Aviation Investigation Final Report

Location:	Burnsville, North Carolina	**Accident Number:**	ERA19LA257
Date & Time:	August 22, 2019, 12:54 Local	**Registration:**	N404PE
Aircraft:	Cirrus SR22	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot stated that he obtained a thorough weather briefing that included a Convective SIGMET with embedded thunderstorms and AIRMETs for instrument flight rules conditions and icing in effect along the intended route of flight. While in cruise flight with the student pilot passenger at the flight controls, the pilot selected a heading that would take the airplane "on top of" and "between" two developing storm cells as depicted on the satellite radar imagery displayed in the cockpit. Upon entering the clouds, the airplane encountered turbulence and descended about 11,000 ft in about 36 seconds before the pilot regained control at an altitude below surrounding terrain. As the pilot increased engine power to climb above the terrain, the engine lost total power, and he deployed the airframe parachute. The airplane descended under canopy and came to rest in trees, resulting in substantial damage.

Review of weather information indicated that, before the upset, the airplane entered an area of radar echoes with reflectivities of 46.5 dBZ and likely encountered strong updrafts, severe turbulence, and severe icing associated with the thunderstorm activity. The pilot's decision to use the airplane's onboard satellite weather information, which has known latencies that can result in outdated data, for tactical weather avoidance resulted in the airplane encountering these conditions and the pilot's loss of airplane control.

Examination of onboard data and the engine magnetos revealed that the engine experienced an overspeed during the uncontrolled descent, which resulted in the catastrophic failure of both magnetos and the subsequent total loss of engine power.

Probable Cause and Findings

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

The pilot's reliance on latent satellite weather imagery for tactical weather avoidance, which resulted in flight into thunderstorms and a loss of control. Also causal was an engine overspeed during the uncontrolled descent, which resulted in catastrophic damage to the magnetos and a total loss of engine power.

Findings

Environmental issues	Thunderstorm - Effect on operation

Findings

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Aircraft	Angle of attack - Capability exceeded
Personnel issues	Decision making/judgment - Pilot

Factual Information

History of Flight

Enroute-cruise	Loss of control in flight (Defining event)
Emergency descent	Off-field or emergency landing

On August 22, 2019, about 1254 eastern daylight time, a Cirrus SR22, N404PE, was substantially damaged when it was involved in an accident near Burnsville, North Carolina. The commercial pilot and student pilot passenger were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot reported that he completed a cross-country flight earlier the day of the accident. Before departing on the return flight, he serviced the airplane with fuel, reviewed the weather, and confirmed that there were no changes from the weather briefing he had received that morning.

After departure, the pilot was incrementally cleared to climb to 17,000 ft mean sea level (msl). The pilot noted both visually and on his onboard NEXRAD radar display that "thunderstorms were building with cumulonimbus clouds along the route of flight." The controller advised a 30° left turn when the clearance to 17,000 ft was issued, and the pilot "believed" the new course and altitude would place the airplane "on top of the build-up" and "between the two cells." Shortly thereafter, the controller advised the pilot of areas of moderate-to-heavy precipitation. The pilot replied that he could see the areas of precipitation on the airplane's weather radar and that he would request additional assistance if needed. The controller subsequently cleared the pilot to "deviate left and right as necessary."

The pilot reported that, as the airplane approached the developing weather system, the NEXRAD display showed the airplane's path between the two cells and that the airplane would penetrate clouds that "did not appear dangerous." Upon entry into the clouds, the airplane encountered "very strong" turbulence. At that time, the pilot disabled the autopilot and leveled the wings "with a climbing attitude." The airplane was below the clouds, and the pilot could see that the airplane was heading toward a mountain.

The pilot initiated a climb to avoid the mountain when the engine stopped producing power. The pilot then decided that there was not sufficient time to attempt to troubleshoot and chose instead to deploy the Cirrus Airframe Parachute System (CAPS). In a telephone interview with a Federal Aviation Administration (FAA) aviation safety inspector, the passenger, who held a student pilot certificate and was seated in the left seat, stated he and the pilot had been "making that trip for 4.5 years." He said that when the airplane penetrated the clouds, the flight became "rough" and the airplane "stalled because of the weather." The passenger stated that the airplane was in a spin when it descended below the base of the clouds, and the pilot then deployed the CAPS. The passenger stated that he was flying the airplane at the time it entered the clouds, and that the pilot joined him on the controls after the loss of control.

Engine and GPS data recovered from the airplane's multifunction display (MFD) revealed that, after departure, the airplane climbed to 16,800 ft pressure altitude and remained at that altitude for several minutes. About 1248:24, the airplane entered a sharp, steep, descending right turn. The data indicated an 11,050-ft loss of altitude over approximately 36 seconds, while manifold pressure, fuel flow, and exhaust gas temperatures (EGT) all decreased. The loss of altitude was arrested at 5,237 ft, and the data indicated that the airplane climbed to 8,275 ft following the recovery. At the top of the climb following recovery, EGT and engine rpm values fell to those consistent with a loss of engine power, and another descent was depicted.

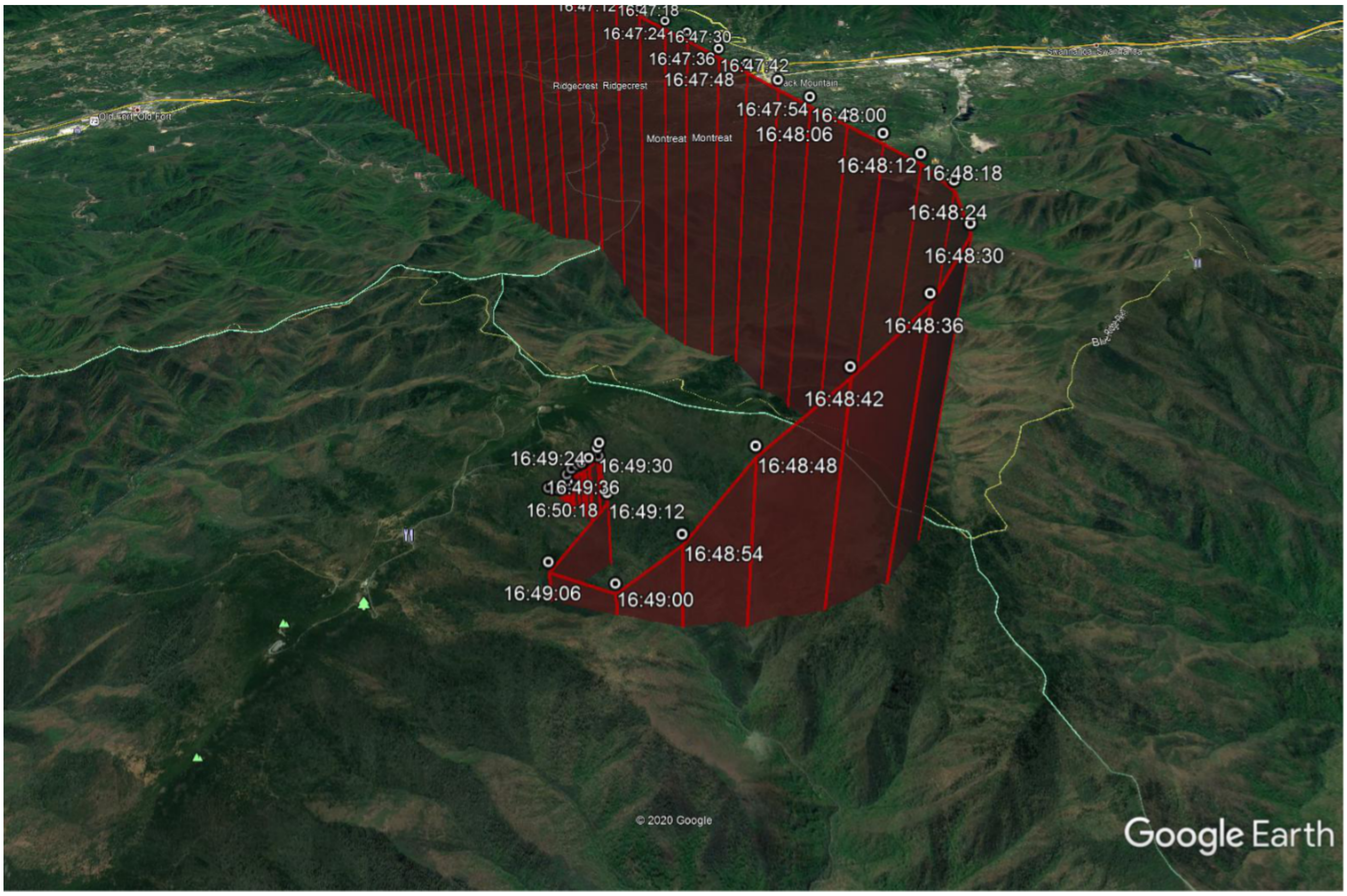


Figure 1. Cruise Flight and Descent Profiles (GPS plots in UTC)

According to the airplane manufacturer, the descent rates stabilized about 1249:36 were consistent with a descent under parachute.

During the initial descent, engine rpm increased to 3,220 rpm, which was 520 rpm above the engine manufacturer's maximum limit of 2,700 rpm.

The airplane came to rest in trees on Mount Mitchell (elevation 6,684 ft msl), was recovered from the accident site by helicopter, and then retained for further examination.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	64,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 13, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	5343 hours (Total, all aircraft), 1907 hours (Total, this make and model), 4632 hours (Pilot In Command, all aircraft), 119 hours (Last 90 days, all aircraft), 42 hours (Last 30 days, all aircraft)		

The pilot held a commercial pilot certificate with ratings for airplane single-engine land, multiengine land, and instrument airplane. He also held a flight instructor certificate with ratings for airplane single engine and instrument airplane. He was issued a second-class medical certificate on March 13, 2019. The pilot reported 5,343 total hours of flight experience, of which 1,907 were in the accident airplane make and model.

The student pilot passenger was issued his student pilot and third-class medical certificate on November 5, 2004. He reported 15 total hours of flight experience on that date.

Aircraft and Owner/Operator Information

Aircraft Make:	Cirrus	**Registration:**	N404PE
Model/Series:	SR22 Undesignat	**Aircraft Category:**	Airplane
Year of Manufacture:	2007	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	2429
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	June 28, 2019 100 hour	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	63 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3187 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	TSIO-550-K-1B
Registered Owner:	On file	**Rated Power:**	315 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The four-seat, single-engine, low-wing, fixed-gear airplane was manufactured in 2007 and equipped with a Continental TSIO-550-K1B, 315-horsepower reciprocating engine. The airplane's most recent annual inspection was completed on June 28, 2019, at 3,187 total aircraft hours.

The airplane was equipped with an Avidyne Entegra EXP5000 primary flight display and an EX5000 multifunction display.

Meteorological Information and Flight Plan

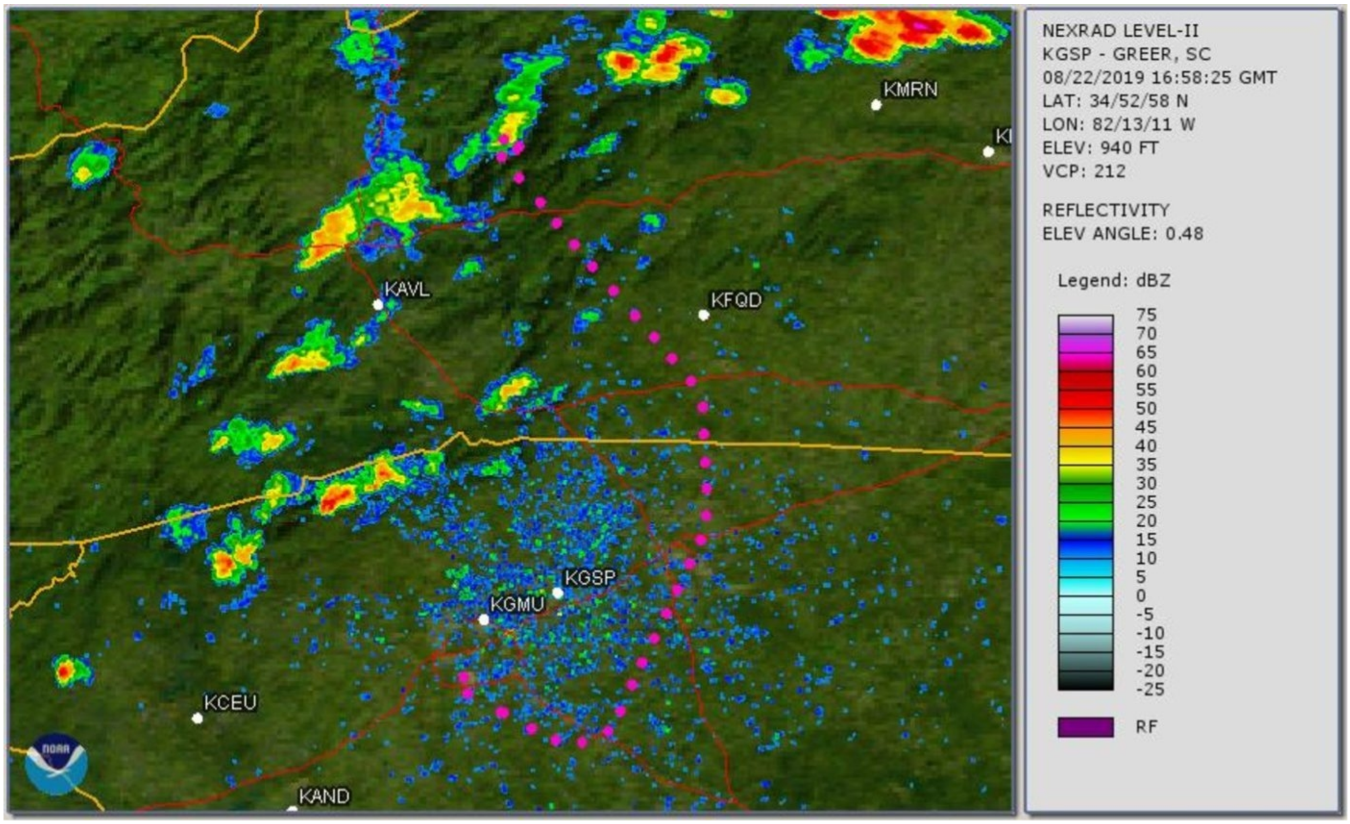
Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KAVL,2165 ft msl	**Distance from Accident Site:**	28 Nautical Miles
Observation Time:	16:42 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 6000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	340°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.12 inches Hg	**Temperature/Dew Point:**	28°C / 18°C
Precipitation and Obscuration:	Moderate - Thunderstorm -		
Departure Point:	Greenville, SC (GYH)	**Type of Flight Plan Filed:**	IFR
Destination:	Medina, OH (1G5)	**Type of Clearance:**	IFR
Departure Time:	12:16 Local	**Type of Airspace:**	Class G

A Convective SIGMET with an area of embedded thunderstorms moving from 240° at 25 knots with cloud tops to 40,000 ft, AIRMET Sierra for IFR conditions, and AIRMET Zulu for icing above 12,000 – 14,000 ft were in effect along the airplane's route of flight.

The pilot reported that he was aware of the Convective SIGMETs valid for the route of flight.

Weather radar mosaic imagery created from Next Generation Radar (NEXRAD) data was available to the pilots in the cockpit via the flight information service-broadcast and private satellite weather service providers. Due to latencies inherent in processes used to detect and deliver the NEXRAD data from the ground site to the service provider, as well as the time intervals used for the mosaic-creation process set by the service provider, NEXRAD data can age significantly by the time the mosaic image is created. In extreme latency and mosaic-creation scenarios, the actual age of the oldest NEXRAD data in the mosaic can exceed the age indication in the cockpit by 15 to 20 minutes.

Examination of the airplane's flight track overlaid in base reflectivity imagery as seen in figure 2 revealed that the airplane entered an area of echoes of approximately 40dBZ and greater, and abruptly turned to its right and descended rapidly from 17,000 ft about 1249.



Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	35.745277,-82.28833

Examination of photographs revealed damage to the nose landing gear, cowling, and the airframe skin where the parachute's risers tore free during its deployment.

Figure 3 – View of Airplane as Found (courtesy U.S. Park Service)

Additional Information

After recovery, an engine run was attempted on the airframe, and it was unsuccessful. The magnetos were replaced, and the engine subsequently started immediately, accelerated smoothly, and ran continuously without interruption.

The magnetos were disassembled, and the internal damage displayed by each was consistent throughout. The magneto rotating magnets each had fractured pieces separated just below the pinion drive gears. The plastic drive gear driven by the pinion gear in each magneto displayed stripped and fractured teeth.

Figure 4. View of Left Magneto During Disassembly (courtesy Myers Aviation)

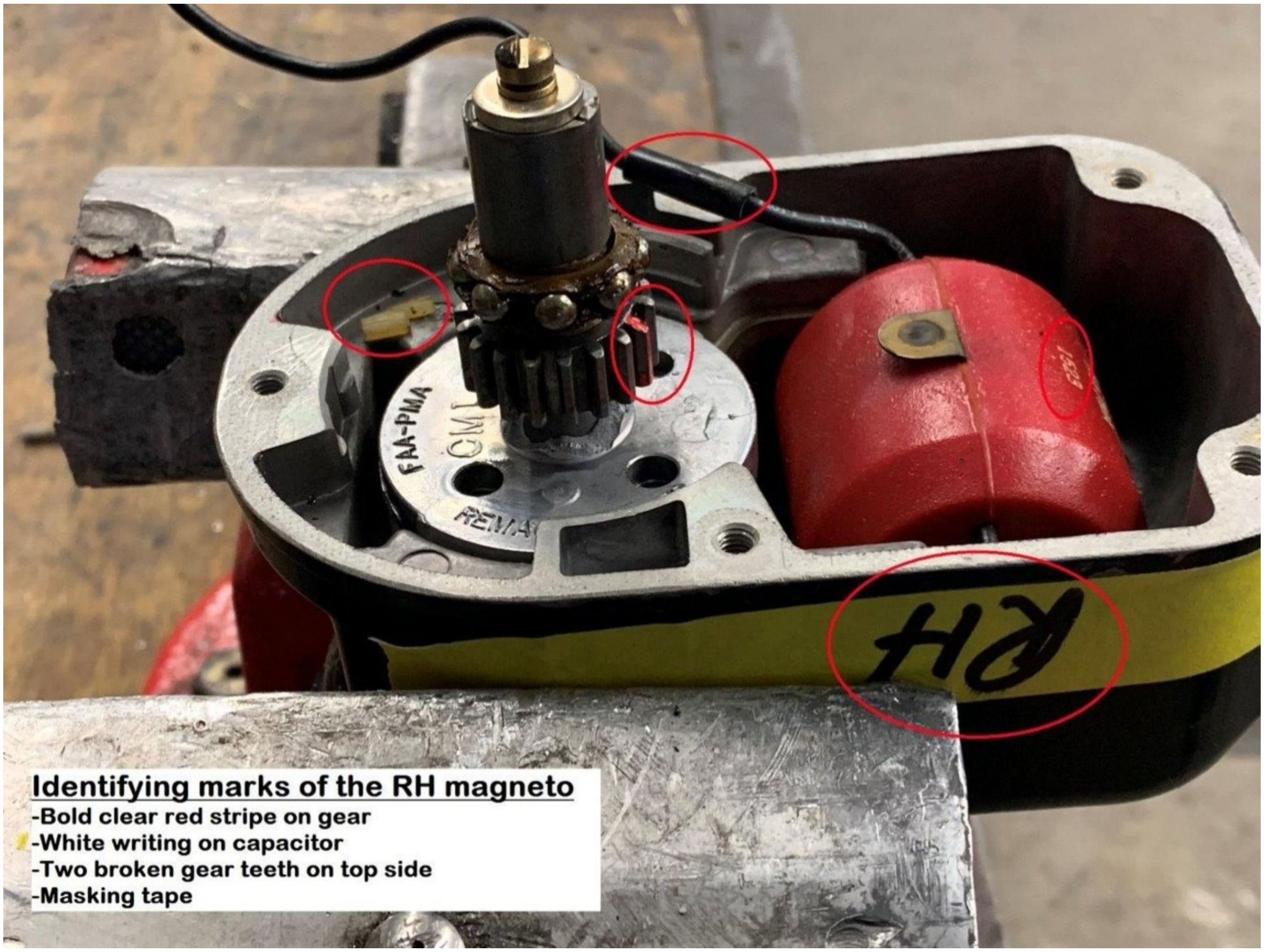


Figure 5. View of Right Magneto During Disassembly (courtesy Myers Aviation)

Preventing Similar Accidents

In-Cockpit NEXRAD Mosaic Imagery (SA-017)

The Problem

Weather radar "mosaic" imagery created from Next Generation Radar (NEXRAD) data is available to pilots in the cockpit via the flight information service-broadcast (FIS-B) and private satellite weather service providers. A mosaic image presents radar data from multiple radar ground sites on a single image on the cockpit display. When a mosaic image is updated, it may not contain new information from each ground site. The age indicator associated with the mosaic image on the cockpit display **does not** show the age of the actual weather conditions as detected by the NEXRAD network. Instead, the age indicator displays the age of the mosaic image created by the service provider. Weather conditions depicted on the mosaic image will **ALWAYS be older than the age indicated on the display**. Due to latencies inherent in processes used to detect and deliver the NEXRAD data from the ground site to the service provider, as well as the time intervals used for the mosaic-creation process set by the service provider, NEXRAD data can age significantly by the time the mosaic image is created.

Although such situations are not believed to be typical, in extreme latency and mosaic-creation scenarios, the actual age of the oldest NEXRAD data in the mosaic can **EXCEED** the age indication in the cockpit by **15 to 20 minutes**. Even small time differences between the age indicator and actual conditions can be important for safety of flight, especially when considering fast-moving weather hazards, quickly developing weather scenarios, and/or fast-moving aircraft. The general issue of latency with in-cockpit NEXRAD is discussed in pilots' guides, in industry literature, and on service providers' websites. However, the NTSB has not found that such guidance contains details about the potential time difference between the age indicator and actual conditions.

What can you do?

- Remember that the in-cockpit NEXRAD display depicts where the weather **WAS**, not where it **IS**. The age indicator does not show the age of the actual weather conditions but rather the age of the mosaic image. The actual weather conditions could be up to 15 to 20 minutes OLDER than the age indicated on the display. You should consider this potential delay when using in-cockpit NEXRAD capabilities, as the movement and/or intensification of weather could adversely affect safety of flight.
- Understand that the common perception of a “5-minute latency” with radar data is not always correct.
- Get your preflight weather briefing! Having in-cockpit weather capabilities does not circumvent the need for a complete weather briefing before takeoff.
- Use all appropriate sources of weather information to make in-flight decisions.
- Let your fellow pilots know about the limitations of in-cockpit NEXRAD.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-017.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).

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	Michael Moran; FAA/FSDO; Charlotte, NC
Original Publish Date:	March 4, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100125