



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

November 1, 2022

Specialist's Factual Report

METEOROLOGY

ERA22FA354

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A. ACCIDENT

Location: Cynthiana, Kentucky
Date: August 3, 2022
Time: 1725 eastern daylight time (2125 UTC¹)
Aircraft: Type – Piper J3C-65; Registration – N88550

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
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C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board’s meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in eastern daylight time for August 3, 2022 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl). The accident site was located at about: 38.365936° north latitude; 84.281355° west longitude at an elevation of about 720 feet.

This report provides information on the weather conditions and forecasts applicable to the accident time and location.

D. WEATHER INFORMATION

1.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at Georgetown-Scott County Regional Airport (27K²) in Georgetown, Kentucky, and was located 11 miles southwest of the accident location at an elevation of about 950 feet and had a magnetic variation of about 6° west. Automated longline³ reports from the 27K AWOS during the times surrounding the accident time

¹ UTC – abbreviation for Coordinated Universal Time

² This report uses the 3-digit International Air Transport Association format for airport identification, which does not use the geographic designating digit (e.g., “K” for stations in the continental U.S. and “P” for U.S. stations in Alaska and the Pacific region) as found in the 4-digit International Civil Aviation Organization (ICAO) identifier format. Weather observations from airports in this report are referenced by their reporting station’s identifier (using ICAO format that includes the geographic designating digit), not by the airport at which the reporting station is located.

³ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large

are presented here, and the observation closest in time to the accident time is highlighted by bold text.

[1655] METAR K27K 032055Z AUTO 24009KT 10SM SCT047 32/23 A2999 RMK AO1=

[1715] **METAR K27K 032115Z AUTO 23007KT 10SM SCT047 SCT055 32/23 A2998 RMK AO1=**

[1735] **METAR K27K 032135Z AUTO 16019G25KT 10SM SCT045 BKN055 BKN070 28/20 A3000 RMK AO1=**

[1755] METAR K27K 032155Z AUTO 16008KT 10SM SCT043 BKN080 OVC110 26/19 A2998 RMK AO1=

At 1715, the 27K AWOS reported a wind from 230° at 7 knots, visibility of 10 statute miles or greater, scattered clouds at 4,700 feet above ground level (agl), scattered clouds at 5,500 feet agl, temperature of 32° Celsius (C) and dew point temperature of 23°C, altimeter setting of 29.98 inches of mercury; Remarks: automated station without a precipitation discriminator.

At 1735, the 27K AWOS reported a wind from 160° at 19 knots with gusts to 25 knots, visibility of 10 statute miles or greater, scattered clouds at 4,500 feet agl, ceiling broken at 5,500 feet agl, broken clouds at 7,000 feet agl, temperature of 28°C and dew point temperature of 20°C, altimeter setting of 30.00 inches of mercury; Remarks: automated station without a precipitation discriminator.

2.0 Weather Radar

WSR-88D⁴ Level-II base reflectivity weather radar imagery from near Jackson, Kentucky, site (KJKL) is presented in Figures 1-6. KJKL was located about 65 miles southeast of the accident location at an elevation of about 1,461 feet. Assuming standard refraction and considering the 0.95° beam width⁵ for the WSR-88D radar beam, the KJKL 0.484° tilt would have “seen” altitudes over the accident location of between about 4,300 and 7,600 feet.

number of vendors. This does not include public accessibility to observations from a reporting station’s Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline-dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

⁴ Weather Surveillance Radar 88 Doppler (WSR-88D)

⁵ Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward from the radar antenna.

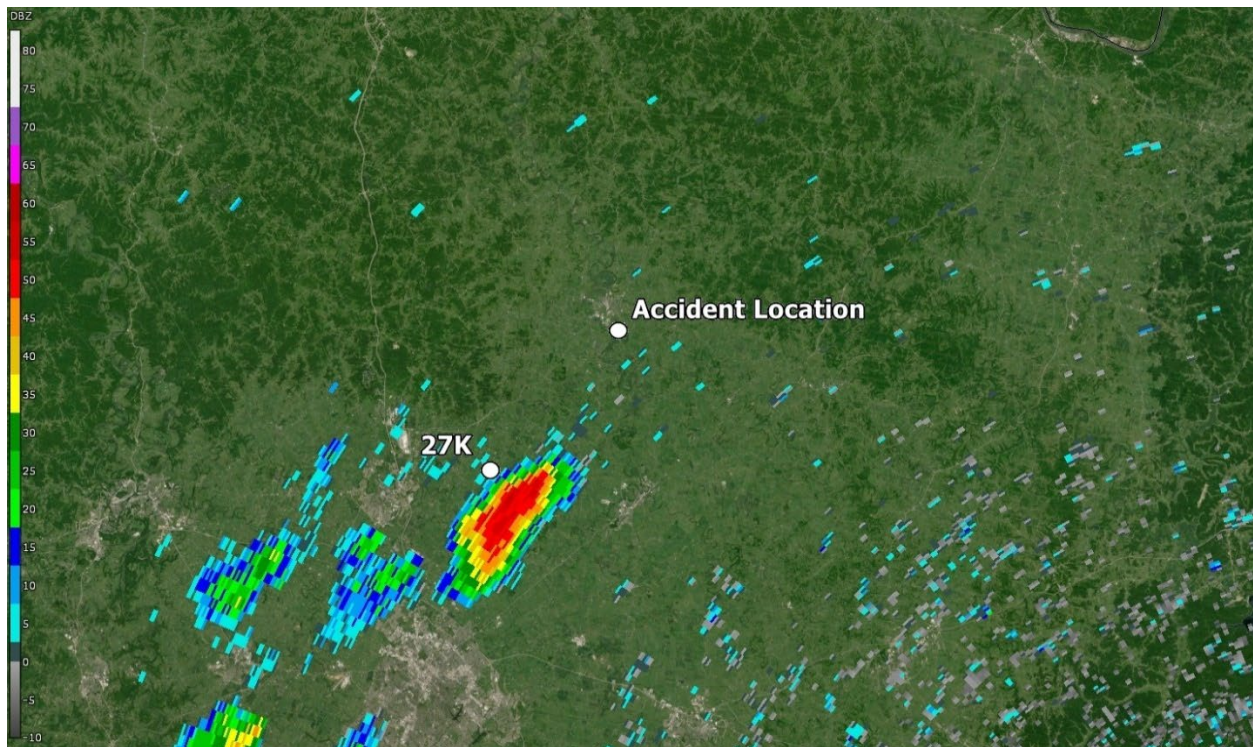


Figure 1 – KJKL 0.484° Level-II base reflectivity product from 1703.

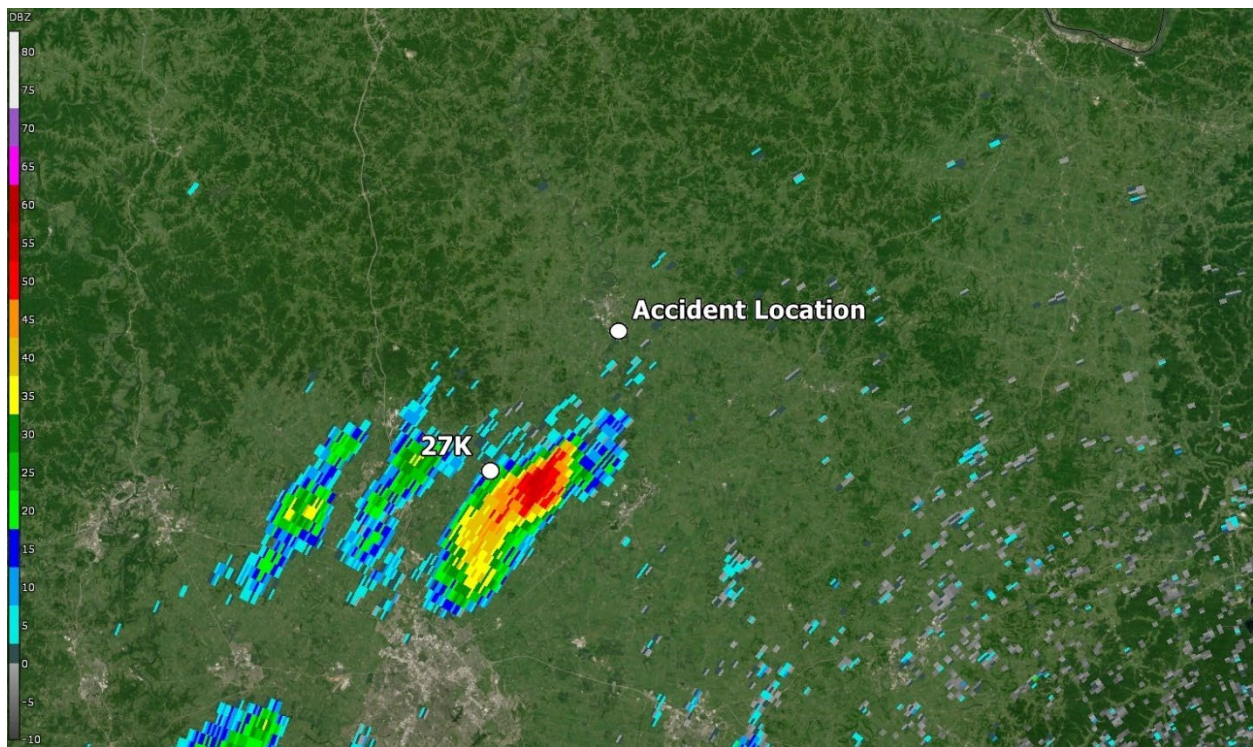


Figure 2 – KJKL 0.484° Level-II base reflectivity product from 1711.

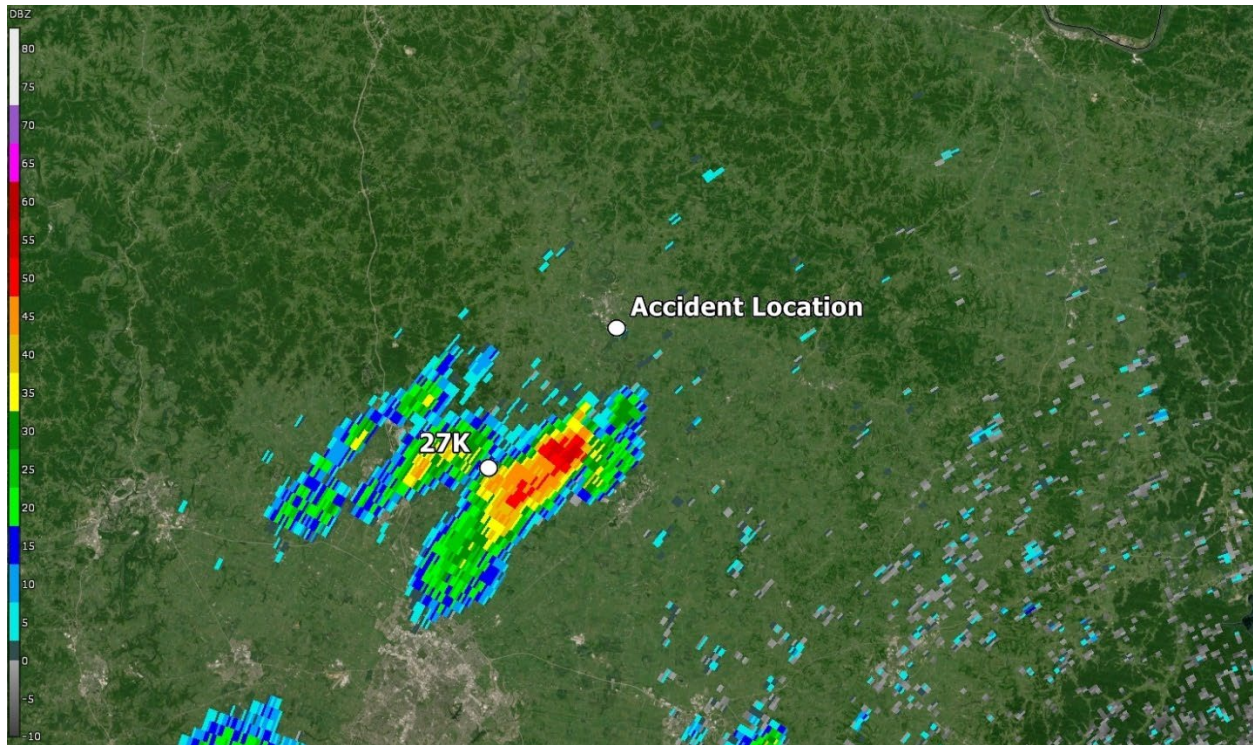


Figure 3 – KJKL 0.484° Level-II base reflectivity product from 1718.

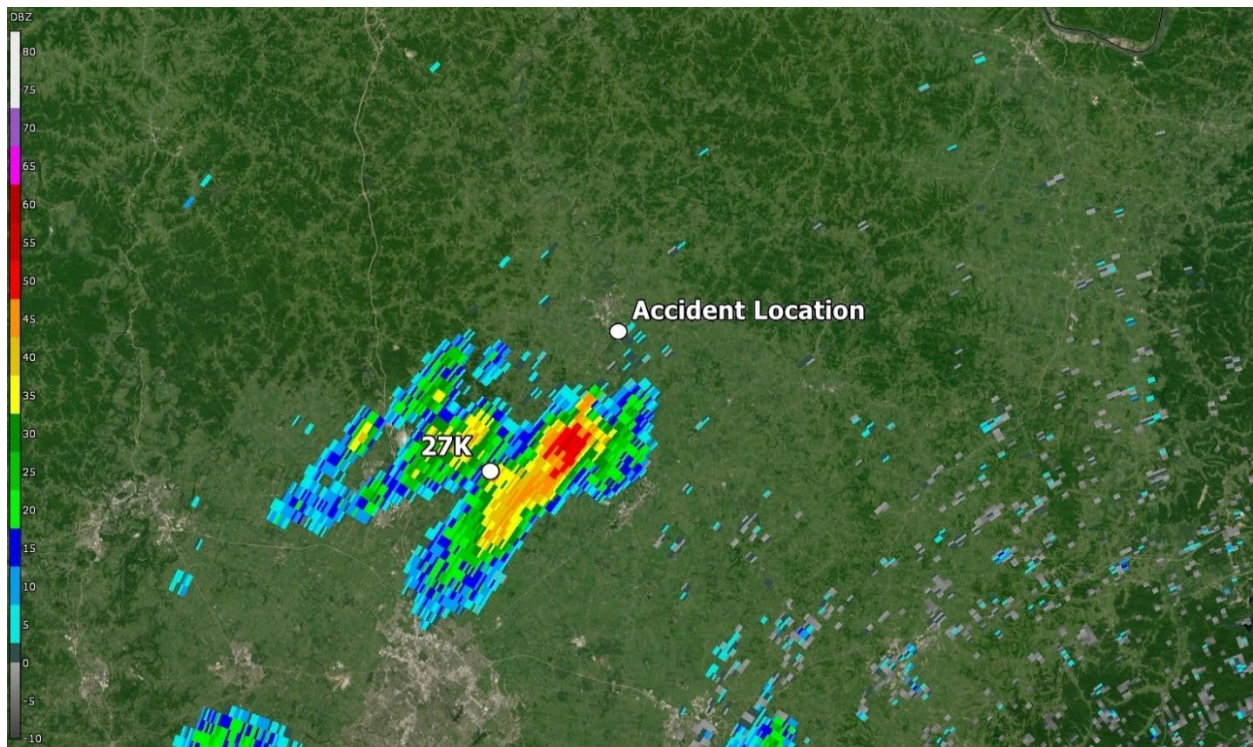


Figure 4 – KJKL 0.484° Level-II base reflectivity product from 1721.

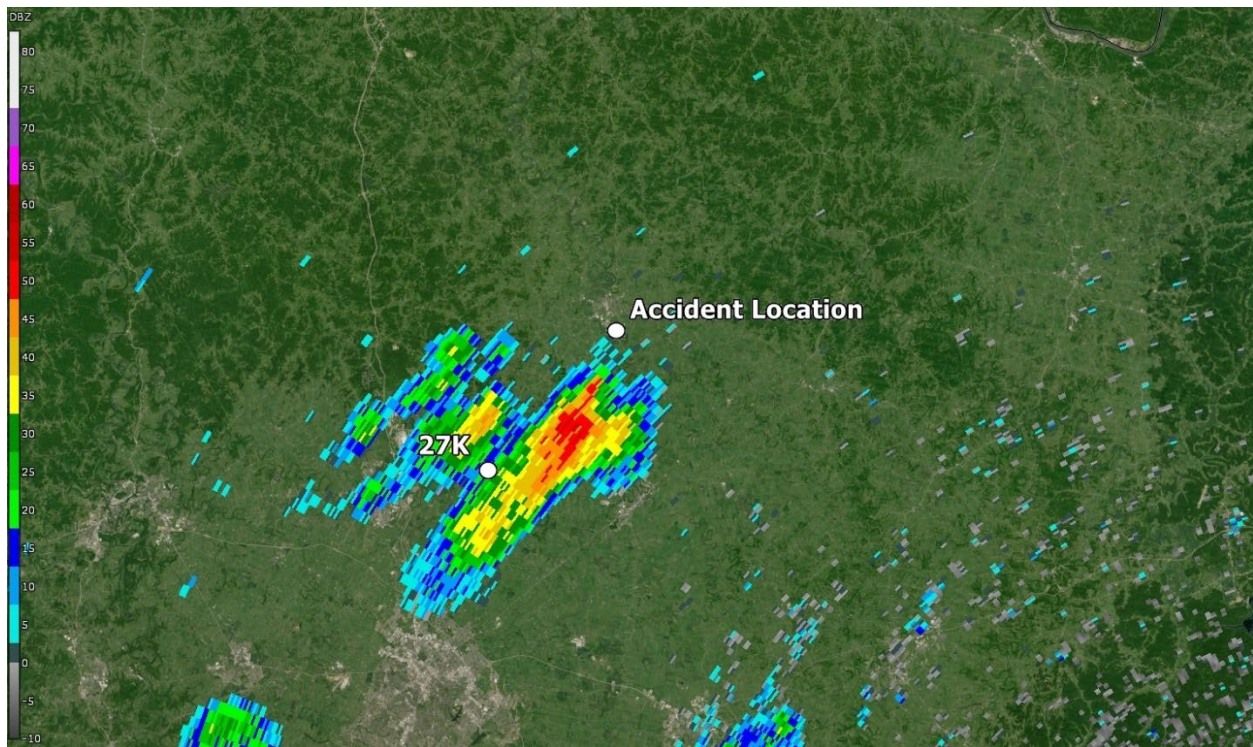


Figure 5 – KJKL 0.484° Level-II base reflectivity product from 1725.

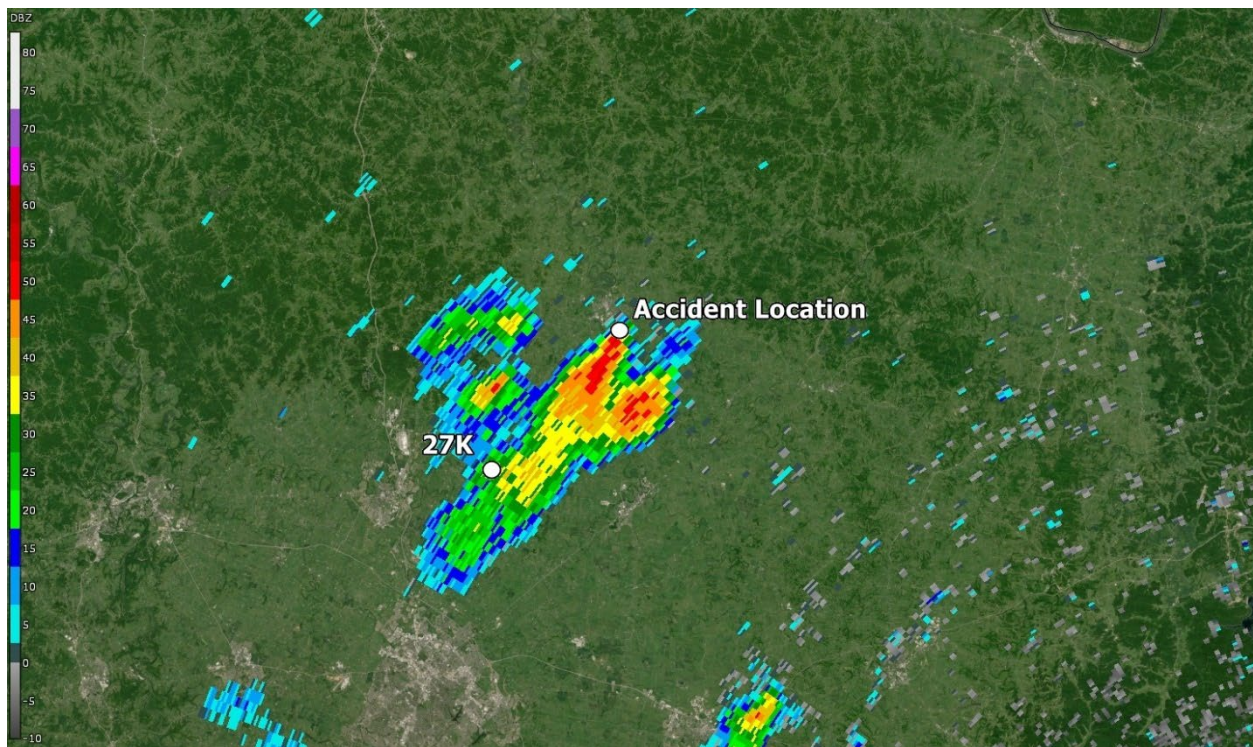


Figure 6 – KJKL 0.484° Level-II base reflectivity product from 1735.

3.0 CIWS

Archive data from the FAA's Corridor Integrated Weather System (CIWS) for the accident region at 1725 is presented in Figure 7. This image presents visible satellite imagery, precipitation, convective growth and decay (orange and blue hatched areas, respectively) and echo top information.

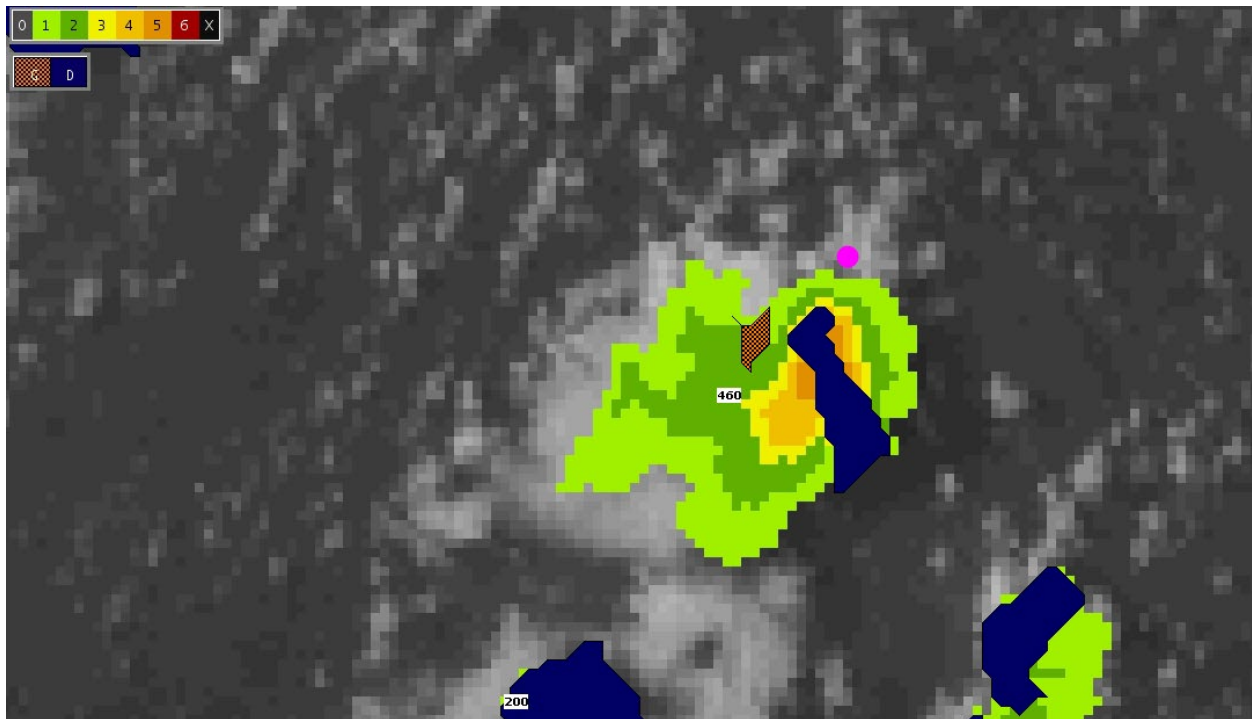


Figure 7 – Archive CIWS display from 1725. Areas of convective growth and decay are identified by the orange and blue hatched areas, respectively. Echo top heights are found in the white boxes in hundreds of feet. The accident location is denoted by the pink dot.

4.0 Lightning

A review of the Earth Networks Total Lightning Network (ENTLN) lightning database revealed the following flash total lightning activity between 1715 and 1735 in the accident region.⁶ No activity was noted within 2.5 miles of the accident location during this time period.

<u>Time</u>	<u>Type</u>	<u>Latitude</u>	<u>Longitude</u>
1717:24.3	Cloud-to-ground	38.303315	-84.364891
1724:35.2	Cloud-to-ground	38.297531	-84.329859
1724:55.6	In cloud	38.279074	-84.364449
1725:16.0	In cloud	38.27473	-84.33943
1726:53.5	Cloud-to-ground	38.287018	-84.292116
1729:45.5	In cloud	38.296556	-84.326656
1732:52.0	In cloud	38.306862	-84.305287
1734:10.5	Cloud-to-ground	38.322267	-84.305162
1734:59.6	In cloud	38.30557	-84.308628

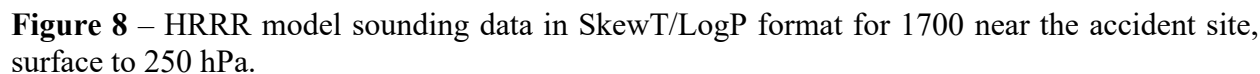
5.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁷ sounding (figure 8) for near the accident site⁸ at 1700 using an elevation of about 760 feet was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory and analyzed by the RAOB program. Clear skies were identified by RAOB for this atmosphere. The freezing level was noted at about 15,000 feet. The wind below 2,000 feet was from the southwest at magnitudes of about 10 knots. The most-unstable Convective Available Potential Energy (CAPE) parameter was 2,311 Joules/kilogram (from 986 hectopascals [hPa]). The Lifting Condensation Level (LCL) was at 5,533 feet and the Level of Free Convection (LFC) was at 6,229 feet. Downdraft CAPE (DCAPE; 6 kilometers above ground level; coldest wetbulb temperature method) was measured at 1,319 Joules/kilogram. The T2Gust ("Severe Weather Gust Potential") and WindEx ("Microburst Gust Potential") parameters were 52 knots and 64 knots, respectively.

⁶ The ENTLN was queried for a geographic area bounded by latitudes 38.4891°N and 38.2738°N, and longitudes 84.4588°W and 84.136°W.

⁷ The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.

⁸ Coordinates used for the model were 38.37, 84.28.



Geostationary Operational Environmental Satellite (GOES)-16 visible ($0.64\mu\text{m}$) and infrared ($10.3\mu\text{m}$) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Images from around the accident time are presented in Figures 9-13. The GOES-16 visible imagery depicted cloudy conditions in the accident region, with an area of clouds approaching and covering the accident location at the accident time. However, these images are not corrected for parallax error, and application of a parallax correction that adjusts the accident location to its true position *relative to the 10,400 foot-high cloud tops above it* at 1726, is presented in Figure 12. The height of those cloud tops was determined from the infrared cloud-top temperature over the accident site (Figure 13), which was about 8°C . When considering the 1700 HRRR sounding, 8°C corresponded to a height of about 10,400 feet.

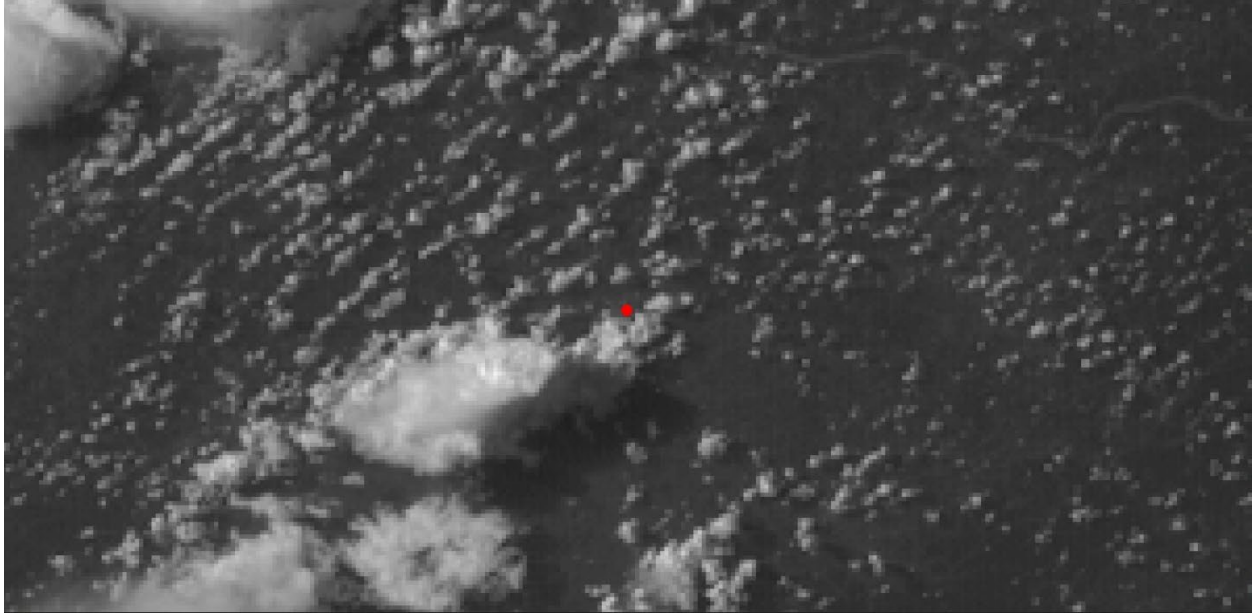


Figure 9 – GOES-16 visible imagery from 1711. Accident location denoted by the red dot. Image is not corrected for parallax error.

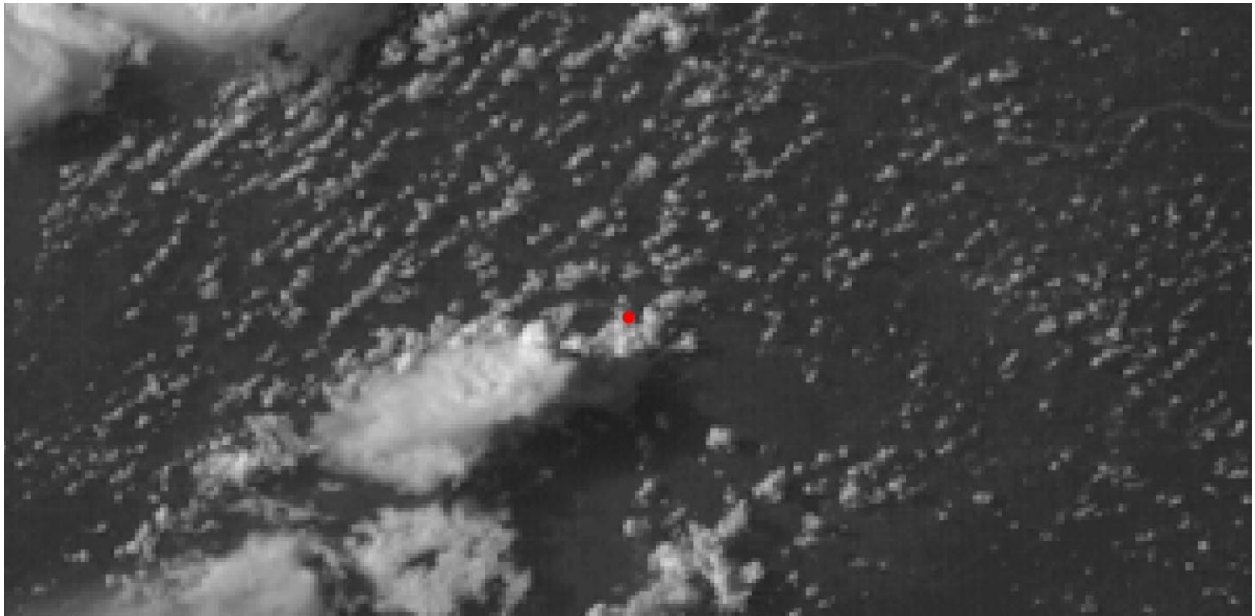


Figure 10 – GOES-16 visible imagery from 1716. Accident location denoted by the red dot. Image is not corrected for parallax error.

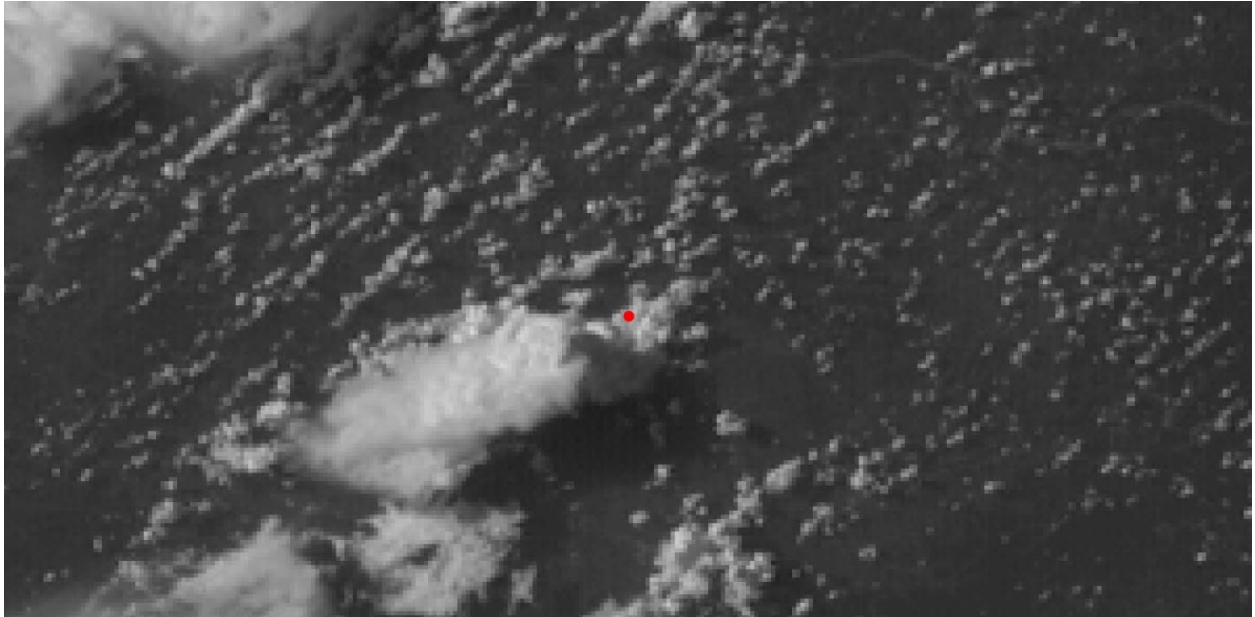


Figure 11 – GOES-16 visible imagery from 1721. Accident location denoted by the red dot. Image is not corrected for parallax error.

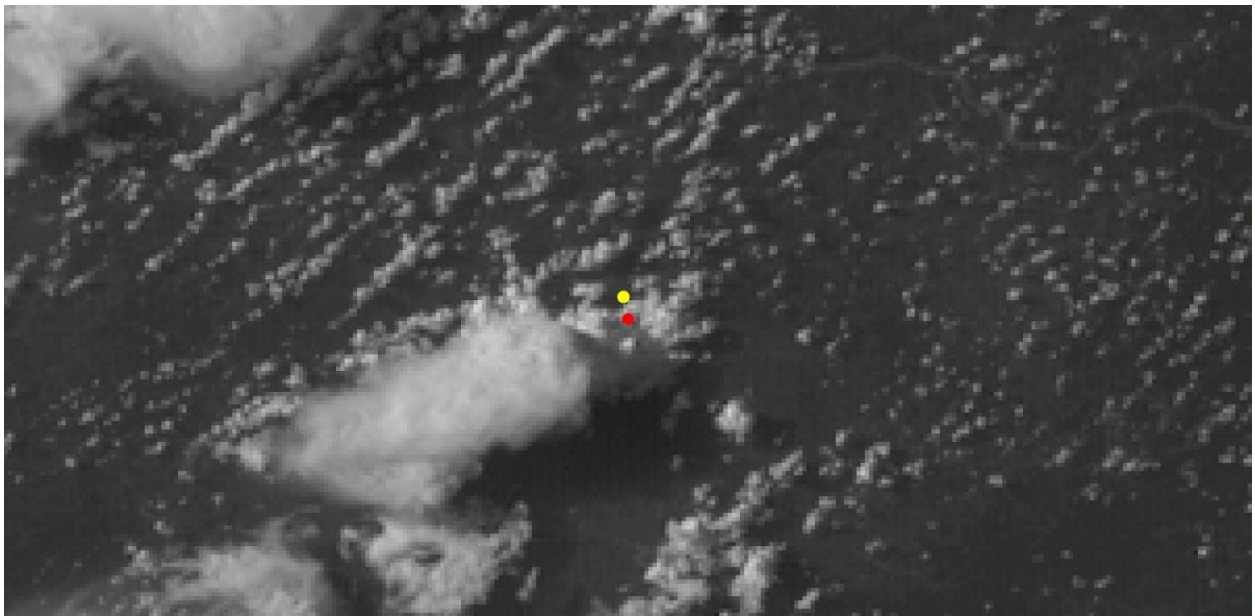


Figure 12 – GOES-16 visible imagery from 1726. Accident location denoted by the red dot. Yellow dot identifies the location of the accident site relative to the cloud tops (of 10,400 feet) when corrected for parallax.

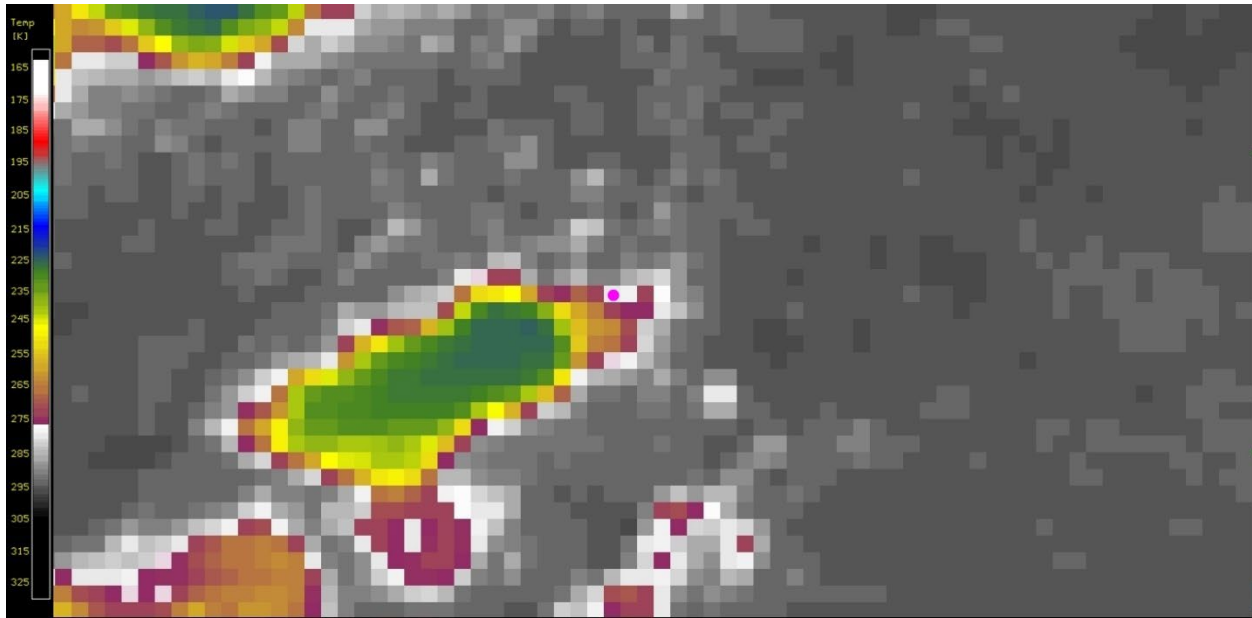


Figure 13 – GOES-16 infrared imagery from 1726. Accident location denoted by the purple dot. Image is not corrected for parallax error.

7.0 Pilot Reports

The following are the longline-disseminated pilot reports⁹ (PIREPs) reported within about 2 hours of the accident time that were applicable within 25 miles of the accident location.

LEX UA /OV FLM180020/TM 2001/FL380/TP B737/TB SMOOTH

LEX UUA /OV FLM165030/TM 2053/FL340/TP B39M/TB MOD-SEV/RM MOD-EXTRM PRECIP

IOB UA /OV SYM270010 /TM 2217 /FL030 /TP P28A /SK SCT040 /TB LGT /RM TURB VERY LGT

8.0 Area Forecast Discussion

The National Weather Service (NWS) Weather Forecast Office in Louisville, Kentucky, issued the following Aviation section of an Area Forecast Discussion at 1511.

FXUS63 KLMK 031911

AFDLMK

Area Forecast Discussion

National Weather Service Louisville KY

⁹ These do not include pilot reports only broadcast via radio.

311 PM EDT Wed Aug 3 2022

.Aviation...(18Z TAF Issuance)

Issued at 105 PM EDT Wed Aug 3 2022

Plenty of heat and humidity this afternoon, but with convective temps just barely being reached, impacts will be limited to a few diurnal cu. Otherwise look for SSW breezes with gusts just short of 20 kt. Light south winds overnight, then enough cover for a mid-level ceiling in the pre-frontal regime Thu morning. Best chance for precip is in HNB after about 13Z, and SDF in the planning period after 18Z. Will handle both of those with PROB30, keeping BWG and LEX dry through the valid TAF period.

9.0 SIGMETs

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories active for the accident location at the accident time.

10.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the NWS Center Weather Service Unit (CWSU) at the Indianapolis Air Route Traffic Control Center that were active for the accident location at the accident time.

11.0 Convective Outlook

At 1537, the NWS Storm Prediction Center issued a Convective Outlook that identified a general “thunderstorm” risk for the accident site (figure 14). Figure 15 provides a description of the different categories found in the Convective Outlook.

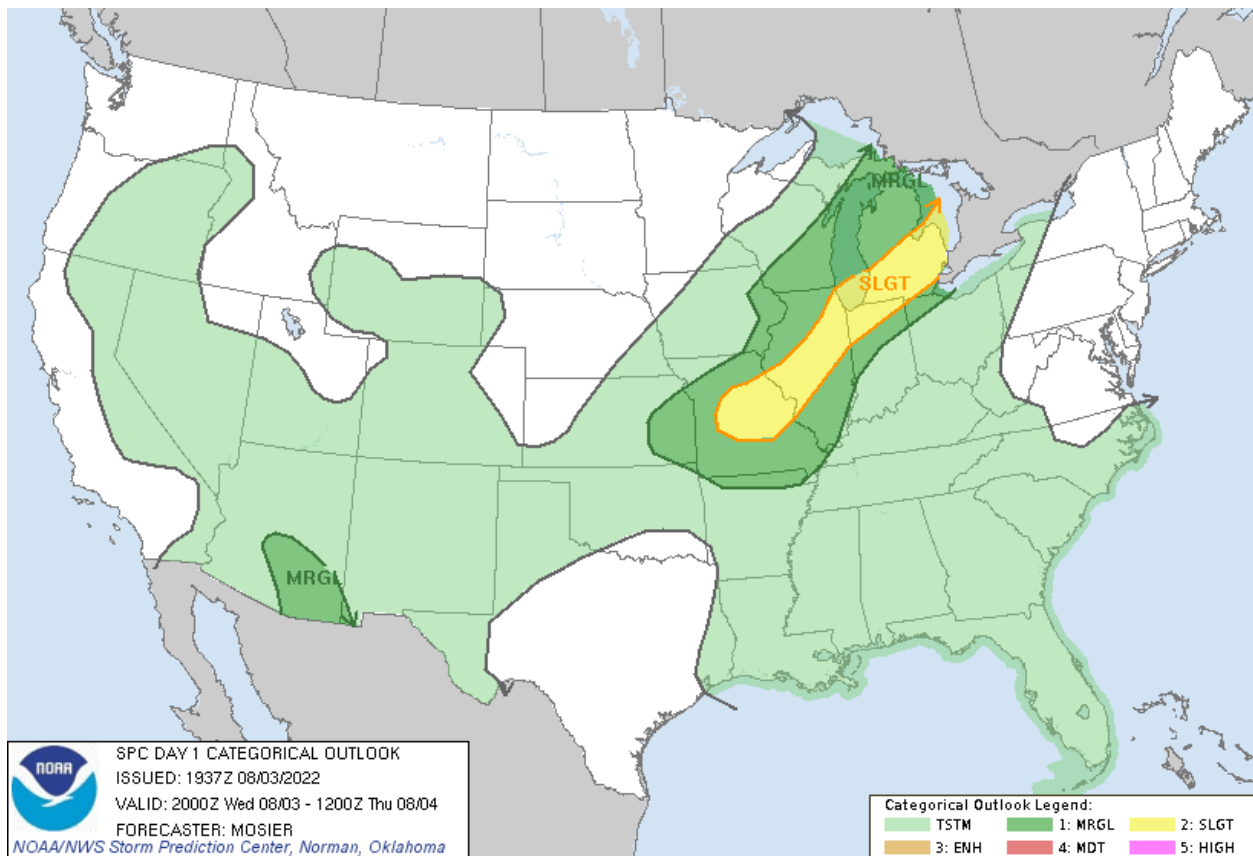


Figure 14 – SPC Convective Outlook issued at 1537.

Understanding Severe Thunderstorm Risk Categories					
THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with <u>all</u> thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					
• Winds to 40 mph • Small hail	• Winds 40-60 mph • Hail up to 1" • Low tornado risk	• One or two tornadoes • Reports of strong winds/wind damage • Hail ~1", isolated 2"	• A few tornadoes • Several reports of wind damage • Damaging hail, 1 - 2"	• Strong tornadoes • Widespread wind damage • Destructive hail, 2" +	• Tornado outbreak • Derecho
* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.					

Figure 15 – Convective Outlook categories.

12.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) are intended to provide the necessary aviation weather information to give users a complete picture of the weather that might impact flight in the continental United States. Hourly model data and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and other output from the NWS are available, however only certain imagery are archived by the NWS.

Figures 16 and 17 depict GFA forecast information on sky condition, icing, mountain obscuration, instrument flight rule (IFR)¹⁰ condition and surface wind Graphical Airmen's Meteorological Information (G-AIRMET) advisories, surface visibility, surface wind, precipitation, and other obscurations and hazards, valid for a time near the accident time. The GFA forecast imagery (Figure 16) depicted generally clear sky conditions over the accident region. The GFA surface forecast (Figure 17) depicted a southwesterly surface wind of 5-10 knots and a surface visibility of greater than 5 statute miles in the accident region. No weather phenomena were forecast in the GFA for the accident area.

¹⁰ IFR conditions - Ceilings less than 1,000 feet agl and/or visibility less than three statute miles.

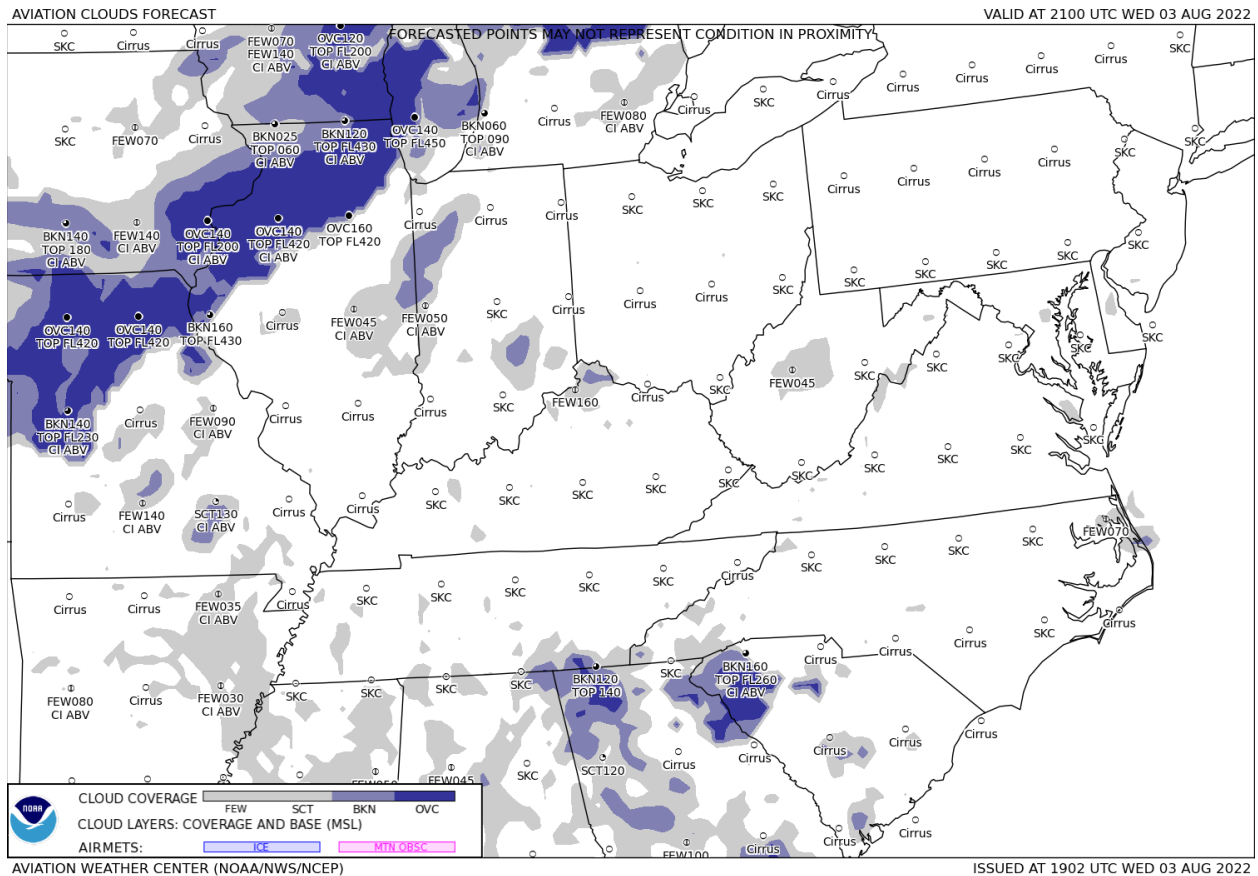


Figure 16 – GFA forecast imagery depicting sky condition and icing and mountain obscuration G-AIRMETS issued about 1500 and valid for 1700.

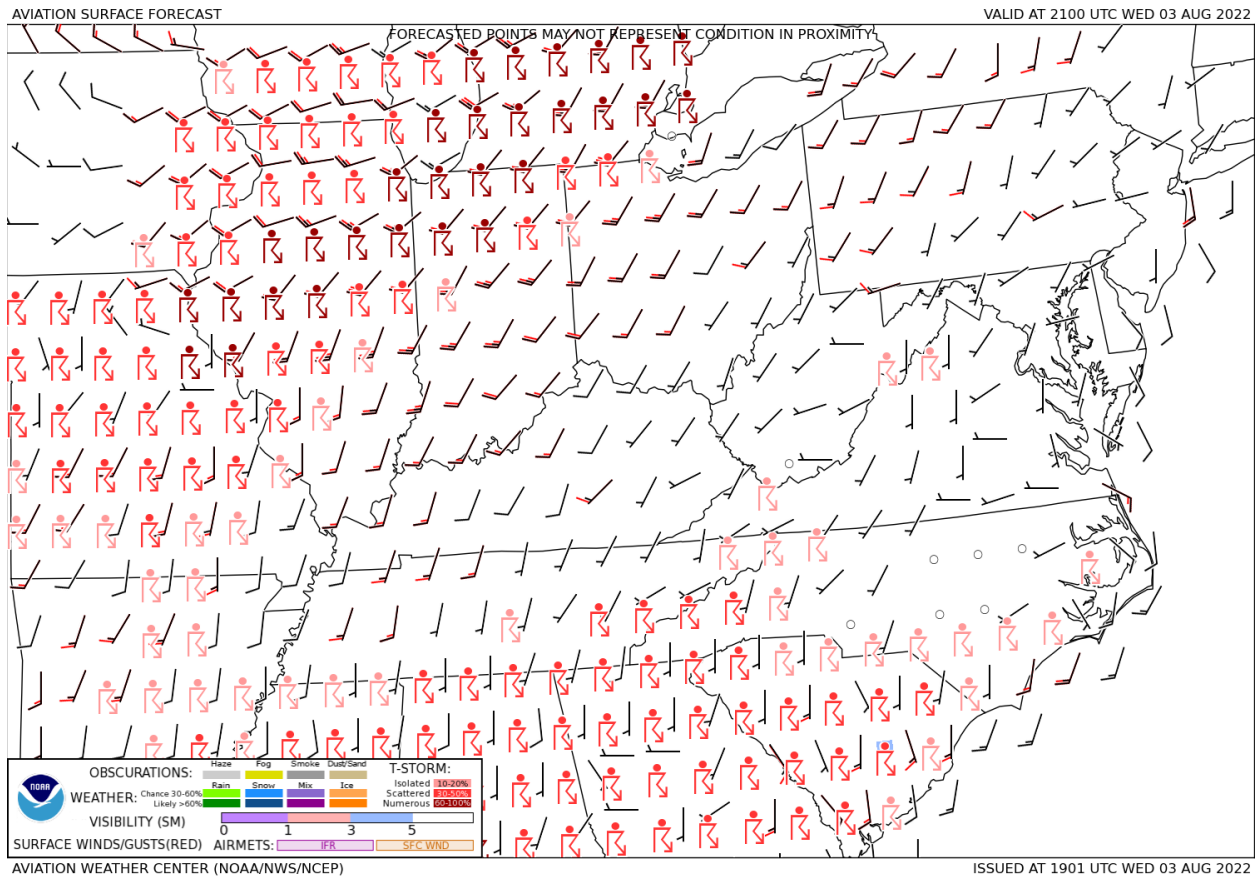


Figure 17 – GFA forecast imagery depicting IFR conditions and surface wind G-AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 1500 and valid for 1700.

Submitted by:

Mike Richards
Senior Meteorologist