



National Transportation Safety Board Aviation Accident Final Report

Location:	Modena, UT	Accident Number:	WPR12GA243
Date & Time:	06/03/2012, 1347 MDT	Registration:	N14447
Aircraft:	LOCKHEED P2V-7	Aircraft Damage:	Substantial
Defining Event:	Low altitude operation/event	Injuries:	2 Fatal
Flight Conducted Under:	Public Aircraft		

Analysis

Tanker 11 departed the tanker base to conduct its second fire retardant drop of the day in the same location. Upon arriving in the fire traffic area, Tanker 11 followed the lead airplane into the drop zone, which was located in a shallow valley 0.4 mile wide and 350 feet deep. The lead airplane flew a shallow right turn onto final and then dropped to an altitude of 150 feet above the valley floor while approaching the intended drop zone. While making the right turn onto final behind the lead airplane, Tanker 11's right wing tip collided with terrain, which resulted in a rapid right yaw and subsequent impact with terrain. The wreckage created a 1,088-foot-long debris field, and a postimpact fire ensued.

Two witnesses took photographs of the accident sequence photos, and an examination of these photographs showed that the lead airplane was positioned ahead of the tanker throughout the flight; however, the orientation of the lead airplane compared to the orientation of Tanker 11 indicated that Tanker 11 did not directly follow the lead airplane's path to the final drop course. Rather, it was about 700 feet left of the lead airplane's path and made a wider right turn as it attempted to align with the final drop course. The accident flight crewmembers had previously flown nearly the same exact drop and the lead pilot cautioned them about tailwind conditions during the flight; however, the wider turn suggests that they did not properly compensate for the wind conditions while maneuvering. In addition, the previous flight was conducted at an altitude above the ridgeline. GPS evidence indicates that the accident flight was conducted below the ridgeline, which would have made it more difficult to detect the rising terrain during the wider turn. A review of the airplane's cockpit voice recorder audio information revealed that the flight crew did not recognize or attempt to correct the reduced clearance between Tanker 11 and the rising terrain until about 2 seconds before impact.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The flight crew's misjudgment of terrain clearance while maneuvering for an aerial application run, which resulted in controlled flight into terrain. Contributing to the accident was the flight crew's failure to follow the lead airplane's track and to effectively compensate for the tailwind

condition while maneuvering.

Findings

Aircraft	Altitude - Not attained/maintained (Cause) Descent/approach/glide path - Not attained/maintained (Factor)
Personnel issues	Incorrect action performance - Flight crew (Cause) Use of equip/info - Flight crew (Cause)
Environmental issues	Mountainous/hilly terrain - Contributed to outcome Tailwind - Contributed to outcome

Factual Information

HISTORY OF THE FLIGHT

On June 3, 2012, at 1347 mountain daylight time, a Lockheed P2V-7, N14447, designated as Tanker 11 (T-11) collided with mountainous terrain while conducting firefighting operations, 20 miles north of Modena, Utah. The airplane was operated by Neptune Aviation Services under contract with the US Forest Service as an exclusive public-use fixed-wing airtanker service contract conducted under the operational control of the Bureau of Land Management (BLM). Both pilots were fatally injured. The airplane was destroyed by impact forces and post crash fire. Visual meteorological conditions prevailed, and a company flight plan had been filed. The flight originated in Cedar City, Utah, at 1315.

The crew of Tanker 11 consisted of the pilot, copilot, and crew chief. They were based out of Missoula, MT, and had been together as a crew for the previous 3 weeks. Normally, the crews stay together for the entire fire season. Tanker 11 crew had operated out of Reno for the 2 weeks prior to the accident. During fire drop operations the tanker is manned by the pilot and copilot, while the crew chief remains at the fire base as ground personnel. The day before the accident while en route from Reno to Cedar City they performed one retardant drop on the White Rock fire, then landed at Cedar City. The crew departed the Cedar City tanker base and arrived at their hotel in Cedar City around 2230. The following morning, the day of the accident, the crew met at 0815, and rode into the Cedar City tanker base together. Tanker 11 took off at 1214 on its first drop on the White Rock fire, and returned at 1254. The crew shut down the airplane, reloaded the airplane with retardant, and did not take on any fuel.

Tanker 11 departed the tanker base at 1307 to conduct its second retardant drop of the day, which was to be in the same location as the first drop. Upon arriving in the Fire Traffic Area (FTA) Tanker 11 followed the lead airplane, a Beech Kingair 90, into the drop zone. The drop zone was located in a shallow valley that was 0.4 miles wide and 350 feet deep. The lead airplane flew a shallow right-hand turn on to final, then dropped to an altitude of 150 feet above the valley floor over the intended drop area. While making the right turn on to final behind the lead plane, Tanker 11's right wing tip collided with terrain that was about 700 feet left of the lead airplane's flight path, which resulted in a rapid right yaw, followed by impact with terrain; a fire ball subsequently erupted. Tanker 11 created a 1,088-foot-long debris field and post impact fire.

PERSONNEL INFORMATION

The captain, age 48, held an Airline Transport Pilot (ATP) certificate with ratings for airplane multiengine land, and commercial privileges for single-engine land, issued on January, 25, 2010, and a second-class airman medical certificate issued on January 17, 2012, with no limitations. The captain reported on his Forest Service Airplane Qualification and Approval Record, dated February 23, 2012, that he had 6,136 total flight hours. His most recent Federal Aviation Regulation (FAR) Part 61.58 pilot-in-command proficiency check was dated February 20, 2012, and was issued his USDA USID Interagency Airplane Pilot Qualification Card, with an expiration date December 31, 2012.

The first officer, age 40, held an Airline Transport Pilot (ATP) certificate with ratings for airplane multiengine land, commercial privileges for airplane single-engine land issued on October 29, 2010, and a first-class airman medical certificate issued on March 5, 2011, with no

limitations. The pilot reported on his Forest Service Airplane Pilot Qualification and Approval Record, dated February 20, 2012, that he had 4,253 total flight hours. His most recent FAR Part 61.55 second-in-command check flight was completed on February 20, 2012, and was issued his USDA USID Interagency Airplane Pilot Qualification Card, with an expiration date of December 31, 2012.

AIRPLANE INFORMATION

The Lockheed P2V-7 Neptune was a decommissioned US Navy 4 engine maritime patrol airplane that had been converted for firefighting operations by Neptune Aviation Services, Inc., and was registered to Neptune Aviation Services on September 13, 1993. The airplane, serial number 8010, was manufactured in 1962. It was powered by two Curtis Wright R3350-32W 3,400-hp engines, equipped with two 4-bladed Hamilton Standard model 24260-323 constant speed propellers, and two Westinghouse J34-WE-36A 3,400-lbf jet engines. Review of airplane maintenance records showed that the airplane was on an approved inspection program (AIP), and the most recent annual inspection was completed on March 9, 2012, at a total aircraft time of 12,293.6 hours. At the time of the accident the total airframe time was 12,311.9 hours, the No. 1 radial engine had 1,643.9 hours since major overhaul (TSMOH), the No. 2 radial engine had 948 hours TSMOH, the No. 1 propeller had 2,777.3 hours TSMOH, the No. 2 propeller had 2,360.9 hours TSMOH, the No. 1 jet engine had 227.3 hours of time in service, and the No. 2 jet engine had 246.8 hours of time in service.

A review of the most recent airplane weight and balance documentation dated June 26, 2010, showed that the maximum gross weight for the airplane was 80,000 lbs, and that the operational weight with 18,720 lbs of fire retardant was 76,793 lbs. Maximum forward center of gravity (CG) limitation was 19.5% of the mean aerodynamic chord (MAC) and maximum aft CG limitation was 38.0% of MAC. The calculated weight of the airplane at the time of the accident with 2 crew, 18,676 lbs of fire retardant, and 7,500 lbs of fuel was 71,117 lbs, which resulted in a calculated takeoff CG of 32.4% of MAC.

FLIGHT RECORDERS

Appareo GAU2000

The Appareo GAU2000 recorder is a lightweight, self-contained attitude, air-data and GPS recording system. The small recorder has an internal GPS unit that provides latitude and longitude position, and GPS altitude and GPS track. The unit also has air data inputs, that when attached to the aircraft's pitot static system, provides indicated airspeed and pressure altitude of the aircraft. The unit also has a mini attitude reference (AHARS) unit that senses 3-axis accelerations and records sufficient information to derive aircraft pitch, roll, and yaw. The memory module that was recovered at the accident scene was sent to the NTSB Vehicle Recorder Laboratory, Washington, DC.

The memory chip from the accident unit was removed from what was left of the circuit card. The chip was cleaned and placed in the lab's memory chip programmer/reader using the appropriate device socket. An image copy of the accident memory chip was obtained. The recording contained approximately 60 flights, which dated back several years. It should be noted that the recorded data stops about 1/4 of a mile from the point of 1st impact as provided by the investigator-in-charge (IIC). The Appareo units buffer a small segment of data prior to writing it to memory. Where the unit is at in its buffer/write cycle determines how much data is lost during a catastrophic shutdown of the unit.

The data for the day of the accident included the flight tracks for both the first retardant drop of the day and the accident flight. Both the first retardant drop flight and the subsequent accident flight departed from the Cedar City airport, with the intended retardant drop zone in the same location.

The track data of the first flight depicts the tanker flying northwest from Cedar City 58 miles. Upon arrival into the FTA, the track shows a single 180° holding orbit, followed by a teardrop type course reversal that progresses into a right-hand turn onto the final drop course. During the 90 seconds prior to the release of the retardant load the mean sea level (msl) altitude data depicts a fairly steady 6° glide slope into the target area, starting at 8,500 feet msl, down to 7,750 feet msl at a rate of descent of 562 feet per minute (fpm); during the same period the ground was rising at a rate of about 1,350 fpm. During the last 10 seconds of the run the airplane descended 500 feet, then leveled off at 7,250 feet msl, about 100 feet above ground level (agl), and remained at that altitude for 5 seconds before gaining altitude. The track data shows that the airplane departed from the drop zone by making a climbing right-hand turn towards a southwest course back to Cedar City.

The data for the accident flight is continuous from Cedar City to ¼ mile before the location of terrain impact. The track data depicts the tanker flying northwest from Cedar City 58 miles. Upon arriving in the FTA, the track data shows Tanker 11 executing a right-hand 360° holding orbit, followed by a tighter 270° orbit, then a left turn for a teardrop type of course reversal to start the approach into target zone. The last 74 seconds of data depicts the tanker at a steady altitude of 7,750 feet msl (zero glide slope) while the terrain was rising at a rate of about 712 fpm. The ground track of Tanker 11 as it aligned its final course with the drop zone was similar to the first drop earlier that morning.

Comparing the two flights, certain aspects tend to stand out. The same drop zone was identified for both the first and second retardant drops. Tanker 11 approached the drop zone from the south, in a right-hand turn, and the direction of the final drop course was exactly the same for both flights. Tanker 11's rate of turn on to the final course for both drops was performed at the same rate. The most significant difference between the first drop approach and the accident drop approach was that Tanker 11's first approach into the drop zone was initiated from a higher altitude, about 1,000 feet above the ridge line surrounding the west side of the fire, and had a relatively steady rate of descent on to the final drop course. In comparison, the accident flight approached the final drop course from a lower altitude that approximated the elevation of the ridge lines surrounding the west side of the drop zone in level flight while it turned onto the final drop course. The track and altitude data that depict the first drop shows that Tanker 11 flew over the west ridge line and then rapidly descended to get to the proper drop altitude while on the final drop course. The track and altitude data that depict the accident flight shows that Tanker 11 was turning inside and below the shallow valley formed by the western ridge line, which would have reduced the amount of altitude needed to descend in order to establish the proper drop altitude as the airplane rolled out onto its final drop course.

Cockpit Voice Recorder (CVR)

Tanker 11 was equipped with a CVR that records the last 30 minutes of aircraft operation. The digital audio recording is stored on solid state memory modules. Four channels of audio

information are retained: one channel for each flight crew and one channel for the cockpit area microphone (CAM).

Upon examination of the CVR by the NTSB Vehicle Recorder Laboratory, it was evident that the CVR had sustained extensive fire and heat damage. The memory case was removed and the interior crash-protected case was opened. The memory board within the crash-protected case was checked for heat or structural damage, and none was found. The accident memory was successfully downloaded from the memory board using the laboratory's surrogate Universal CVR chassis.

The recording and transcript began at 1308:28, just prior to engine start. The recording continued uninterrupted during the taxi, takeoff, and transit to the fire. The crew made contact with the lead airplane (Lead 8) at 1328:54. At 1335:55, the captain calls to start the jet engines and position flaps to 10 degrees. At 1336:25, the first officer states that the number 2 jet engine didn't start, and at the same time Lead 8 informs the crew that there is a bit of a tailwind and to start on to final early. During the same transmission Lead 8 states that 7,100 feet will clear the terrain, and that there will be higher terrain off of the right wing. At 1337:26, the crew gets the number 2 jet engine started. At 1339:09, the captain calls to Lead 8 and states that the spacing (between their aircraft) is good. Lead 8 replies that he'll start the base turn and keep it in all the way to final. At 1340:08, Lead 8 says he has the retardant line in sight. At 1340:13 the captain calls for "jets to idle." Eight seconds later the captain calls for "jets," the first officer calls for "airspeed," the captain calls out "jets" again, which was followed by the sounds of first impact.

The recording ended at 1340:24 when electrical power to the recorder was discontinued.

WRECKAGE AND IMPACT INFORMATION

The Hamblin Valley terrain consisted of two ridges that run downhill to the northeast starting at about 7,500 feet msl, creating a shallow valley with a 26-degree slope. Terrain was populated with pinion pine and juniper trees, with sage brush cover. The area was completely burned over at the time of examination, with the ground foliage cover burned out, and tree canopy completely consumed.

The initial point of impact was identified by severed tree tops and the edge of a strip of retardant that was released by the airplane. Trees and bushes coated with retardant appeared plowed up, split, and uprooted along the retardant line. The farthest piece of heavy debris down range from the initial impact was the right-hand radial engine, which was located about 1,088 feet down the valley on a bearing of 057 degrees magnetic.

Wreckage on the top of the ridge closest to the initial point of impact was the right jet engine, right wing tip, and wing flap section. Two flap jackscrews were located in the vicinity of the initial point of impact. A scattering of light debris, which included some cockpit instruments, canopy bows, propeller, Appareo memory module, and fuselage skin from the nose section, was located about 450 feet down hill from the initial point of impact.

Heavy debris was located starting about 865 feet down hill from the ridge line. This debris section contained the retardant tanks and bay doors, cockpit, left radial engine and propeller, left jet engine, wing box, and tail section. The CVR was located next to the tail wreckage. The right-hand radial engine was located about 225 feet beyond the main wreckage, and a propeller tip was located along the fire access road beyond the right-hand radial engine.

Two witnesses had positioned themselves about 1/3 of a mile from the Hamblin Valley on a fire

access road where they had a view of the fire tankers dropping retardant. The witnesses captured a 5-frame photo sequence of Tanker 11 colliding with the ridge line. The first photo shows the airplane in a right bank, the right wingtip was hidden by the trees and foliage on the ridge, and a plume of red fire retardant product was being released by the airplane. The second photo revealed that the tanker had rotated to the right about 90 degrees, the right wing was completely hidden by the trees, and a fireball near the right wingtip and right wing was erupting. The third photo shows that the airplane had rotated 180 degrees from the direction of travel and a large fireball had emanated from the right side of the airplane. The fourth and fifth photos show an expanding fireball and black smoke. In all frames of the photo sequence the lead airplane, a twin-engine Beech Kingair 90, can be seen ahead of the tanker and positioned slightly more to the south than the tanker, and in the vicinity of the fire access road at a lower altitude between the two ridges.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the captain on June 4, 2012, by the Utah Department of Health, Office of the Medical Examiner, Salt Lake City, Utah. The listed cause of death was blunt force trauma.

The FAA Forensic Toxicology Research Team, Civil Aerospace Medical Institute (CAMI) performed forensic toxicology on specimens from the captain with negative results for ethanol and listed drugs. Carbon monoxide and cyanide tests were not performed.

An autopsy was performed on the first officer on June 4, 2012, by the Utah Department of Health, Office of the Medical Examiner, Salt Lake City, Utah. The listed cause of death was blunt force trauma.

The FAA Forensic Toxicology Research Team, Civil Aerospace Medical Institute (CAMI) performed forensic toxicology on specimens from the first officer with negative results for cyanide, ethanol, and listed drugs. Carbon Monoxide tests were not performed due to the suitability of the specimens.

History of Flight

Maneuvering-low-alt flying

Low altitude operation/event (Defining event)

Pilot Information

Certificate:	Airline Transport; Commercial	Age:	48, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 2 Without Waivers/Limitations	Last FAA Medical Exam:	01/17/2012
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	02/20/2012
Flight Time:	6145 hours (Total, all aircraft), 1850 hours (Total, this make and model), 17 hours (Last 90 days, all aircraft), 7 hours (Last 30 days, all aircraft)		

Co-Pilot Information

Certificate:	Airline Transport; Commercial	Age:	40, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	
Medical Certification:	Class 2 Without Waivers/Limitations	Last FAA Medical Exam:	03/14/2012
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	04/05/2011
Flight Time:	4288 hours (Total, all aircraft), 38 hours (Total, this make and model), 55 hours (Last 90 days, all aircraft), 12 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	LOCKHEED	Registration:	N14447
Model/Series:	P2V-7	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Restricted	Serial Number:	8010
Landing Gear Type:		Seats:	3
Date/Type of Last Inspection:	05/09/2012, AAIP	Certified Max Gross Wt.:	767925 lbs
Time Since Last Inspection:	20 Hours	Engines:	4 Reciprocating
Airframe Total Time:	12313 Hours at time of accident	Engine Manufacturer:	WRIGHT
ELT:	C91 installed, not activated	Engine Model/Series:	R3350-32WA
Registered Owner:	NEPTUNE AVIATION SERVICES INC	Rated Power:	3400 hp
Operator:	NEPTUNE AVIATION SERVICES INC	Operating Certificate(s) Held:	Agricultural Aircraft (137)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	KCDC, 5622 ft msl	Distance from Accident Site:	60 Nautical Miles
Observation Time:	1350 MDT	Direction from Accident Site:	130°
Lowest Cloud Condition:	Clear	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	9 knots / 19 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	220°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.03 inches Hg	Temperature/Dew Point:	32° C / -4° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Cedar City, UT (KCDC)	Type of Flight Plan Filed:	Company VFR
Destination:	Cedar City, UT (KCDC)	Type of Clearance:	None
Departure Time:	1315 MDT	Type of Airspace:	

Airport Information

Airport:	Cedar City Regional Airport (KCDC)	Runway Surface Type:	
Airport Elevation:	5622 ft	Runway Surface Condition:	
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	38.114722, -114.037222

Administrative Information

Investigator In Charge (IIC):	Van McKenny	Report Date:	09/24/2014
Additional Participating Persons:	Robert Hendrickson; Federal Aviation Administration; Washington, DC Keith Raley; Dept of Interior; Boise, ID Dan Snyder; Neptune Aviation Services; Missoula, MT Kirk Rothwell; Bureau of Land Management; Boise, ID Jim Morrison; US Forest Service; Ogden, UT		
Publish Date:	09/24/2014		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=83831		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).