



# Aviation Investigation Final Report

<b>Location:</b>	Eagle Lake, Texas	<b>Accident Number:</b>	CEN19FA140
<b>Date &amp; Time:</b>	May 11, 2019, 08:10 Local	<b>Registration:</b>	N713LA
<b>Aircraft:</b>	Air Tractor AT502	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	VFR encounter with IMC	<b>Injuries:</b>	1 Fatal
<b>Flight Conducted Under:</b>	Part 137: Agricultural		

## Analysis

The non-instrument-rated commercial pilot departed from the operator's airstrip and was planning to conduct a visual flight rules (VFR) aerial application flight in an airplane that was not equipped for instrument flight rules (IFR) flight. Shortly after departure in visual meteorological conditions, the pilot contacted the operator and reported that he observed fog that was "rolling in." The pilot reported that he was flying above the fog layer. The pilot stated that he was going divert to a local airport, instead of returning to the operator's airstrip, and terminate the flight. No further communication was received from the pilot.

Data obtained from two onboard units that contained airplane track data showed that, during the last several minutes of the flight, the airplane entered two spiraling turns. The second spiraling turn included a rapid descent from the airplane's altitude in the direction of the accident site. The airplane wreckage was discovered in a grass field about 7.5 miles southwest from the diversion airport.

Two witnesses who were near the accident site heard the accident airplane flying overhead and reported that they did not hear any sounds associated with an airplane problem before the sound of the airplane's impact. An examination of the airframe and engine revealed no mechanical anomalies.

The investigation was unable to determine, with the available evidence, whether the pilot had received an official weather briefing or accessed weather information before the flight. Multiple weather sources indicated low ceilings and the presence of fog, which were conducive to low IFR conditions, before and at the time of the accident for the area near the accident site. The witnesses who heard the accident airplane reported a low level of fog about the time of the accident and an area of clear visibility between the ground and fog. Fog differs from clouds in that the base of fog is at the Earth's surface, while clouds are above the Earth's surface.

Given the weather data, airplane track data, and witness statements, the airplane likely flew into an area of fog just before the accident for underdetermined reasons. The IMC present at the time was conducive

to the development of spatial disorientation, and the airplane's flight track was consistent with the known effects of spatial disorientation.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The non-instrument-rated pilot's decision to fly into instrument meteorological conditions, which resulted in spatial disorientation, a loss of control, and a subsequent impact with terrain.

### Findings

<b>Personnel issues</b>	Aircraft control - Pilot
<b>Personnel issues</b>	Spatial disorientation - Pilot
<b>Environmental issues</b>	Low ceiling - Effect on operation
<b>Environmental issues</b>	Below VFR minima - Effect on operation
<b>Personnel issues</b>	Total instrument experience - Pilot

## Factual Information

### History of Flight

<b>Enroute</b>	VFR encounter with IMC (Defining event)
<b>Enroute</b>	Attempted remediation/recovery
<b>Enroute</b>	Loss of visual reference
<b>Enroute</b>	Loss of control in flight
<b>Enroute</b>	Collision with terr/obj (non-CFIT)

On May 11, 2019, about 0810 central daylight time, an Air Tractor AT-502A airplane, N713LA, impacted a grass field while maneuvering about 6 miles southwest of Eagle Lake, Texas. The commercial pilot received fatal injuries. The airplane was destroyed by impact forces. The airplane was registered to a private individual and was operated by ANF Air Service Inc. as a Title 14 *Code of Federal Regulations (CFR) Part 137* aerial application flight. Instrument meteorological conditions (IMC) prevailed at the time of the accident, and no flight plan was filed for the visual flight rules (VFR) flight. The flight originated from the operator's private airstrip, which was about 5.5 miles west of Garwood, Texas, at 0743.

The operator (the pilot's father, who owned the operation), reported that the purpose of the flight was for the pilot to spray herbicide on several rice fields about 10 miles south of Garwood. According to the operator, the pilot used Aeroweather on his cell phone for preflight weather planning. Shortly after departure, the pilot contacted the operator using his cell phone and a Bluetooth adapter (which was connected to the pilot's flight helmet and interfaced with the cockpit intercom system) and reported that he observed fog "rolling in." The pilot also reported that he was flying above the fog layer. The pilot indicated his intention to divert to Eagle Lake Airport (ELA), Eagle Lake, Texas, instead of the operator's airstrip and terminate the flight. The operator received no further communication from the pilot. An overview of the route of flight and time, altitude, and airspeed data are shown in figure 1.

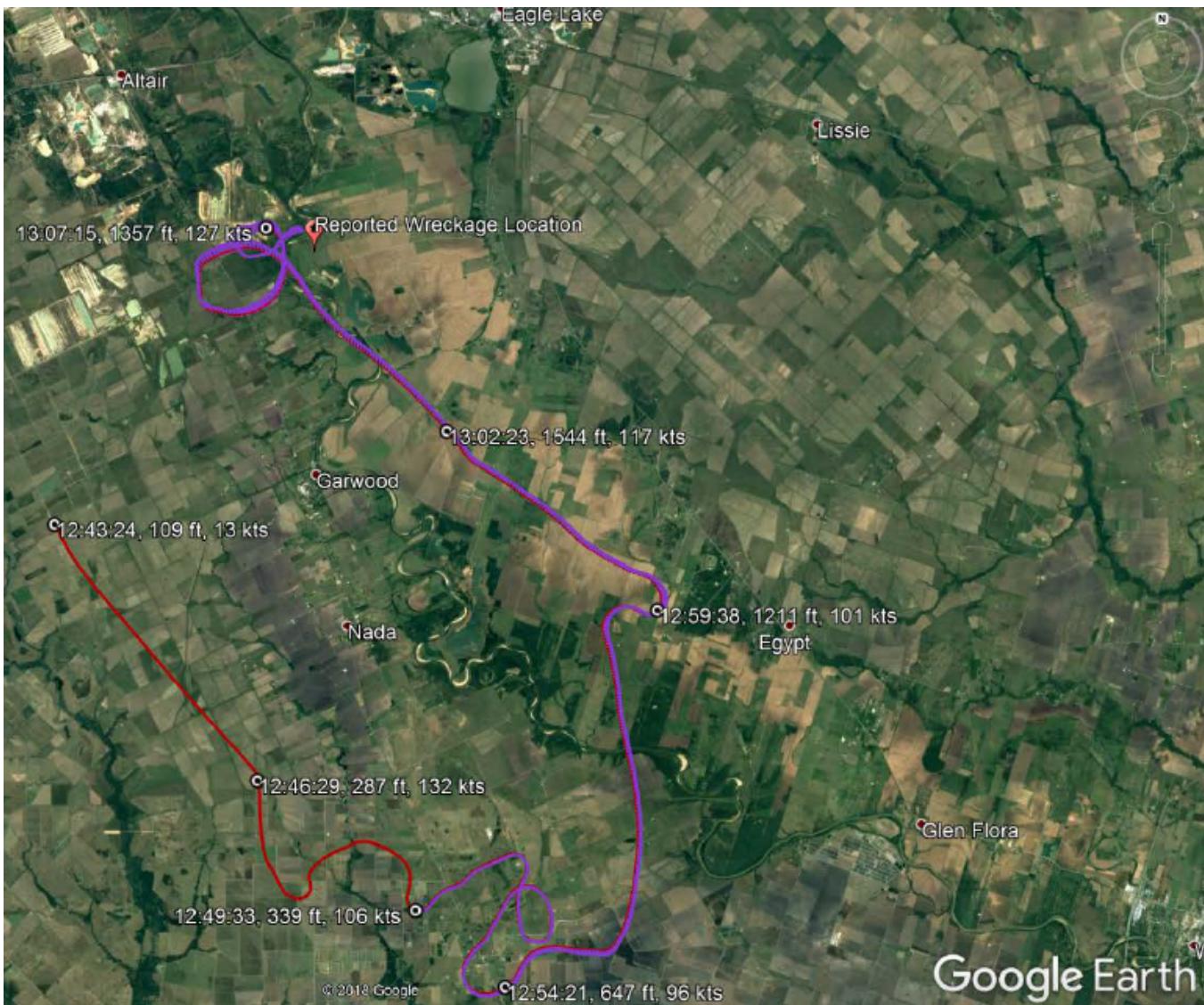


Figure 1 – Route of flight based on Garmin Aera 560 GPS (red track) and SATLOC M3 (purple track) data.

The airplane was equipped with a Garmin Aera 560 GPS unit. Data recovered from the device included time, airspeed, altitude, and track. Data from the last several minutes of the flight showed that the airplane entered a spiraling turn with altitudes decreasing from 1,595 to 980 ft. The turn initiated to the west, and the airplane continued to turn to the west before the data ended. The airplane's airspeed during the last several minutes of the flight ranged from 86 to 127 knots.

The airplane was equipped with a SATLOC M3 unit. Data were recovered from the device included time, airspeed, altitude, and track. Data from the last several minutes of the flight showed that the airplane entered a spiraling turn that initiated to the west and that the airplane then entered a spiraling turn with altitudes decreasing from 1,774 to 172 ft. The airplane was traveling east and just north of the accident site before the data ended. The airplane's airspeed during the last several minutes of the flight

ranged from 80 to 200 knots.

After no updates from the pilot and several communication attempts, the operator contacted first responders, who initiated a search of the area in which the pilot was operating. The airplane wreckage was discovered about 1030, as shown in figure 2.



Figure 2 – View of the accident site, with the impact crater and the wreckage, looking to the north.

Two witnesses who were located about  $\frac{1}{2}$  mile south of the accident site reported that they heard an airplane operating about the time of the accident but did not see the airplane. The witnesses reported that they initially heard no sounds indicating that the airplane was having problems. Shortly afterward, one witness heard a "big thump" sound, and the other witness heard a "boom" sound. Both witnesses reported "lots of fog" in the area at the time; one witness estimated that the fog was about 20 ft above ground level (agl), and the other witness estimated that the fog was about 65 ft agl. Both witnesses reported clear visibility below the fog.

## Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	36, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Single
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	February 25, 2019
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	February 25, 2019
<b>Flight Time:</b>	(Estimated) 3164 hours (Total, all aircraft), 511 hours (Total, this make and model)		

The pilot held a Federal Aviation Administration (FAA) commercial pilot certificate and a mechanic certificate authorizing him to perform airframe and powerplant maintenance tasks. The pilot did not have an instrument rating.

The operator reported the pilot had experience flying the Air Tractor AT-402, -502, and -802-series airplanes. The operator reported that the pilot did not have any actual or simulated instrument flight time. The operator described the pilot as "very competent" and "safe" in performing aerial application operations. The pilot's flight logbook was unavailable for review.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Air Tractor	<b>Registration:</b>	N713LA
<b>Model/Series:</b>	AT502 A	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1992	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Restricted (Special)	<b>Serial Number:</b>	502A-0177
<b>Landing Gear Type:</b>	Tailwheel	<b>Seats:</b>	1
<b>Date/Type of Last Inspection:</b>	February 17, 2019 Annual	<b>Certified Max Gross Wt.:</b>	8000 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Turbo prop
<b>Airframe Total Time:</b>	9087.7 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Pratt & Whitney Canada
<b>ELT:</b>	Not installed	<b>Engine Model/Series:</b>	PT6A-45R
<b>Registered Owner:</b>		<b>Rated Power:</b>	1120 Horsepower
<b>Operator:</b>		<b>Operating Certificate(s) Held:</b>	Agricultural aircraft (137)
<b>Operator Does Business As:</b>	A N F Air Service, Inc.	<b>Operator Designator Code:</b>	A3NG

The single-seat, low-wing, fixed-gear airplane was configured for aerial application operations with an aerial spray system. The airplane was equipped with an inclinometer (slip indicator) but was not

equipped with any other instruments required for instrument flight, The Air Tractor AT-502A AFM stated that the operation of the airplane is restricted to day and night VFR conditions.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Instrument (IMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KELA,185 ft msl	<b>Distance from Accident Site:</b>	6 Nautical Miles
<b>Observation Time:</b>	08:15 Local	<b>Direction from Accident Site:</b>	37°
<b>Lowest Cloud Condition:</b>			<b>Visibility</b> 4 miles
<b>Lowest Ceiling:</b>	Overcast / 200 ft AGL		<b>Visibility (RVR):</b>
<b>Wind Speed/Gusts:</b>	8 knots / 14 knots	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	330°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	29.89 inches Hg	<b>Temperature/Dew Point:</b>	18°C / 17°C
<b>Precipitation and Obscuration:</b>	Moderate - None - Mist		
<b>Departure Point:</b>	Garwood, TX	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Garwood, TX	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	07:43 Local	<b>Type of Airspace:</b>	Class G

An automated weather observing system (AWOS) was located at ELA, which was about 7.5 miles northeast of the accident site. At 0815, the AWOS reported wind from 330° at 8 knots gusting to 14 knots, visibility 4 miles, mist, ceiling overcast at 200 ft agl, temperature 18°C, dew point 17°C, and an altimeter setting of 29.90 inches of mercury.

At 0613, the National Weather Service (NWS) Aviation Weather Center issued an AIRMET for instrument flight rules (IFR) conditions that was active for the accident site at the accident time. The AIRMET stated that ceilings were below 1,000 ft and visibility was below 3 miles with precipitation and mist.

An area forecast discussion (AFD) was issued at 0623 by the NWS Weather Forecast Office in Houston/Galveston, Texas. The AFD discussed low ceilings, patchy fog, IFR conditions, and marginal VFR conditions across southeast Texas during the 2 hours after the AFD's issuance. Two center weather advisories (CWA) for low IFR conditions were issued at 0736 and 0739 by the center weather service unit at the Houston Air Route Traffic Control Center as shown in figure 3. The CWAs were active for the area near the accident site and were valid until 0930.

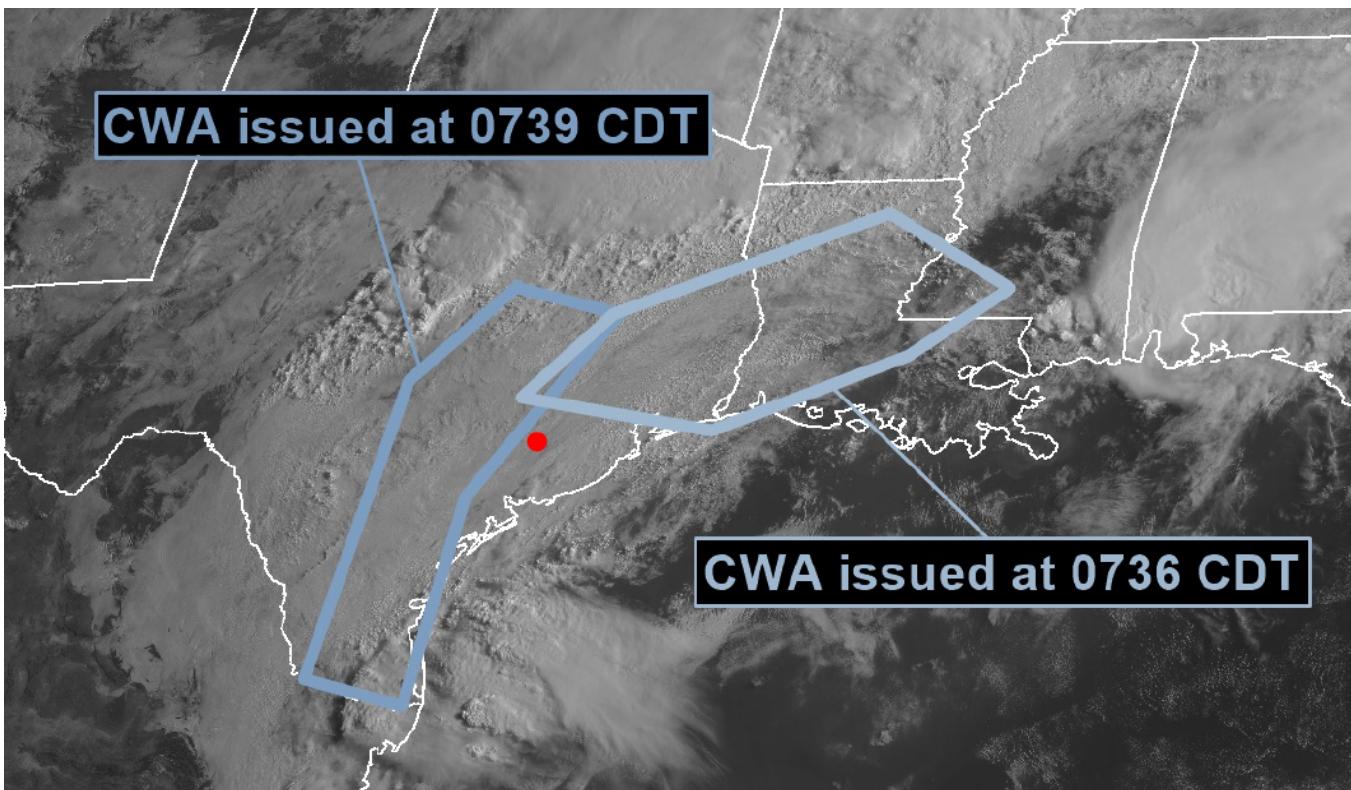


Figure 4 – Two CWAs for near the accident site, at the accident time. The accident site is marked by the red dot.

It could not be determined if the pilot accessed weather information before departure and, if so, what data was retrieved. According to the operator, the airplane had no onboard weather capability. According to Leidos, neither it nor any third-party vendors using Leidos flight planning services had any contact with the accident pilot on the day of the accident or the day before the accident. However, it is possible that the pilot obtained weather information from a commercial service that did not track the activity to a particular pilot or aircraft.

FAA Advisory Circular (AC) 00-6B Aviation Weather provides information for pilots about how weather systems form. This document discusses fog and states in part:

*Fog is a visible aggregate of minute water droplets that are based at the Earth's surface and reduces horizontal visibility to less than 5/8 statute mile (1 kilometer); unlike drizzle, it does not fall to the ground. Fog differs from cloud only in that its base must be at the Earth's surface, while clouds are above the surface.*

This document discusses low ceilings and states in part:

*Stratus is the most frequent cloud associated with low ceilings. Stratus clouds, like fog, are composed of extremely small water droplets or ice crystals suspended in air. An observer on a mountain in a stratus layer would call it fog. Stratus and fog frequently exist together. In many cases, there is no real line of distinction between the fog and stratus; rather, one gradually merges into the other. Flight visibility may*

*approach zero in stratus clouds. Stratus over land tends to be lowest during night and early morning, lifting or dissipating due to solar heating by late morning or early afternoon. Low stratus clouds often occur when moist air mixes with a colder air mass, or in any situation where temperature-dewpoint spread is small.*

## **Wreckage and Impact Information**

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Fatal	<b>Latitude, Longitude:</b>	29.516111,-96.397781(est)

The accident site was located in a remote, sparsely populated area that was about 7.75 miles northeast of the operator's airstrip and about 4.50 miles north of Garwood at an elevation of about 155 ft mean sea level. The wreckage was found on private land in a flat grass field about 250 ft directly east of the western corner of the field. The trees near the accident site did not display any evidence of impact damage.

During the onsite examination of the airframe, flight control continuity was established to the extent possible, but there were some separations in the flight control system that were consistent with impact forces. All observed separations in the wreckage were consistent with overstress signatures. No preimpact mechanical malfunctions or failures were noted with the airframe.

An examination of the engine found rotational signatures on the compressor turbine, the power turbine vane, and the power turbine. The first-stage compressor rotor blades exhibited rolled-over material from contact with their respective shroud. The propeller shaft exhibited a torsional overload fracture. The rotational signatures and fractured shaft indicated that the engine was rotating under power at the time of the accident. No preimpact mechanical malfunctions or failures were noted with the engine.

## **Additional Information**

### **Weather-Related Accidents**

The FAA *Risk Management Handbook*, FAA-H-8083-2, contains information regarding weather-related accidents. Although this handbook references general aviation (GA) operations, the information is applicable to aerial application operations. The handbook states in part the following:

*Weather is the largest single cause of aviation fatalities. Most of these accidents occur to a GA operator, usually flying a light single- or twin-engine aircraft, who encounters instrument meteorological conditions (IMC) while operating under VFR. Over half the pilots involved in weather accidents did not receive an official weather briefing. Once the flight is under way, the number of pilots who receive a weather update from automated flight service station (AFSS) is dismal..... It is important*

*to recognize weather presents a hazard, which in turn can become an unmanageable risk. GA aircraft travel slowly and must fly in the weather rather than above it. Since weather is unpredictable, it is highly likely that during a flight, a pilot will encounter weather conditions different from what he or she expected. These weather conditions are not necessarily severe, like ice or thunderstorms, and analysis has shown that most VFR encounters with IMC involved low clouds and restrictions to visibility.*

*Scud running, or continued VFR flight into instrument flight rules (IFR) conditions, pushes the pilot and aircraft capabilities to the limit when the pilot tries to make visual contact with the terrain. This is one of the most dangerous things a pilot can do and illustrates how poor ADM [aeronautical decision-making] links directly to a human factor that leads to an accident....*

*Continuing VFR into IMC often leads to spatial disorientation or collision with ground/obstacles. It is even more dangerous when the pilot is not instrument rated or current.*

### Spatial Disorientation

The FAA Civil Aerospace Medical Institute's publication, "Introduction to Aviation Physiology," defines spatial disorientation as a "loss of proper bearings; state of mental confusion as to position, location, or movement relative to the position of the earth." This document lists flight factors contributing to spatial disorientation, including changes in angular acceleration, flight in IFR conditions, frequent transfer from VFR to IFR conditions, and unperceived changes in aircraft attitude. This document concludes, "anytime there is low or no visual cue coming from outside of the aircraft, you are a candidate for spatial disorientation."

The FAA's *Airplane Flying Handbook*, FAA-H-8083-3B, describes hazards associated with flying when the ground or horizon is obscured. The handbook states in part the following:

*The vestibular sense (motion sensing by the inner ear) can and will confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in airplane attitude, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, false sensations are often generated, leading the pilot to believe the attitude of the airplane has changed when, in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation.*

## Medical and Pathological Information

---

The Travis County Medical Examiner's Office, Austin, Texas, conducted an autopsy of the pilot. His cause of the death was multiple blunt force injures.

Toxicology testing performed at the FAA Forensic Sciences Laboratory detected ethanol in various pilot specimens but not in his liver specimens. After absorption, ethanol is distributed throughout the body; therefore, the toxicology results are consistent with postmortem ethanol production. The toxicology testing found no carbon monoxide in the pilot's blood specimens and no drugs in the pilot's urine specimens.

## Organizational and Management Information

---

ANF Air Service, Inc., is a 14 CFR Part 137 aerial application operator based in Garwood, Texas. The operator conducts aerial application operations throughout Texas. The operator employs several pilots and utilizes the Air Tractor AT-402, -502, -802-series airplanes. The 14 CFR Part 137 operating certificate for ANF Air Service, Inc., is managed by the FAA Houston Flight Standards District Office, Houston, Texas.

14 CFR Part 137.19 discusses the certification requirements for operators. A pilot who desires to perform aerial application operations must successfully complete a knowledge (written test) and skills test (flight evaluation), consisting of a variety of topics unique to aerial application operations. The topics areas for the knowledge and skills test does not include weather-related knowledge (such as pre-flight weather planning) and skills (such as leaving inadvertent IMC) that are unique for aerial application operations.

FAA Order 8900.1 Flight Standards Information System contains guidance for FAA principal operations inspectors (POIs) regarding oversight and surveillance of 14 CFR Part 137 operators. A review of FAA Order 8900.1 found no guidance for FAA POIs when conducting oversight and surveillance operations on agricultural aircraft operators regarding topics such as VFR into IMC avoidance.

FAA AC 137-1B Certification Process for Agricultural Aircraft Operators contains information of the certification process 14 CFR Part 137 operations. FAA AC 137-1B does not contain any guidance for operators to develop strategies for VFR into IMC avoidance.

Title 14 CFR Part 137 does not require operators to have a Safety Management System.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Hodges, Michael
<b>Additional Participating Persons:</b>	Justin Kelly; FAA Houston FSDO; Houston, TX Dakota Lowe; Air Tractor; Olney, TX Helen Tsai (Accredited Representative); Transportation Safety Board of Canada; Gatineau Jeffery Davis (Technical Advisor); Pratt & Whitney Canada; Longueuil
<b>Original Publish Date:</b>	June 3, 2020
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.ntsb.gov/Docket?ProjectID=99410">https://data.ntsb.gov/Docket?ProjectID=99410</a>

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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](#).