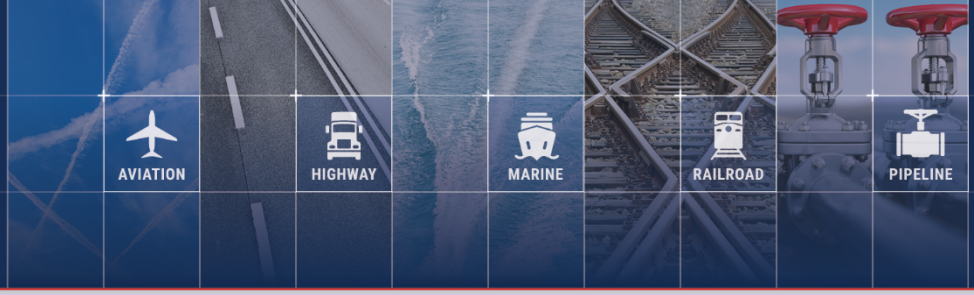

Aviation Investigation Final Report

Location:	Reliance, Tennessee	**Accident Number:**	ERA23FA219
Date & Time:	May 7, 2023, 18:49 Local	**Registration:**	N725AS
Aircraft:	Cessna 182	**Aircraft Damage:**	Substantial
Defining Event:	Windshear or thunderstorm	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The instrument-rated private pilot departed on an instrument flight rules (IFR) flight and climbed to 9,000 ft mean sea level (msl) on a southeast heading. Radar data indicated that for about the first 2 hours and 30 minutes, the airplane maintained a relatively straight course. Twice the pilot requested air traffic control (ATC) provide radar vectors around weather, confirming with one controller that the airplane was equipped with on-board weather observation capability. During cruise flight, while flying at an airspeed above the airplane's published maneuvering speed in an area with a valid Convective SIGMET, the airplane encountered the leading edge of precipitation and building cumuliform clouds in convective updrafts. This weather system was associated with a line of forecast thunderstorms and other pilots had reported the presence of severe to extreme turbulence while flying in the vicinity of it. The accident airplane's heading and altitude changed several times during the final portion of the flight, and these deviations were not instructed by the controller or announced by the pilot.

Following a second right turn the controller commented to the pilot, "it looks like you are in a little bit of a descent in a turn is everything alright?" The pilot did not reply to that communication and radar contact with the airplane was lost. A radar performance study indicated that when the airplane was last observed by radar, while flying at an altitude of about 8,850 ft msl, it was operating at a calibrated airspeed of 134 knots, which was 35 knots greater than the published maneuvering speed. Although the radar data did not capture the final descent, the airplane likely began descending after encountering severe to extreme turbulence. During that descent, the airplane's airspeed which was already well above the published maneuvering speed likely increased and an in-flight break-up occurred, separating both wings and a majority of the right horizontal stabilizer and right elevator from the fuselage.

The postaccident examination of the airframe revealed that all fracture surfaces displayed features consistent with overload failure with no evidence of preexisting cracking. The examination of the engine revealed no evidence of any preimpact failures or malfunctions. The airplane was equipped with a Ballistic Recovery Systems (BRS), and that system's parachute and riser (lanyard) were not recovered following the accident.

Examination of the BRS airframe system components revealed that the fire pin actuator was inside the rocket cone with the activation cable still attached, which was consistent with normal activation. Evidence indicated that the forward straps that connected to each front main spar, and the rear straps that were connected to the left and right attach plates on the rear bulkhead, remained connected to their respective bolts at the 3-point shackle. The 3-point shackle, which had separate attach points (bolts) for the forward and aft straps, and for the riser (lanyard) of the parachute, was located within the main wreckage. However, the riser for the airframe parachute was not attached to the 3-point shackle. The 3-point shackle bolt for the parachute riser was not visibly deformed. The other two bolts of the 3-point shackle that secured the forward and aft straps also did not exhibit any visible damage. Examination of a portion of the rear harness revealed that the shock absorption stitching pattern was not peeled/torn, indicating that there was no force applied to the rear harness at the 3-point shackle level.

Based on this information, it is likely that the pilot activated the airframe parachute at some point during the accident sequence, the parachute bag properly deployed from its canister, and the forward harness straps opened from their stowed position; however, with the parachute riser not attached to the 3-point shackle, the BRS parachute would have been useless. Because the parachute and riser were not located, it could not be determined why the parachute riser, which last had maintenance performed nearly 6 years earlier, was not attached to the 3-point shackle.

The pilot's logbook was not located; therefore, the date of his last flight review and his instrument currency could not be determined. About 7 months before the accident, he last reported having accumulated 341 total hours of flight experience, of which 265 hours were in the accident airplane make and model.

Toxicological testing results were positive for amphetamine, quetiapine, hydroxychloroquine, tadalafil, acetaminophen and ethanol. The FAA considers amphetamine and quetiapine as "Do Not Issue/Do Not Fly" medications. Whether the effects of the pilot's use of amphetamine, quetiapine, hydroxychloroquine, or any associated underlying conditions contributed to the accident or affected his decision making could not be determined. Some or all of the small amount of detected ethanol could have been the result of postmortem production, and it is unlikely that ethanol effects contributed to the accident.

In summary, the relatively low-time instrument pilot, who was flying while using multiple unapproved medications, flew into an area of a forecast convective weather that included precipitation and building cumuliform clouds in convective updrafts. These conditions were

associated with a line of thunderstorms and severe to extreme turbulence, the latter of which by definition can render an airplane practically impossible to control. While flying well above the published maneuvering speed for the airplane's weight, the airplane likely began descending with a corresponding airspeed increase, followed by an abrupt or full-control input that resulted in the in-flight breakup.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's decision to continue an instrument flight into an area of forecast weather with severe to extreme turbulence associated with a line of thunderstorms, which resulted in an in-flight breakup. Contributing was the pilot's operation of the airplane in excess of its published maneuvering speed.

Findings

Personnel issues	Decision making/judgment - Pilot
Environmental issues	Thunderstorm - Decision related to condition
Personnel issues	Use of equip/system - Pilot
Aircraft	Airspeed - Capability exceeded

Factual Information

History of Flight

Enroute-cruise	Windshear or thunderstorm (Defining event)
Enroute-cruise	Course deviation
Enroute-cruise	Altitude deviation
Other	Aircraft structural failure
Enroute-descent	Part(s) separation from AC
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On May 7, 2023, about 1849 eastern daylight time, a Cessna 182Q, N725AS, was substantially damaged when it was involved in an accident near Reliance, Tennessee. The private pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to FAA air traffic control (ATC) records, the flight departed the South Bend International Airport (SBN), South Bend, Indiana, about 1559, on an IFR flight plan enroute to the Jackson County Airport (JCA), Jefferson, Georgia. Radar data indicated that for about the first 2 hours and 30 minutes of the flight, the airplane maintained a relatively straight course on a southeast track, at an altitude of about 9,100 ft msl. Two times during the flight while in contact with separate ATC facilities the pilot requested a radar vector around weather, confirming with one controller that the airplane was equipped with on-board weather observation capability.

About 1834, while flying on a southerly heading assigned by the controller, the airplane was located north of moderate to heavy precipitation as indicated by ground-based weather radar returns. The precipitation was associated with thunderstorms that were moving north to south. The associated cumuliform clouds building ahead of the precipitation line would have had strong updrafts as well.

At 1839:29, the pilot was provided with a radar vector for weather and advised to proceed direct to the destination airport. The airplane remained briefly on the vectored heading and then turned left flying on a southeasterly heading. At 1844:00, the pilot established contact with the Atlanta Air Route Traffic Control Center and advised the controller that the airplane was at 8,900 ft msl, which the controller acknowledged. At 1845:04, the controller asked the pilot if he was assigned 8,900 ft msl, to which he replied that he was assigned 9,000 ft msl but was getting “bounced around a little bit.” The controller advised the pilot that the airplane appeared to be out of the southern edge of the weather and appeared to be “…clear of anything

I am showing uh although we do show moderate or greater." About 1847, a Convective SIGMET was valid for the area and the airplane was at the leading edge of precipitation and building cumuliform clouds, and in an area with multiple pilot reports of moderate to severe turbulence.

The airplane continued on the southeasterly heading when, after 1847:22, heading and altitude deviations occurred. A performance study of the airplane's flight track, based on ATC radar information, showed that the airplane was flying at a calibrated airspeed that was about 11 knots above the published maneuvering speed for its weight. The calibrated airspeed remained above the published maneuvering speed for the remainder of the flight. Beginning about 1848, while flying at 110 knots calibrated airspeed, the airplane began a second right turn increasing to at least a 20° bank angle; the turn was not announced by the pilot or instructed by the controller. About that time, while flying about 26 knots above the published maneuvering speed, the controller broadcast the call sign of the airplane, which the pilot acknowledged. At 1848:24, the controller informed the pilot, "it looks like you are in a little bit of a descent in a turn is everything alright." The pilot did not reply to that communication and radar contact with the airplane was lost. At the last radar return the airplane was at an altitude of about 8,900 ft msl, at a calibrated airspeed of about 134 knots, and was flying toward the west-northwest.

An alert notice was issued for the missing airplane and ground and air searches were performed. The airplane's fuselage was located the next day about .3 nautical mile south-southeast from the last radar target.

Pilot Information

Certificate:	Private	**Age:**	54,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	February 2, 2022
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 363.4 hours (Total, all aircraft), 287.4 hours (Total, this make and model)		

According to the pilot's FAA airman records, on November 21, 2020, he received notification of disapproval of application for adding an instrument rating to his private pilot certificate. The notice indicated he would be re-examined on preflight procedures, air traffic control clearances and procedures, flight by reference to instruments, navigation systems, and instrument approach procedures. On December 15, 2020, he passed a check ride in the accident airplane,

adding an instrument rating to his private pilot certificate. He reported having accumulated 270 total hours of flight experience and 49.5 hours of instrument flight experience on the application for the instrument rating.

The pilot's logbook was not located; therefore, the date of his last flight review and his instrument currency could not be determined. He reported to an insurance company having 341 total hours of flight experience and 265 hours of flight experience in the accident airplane make and model as of October 10, 2022.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N725AS
Model/Series:	182 Q	**Aircraft Category:**	Airplane
Year of Manufacture:	1978	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	18266640
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	September 1, 2022 Annual	**Certified Max Gross Wt.:**	3100 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	3265.29 Hrs as of last inspection	**Engine Manufacturer:**	Teledyne Continental
ELT:	C126 installed	**Engine Model/Series:**	IO-470-F (33)
Registered Owner:	On file	**Rated Power:**	260 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane Type Certificate design was modified in December 2006 in accordance with (IAW) Supplemental Type Certificate (STC) SA01999CH by installation of a BRS-182 parachute recovery system.

Review of the maintenance records indicated that on August 13, 2007, BRS, Inc., Service Bulletin 07-02 was accomplished by installation of kit part number 014125-01, pickup collar upgrade. On February 12, 2016, the BRS parachute was removed for a 10-year repacking., On August 24, 2017, the repacked BRS parachute was reinstalled, and the rocket and igniter were replaced. That same entry specified that the line cutter was due for replacement in August 2022. There was no record that the line cutter was replaced.

By design, the BRS airframe parachute assembly was secured to the airframe by straps connected to both main spars at each wing root and also by straps connected to the left and right attach plates on the rear bulkhead. The front and rear harness straps were connected to separate bolts/bushings of a 3-point shackle assembly (3-point shackle). The riser (strap) of

the parachute was connected to the third bolt/bushing of the 3-point shackle. The flight manual supplement associated with the BRS specified that deployment was approved by the FAA up to an airspeed of 135 knots, which matched a placard on the instrument panel.

As part of the parachute repacking, the technician attached the parachute riser strap and the rear harness strap to separate attach points of the 3-point shackle; the work was confirmed and signed off by a quality assurance inspector. During installation of the parachute into the airplane after repacking, the front harness was the only harness required to be attached to the remaining separate bolt of the 3-point shackle. During the airplane's last annual inspection, which was completed on September 1, 2022, the mechanic who signed off the inspection reported that he performed an inspection of the airframe parachute system using instructions provided by the airplane owner. He reported that the inspection was mostly visual, and he did not report any discrepancies with the system. The BRS system instructions for continued airworthiness (ICA) inspections specified external and internal inspections; however, the 3-point shackle was not specifically mentioned, and it could not be viewed during the external or internal inspection as part of the ICA.

The airplane was equipped with an Avidyne EX500 multifunction display that was able to display weather radar images, datalink weather that included METARs, AIRMETs, and SIGMETs, and traffic and terrain information. The airplane was also equipped with a Sandel SN3500 electronic horizontal situation indicator (EHSI) that could display lightning and datalink weather. Both retained components were submitted to the NTSB's Vehicle Recorder Laboratory for read-out. Data recovered from the Avidyne indicated that the weather receiver of the device was functional during the accident flight, but the recovered data did not contain any other pertinent information to the investigation. Each non-volatile memory chip of the EHSI was removed from the circuit board and read out and imaged successfully but further attempts to recover data from the chips were not performed.

Weight calculations were performed using the airplane's latest empty weight (1,894 pounds), the weight of useable fuel with full fuel tanks (528 pounds), the weight listed at the pilot's last medical (185 pounds), the estimated weight of a duffle bag found in the wreckage (30 pounds), and subtracting the estimated fuel consumed (255 pounds) during the 2-hour-and-50-minute flight based on the flight plan fuel consumption of 15 gallons per hour. Thus, the estimated airplane weight at the time of the accident was about 2,382 pounds.

According to the airplane Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, the published maneuvering speeds (no abrupt or full control movements) at 2,450 pounds were 100 knots indicated airspeed, or 99 knots calibrated airspeed.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMMI,874 ft msl	**Distance from Accident Site:**	12 Nautical Miles
Observation Time:	18:35 Local	**Direction from Accident Site:**	327°
Lowest Cloud Condition:	Scattered / 4200 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 4900 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots / 29 knots	**Turbulence Type Forecast/Actual:**	Convective / Convective
Wind Direction:	360°	**Turbulence Severity Forecast/Actual:**	Moderate / Extreme
Altimeter Setting:	30.11 inches Hg	**Temperature/Dew Point:**	21°C / 15°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	South Bend, IN (SBN)	**Type of Flight Plan Filed:**	IFR
Destination:	Jefferson, GA (JCA)	**Type of Clearance:**	IFR
Departure Time:	15:59 Local	**Type of Airspace:**	

The accident pilot requested and received a standard preflight weather briefing package from ForeFlight at 1544 on May 6th. The weather briefing package contained all the standard weather forecast information valid at that time. Because the weather briefing was more than 18 hours before the intended departure, the weather data provided to the pilot did not include graphical forecast data.

The pilot did not request a standard, updated or abbreviated briefing package from ForeFlight before departure on May 7th. Had he done so, forecast data and graphics would have been provided. The pilot also viewed airport information at 1301, 1313, 1429, and while in-flight at 1624 for his destination airport.

Convective SIGMET 26E, which implied severe or greater turbulence, severe icing, and low-level windshear, was issued at 1755, or about 54 minutes before the accident, and it was valid until 1955. The Convective SIGMET was valid for VA, NC, TN, and KY and it reported an area of severe thunderstorms moving from 320° at 35 knots, with tops to Flight Level (FL) 410, hail to 1 inch, and wind gusts to 50 knots possible.

High-Resolution Rapid Refresh (HRRR) modeling for the approximate accident site coordinates for 1900 hours local indicated that the wind at about 8,500 ft was from 270° at 16 knots.

One witness near the accident site reported that about the time of the accident a varying wind gust from 168° to 340° occurred, with the gust from the south-southeast being described as “really hard.”

Pilot reports indicated that severe turbulence was encountered in the area of the accident. One pilot, flying a Beech 350 airplane about 131 nautical miles west-northwest of the accident site in the same moving line of thunderstorms reported about 31 minutes after the accident encountering severe turbulence at 5,000 ft msl with ± 500 ft altitude change. Another pilot flying a Piper PA-46 airplane about 156 nautical miles west-northwest of the accident site in the same moving line of thunderstorms also submitted an urgent pilot report about an hour before the accident encountering extreme turbulence between 10,000 and 11,000 ft msl. There was no injury or damage reported by either pilot.

FAA Aviation Weather Services Advisory Circular 00-45E defined moderate turbulence as causing changes in altitude and/or attitude but the aircraft remained in positive control at all times and usually caused variations in indicated airspeed. Severe turbulence was defined as large, abrupt changes in altitude and/or attitude causing large variations in indicated airspeed, with momentary times where the aircraft is out of control. Extreme turbulence was defined as the aircraft being violently tossed about and being practically impossible to control with possible structural damage.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	35.225799,-84.421951

The main wreckage, consisting of the fuselage and cabin, came to rest in a wooded area behind a house. Damage to a tree immediately adjacent to the main wreckage was noted about 30 ft above ground level; the impact mark was oriented on a magnetic heading of 167°. No fire was noted on any observed components. Both wings, the aft empennage, both wing lift struts, both cockpit/cabin entry doors, majority of the right horizontal stabilizer, right elevator, and right elevator trim tab were not attached. The propeller remained attached to the engine, which remained attached to the fuselage by one engine mount. The empennage was separated at approximately fuselage station (FS) 156.0.

Exiting the aft portion of the fuselage were black (front) and yellow straps (rear) associated with the front harnesses connecting through the 3-point shackle to the rear harness of the airframe ballistic parachute. The front harness strap was wrapped tightly several times to the left. Entrapped with the twisted webbing harness were the elevator and rudder primary control cables, trim cables, and red rope, which was the same kind of rope found in the cabin section

of the wreckage. Examination of the front harness revealed it exhibited entanglement and tightening.

The left and right wings were located about 0.6 nautical mile (nm) and 165° and 0.7 nm and 185°, from the main wreckage respectively. The aft empennage was located about 434 ft and 203° from the main wreckage. The right wing and a piece of left-side fuselage skin between FS 156.0 and 172.0 was found embedded into the fractured right aileron at approximately wing station 154.0. The airframe parachute and rocket were never located.

Inspection of the aft empennage revealed a 1/4-inch diameter rope was wrapped around the elevator trim cable and multiple loops of the rope were noted. The vertical stabilizer and rudder remained attached, but the rudder counterweight was separated and not located. The left horizontal stabilizer and elevator remained attached, but the left elevator counterweight was subsequently recovered away from the main wreckage. Examination of the remaining section of the right horizontal stabilizer revealed the forward and aft spars were fractured outboard from the root about 9.5 inches and 23 inches, respectively. The forward spar top spar cap was displaced down, while the lower spar cap was displaced up. The spar web was displaced aft. The aft spar was displaced down about 90° beginning 4 inches outboard of the attach. The fracture surfaces exhibited evidence consistent with overload with no evidence of preexisting cracking.

Examination of the left wing forward spar structure revealed the main attach fitting (spar block) was structurally separated but still had the BRS attachment bracket and associated harness installed; it was located near the main wreckage. A small section of left-wing front spar root reinforcement plate remained entrapped by the spar attach bolt. The reinforcement plate was bent forward. The forward-wing attach bolt was in place and the bolt was bent. Examination of the airframe and left-wing aft structure revealed the aft spar (wing side) was fractured about 1.5 inches outboard of the wing attach bolt. Two sections of wing spar reinforcement plate and spar remained attached. The rear spar carry thru was twisted down 90° and aft 90°. The wing spar reinforcements were rotated up about 30° and bent aft. The wing lift strut lower fitting was fractured consistent with overload.

Examination of the airframe and right wing forward structure revealed a section of door post remained attached. The spar block remained attached. The bolt was in place, and a small section of front root reinforcement plate and spar “L” shaped remained attached. The BRS bracket remained attached with corresponding 54 inches of fractured webbing. The front spar root reinforcement plate was bent forward and the spar “L” shaped was bent slightly aft. The right wing lift strut exhibited a semi-circular impact damage and was fractured consistent with overload about 31 inches from the upper attach point; thus, 61 inches of lift strut were not accounted for. Examination of the right wing aft spar revealed it was displaced forward and slightly down. Further examination of the aft spar fitting revealed a portion of fractured rear fuselage spar remained attached by the securing hardware. The fracture surfaces exhibited evidence consistent with an overload fracture with no evidence of preexisting cracking.

All fracture surfaces of both wings' main and aft spars and left-wing lower lift strut fitting exhibited evidence consistent with overload failure with no evidence of preexisting cracking. Examination of the flight controls for roll, pitch, yaw, including the canards that were installed IAW an STC, revealed no evidence consistent with preimpact failure or malfunction. The flap actuator depicted the flaps were fully retracted, which corresponded to the flap selector position in the cockpit.

Examination of the cockpit revealed extensive impact damage, and the instrument panel was structurally separated with numerous avionics separated from the instrument panel and radio stack. Evidence of circumferential scoring was noted on either the rotor, housing, or both of several gyroscopic flight instruments including from a loose rotor, from the rotor of the S-Tec gyroscope instrument, and the attitude indicator. The throttle, propeller, and mixture controls were full in, and the BRS Activation Handle was outside the handle housing and the activation cable had a slight kink near the handle.

Examination of the airframe BRS parachute system components revealed the parachute canister and rocket support, and the rocket fairing exhibited extensive impact damage. The fire pin actuator was found inside the rocket cone with the activation cable still attached consistent with normal activation. Kevlar straps that connected to each front main spar and also behind the rear seats on both sides of the airplane remained connected at all attach points on the airplane and at the 3-point shackle; however, the right forward strap was fractured 54 inches from the spar attach point. The 3-point Shackle, which had separate attach points for the forward and aft straps and also for the riser of the airframe parachute, was located within the main wreckage; however, the riser for the airframe parachute was not attached to the 3-point shackle. The bolt/bushing at the 3-point shackle that would have secured the parachute riser did not have any strap in place and the bolt/bushing were not visibly deformed. The other two bolts/bushings of the 3-point shackle that secured the forward and aft straps also did not exhibit any visible damage. Further examination of a portion of the rear harness revealed that the shock absorption stitching pattern was not peeled or torn, consistent with no force having been applied to the rear harness at the 3-point shackle level.

Examination of the engine following recovery revealed thumb suction and compression on all cylinders, valvetrain continuity, and continuity was confirmed to the accessory section when the propeller was rotated through 720° by hand. The propeller governor remained attached to the engine and the governor oil screen was clear of debris. The propeller control cable remained attached to the governor and continuity was confirmed to the propeller control knob. Examination of the ignition, lubrication, and engine fuel system components revealed no evidence consistent with preimpact failure or malfunction.

Examination of the vacuum system components revealed the vacuum pump was impact damaged but remained attached to the engine by one bolt. The top two bolts remained in place, but the housing impact separated and one of the lower attachment bolts sheared. One tooth of the engine-side vacuum pump drive coupling was missing, and one was damaged.

The teeth of the vacuum-pump drive coupling and the vacuum pump shear coupling remained intact; the pump could not be rotated by hand. Following removal of the back cover the rotor exhibited several cracks and one vane was cracked.

The propeller hub remained attached to the crankshaft flange and was undamaged. The propeller spinner was impact crushed aft and torn. Both blades remained secured inside the hub but could be rotated using hand force. One blade was bent aft about 90° about 8 inches from the hub attachment point, exhibited both chordwise and longitudinal scratching, and the outer 2 inches were slightly curled, while the remaining blade exhibited distortion, and the tip was curled aft.

Medical and Pathological Information

A postmortem examination of the pilot was performed by an Assistant Medical Examiner, Knox County, Knoxville, Tennessee. The cause of death was multiple blunt force trauma, and his manner of death was accident.

Forensic toxicology was performed on the putrefied specimens of the pilot by the FAA Forensic Sciences Laboratory, Oklahoma City, Oklahoma. Ethanol (14 mg/dL) was detected in the liver but was not detected in the brain. The results were also positive in the liver and muscle for amphetamine, acetaminophen, tadalafil, and hydroxychloroquine. Quetiapine (unquantified amount) was also positive in the liver specimen.

Ethanol is a type of alcohol. It is the intoxicating alcohol in beer, wine, and liquor, and if consumed, can impair judgment, psychomotor performance, cognition, and vigilance. FAA regulation imposes strict limits on flying after consuming ethanol, including prohibiting pilots from flying with a blood ethanol level of 0.04 g/dL or greater. Alcohol consumption is not the only possible source of ethanol in postmortem specimens. Ethanol can sometimes be produced by microbes in a person’s body after death. Postmortem ethanol production is made more likely by extensive traumatic injury.

Quetiapine, sometimes marketed as Seroquel, is a prescription antipsychotic medication. In the United States, quetiapine is approved by the Food and Drug Administration (FDA) for treating schizophrenia, and conditions associated with bipolar disorder. Quetiapine is regularly prescribed for off-label (non-FDA-approved) uses, including treatment of insomnia without underlying psychiatric illness, as well as treatment of post-traumatic stress disorder and anxiety. Quetiapine may also be misused or abused, often in combination with other recreational substances. Quetiapine commonly causes drowsiness, especially in the initial

days after starting a treatment regimen; users may develop tolerance to this effect over time. Quetiapine typically carries a warning that use has the potential to impair judgment, thinking, and motor skills, and that users should be cautioned about performing activities requiring mental alertness, such as operating a motor vehicle or hazardous machinery, until they are reasonably certain that the drug does not affect them adversely. The FAA considers quetiapine to be a “Do Not Issue/Do Not Fly” medication.

Amphetamine is a prescription medication and a Schedule II controlled substance. Amphetamine may be prescribed for attention-deficit/hyperactivity disorder, attention-deficit disorder, narcolepsy, and obesity. Amphetamine usually carries a warning that the drug may impair the ability to operate a vehicle or machinery, and that care should be taken until the effects of the drug are assessed after initiation of use. At lower doses, amphetamine has few effects on cognitive functioning and use may result in an enhancement of some psychomotor tasks, including improved reaction time, less fatigue and increased alertness, but may increase willingness to make high-risk choices. Amphetamine use at higher doses may cause poor impulse control and altered cognition, including inability to focus on divided attention tasks, worsened reaction time, and depressed reflexes. Amphetamine can also be used recreationally by users seeking euphoric effects, increased alertness, and relief of fatigue. According to the FAA, amphetamine is a “do not issue/do not fly” medication.

Hydroxychloroquine, sometimes marketed as Plaquenil, is a prescription medication; in addition to FDA- approved uses, hydroxychloroquine was proposed for use in treatment or prevention of COVID-19, however, studies have not demonstrated effectiveness for such use. Hydroxychloroquine typically carries a warning that use may cause, cardiac arrhythmias, retinal toxicity, anemia, and neuropsychiatric disorders. In addition, studies noted that persons using hydroxychloroquine for COVID-19 symptoms or prevention, had an increased risk of having abnormal electrocardiograms, increasing their risk for cardiac arrhythmias. The FAA’s Guide for Aviation Medical Examiners issuing medical certificates to pilot’s using hydroxychloroquine for conditions such as arthritis includes a status report form for the purpose of collecting information from an ophthalmologist or optometrist on an individual on hydroxychloroquine who is being considered for medical certification.

Tadalafil is a prescription medication commonly used to treat erectile dysfunction, symptoms of an enlarged prostate, and to treat pulmonary hypertension. Occasional use of tadalafil for erectile dysfunction is acceptable for pilots if there are no side effects and a 24-hour waiting period is observed from the last dose prior to flying. Daily use of tadalafil for an enlarged prostate is also acceptable for pilots if there are no side effects with use, and a 1-week waiting period has passed after initiation of therapy.

Acetaminophen is an over-the-counter medication commonly used to treat minor aches and pains and reduce fever. Acetaminophen is not generally considered impairing.

Additional Information

According to the FAA Instrument Flying Handbook, a turn to a specific heading should be made at standard rate, defined as 3° per second, which results in a complete 360° turn in 2 minutes. For purposes of instrument flight training in conventional airplanes, any turn greater than a standard rate may be considered steep. A rule of thumb to determine the approximate angle of bank is to use 15% of the true airspeed.

Preventing Similar Accidents

Thunderstorm Encounters (SA-011)

The Problem

Even when pilots are flying under instrument flight rules (IFR) and in contact with air traffic controllers, accidents can still occur due to in-flight weather because the pilots are either not advised of the severe weather ahead or are given incorrect information. Often, pilots have readily available alternatives that, if utilized, could prevent an accident.

What can you do?

- Severe weather avoidance is primarily ***your responsibility***.
- The primary job of ATC is to keep IFR aircraft separated. When their workload permits, controllers are also required to provide additional services such as weather advisories, and, upon pilot request, suggested headings to avoid radar-displayed precipitation.
- The proper use of ATC weather advisory services may be critical to your safety when operating near areas of convective activity.
- Approach control radar systems provide near-real-time weather depiction. En route centers receive weather radar information from National Weather Service NEXRAD sites that refresh the color precipitation data on ATC displays every 4 to 5 minutes. Be aware that en route weather displays may be a few minutes behind the storm and allow extra distance from reported intense precipitation, especially in front of fast-moving

convective activity. Also be aware that cockpit NEXRAD data can be 15 to 20 minutes older than indicated on the cockpit display.

- ATC radar systems depict ***only*** precipitation. Controllers cannot use radar to warn of turbulence, icing, freezing rain, or other hazards to flight. However, the presence of substantial precipitation implies the existence of thunderstorm hazards such as severe turbulence and hail.
- ATC weather advisories should include the location, extent, and intensity of radar-observed precipitation. The descriptive words for intensity were recently changed to ensure consistency across all ATC facilities. The old level 1 is now “light”; level 2 is “moderate”; levels 3 and 4 are described as “heavy”; and levels 5 and 6 are described as “extreme.” If precipitation is described to you without any reference to intensity, ask for the information so you can make a good decision about how to proceed.
- Not all ATC radar systems can provide intensity information. In such situations, you should be told “intensity unknown.”
- Some accidents appear to have involved controller uncertainty about whether the pilot was visually avoiding severe weather areas or needed radar weather assistance. The controller thought the pilot was able to see what was ahead, and the pilot thought the controller was watching out for him. It is especially important that you advise controllers if your flight conditions change from visual to instrument, and that when operating in instrument conditions you regularly request updated information on radar-depicted weather ahead of your aircraft.
- Be especially diligent about asking for updates after being transferred from one ATC facility to another. The new controller may have better equipment or be using a different radar site and have an entirely different picture of what lies ahead.
- Ambiguous use of the term “when able” has also led to confusion. Some controllers use “Cleared direct xxx when able” to mean “when weather permits you to turn safely on course,” while pilots may understand such an instruction to mean “Go direct to xxx as soon as you can navigate there.” In some cases, this ambiguity has apparently led pilots receiving ATC weather avoidance assistance to conclude that it was safe to turn direct to the specified fix, resulting in subsequent entry into thunderstorms. If you have any uncertainty about whether a course change will keep you clear of convective weather, ***ASK!***
- Give pilot reports. Controllers use them to confirm their radar weather depiction, and to obtain details such as cloud tops or the existence of icing that may not be available through any other source. Pilot reports also help controllers advise other aircraft about what to expect and what to avoid.
- The safest plan when avoiding severe weather activity is to entirely avoid the affected area or land and wait for it to pass. However, if you find yourself in need of ATC assistance, ask specific questions. Where is it in relation to my route? What does it cover? How far away is it? What intensities do you see? What looks like the best way around it?
- Make decisions about weather deviations as far in advance as possible. Controllers will have more time to respond to your needs, perform any necessary coordination, and provide you with the information you require to conduct a safe flight.

- Pay attention to weather alerts broadcast by ATC, especially SIGMETS and Center Weather Advisories, and obtain further details from HIWAS or Flight Watch if the advisory is anywhere along or near your route. Flight Watch can also supply “big picture” weather information beyond what ATC may have time to provide to you.
- Become familiar with the various on-board weather avoidance technologies available, including data-linked onboard NEXRAD weather services, and consider whether the additional information will help you to avoid encounters with severe weather.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-011.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

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