begun to increase airspeed beyond the 120 knots used on the run. He estimated that the Baron was most likely doing 130 knots over the target when he initiated the pitch up and bank that terminated in the mishap. The airtanker pilot said that he saw and noted nothing different about the way the run was conducted and indicated he saw nothing fall from the aircraft as he observed the aircraft during the run.

The airtanker Captain had banked the airtanker slightly after the drop and was able to follow the leadplane as it passed through 90 degrees over the top of his left wing. He said that the elapsed time from the start of the leadplane turn until the mishap was about three seconds. The mishap occurred at 1843 MDT. Dispatch was notified and a search and rescue helicopter was ordered.

The airtanker pilot said that immediately after impact, the Baron appeared to bounce and a fire ensued. The ground crew, including the Incident Commander, reached the scene on foot within 15 minutes of impact. The Baron pilot had been fatally injured.

It appeared that the leadplane had first contacted vegetation with the left wing immediately outboard of the left engine nacelle. Impact occurred seven and one half feet high on a Ponderosa Pine, which was four and one half dbh. The tree was completely severed at the impact point.

The mishap investigation team determined that both engines were developing power and both propellers were turning approximately 2,400 to 2,500 rpm at the time of impact. All control surfaces were accounted

for. They had sustained impact damage, but showed control continuity. The landing gear was found in the retracted position. Flap position could not be determined. Each fuel tank contained at least 17 to 20 gallons of fuel.

The Baron pilot was fully qualified, but was not current in accordance with Forest Service standards in the Baron. He had not complied with recurrency training and check ride requirements for 1991. He was designated to act as a leadplane pilot and Airtanker Coordinator on October 10, 1980, but had not completed 1990 check ride requirements for this mission.

The Baron pilot had original leadplane qualifications dated October 24, 1980 and had been assigned the leadplane mission continuously since. He attended the National Leadplane Qualification Standardization School in April of 1989. His latest regional leadplane qualification letter was dated April 6, 1989 and remained valid. He had a total flight time of an estimated 5,395 hours. From May 1, 1990 to June 20, 1991, he had logged 195.5 hours, most of this time in the Baron. In the previous 30 days, he had logged eight hours and had accumulated 14.9 hours leadplane time since the first of the year. In the previous 24-hour period leading up to the mishap, he had flown 4.15 hours. June 21, 1991 was his second day of work following a two-week vacation.

Airtanker pilots said that weather conditions that day over the fire were not severe and turbulence did not interfere with airtanker operations. Local weather reports indicated excellent visibility and winds east-southeast at five to nine knots. Personnel on the fire reported weather at 1800 MDT as clear, the temperature between 70 and 80 degrees Fahrenheit, and winds south-southeast at five to 12 mph. Winds were reported to be squirrely (erratic) and close to the ground. Smoke reduced visibility, but was determined not being prohibitive conducting of safe flight operations. Density altitude was 11,000 feet at the time of the mishap.

The terrain was not a factor. There were canyons in the rim rock, which dropped off sharply to the east of the fire. Vegetation was sparse, a mix of Ponderosa Pine and Juniper, with some Oak brush present. The uneven aged stand varied from young to near mature trees.

It was determined that the leadplane was flown at an airspeed of 120 to 130 knots on the retardant run and then performed an immediate climbing left turn into an increasing tail wind condition immediately before the mishap occurred.

The actual causal factor(s) were not identified in the investigation report.



The Baron at the impact site. The Baron is inverted.

On November 2, 1992, a Beechcraft Baron 58 owned and operated by the Forest Service, departed the Medford, Oregon Airport to begin a mission at 0759 hours Pacific Standard Time (PST). The pilot obtained an IFR clearance to Baker, Oregon via Victor 595 to Redmond, Oregon, and Victor 121 to Baker with instructions to climb and maintain 12,000 feet MSL. The Forest Service pilot and three passengers were planning to make an interim VFR stop at John Day, Oregon, weather permitting.

At 0844 PST, SEA ARTCC queried the pilot as to whether he would prefer to proceed direct to Baker from his present position. The pilot acknowledged “yes,” at which time he was given a vector to fly heading 055-degree magnetic and cleared to proceed direct to Baker.

At 0848 PST, the pilot contacted SEA ARTCC and asked what the minimum vectoring altitude was in the John Day Airport area and was advised that it was 11,000 feet MSL. The pilot then asked for any current weather in the John Day area and was advised “no weather available in that vicinity, I have the Baker weather showing at 1550 hours Universal Coordinated Time (UTC) observation 5,500 scattered (SCT), estimated 12,000 broken (BKN), visibility 40 miles, winds 320 at 18 gust to 27, the altimeter out there is 30.11.”

At 0849 PST, the pilot, having received this weather information, queried, “wonder if it would be possible for us to proceed direct to John Day (OR) instead of Baker. If we can’t land at John Day, we’d like to proceed on from above John Day over to Baker as originally planned.” He was then “cleared to Baker via direct to John Day direct maintain 12,000” by SEA ARTCC.

The pilot was subsequently given a bearing to John Day and then vectors around military airspace, which was becoming active. At 0902 PST, the pilot was told to “resume own navigation direct John Day” and at 0903 PST was told to “descend and maintain 11,000.” The pilot then reported leaving 12,000 feet for 11,000 feet.

At 0922 PST, SEA ARTCC queried the aircraft regarding the current flight conditions and the pilot reported that he was flying over a slight under cast and was 12 miles from John Day.

At 0923 PST, SEA ARTCC advised the pilot that he was “five miles to the west of John Day and uh to about five miles north of John Day in that quadrant if I keep you away from the airport I can get you down to 9,000 if it’s necessary.” The pilot responded with, “okay, that might do it for us.”

At 0926 PST, the pilot reported to SEA ARTCC that “tops are at 11,000 pretty solid right now we should be right over the top of John Day so if you could vector us down to 9,000, I don’t know what the bases are here but if we break out then we’ll cancel. If not we’ll go on to Baker.” The pilot was then issued a left turn heading 330 degrees with the expectation of a descent clearance in about eight miles.

At 0929 PST, the pilot was cleared to “descend and maintain 9,000” and the pilot reported leaving 11,000.

At 0932 PST, the pilot reported to SEA ARTCC that he was “at 9,000 level still in the soup” and further stated that it was “not going to work appreciate your effort but I guess we’ll go direct to Baker.” The pilot then received a clearance direct to Baker and was given a climb to 11,000. He reported out of 9,000.

At 0935 PST, the pilot radioed, “Center I don’t know what we’re in here but we can’t make a climb out of 9,300. Would you keep an eye on me?” The controller queried the pilot asking, “is there a downdraft?” and the pilot stated, “It sure feels like something but we’re shaking at (unintelligible) out of 9,000.”

At 0938 PST, following a query by the controller regarding the aircraft’s ability to climb, the pilot reported “I uh I’d be careful of this area over here on your right side. I don’t know what that was but we couldn’t maintain airspeed and we could not climb.”

At 0940 PST, the controller asked “are you able to make it to 11,000?” and the pilot responded, “At this point that’s all we can do and we’re at blue line climb right now too so I’ll let you know.” “Blue line” or

“blue radial” airspeed is documented at 100 knots, indicated airspeed (KIAS) in the Pilot’s Operating Handbook (POH) and is considered to be the one engine inoperative best rate of climb speed.

At 0941 PST, the controller coordinated with SLC ARTCC and stated that the aircraft was “struggling to maintain 10,000. Can he do that between there and Baker?” and the SLC controller stated, “No, he needs to go up to 11,000, that’s our MIA (Minimum IFR Altitude) there.” The SEA controller then stated, “Okay, he’s got some sort of problem. I’ll vector him to how about approaching Baker from the north side? Is uh any better?” The SLC controller responded “he’d have to be north of the 297 radial to get anything lower than 11,000.”

At 0941 PST, the SEA controller radioed the aircraft and stated “for terrain turn left heading of 350 vector you up to the north of uh northwest of destination and then you’ll be able to approach at a lower altitude. Higher altitudes between your present position and Baker make it unable at 10,000.”

At 0942 PST, the pilot radioed “We’re losing it here.” Ten seconds later the transmission was repeated. There were no further radio communications with this aircraft.

Several witnesses took note during the mishap chain of events. A witness who was located approximately three nautical miles south of the mishap site reported that a little after 0900 PST on the morning of the mishap he observed an aircraft “come out of the clouds.” He indicated that the aircraft was turning and that he “could hear the motors or motor” and that “it sounded OK to me.” He also stated the weather conditions in his area were “cloudy and stormy with blowing snow squalls.”

The wreckage was located in mountainous terrain approximately ten nautical miles northwest of Bates, Oregon by three witnesses lodging at a cabin several hundred yards generally south of the mishap site. They reported hearing the aircraft, but none observed the aircraft in flight. Their description of the sound made by the aircraft included statements reporting “the engine was running,” “it sounded to me like it was under full throttle and power,” and “sounded to me like it had engines running with power.” A fourth person in the cabin group who had left the cabin just prior to the mishap described what he heard as “a very loud roar of airplane motors.”

The witnesses reported that the aircraft sounded as if it were low and turning. Subsequent to the sound of impact, the witnesses proceeded to the mishap site taking approximately five minutes to arrive and found the wreckage with its forward section engulfed in a post mishap fire. The pilot and all three passengers lost their lives. The aircraft was destroyed.

One of these witnesses took a number of photographs while proceeding circumferentially around the mishap site. Additionally, a close-up photograph of the empennage during the post crash fire shows ice accretion on the leading edge of the vertical and right horizontal stabilizers.

The aircraft had been fueled with 35 gallons of fuel per side the night previous to the mishap. The fueling facility could not verify whether the aircraft’s fuel tanks were topped off at the time of the fueling. A weight and balance was correctly completed prior to the mission.

The POH (found at the mishap site) contained information on icing and this aircraft. A warning provided stated that ice protection equipment on the aircraft was “not demonstrated to meet requirements for flight into known icing conditions.” Another section reiterates the same point. This aircraft did not have ‘Beech Kit No. 58 5012’ and as a result, was not certificated for flight into known icing conditions. A minimum of 130 KIAS was needed when encountering icing conditions.

This aircraft’s last inspection, a 100 hour, was performed in September of 1992. Engine number one had an unknown total time on it, but had worked ten hours since it’s last inspection. The same was true for engine number two. The airframe had a total time of approximately 3,100 hours.

The NTSB analyzed the recorded communications between the aircraft and the ARTCC’s during the time span between 0922 PST and 0942 PST. The calculated propeller rpm during these transmissions ranged

from a low of 2,442 to a high of 2,560; however, it could not be determined whether the propeller rpm calculated was representative of one or both propellers. The rpm's remained relatively consistent at 2,500 during the last two minutes of communication and at the time of the second to last transmission whereby the pilot radioed, "Uh, we're losing it here."

The commercially certificated instrument rated pilot had an accumulated total time in all aircraft of 2,380 hours. 2,073 of these hours were as the PIC. He had 245 hours in this make and model; two of these hours were in the previous 24 hours. He had 1,962 hours ASE, 310 hours in AME, 125 hours at night, 199 hours actual instrument, and 35 hours simulated instrument time. This flight experience was primarily derived using the pilot's Forest Service initial qualification form dated May 15, 1992. Additional flight time was acquired from records maintained by the FAA medical division. He had successfully completed an FAA administered FAR Part 135 check ride conducted in this aircraft on May 13, 1992, demonstrating currency, competency, line check completion, and IFR proficiency.

In addition to employment with the Forest Service, this pilot was the Chief Pilot and only known employee of a recently certificated Part 135 operator that maintained a contract for air services with the Forest Service dated July 28, 1992.

When an individual identifying himself with this aircraft's registration number called the McMinnville, Oregon FAA Flight Service Station (FSS) to obtain a weather briefing, he was told that "winds aloft at 12,000 feet for this morning until 1000 starting out over the Medford area, winds are 300 at 55 knots. By the time you get to Redmond and eastward same direction 60 knots. (sic)" The weather briefer remarked at the beginning of the weather briefing that "we're going to have some not too friendly airmets here" and that "you've got an airmet for icing, occasional moderate rime or mixed icing in clouds and in precipitation. Freezing level to 18,000 feet and the highest I see freezing level is down around Medford area, probably in the order of 9,000 feet. And over Redmond freezing level around 6,000, over Baker maybe around 5,000, be getting pretty close to the ground back there."

The briefer continued, stating "and that was occasional moderate or mixed in any clouds or precip, occasional moderate to isolated severe turbulence surface to 18,000 feet anywhere along the route, but especially lee of the mountains and lee of the mountains will be on the east side today." Additionally, the briefer referenced a pilot report as follows, "I have one pilot weather report, a British Jetstream out of Medford apparently one of the Horizon flights indicated 11,000 overcast, tops 15,000 feet on layers above these that are showing up on the observation, indicated light icing 11,000 to 15,000, didn't indicate the type of icing that was rime icing on that."

The NTSB concluded that the aircraft collided with terrain during an uncontrolled descent following a loss of control after being issued a heading change by SEA ARTCC during climb. The aircraft appeared to have impacted the ground at approximately 7,300 feet MSL. The terrain at the site was characterized as an open, snow covered, mountainous area, sloped uniformly 17 degrees downhill to the south along a 190-degree magnetic bearing line. Instrument Meteorological Conditions (IMC) prevailed in the vicinity of the mishap site.

The Forest Service investigation report simply stated the causal factor of this mishap to be that the aircraft was flown into meteorological conditions that resulted in the loss of the aircraft's ability to climb and maintain a safe altitude and flying speed. Control of the aircraft was lost as a result of the effects of the adverse conditions.



Composite view of the ground impact site looking upslope 343-degree magnetic. Note the right wingtip (arrow 1) and right wing outboard (aileron) trailing edge (arrow 2).

This photo was taken after the investigation team was able to gain access to the site, previously unable due to inclement weather conditions, on the afternoon of November 5, 1992.

A Cessna 340 had been flying air attack over fires on the Lincoln National Forest for one week based out of the Alamogordo Airtanker Base at the Alamogordo-White Sands Regional Airport (ALM), New Mexico. The ATGS flying in this aircraft knew the 100-hour inspection time was approaching and requested a replacement aircraft. The replacement aircraft, a Forest Service contracted Cessna T337C (Skymaster), and contract pilot arrived at the ALM on May 12, 2000 to fill this request.

A standard briefing was conducted upon the Cessna T337C's arrival at the ALM. Zone Dispatch requested two aerial fire detection flights over the Sacramento Mountain Range for Monday, May 15th. The first flight was requested to take place around 1100 MDT and the second flight was to take place later in the afternoon.

There were three available ATGSs and four available pilots (platforms) at the ALM and they called themselves into a meeting where upcoming maintenance, flight times, and duty times were discussed. A schedule for the next few days was formulated. One of the air attack/observers had been assigned to fly in the Cessna 340 on May 15th, but he reasoned that since there were two aerial detection missions scheduled, it would be beneficial to split the flight time between the two aircraft assigned to the Zone. He therefore announced, in the meeting, that he would take the Cessna T337C on the morning flight and the Cessna 340 on the afternoon flight. Dispatch was not officially informed of this change in aircraft for the two missions.

At 1229 MDT, the Cessna T337C departed Runway 21 at the Alamogordo Airport with the pilot occupying the left seat and the ATGS/observer in the right seat. They departed climbing easterly towards Alamo Canyon, which was not the flight route normally used for aerial detection flights. The aircraft flew toward very high terrain and into conditions of reported down drafts.

Minutes later, Zone Dispatch was informed of a smoke sighting near Alamo Canyon at 1235 MDT. Suspecting an aircraft mishap, there was initial uncertainty as to which aircraft and crew might have experienced the mishap. Nonetheless, they immediately attempted radio contact with the Cessna T337C. Receiving no contact, immediate search and rescue actions were taken.

Aircraft were launched to the smoke at 1251 MDT. At 1304 MDT, all air operations, except those involved in search and rescue, were shut down. The post mishap fire required retardant drops and was contained at six acres. The site was secured by 1356 MDT. The two persons on board the Cessna T337C were confirmed fatally injured at 1515 MDT.

An eyewitness reported seeing the aircraft near Alamo Canyon making a left turn toward a northeasterly direction and then entering a spin. He could not hear any engine sounds. Within a couple of seconds, the eyewitness observed the aircraft go behind a ridgeline. He heard the sound of the mishap and then saw a plume of rising black smoke.

The terrain of the mishap site was in foothills at an elevation of 6,254 feet MSL. The weather was VMC with ten miles of visibility, calm winds, and clear. Aircraft were operating in high-density altitude conditions. There was light turbulence.

The aircraft was certified by the FAA. In addition, the aircraft was certified by the Forest Service for the mission being flown at the time of the mishap, but was certified as an air attack platform without a physical inspection. The aircraft had its last inspection, a 100 hour, on May 11, 2000. The aircraft had no known maintenance deficiencies at the time of the mishap flight. It had a reported 76.77 gallons of 100 low lead (LL) on board (522 pounds) at the time of the mishap.

The fuel selector was found in the auxiliary position, a non-standard position for the climb-out phase of flight. The post mishap fire destroyed the aircraft fuselage and wings. The tailbooms, vertical and horizontal stabilizers, rudders, and elevators sustained substantial damage. The aircraft was being operated in standard configuration and was within weight and balance limits. The cabin did not maintain structural integrity.

The forward engine sustained severe impact damage on the nose section and was subject to severe fire damage. The nose case was broken, exposing the forward crankshaft. The propeller remained attached.

The aft engine sustained severe fire damage, though not as severe as the forward engine. The impact damage to the rear engine was not as extensive as that to the forward engine. The propeller remained attached to the flange and it was noted that this propeller appeared to be feathered. Engine teardown analysis revealed that the pilot had manually feathered the rear engine.

The pilot was properly certified by the FAA and was certified by the Forest Service for the mission being flown. He held an ATP and had accumulated 8,800 hours of total time in all aircraft. 8,120 of those hours were as the PIC. He had 875 hours in the Cessna 337. He had flown 6,350 hours ASEL and 2,350 hours in AMEL. In the previous 24-hour period, he had flown 1.6 hours and had the required rest period. His last agency flight evaluation was upon initial certification in 1984.

The passenger acting as the ATGS/observer was a Forest Service employee who was qualified, certified, and current for the mission being flown. The investigation team made these observations: 1. The pilot and the observer did not follow the normal flight mission profile for Southwest Zone aerial detection missions. The normal flight mission profiles were not documented in any written form. 2. The pilot and observer were behind schedule for the days' mission and may have departed from the normal flight profile in an attempt to make up time. 3. The pilot and the observer may have flown into Alamo Canyon with the intent of capturing updrafts off the mountains to gain altitude to clear the terrain and start the mission at midpoint in order to make up time. 4. The engine teardown analysis revealed no mechanical explanation for the aft engine to be feathered. 5. The forward engine turbocharger teardown showed slight scoring possibly caused by foreign object damage.

Wind conditions associated with mountain updrafts and downdrafts may have contributed to the mishap sequence.



View of Cessna T337C, looking approximately southwest, towards Alamogordo-White Sands Regional Airport, New Mexico.



Overhead view of mishap site, approximate southwest heading.