

HISTORY OF FLIGHT

On June 6, 2016, about 1530 Alaska daylight time, a tailwheel-equipped Air Tractor AT-802 airplane, N802CE, lost engine power while en route to Fairbanks, Alaska, and collided with large trees and steep, rocky terrain during a forced landing near the Murphy Dome Air Force Station, about 22 miles northwest of Fairbanks. The commercial pilot, the sole occupant, sustained no injury, and the airplane sustained substantial damage. The airplane was registered to, Arctic One, LLC, Fairbanks, and was operated by, Everts Air Fuel, Inc., Fairbanks, as a visual flight rules (VFR) commercial bulk fuel transportation flight under the provisions of Title 14 *Code of Federal Regulations (CFR)* Part 91. Visual meteorological conditions prevailed at the time of the accident, and company flight following procedures were in effect. The flight originated from the Rampart Airport (RMP) in Rampart, Alaska, about 1510.

The pilot had two scheduled bulk fuel delivery operations for the day. The bulk fuel is transported in the hopper of the airplane. The first operation consisted of delivery of bulk fuel to Stevens Village Airport (SVS), Stevens Village, Alaska and the second operation consisted of delivery of bulk fuel to RMP. SVS is about 90 miles northwest of Fairbanks International Airport (FAI), Fairbanks. RMP is about 82 miles northwest of FAI. Both Stevens Village and Rampart are remote communities situated next to the Yukon River.

Prior to departing for SVS, the pilot added 90 gallons of fuel to an unknown amount of fuel in the airplane's fuel tanks at FAI. The pilot departed FAI about 1100 and flew to SVS and unloaded the bulk fuel from the hopper without further incident. The pilot departed from SVS about 1210 and landed at FAI. Upon landing at FAI, the Shadin Avionics fuel flow indicator showed 167 gallons of fuel in the airplane's fuel tanks. The pilot added 20 gallons of fuel to the right wing fuel tank prior to departing for RMP, for a total of 187 gallons of fuel in the airplane's fuel tanks, as shown by the Shadin fuel flow indicator. The pilot did not report what the fuel gauges were reading at this time. For the trip to RMP, the pilot reported the travel time was about 25 minutes and the wind condition was "negligible." The pilot landed at RMP and unloaded the bulk fuel from the hopper without further incident. The pilot did not conduct any refueling operations for the airplane at RMP.

The operator reported that on the climb out from Rampart, the low fuel warning (red) light in the cockpit was flickering but went away. About halfway to FAI, the pilot reported the low fuel warning (red) light illuminated. About 20 miles out from FAI, shortly after calling Fairbanks Approach Control, the pilot reported the engine ceased producing power. He noted that the fuel flow indicator showed that he was going to land with 95 gallons remaining in the fuel tanks. The pilot immediately executed the engine out emergency procedures with no success. The pilot lowered the nose and "rocked" the airplane to see if the engine would restart. The engine still did not produce power. The pilot reported the loss of engine power to Fairbanks Approach Control. The pilot proceeded with the engine out checklist, feathered the propeller, shut off the various airframe systems, and prepared for a forced landing.

He attempted to land the airplane at the Murphy Dome Air Force Station, a permanently closed U.S. Air Force (USAF) radar site. The pilot was unable to achieve a forced landing at the Murphy Dome Air Force Station and landed the airplane in a remote area with various large spruce trees and steep, rocky terrain, about 2 miles northwest of the Murphy Dome Air Force Station. The airplane subsequently struck several trees and terrain during the landing and came to rest upright. The airplane sustained substantial damage to the fuselage, both wings, and the empennage. At 1549, the Federal Aviation Administration (FAA) issued an Alert Notice (commonly referred to as an "ALNOT") for the airplane. A USAF HH-60G (Pave Hawk) helicopter with a team of USAF Pararescuemen from Joint Base Elmendorf-Richardson, Alaska, traveled to the accident site and retrieved the pilot.

AIRCRAFT INFORMATION

Configuration

The Air Tractor AT-802 is a two-seat tandem cockpit, restricted category airplane originally designed for use in aerial application operations. The operator had the airplane modified for the transportation of bulk fuel. The airplane can also be configured and used for other operations such as aerial firefighting and attack/reconnaissance missions for military forces. The airplane was powered by a Pratt & Whitney Canada PT6A-67F turbine engine with a 5-blade Hartzell propeller. For carrying a liquid product such as bulk fuel, the maximum hopper load is 8,800 pounds (800 gallons).

Crashworthiness

~~Field Air, an Air Tractor dealer and operator in Australia, has published, Guide to Air Tractor Aircraft. This document discusses the crashworthy design of Air Tractor airplanes and states in part:~~

~~"The rugged design and tubular structure of the aircraft makes it one of the safest and most crashworthy agricultural aircraft ever designed."~~

METEOROLOGICAL INFORMATION

FLIGHT RECORDERS

The airplane did not carry, nor was required to carry, a crashworthy flight data recorder.

WRECKAGE AND IMPACT INFORMATION

Airframe and Engine Examination

The wreckage was recovered and transported to a secure facility for future examination of the airframe and engine. During the recovery operation, the operator reported that both fuel tanks remained intact from the accident sequence and no usable fuel was found in either fuel tank. On July 15, 2016, a wreckage examination and layout were done under the direction of the National

Transportation Safety Board (NTSB) investigator-in-charge (IIC) at the operator's hangar at FAI. Also present were two air safety investigators from the NTSB, an aviation safety inspector from the FAA Fairbanks Flight Standards District Office (FSDO), an air safety investigator from Air Tractor, two air safety investigators (technical advisors) from Pratt & Whitney Canada, and two representatives from Everts Air Fuel. During the examination, no preimpact mechanical malfunctions or failures with the airframe and engine were noted.

During the examination of the header tank, a total of 3 quarts of fuel was drained from the header tank sump location. The fuel was found to be clear with no significant debris or contamination. It was noted by Air Tractor, that 3 quarts of fuel would bring the fuel level down to the top of the header tank fuel pickup (suction) tube and considering in-flight sloshing, it is likely that the fuel system would have ingested large amounts of air with this fuel level.

Engine Accessories Examination/Testing

The flow divider, fuel pump, and the fuel control unit were removed from the engine and transported to facilities of Pratt & Whitney Canada, located in Quebec, Canada. The three components were examined and tested on September 15, 2016 under the direction of the Accredited Representative of the Transportation Safety Board of Canada, along with a technical advisor from Woodward. During the examination and testing, no preimpact mechanical malfunctions or failures with the three components were noted.

Fuel Sensing Components Examination/Testing

The fuel sensing components of the airplane were transported to the facilities of Air Tractor, located in Olney, Texas. The fuel gauging system, the low fuel warning system, and the fuel flow indicator were examined and tested on October 13, 2016 under the direction of an aviation safety inspector from the FAA Lubbock (Texas) FSDO. During the examination and testing, no preimpact mechanical malfunctions or failures with the fuel sensing components were noted.

Per the Air Tractor AT-802 Airplane Flight Manual (AFM), the low fuel caution light is set to illuminate when the fuel in either wing tank reaches approximately 14 gallons of usable fuel. Assuming equal fuel levels in each wing, this would be approximately 28 gallons of usable fuel remaining in the wing tanks.

When utilizing an average fuel burn of 110 gallons per hour for the Pratt & Whitney Canada PT6A-67F engine, 28 gallons of fuel would provide about 15 minutes of flight time.

During the examination of the fuel flow indicator, which reads in gallons, the indicator was plugged into a bench test harness and power was applied with a benchtop power supply. When power was applied, the indicator ran a self-test and returned the word "- GOOD -" indicating that the self-test was successful. Pushing the "Used/Rem" switch down displayed the value of 96.4, gallons which is the calculated fuel remaining on board. Pushing the "Used/Rem" switch upward displayed the value of 77.4 gallons, which is the measured fuel used since the last input/reset of the indicator. It was noted that the indicator was marked on the outside and in the programming with a K-factor of 23.1 (K-factor is the number of pulses expected for every one volumetric unit

of fluid passing through a given flow meter). It did not appear that the indicator had been tampered with or reprogrammed since the accident occurred.

The fuel flow indicator has no fuel level sensing capabilities. The fuel remaining calculation relies solely on the pilot's input of fuel added. The indicator then subtracts the gallons used (using the fuel flow transducer) as the flight proceeds and fuel is used. Adding the values of 96.4 and 77.4 together indicates that the fuel flow indicator was programmed with 173.8 gallons of fuel onboard at the last fueling or instrument reset.

Per the Shadin Avionics Microflo-L Digital Fuel Management System Operating Manual, a visual inspection and positive determination of the usable fuel in the fuel tanks is a necessity. The manual further states that it is imperative that the determined available usable fuel be manually entered into the system.

SURVIVAL FACTORS

Emergency Locator Transmitter

The airplane was equipped with an Artex ME-406 emergency locator transmitter (ELT), a C126 (406 MHz) series. The ELT, which remained mounted to the airframe and connected to the antenna assembly, activated during the accident sequence, which relayed the precise location of the wreckage to the U.S. Air Force Rescue Coordination Center at Joint Base Elmendorf-Richardson.

Restraint System

The pilot reported that for the accident flight, he utilized the 5-point restraint system in the airplane. The 5-point restraint system was equipped with inflatable restraints manufactured by AmSafe, which did not deploy in the accident sequence. During the examination of the wreckage, no anomalies were noted with the restraint system and the inflatable restraint system was found properly armed. ~~According to information provided by Air Tractor, the sensing system of the inflatable restraints requires 9Gs (gravitational force) of sustained deceleration along the length of the airplane to activate the system.~~

Flight Helmet

The Air Tractor AT-802 AFM states in the operating limitations section, along with a required cockpit placard, that a "Department of Transportation approved or military-specification crash helmet must be worn when operating aircraft." ~~At the time of this accident report, there are no Department of Transportation or FAA issued safety specification standards for civilian flight helmets.~~ The pilot reported that he wore an MSA Gallet LH250 flight helmet in the airplane. The pilot was unsure if the helmet impacted the cockpit structure or not during the accident sequence. The pilot did not report any damage sustained to the flight helmet from the accident sequence. ~~During the egress sequence, the pilot reported that he could not reach the flight helmet intercommunication system (ICS) cord for disconnection that was plugged into the airframe ICS port, which was located above, and to the right rear of him. The pilot egressed, and the ICS cord~~

ripped loose. The pilot concluded that the ICS cord remaining attached to the airframe and subsequently ripping loose did not slow down his egress from the airplane.

In this Air Tractor AT-802, the ICS ports were installed after initial production and were located facing forward and are in a top right, rear area of where each occupant sits. When sitting in the cockpit, the direction of egress is to the left or right. The ICS ports are not oriented in the direction of occupant egress.

The NTSB has released Safety Alert SA-068 Flight Helmet Cords Can Impede Egress. This document discusses the importance of fast and unimpeded egress from the aircraft and states in part:

"Direct to airframe ICS cord connections between the flight helmet and the airframe can impede egress during an accident or emergency. The cord connecting the flight helmet to the aircraft's ICS might not release readily from the airframe ICS port if the direction of egress is contrary to the direction needed to easily release the cord."

"Use a compatible intermediate cord between the ICS cord and the airframe ICS port to facilitate a clean separation during egress. The intermediate cord is a cord connecting to the airframe ICS port on one end and to the ICS cord on the other end, allowing the ICS cord to be disconnected in the direction of egress."

TESTS AND RESEARCH

The airplane was equipped with a Perkins Technologies DAAM (data acquisition alarm monitor) system. The DAAM system allows pilots and maintenance personnel to monitor engine usage, recording trends, exceedances, hot starts, and other potentially damaging events that standard instrumentation doesn't detect. The system continuously monitors up to 13 engine and airframe parameters, recording usage, and performance data. If an exceedance occurs, an alert on the cockpit display unit allows the pilot to take immediate corrective action. The parameters from the accident flight were recorded and retrieved from the unit. Based on the data received, no anomalies were noted with the DAAM system.

Refer to the Perkins Technologies DAAM Data Sheet in the public docket.

ORGANIZATIONAL MANAGEMENT

Everts Air Fuel is a 14 *CFR* Part 125 certificated operator (airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 pounds or more - certificate number EVAB729D) and has held this certification since February 1, 1983. Everts Air Fuel is owned by a private individual and Everts Investments.

ADDITIONAL INFORMATION

14 CFR Part 91 Fuel Requirements

14 CFR Part 91.151 discusses fuel requirements for flight in VFR conditions and states in part:

"No person may begin a flight in an airplane under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed – during the day, to fly after that for at least 30 minutes."

Minimum Fuel at Takeoff

~~The Air Tractor AT-802 AFM does not specify a minimum fuel quantity at takeoff.~~

AFM Changes

During the investigation, conversations were held between the NTSB IIC and the investigative team from Air Tractor. The investigators discussed improving the actions required once the low fuel caution light is flickering. Air Tractor agreed to make changes to all their airplane models (via the AFM) concerning treatment of an intermittent (flickering) low fuel caution light the same as a steady low fuel caution light. These changes were approved by the FAA aircraft certification office for Air Tractor airplanes in March 2017 and Air Tractor distributed these changes throughout their dealer and customer network starting in March 2017.

Flight Helmet Usage in Alaska

~~The Alaska Aviation Safety Foundation has published a Safety Briefing, Flight Helmets—You Should Wear One! This document discusses the importance of wearing a flight helmet during certain flight profiles and states in part:~~

~~"Are you protecting the most valuable item in your aircraft? Without proper protection, occupants in aircraft can potentially sustain serious head injuries during an accident. Some flight profiles, such as off-airport operations, aerobatic flights, aerial application flights, warbird flights, public use flights, and helicopter flights are higher risk. Examples of occupant head and facial injury scenarios in an accident sequence include impacting the cockpit dashboard, impacting cockpit and cabin structures, unsecured items inside of the aircraft moving and impacting the head and face, and debris impacting the head and face. Flight helmets can provide an additional head and facial protective safety layer when flying in Alaska and can aid in hearing protection from loud noises."~~