

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# CEN15FA331	08/01/2015 700 CDT	Regis# N6007N	Wilmot, AR	Apt: N/a
Acft Mk/Mdl AIR TRACTOR INC AT 602-NO SERIES	Acft SN 602-1192	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual	Prob Caus: Pending
Eng Mk/Mdl PRATT AND WHITNEY PT6A-60AG	Acft TT 2670	Fatal 1 Ser Inj 0	Flt Conducted Under: FAR 137	
Opr Name: BAYLEE CO	Opr dba:		Aircraft Fire: NONE	

Summary

The commercial pilot was repositioning the airplane to a grass airstrip where it was to be loaded with chemical for aerial application work. Visual meteorological conditions prevailed with clear skies and 10-mile visibility. GPS data extracted from an onboard aerial guidance system showed that the airplane took off, climbed to 1,000 ft mean sea level (msl), and proceeded south on course. While en route, the airplane descended to 500 ft and turned to the southwest. About 8 minutes into the flight, the airplane began a rapid climb, turned to the northwest, and decreased and increased in altitude before it entered a rapid descent to the ground.

When the airplane did not arrive at the grass airstrip, one of the operator's crewmembers contacted the county sheriff's department and reported the airplane missing. The airplane wreckage was found in a cornfield about 18 nautical miles (nm) southwest of the departure airport and about 2 nm to the west of the direct course to the grass airstrip. No witnesses to the accident were identified.

Examination of the wreckage and ground scars revealed signatures consistent with the airplane impacting the ground in a steep, nose-down attitude. Control continuity was established from the cockpit to the flight control surfaces. An examination of the airplane's engine and systems revealed no anomalies that would have precluded normal operations.

The pilot's autopsy identified moderate three vessel coronary artery disease without evidence of previous scar or muscle injury, and he had a family history of sudden cardiac death in his father at age 39. Based on his age (38) and family history, the pilot was at increased risk of an acute cardiac event such as an arrhythmia or a heart attack that could have caused acute symptoms to include chest pain, shortness of breath, palpitations, or fainting. Any such symptom would likely have been impairing or incapacitating.

The pilot's toxicology showed evidence of the use of two potentially impairing medications, Suboxone, used to treat opioid addiction, and diphenhydramine, a sedating antihistamine. Suboxone is typically dosed based on the patient's response to the drug, which is influenced by the degree of underlying tolerance and addiction. Regular users are likely to become tolerant to the sedating effects of Suboxone, but there is a potential for abuse; users may increase their dose to obtain desired psychoactive effects. These effects are similar to those of other opioids to include euphoria, a feeling of well-being, relaxation, drowsiness, sedation, lethargy, disconnectedness, self-absorption, mental clouding, and delirium.

Compared to other antihistamines, diphenhydramine causes marked sedation, and altered mood and impaired cognitive and psychomotor performance may also be observed. In a driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol of 0.100. The usual therapeutic range for diphenhydramine is 0.250 to 0.1120 ug/ml, much lower than the measured level of 1.861 ug/ml in the pilot. However, diphenhydramine undergoes significant postmortem distribution; central levels may be three times higher than peripheral levels. Taking postmortem distribution into account still leaves the pilot at a high level of diphenhydramine, almost six times higher than the usual high end of the therapeutic range. The GPS data for the initial part of the flight, which shows the pilot in control of the airplane suggests that the pilot was regularly using high doses of diphenhydramine and may have become tolerant to some of its effects.

However, even if the pilot had become tolerant to some of the effects of Suboxone and diphenhydramine, in combination, they were likely causing some degree of impairment. If the pilot had taken extra Suboxone or diphenhydramine and unintentionally overdosed, the effects would likely have been acutely impairing or incapacitating.

The airplane's GPS track and its steep, nose-down impact attitude indicate that the pilot lost control of the airplane. Given that weather was not a factor and that the airplane was capable of normal operation, the most likely reason for the loss of control was pilot incapacitation. Whether the incapacitation was from overuse of a combination of sedating medications or an acute cardiac event could not be determined.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's inability to maintain control of the airplane as a result of incapacitation by drug effects or an acute cardiac event.

National Transportation Safety Board - Aircraft Accident/Incident Database

Events

1. Maneuvering-low-alt flying - Loss of control in flight

Findings - Cause/Factor

1. Not determined-Not determined-(general)-(general)-Unknown/Not determined - C
2. Personnel issues-Task performance-Use of equip/info-Aircraft control-Pilot - C
3. Personnel issues-Physical-Impairment/incapacitation-(general)-Pilot - C
4. Personnel issues-Physical-Health/Fitness-Predisposing condition-Pilot
5. Personnel issues-Physical-Health/Fitness-Use of medication/drugs-Pilot

Narrative

HISTORY OF FLIGHT

On August 1, 2015, about 0700 central daylight time, an Air Tractor AT-602 airplane, N6007N, impacted terrain following a loss of control near Wilmot, Arkansas. The commercial pilot was fatally injured, and the airplane was substantially damaged. The airplane was registered to and operated by the Baylee Company under 14 Code of Federal Regulations Part 137. Visual meteorological conditions prevailed, and no flight plan was filed for the aerial application positioning flight that originated at Lake Village Municipal Airport (M32), Lake Village, Arkansas, about 0646, and was en route to a grass airstrip 6 nautical miles (nm) east of Wilmot.

GPS data extracted from an onboard Hemisphere Intellistar CPU aerial guidance system showed that the airplane departed M32, climbed to 1,000 ft mean sea level (msl), and proceeded south. About 4 minutes into the flight, the airplane turned to the southwest and began a gradual descent to 500 ft where it leveled off.

About 4 minutes later, the airplane began a rapid climb to 1,000 ft msl and entered a 270° left turn toward the northwest. The airplane's altitude then decreased and then began to increase again as the airplane continued to turn left. The airplane then entered a rapid descent. The recording ended at 0654:24 with the airplane at 520 ft msl, in a descent and turning toward the south at a groundspeed of 150 knots.

At 0938, one of the operator's crewmembers contacted the county sheriff's department and reported that the airplane had not arrived at the grass airstrip where chemical loading operations were to take place. A search was started, and the airplane wreckage was found about 1058 in a cornfield about 2 nm northeast of Wilmot. The accident site was about 18 nm southwest of M32 and about 2 nm to the west of a direct course from M32 to the grass airstrip. No witnesses to the accident were identified.

PERSONNEL INFORMATION

The pilot, age 38, held a commercial pilot certificate with single-engine land airplane rating. On January 23, 2015, he received a second-class medical certificate limited by a requirement to wear corrective lenses when he flew. The pilot did not include his current flight time on the application for this medical certificate.

No pilot logbooks were made available during the investigation. On his previous medical application, on July 1, 2014, the pilot reported 13,600 total hours and 300 hours during the 6 months before the exam. A paper found among the pilot's personal effects showed that he successfully completed a flight review on June 25, 2014.

AIRCRAFT INFORMATION

The single-place, low-wing, turbine-engine-powered airplane, serial number 602-1192, was configured for aerial application. It was equipped with two 108-gallon fuel tanks and was powered by a 1,050-horsepower Pratt and Whitney PT6A-60AG engine, serial number RG0168, and a 5-bladed Hartzell HC-B5MP-3C propeller. A 630-gallon chemical tank was located forward of the cockpit and aft of the firewall.

A review of the airplane maintenance records revealed that the airplane had undergone an annual inspection on December 12, 2014, at a total airframe time of 2,195.6 hours. The Hobbs meter read 2,669.9 hours at the accident site.

METEOROLOGICAL INFORMATION

At 0653, the automated weather observation station at Mid-Delta Regional Airport, Greenville, Mississippi, 34 nm northeast of the accident site, recorded wind 360ø at 5 knots, visibility 10 miles, clear skies, temperature 70øF, dew point 66øF, and altimeter setting 30.02 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest in a nose-down, inverted attitude on an impact heading of 060ø. The wreckage was confined to an area that was about 35 ft long and 60 ft wide. The main wreckage consisted of the engine cowling, engine, propeller, chemical tank, main landing gear, wings, fuselage, empennage, and tail wheel. Broken 7 to 8 ft tall cornstalks were crushed beneath the wreckage. There were no broken cornstalks in the area surrounding the wreckage. An impact crater adjacent to the nose of the airplane contained the propeller blades and spinner. A burned area indicative of a postimpact fire was confined to the area beneath and around the engine. The propeller fractured from the engine with mounting flange damage indicating engine torque. The spinner dome was crushed aft around the cylinder, counterweights, and hub components. Two of the five propeller blades fractured from their respective clamps and were found in the impact crater. All five propeller blades showed leading edge chordwise abrasion, and the two fractured blades had forward/thrust direction bending. Impact marks in the piston and on the blade shanks indicated the propeller angle was in the normal operating range at the time of impact.

The airplane's nose section forward of the firewall, including the engine, chemical tank, and main landing gear, was broken downward and separated. The chemical tank was empty. The front cockpit, instrument panel, and glareshield were broken forward and down.

The left and right wings showed aft and downward leading-edge crushing. The smell of fuel was prevalent at the accident site. The flaps and ailerons remained attached to the wings. Examination of the flap system showed that the flap actuator was extended to a 3 7/8-inch position, corresponding to a flap deflection of 28ø or about full flaps. The fuselage aft of the cockpit was intact. The left horizontal stabilizer and elevator were bent forward. The right horizontal stabilizer and elevator were bent aft. The vertical stabilizer and rudder were bent to the right about 25ø starting at mid-span. The tail wheel was undamaged.

Flight control continuity was confirmed from the cockpit to all flight control surfaces. An examination of the engine revealed no preimpact anomalies.

MEDICAL AND PATHOLOGICAL INFORMATION

The Arkansas State Crime Lab, Medical Examiner Division, performed an autopsy on the pilot. The cause of death was reported to be "multiple blunt force injuries." The autopsy identified significant heart disease. All three of the main coronary arteries had atherosclerotic plaque; the left anterior descending and right coronary arteries had luminal narrowing up to 60%, and the left circumflex coronary artery had a focal area of 20% maximum luminal narrowing. None of the coronary arteries had evidence of thrombosis, prior scarring, or muscle injury.

The autopsy report noted the presence in the pilot's pocket of a "clear plastic bag with a prescription label. In the bag were three medication foils (Suboxone) that had been opened in a similar pattern (as if all three were held together in a stack and were torn open at one time)."

The Federal Aviation Administration's (FAA) Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicology testing of specimens from the pilot. The tests detected buprenorphine, norbuprenorphine (buprenorphine's metabolite), ranitidine, and diphenhydramine in heart blood. All of these substances and naproxen were identified in urine.

Buprenorphine is an opioid medication listed as a Schedule III controlled substance, available in combination with the opioid antagonist naloxone as a film that dissolves in the mouth and is commonly marketed with the name Suboxone. This drug is used in the treatment of opioid addiction. Prescription use of Suboxone is limited under the Drug Addiction Treatment Act, which requires prescribers to have special training and certification. It carries a warning, "may impair mental and/or physical ability for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)." Overdosing can cause significant sedation including respiratory depression and death.

Diphenhydramine is a sedating antihistamine used to treat allergy symptoms and as a sleep aid. It is available over the counter under the trade names Benadryl and Unisom. Diphenhydramine carries the following warning: "may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)." Compared to other antihistamines, diphenhydramine causes marked sedation; it is also classed as a central nervous system depressant, which is the rationale for its use as a sleep aid. Altered mood and impaired cognitive and psychomotor performance may be observed. In a driving simulator study, a single dose of diphenhydramine impaired driving ability greater than a blood alcohol concentration of 0.100%. The

National Transportation Safety Board - Aircraft Accident/Incident Database

usual therapeutic range is 0.250 to 0.1120 ug/ml. The pilot's toxicology results indicated 1.861 ug/ml was detected in heart blood.

Ranitidine is a heartburn medication commonly available over the counter with the name Zantac. Naproxen is a non-steroidal anti-inflammatory analgesic available over the counter with the name Aleve. These medications are not generally considered impairing. At the time of the pilot's most recent medical certificate examination on January 23, 2015, he was 69 inches tall and weighed 195 pounds. He reported a previous eye problem, surgery, and hospitalization related to injuries sustained in a motor vehicle crash in 2007. Among his injuries was a broken neck with spinal cord involvement, which required surgery. He was thought to have fully recovered from these injuries. He reported chronic back pain and the use of ibuprofen to control it. According to his family history, the pilot's father died of a heart attack at age 39.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# GAA17CA454	07/25/2017	615 CDT	Regis# N802DL	Trumann, AR	Apt: N/a
Acft Mk/Mdl AIR TRACTOR INC AT 802			Acft SN 802A-0679	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
			Acft TT 358	Fatal 0 Ser Inj 1	Flt Conducted Under: FAR 137
Opr Name: MICHAEL DARIN WALTON			Opr dba:		Aircraft Fire: NONE

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# GAA17CA342	06/15/2017 1300 CDT	Regis# N915AJ	Pocahontas, AR	Apt: N/a
Acft Mk/Mdl AIR TRACTOR INC AT 802		Acft SN 802A-0566	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl P&W CANADA PT6A-65AG		Acft TT 1045	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 137
Opr Name: C&C FLYING SERVICE INC.		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPR

Events

2. Initial climb - Loss of control in flight

Narrative

The aerial application pilot reported that, during the initial climb as soon as the airplane "broke ground," he turned left and subsequently encountered turbulence that caused the left wing to "dip." He added that, he applied full right aileron and rudder, but the airplane continued to sink and turn left. Subsequently, the left wing impacted terrain, the airplane cartwheeled, and a post-crash fire ensued.

The fuselage, empennage, and both wings sustained substantial damage during the impact and post-crash fire.

The pilot reported that there were no preaccident mechanical malfunctions or failures with the airplane that would have precluded normal operation.

An automated weather observation station, 12 nautical miles south, about the time of the accident, reported the wind as calm, clear skies, temperature 84øF (29øC), and dewpoint 64øF (18øC).

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# WPR17LA177	07/31/2017 1140 PDT	Regis# N70LA	Wells, NV	Apt: Wells Muni/harriet Field LWL
Acft Mk/Mdl AIR TRACTOR INC AT 802A		Acft SN 802A-0102	Acft Dmg: SUBSTANTIAL	Rpt Status: Prelim Prob Caus: Pending
Eng Mk/Mdl PRATT AND WHITNEY PT6A-67AG		Acft TT 3653	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 137
Opr Name:		Opr dba:		Aircraft Fire: NONE
				AW Cert: SPR

Events

1. Landing-landing roll - Loss of control on ground

Narrative

On July 31, 2017, about 1140 Pacific daylight time, an Air Tractor AT-802A, N70LA, was substantially damaged during a landing roll at Wells Municipal Airport/Harriet Field (LWL), Wells, Nevada. The commercial pilot was not injured. The airplane was registered to Custom Air, Inc., operated by Henry's Aerial Service, Inc. and under contract with the Department of the Interior to provide aerial application services. Visual meteorological conditions prevailed and a company flight plan was filed for the cross-country flight that departed Battle Mountain, Nevada about 1042 under the provisions of 14 Code of Federal Regulations Part 137.

According to the pilot, after an uneventful flight he entered the airport through the left downwind leg of the traffic pattern for runway 26, which was the active runway at the time of the accident. He observed winds from the north at approximately 10 mph from the midfield windsock and configured the airplane for a wheel landing. The airplane touched down on the main landing gear at approximately 85 mph on the runway centerline. As the airspeed bled off and the tailwheel began to sink back down to the runway surface, the pilot lost all rudder and aileron authority. The pilot subsequently unlocked the tailwheel to prevent the airplane from departing the runway, but it entered a hard right turn. The left main landing gear collided with an imperfection in the asphalt and separated. The left wing then impacted the ground and the airplane rotated 180 degrees before it came to rest on the north side of the runway.

In a subsequent statement, the pilot reported that he did not encounter any mechanical anomalies that could have precluded normal operation. Further, both the pilot and a representative of the Department of the Interior confirmed continuity and function of the rudder after the airplane came to rest.

According to preliminary weather data, variable winds consistent with local circulations and thermals were present in the area at the time of the accident. The data did not show any fronts or existing weather systems at the time of the accident.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ERA16LA042	11/06/2015 1710 EST	Regis# N731LT	Atlanta, GA	Apt: Dekalb-peachtree PDK
Acft Mk/Mdl CESSNA P210-N		Acft SN P21000436	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl ALLISON 250-B17F/2		Acft TT 4809	Fatal 0 Ser Inj 0	Flt Conducted Under: FAR 091
Opr Name: HORST AVIATION LLC		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Events

1. Landing-landing roll - Landing gear collapse

Narrative

On November 6, 2015, about 1710 eastern standard time, a Cessna P210N, N731LT, was substantially damaged while landing at DeKalb-Peachtree Airport (PDK), Atlanta, Georgia. The private pilot and one passenger were not injured. The airplane was registered to Horst Aviation, LLC, but operated by an individual under the provisions of 14 Code of Federal Regulations Part 91 as a business flight. Visual meteorological conditions prevailed at the time of the accident, and the flight was operating on an instrument flight rules flight plan. The flight originated from Smoketown Airport (S37), Smoketown, Pennsylvania, about 1330, and was destined for PDK.

The pilot stated that he expected and was set up for an RNAV approach, but was cleared for the ILS approach to runway 21L. He continued inbound to PDK and upon reaching the final approach fix, he recalled lowering the landing gear, but because of the approach distraction he did not verify that the landing gear was down and locked. He continued the approach, and reported breaking out of the clouds at 2,000 feet. When the airplane was at 200 feet above ground level, he reduced power and did not hear any warning horn. He indicated the landing was normal and very smooth, and after rolling about 400 feet, he heard a "snap" and felt the airplane drop and veer to the left. The airplane rolled off the runway onto grass and came to rest with the nose landing gear down and locked but both main landing gear collapsed. The airplane was raised, and both main landing gear were extended for towing to the ramp.

Following recovery of the airplane, examination of both main landing gear actuators revealed no evidence of leaks or hydraulic residue. A test gauge was plumbed into the aircraft's landing gear hydraulic system and held pressure (1,500+ psi) in the up and down position for more than 10 minutes. The airplane was placed on jacks and several fault-free gear cycles were performed including an emergency extension. The single landing gear down and locked light functioned normally, and left main landing gear down limit switch which felt, "a little sticky", was replaced. There was no report of any damage to either main landing gear downlock hook assembly. A check of the landing gear warning horn revealed it was set 0.3 inch above the flight idle gate, while it is specified to be set 0.6 inch above the flight idle gate. It was adjusted to the specified amount, and although a flight check of the landing gear warning system was not performed during a postaccident maintenance flight check, the repair facility reported it was performed by the owner on the first flight after completion of repairs and no discrepancy was reported.

The airplane's landing gear was hydraulically controlled, and by design the nose landing gear extended aft while the main landing gears extended forward. A representative of the airplane manufacturer reported that during landing gear extension, the nose landing gear locked into place followed by the main landing gear. This was because the nose landing gear extended aft and was assisted by airloads, while the main landing gear extend forward against airloads. During retraction of the main landing gear, the wheel assembly drops about 12 inches below the position when fully extended. Fully locking down of the main landing gear actuator occurs with a downlock hook assembly installed on each main landing gear.

The airplane's last annual inspection was completed on February 26, 2015. There were no reported discrepancies during cycling of the gear that was performed during the inspection. The airplane had accrued about 66 hours since the inspection was performed.

National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# ANC15FA071	09/15/2015 606 AKD	Regis# N928RK	Iliamna, AK	Apt: N/a
Acft Mk/Mdl DEHAVILLAND DHC 3T		Acft SN 61	Acft Dmg: SUBSTANTIAL	Rpt Status: Factual Prob Caus: Pending
Eng Mk/Mdl HONEYWELL TPE33112JR702		Acft TT 15436	Fatal 3 Ser Inj 5	Flt Conducted Under: FAR 091
Opr Name: RAINBOW KING LODGE INC		Opr dba:		Aircraft Fire: NONE
				AW Cert: STN

Summary

The airline transport pilot and nine passengers departed in a float-equipped airplane in dark night, visual meteorological conditions on a 14 Code of Federal Regulations Part 91 other work use flight from a fishing lodge to a remote fishing location. The pilot reported that, before the flight departed, the front and center fuel tanks were filled, and the aft fuel tank had "residual" fuel. He did not weigh the cargo nor did he document any weight and balance calculations. When asked how he calculated the airplane's weight and balance before departure, the pilot said he "guesstimated" it.

According to a witness, after liftoff, the airplane began to climb and then descended, and the floats subsequently struck the water's surface. The airplane then became airborne again and veered right, but he lost sight of it behind an area of rising terrain. The pilot reported that he heard a noise from the left side of the airplane shortly after liftoff, which was likely the floats impacting the water. According to the automatic dependent surveillance-broadcast data, the airplane then began a gradual right turn before reaching a maximum altitude of 175 ft above the water. The airplane then descended toward the water's surface, flew low over the water and terrain, and then climbed briefly again before it impacted terrain. The pilot stated that he did not know that the airplane touched the water's surface after the initial liftoff or that the airplane then turned right.

Impact signatures were consistent with a right-wing-low attitude at impact. The entire airplane was accounted for at the wreckage site. Disassembly and examination of the engine and propeller revealed that both were operating during impact. Examination of the airframe and flight control systems found no preimpact malfunctions or failures that would have precluded normal operation.

A postaccident weight and balance study using the passenger weights, weighed cargo, and fuel load showed that the airplane exceeded its maximum gross weight of 8,367 lbs by about 508.6 lbs and that the center of gravity (CG) was 4.08 inches aft of the aft CG limit. Data from the airplane's automatic dependent surveillance-broadcast (ADS-B) showed that the airplane was at or below the stall speeds listed in the airplane flight manual during both the initial and second climbs. The ADS-B data show that, because the pilot failed to determine the airplane's actual preflight weight and CG and loaded and operated outside of the weight and CG limits, the airplane did not attain a proper airspeed to climb, and it experienced an aerodynamic stall.

The pilot departed during dark night conditions over water and was relying on external visual cues and not the airplane's instrumentation to control the airplane. There were insufficient external cues available to the pilot to reliably control the airplane, and he was likely experiencing spatial disorientation after takeoff and the subsequent maneuvering.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's decision to depart in dark night, visual meteorological conditions over water, which resulted in his subsequent spatial disorientation and loss of airplane control. Contributing to the accident was the pilot's failure to determine the airplane's actual preflight weight and balance and center of gravity (CG), which led to the airplane being loaded and operated outside of the weight and CG limits and to a subsequent aerodynamic stall.

Events

1. Initial climb - Loss of control in flight

Findings - Cause/Factor

1. Personnel issues-Action/decision-Info processing/decision-Decision making/judgment-Pilot - C
2. Personnel issues-Task performance-Use of equip/info-Aircraft control-Pilot - C
3. Environmental issues-Conditions/weather/phenomena-Light condition-Dark-Decision related to condition - C
4. Personnel issues-Psychological-Perception/orientation/illusion-Spatial disorientation-Pilot - C
5. Personnel issues-Task performance-Planning/preparation-Weight/balance calculations-Pilot - F
6. Aircraft-Aircraft oper/perf/capability-Aircraft capability-CG/weight distribution-Not attained/maintained - F

Narrative

HISTORY OF FLIGHT

On September 15, 2015, about 0606 Alaska daylight time, a single-engine, turbine-powered, float-equipped de Havilland DHC-3T (Otter) airplane, N928RK,

National Transportation Safety Board - Aircraft Accident/Incident Database

impacted tundra-covered terrain just after takeoff from East Wind Lake, about 1 mile east of the Iliamna Airport, Iliamna, Alaska. Of the 10 people on board, three passengers died at the scene, the airline transport pilot and four passengers sustained serious injuries, and two passengers sustained minor injuries. The airplane sustained substantial damage. The airplane was registered to and operated by Rainbow King Lodge, Inc., Lemoore, California, as a visual flight rules other work use flight under the provisions of 14 Code of Federal Regulations (CFR) Part 91. Dark night, visual meteorological conditions existed at the departure point at the time of the accident, and no flight plan was filed for the flight. At the time of the accident, the airplane was en route to a remote fishing site on the Swishak River, about 75 miles northwest of Kodiak, Alaska.

The manager of Rainbow King Lodge reported that the accident airplane was being used to transport sport-fishing clients and guides to a remote area for a day of salmon fishing. The manager noted that, on the morning of the accident, a lodge employee transported the guests to East Wind Lake in a lodge-owned van for the early morning departure.

The pilot reported that, on the morning of the accident, he woke at 0430 to check the weather and prepare for the flight. He stated that he had been sleeping normally and was feeling well except for pain in his right knee. He left the lodge at 0515 to conduct a preflight of the airplane. He stated that, for an easterly departure, the light on the building near the departure point is left on so the pilot can use it as a visual reference, but for a westerly departure, there are no lights to use as a reference. The pilot typically used a ridgeline about 7 miles west of Iliamna as a horizon, but the dark night conditions made it difficult to see the ridgeline. He stated that a very small percent of flights departed in the dark.

The lodge employee that drove the guests to the lake stated that they left the lodge at 0545. The airplane had been loaded the day before with fishing equipment. He said that, after all of the passengers boarded the airplane and the pilot had started the engine, he then untied the airplane's floats so the pilot could taxi away from the shoreline. The lodge employee reported it was dark but that he was still able to watch the airplane as it started its westerly takeoff run. He said that, after liftoff, the airplane began to climb and then descended, and the floats subsequently struck the water's surface. The airplane then became airborne again and veered right, but he lost sight of it behind an area of rising terrain.

The pilot stated that, during takeoff, he looks outside the airplane and does not focus on his instruments. The pilot stated that, after the airplane lifted off the water at what seemed like a normal pitch, he heard a noise from the left side of the airplane that distracted him. He looked outside for visual cues but was unable to see due to the dark night conditions. According to the automatic dependent surveillance-broadcast (ADS-B) data, the airplane then began a gradual right turn before reaching a maximum altitude of 175 ft above the water. The airplane then descended toward the water's surface, flew low over the water and terrain, and then climbed briefly again before it impacted terrain. The pilot stated that he did not know that the airplane touched the water's surface after the initial liftoff or that it then turned right.

A search and rescue team was assembled consisting of Iliamna residents, lodge employees, and Alaska State Troopers. Dark night conditions delayed the search and the discovery of the wreckage by about 30 minutes.

PERSONNEL INFORMATION

The pilot, age 54, held an airline transport pilot certificate with an airplane multiengine land rating and commercial pilot privileges with an airplane single-engine land rating. He also held a type rating for Beech 1900 and Beech 300 airplanes and a flight instructor certificate with an airplane single-engine land rating.

According to the Federal Aviation Administration (FAA) medical certification file, the pilot was first medically certificated in 1981. His most recent FAA second-class medical certificate was issued May 12, 2015, with the limitation that he must have available glasses for near vision. At that time, he measured 71 inches tall and weighed 249 lbs. He reported no medications, and the examining physician did not identify any abnormal findings.

According to the pilot's logbooks, he had about 11,280 total flight hours, about 450 hours of which were in the accident airplane make and model. In the 90 and 30 days before the accident, the pilot logged 200 and 70 flight hours, respectively. His most recent flight review was on February 9, 2014, in a Schweizer S269C helicopter.

The pilot had flown for Rainbow King Lodge during the 2012 to 2015 fishing seasons. The first two seasons were before the Otter was converted to a turbine-powered airplane (see the next section for more information about the conversion). The pilot stated that he had not received any training in the airplane since the turbine conversion.

AIRCRAFT INFORMATION

The accident airplane was a high-wing, float-equipped, single-pilot, de Havilland DHC-3T, N928RK, serial number 61, manufactured in 1954. It was powered by a Honeywell TPE 331-12JR-702TT turboprop engine per a Texas Turbine Conversions, Inc., supplemental type certificate (STC). It was equipped with a Hartzell model HC-B4TN-5NL four-bladed propeller.

In April 2014, the airplane was sent to Recon Air Corporation in Geraldton, Ontario, Canada, for a major overhaul and the turbine conversion. The airplane's US registry was changed to N928RK. The airplane was also modified with a Baron STOL kit and an upgross kit per an STC to improve its performance. The upgross kit increased the maximum gross weight of the airplane from 8,000 lbs to 8,367 lbs. The airplane was configured to carry one pilot and 10 passengers and cargo.

On May 24, 2014, after the overhaul, a new weight and balance calculation was performed, which showed that the airplane's basic empty weight on wheels was 4,345 lbs.

On May 30, 2014, an 800-hour inspection of the airplane and special inspection items was completed. The records indicated that all applicable airworthiness directives were complied with at this time. According to maintenance records, the airplane's last inspection was a 100-hour inspection on July 25, 2015, at which time, the airframe had accumulated 15,436 total hours, and the engine had accumulated 384 total hours.

On June 11, 2014, another weight and balance calculation was performed, which indicated that the airplane's empty weight on floats was 4926.8 lbs with a useful load of 3,073.2 lbs and that its center of gravity (CG) was 131.79 inches. A maximum gross weight of 8,000 lbs was used for the computation, not the adjusted weight of 8,367 lbs. The installation of the upgross kit was noted in the equipment list, but the increase of the maximum gross weight was not reflected in the final weight and balance paperwork.

On August 30, 2015, a 150-hour engine inspection was conducted with no defects or leaks noted. At the time of inspection, the engine had a total of 430.3 hours.

Weight and Balance Study

The accident airplane was configured to carry 62 gallons of fuel in the forward tank, 102 gallons of fuel in the center tank, and 51 gallons of fuel in the aft tank. The Texas Turbine Conversions, Inc., Airplane Flight Manual (AFM) supplement instructs the operator to burn fuel from the forward tank during takeoff and, after takeoff, from the aft tank forward to leave as much fuel in the forward tank as possible for landing. The minimum amount of fuel for takeoff is 20 gallons in each of the three tanks to prevent introduction of air into the fuel system. The pilot stated the center and forward tanks were full, and there was "residual" fuel in the aft tank.

Rainbow King Lodge had no procedures in place or equipment available for calculating preflight weight and balance. Pilots should calculate the airplane's actual weight and balance using the procedures contained in the original DHC-3 Otter AFM, published by de Havilland Canada, along with the information in the various flight manual supplements for the STCs installed on the airplane. The entire flight manual and all of its supplements were carried in the airplane during the accident flight. When asked how he calculated the weight and balance for the accident airplane before departure, the pilot said he "guesstimated" it.

As noted, the airplane was carrying the pilot and nine passengers. The seating location of each passenger was determined based on passenger statements. In accordance with passenger statements, 10 lbs was added to each person's weight to account for gear and clothing, including chest waders and boots.

All of the cargo, which included fishing gear, coolers, firewood, and passenger bags, was loaded in the baggage compartment located behind the last row of passenger seating. After the accident, these items were removed and weighed. See table 1 for a summary of the weight and balance calculations.

Using this data, the airplane's weight before takeoff was calculated to be 8,875.6 lbs, which was 508.6 lbs over the maximum gross weight. The CG range for the airplane at 8,367 lbs was between 140.3 and 148.3 inches. The airplane's pretakeoff CG was calculated to be 152.38 inches, 4.08 inches aft of the aft CG limit.

METEOROLOGICAL INFORMATION

The closest weather reporting weather station was Iliamna, about 1 mile south of the accident site. At 0553, a METAR reported, in part, wind 270ø at 7 knots; visibility 10 statute miles; clouds and sky condition, scattered at 700 ft, overcast at 4,400 ft; temperature 48ø F; dew point 47ø F; and altimeter 29.61 inches of mercury.

According to the US Naval Observatory Astronomical Applications Department, civil twilight began at 0706, and sunrise was at 0748.

WRECKAGE AND IMPACT INFORMATION

The main wreckage was found about 510 ft from the shore of East Wind Lake at N59.777778 W154.917778, on a magnetic heading of 020ø, about 0.5 miles from the departure point. The airplane impacted soft, tundra-covered terrain. There was no evidence of any impact with terrain between the lake and the main wreckage. There was a ground scar about 20 ft long and 10 inches deep aft and in line with the right wing. There was an additional ground scar aft of the right float that was about half the length of the right float.

The left wing remained attached, and the left flap and aileron were attached at their respective attachment points. The right wing was separated from the fuselage at the wing root, and the forward attachment point bolt was broken at the wing and remained in the wing. The rear attachment, about 5 inches into the spar, was separated. The right flap was separated, and the right lift strut was separated at the fuselage structure. The last 10 ft of the right wing sustained extensive aft accordion-style crushing from the tip inboard. The right aileron had extensive impact damage and only remained attached outboard of the attachment point.

The tail was displaced about 30ø to the left. The stabilator remained attached and was relatively undamaged. The outboard 2 ft of the right elevator was separated, and the inboard portion of the right elevator had accordion-style crushing where it had impacted the rudder. The left elevator remained attached and undamaged. The rudder remained attached and sustained damage where it was penetrated by the servo tab. The rudder and elevator cables were still attached to their relative attachment points.

The jack screw separated at the top fitting from the horizontal stabilator, and the forward bolts threads were stripped. There was no noted inner movement of the jack screw, which remained attached at the lower attachment point and measured about 3/4 inch.

The left float was attached to the fuselage at the forward and aft attachment points. The forward spreader bar remained attached to the float. The left float came to rest on top of the right float. Multiple outboard panels on the left float had slight inward crushing. The right float was heavily damaged and fragmented at the attachment points.

The elevator, trim indicator, and a manual control wheel were in a nose-up position. The rudder trim was in a slightly right position. The flaps were hydraulically actuated and were in the "takeoff" position.

The navigation, beacon, cockpit, and instrument lights were in the "on" position, and the dome, strobe, and landing lights were in the "off" position.

The propeller was still attached to the propeller flange. Three blades had extensive leading edge gouging and exhibited torsional twisting. One of the blades tip had separated, one of the blades was rotated 180ø in the hub, and another blade was buried in the terrain.

The power lever was slightly above flight idle. The condition lever was midrange. The fuel shut-off was not in an off position, the fuel selector was on the center tank, and the ignition was set to continuous ignition. All three of the fuel caps were on and secure. The fuselage had accordion-style crushing, and at the rear spar there was a tear in the production joint. There was no damage to the engine mounts.

MEDICAL AND PATHOLOGICAL INFORMATION

Hospital treatment records revealed that the pilot had a 1-week history of right leg swelling before the accident. In addition to crash-induced injuries, the pilot was diagnosed with a right leg deep vein thrombosis and bilateral pulmonary emboli. Two days after admission, the pilot suffered a syncopal episode attributed

to another pulmonary embolus.

Toxicology

The FAA Bioaeronautical Sciences Research Laboratory testing of the pilot's urine collected on admission to the hospital was negative for ethanol and drugs of abuse but detected ibuprofen, ketamine, and its metabolite norketamine. Ketamine is an injectable, rapidly acting general anesthetic agent that was administered during the pilot's postaccident transport to the hospital. Ibuprofen is a non-sedating medicine used to treat pain, swelling, and fever and is marketed with various names, including Motrin. (See the Medical Factual Report in the docket for this accident for more information.)

Pilot and Passenger Injuries

The NTSB Medical Officer reviewed hospital treatment records to determine the pilot's injuries. The IIC reviewed the Alaska State Medical examiner's autopsy reports for the three fatally injured passengers. See table 2 for a complete list of pilot and passenger injuries.

TESTS AND RESEARCH

On September 22, 2015, the wreckage was examined at a private hangar in Iliamna under the supervision of the NTSB IIC. Flight control system cable continuity was established from each control surface to the point of impact-related damage.

On November 2, an engine teardown and examination were conducted at Honeywell facilities in Phoenix, Arizona, under the supervision of the NTSB IIC. Disassembly and examination of the engine revealed the following significant characteristics consistent with rotation and operation at the time of impact: rotational scoring of the propeller shaft and rotational scoring throughout the compressor and turbine sections indicate rotation at the time of impact. Metal spray was present throughout the turbine components in the air stream path indicating operation at the time of impact. There were multiple, nonadjacent, vanes in the first-stage compressor impeller bent opposite the direction of rotation. There was dirt and debris in the first- and second-stage compressor housings.

The propeller coupling was fractured. Examination of the coupling and the mating coupling revealed the two axial cracks in the coupling were the result of overload. There was no debris found in the fuel filter or in the fuel collected from the fuel control unit and fuel pump.

The examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

The engine fuel control unit was examined at Woodward Governor Company, Rockford, Illinois, under the supervision of an FAA inspector. The control was functionally tested, and no evidence of a preaccident malfunction was found.

Airplane Performance Study

The accident airplane was equipped with ADS-B technology. In typical applications, the ADS-B-capable aircraft uses an ordinary GPS receiver to derive its precise position from the global navigation satellite system constellation and then combines that position with any number of aircraft parameters, such as speed, heading, altitude, and aircraft registration number. This information is then simultaneously broadcast to other ADS-B-capable aircraft and to ADS-B ground or satellite communications transceivers, which then relay the aircraft's position and additional information to air traffic control centers in real time.

Data from the accident airplane's ADS-B, as shown in figure 1, show the airplane's flightpath. Airspeeds were calculated using the ADS-B position data and the reported wind information. Airplane orientation was calculated from these data and a basic aerodynamic model of the airplane. Calculations made from ADS-B and weather data are subject to uncertainty; therefore, airspeeds and attitude values should not be considered exact.

During the initial climb, the airplane remained below the recommended airspeed per the Texas Turbine Conversions, Inc., AFM. The data show the airplane initially gaining altitude at 0605:54 and reaching 56 mph, as recommended in the AFM. After the initial climb with a 10° bank angle, the airplane made a descending right turn at 57 mph and lost 175 ft of altitude, which placed the airplane at or near the water's surface. Subsequently, the airplane began regaining altitude with a 30° bank angle, and then it made another right turn at less than 57 mph. The airplane's stall speed is 57 mph at a 0° bank angle, 59 mph at a

20° bank angle, and 65 mph at a 40° bank angle.

ADDITIONAL INFORMATION

Weight and Balance Guidance

FAA-H-8083-1A, "Aircraft Weight and Balance Handbook," stated the following:

Improper loading cuts down the efficiency of an aircraft from the standpoint of altitude, maneuverability, rate of climb, and speed. It may even be the cause of failure to complete the flight, or for that matter, start the flight. Because of abnormal stresses placed upon the structure of an improperly loaded aircraft, or because of changed flying characteristics of the aircraft, loss of life and destruction of valuable equipment may result.

The pilot in command of the aircraft has the responsibility on every flight to know the maximum allowable weight of the aircraft and its CG limits. This allows the pilot to determine on the preflight inspection that the aircraft is loaded in such a way that the CG is within the allowable limits.

Excessive weight reduces the efficiency of an aircraft and the safety margin available if an emergency condition should arise. Some of the problems caused by overloading an aircraft are:

- The aircraft will have a higher takeoff speed, which results in a longer takeoff run.
- Both the rate and angle of climb will be reduced.
- Maneuverability will be decreased.

An important part of careful preflight planning includes a check of these charts to determine the aircraft is loaded so the proposed flight can be safely made. If the CG is too far aft, it will be too near the center of lift and the airplane will be unstable, and difficult to recover from a stall.

Federal Aviation Regulations

Title 14 CFR Part 91.9, "Civil aircraft flight manual, marking, and placard requirements," stated the following:

(a) Except as provided in paragraph (d) of this section, no person may operate a civil aircraft without complying with the operating limitations specified in the approved Airplane or Rotorcraft Flight Manual, markings, and placards, or as otherwise prescribed by the certifying authority of the country of registry.

Part 91.103 Preflight action: Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include-

(2) For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.

Spatial Disorientation

The FAA's "Pilot's Handbook of Aeronautical Knowledge" (FAA-H-8083-25), stated, "Spatial disorientation specifically refers to the lack of orientation with regard to the position, attitude, or movement of the airplane in space." The handbook also contained the following guidance:

under normal flight conditions, when there is a visual reference to the horizon and ground, the sensory system in the inner ear helps to identify the pitch, roll,

and yaw movements of the airplane. When visual contact with the horizon is lost, the vestibular system becomes unreliable. Without visual references outside the airplane, there are many situations where combinations of normal motions and forces can create convincing illusions that are difficult to overcome.

FAA Publication "Spatial Disorientation Visual Illusions" (OK-11-1550), stated, in part, the following:

false visual reference illusions may cause you to orient your aircraft in relation to a false horizon; these illusions are caused by flying over a banked cloud, night flying over featureless terrain with ground lights that are indistinguishable from a dark sky with stars, or night flying over a featureless terrain with a clearly defined pattern of ground lights and a dark starless sky.

The FAA publication Medical Facts for Pilots (AM-400-03/1) described several vestibular illusions associated with the operation of aircraft in low-visibility conditions. Somatogravic illusions, which involve the utricle and saccule of the vestibular system, were generally placed into one of three categories, one of which was "the head-up illusion." According to the publication, the head-up illusion involves a forward linear acceleration, such as takeoff, where the pilot perceives that the aircraft's nose is pitching up. The pilot's response to this illusion would be to push the control yoke forward to pitch the aircraft's nose. It added, "A night takeoff from a well-lit airport into a totally dark sky (black hole) can also lead to this illusion, and could result in a crash."