



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 16, 2022

Specialist's Factual Report

METEOROLOGY

CEN22FA145

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A. ACCIDENT

Location: Pond Creek, Oklahoma
Date: March 17, 2022
Time: 1638 central daylight time (2138 UTC)¹
Aircraft: Type – Piper PA30; Registration – N8357Y

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

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 central daylight time (CDT) for March 17, 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) unless otherwise noted. The accident site was located at about: 36.628657° north latitude; 97.887604° west longitude at an elevation of about 1,095 feet.

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

D. WEATHER INFORMATION

1.0 Synoptic Conditions

The central section of the National Weather Service (NWS) Surface Analysis Chart for 1600 CDT is presented as figure 1. The chart depicted a low-pressure system at 996 hectopascals (hPa) over extreme southwest Oklahoma along the Oklahoma/Texas border. A stationary front extended northeast from the low-pressure center, running through the area of the accident, and into northern Missouri. Winds on the warm side of the front in Oklahoma were generally from the south to southeast with temperatures in low- to mid-70s °Fahrenheit (F). On the cold side of the stationary front near the accident location the winds were generally from the north with temperatures in the 50s °F, while temperatures were in the 30s °F in northwestern Kansas.

¹ UTC – abbreviation for Coordinated Universal Time

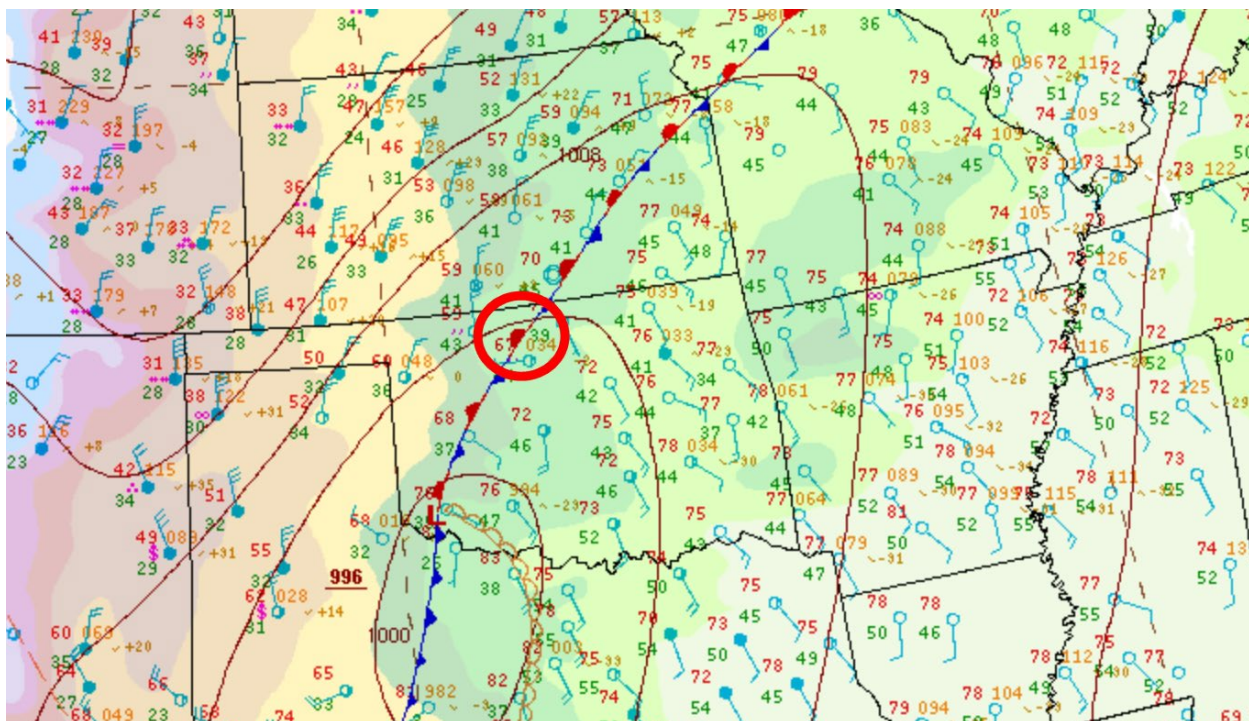


Figure 1 – Section of the NWS Surface Analysis Chart for 1600 CDT. Accident location is within the red circle.

2.0 Surface Observations

An automated weather reporting system of unknown type was located at Vance Air Force Base (END²), which was in Enid, Oklahoma, about 18 miles south of the accident location at an elevation of about 1,310 feet and had a magnetic variation of about 4° east. Automated longline³ reports from the END system during the times surrounding the accident time are presented here, and the observation closest in time to the accident time is highlighted by bold text.

[1456 CDT] METAR KEND 171956Z AUTO 15011KT 10SM SCT130 21/05 A2964
RMK AO2 SLP034 T02100045=

[1556 CDT] METAR KEND 172056Z AUTO 27004KT 10SM -DZ SCT085 SCT100
20/07 A2964 RMK AO2 DZB47 SLP034 P0000 60000 T01960067 58002=

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 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.

**[1656 CDT] METAR KEND 172156Z AUTO 29004KT 10SM BKN070 20/07 A2964
RMK AO2 DZE2057 SLP034 P0000 T01950069=**

[1756 CDT] METAR KEND 172256Z AUTO 33013KT 10SM -RA OVC060 17/09
A2965 RMK AO2 RAB46 SLP038 P0000 T01680087=

At 1656 CDT, the END system reported a wind from 290° at 4 knots, visibility of 10 statute miles or greater, ceiling broken at 7,000 feet above ground level (agl), temperature of 20° Celsius (C) and dew point temperature of 7°C, altimeter setting of 29.64 inches of mercury. Remarks: station with a precipitation discriminator, drizzle ended at 1557 CDT, sea level pressure of 1003.4 hPa, trace amount of liquid equivalent precipitation, since 1556 CDT, temperature of 19.5°C and dew point temperature of 6.9°C.

An Automated Weather Observing System (AWOS) was located at Enid Woodring Regional Airport (WDG) which was in Enid, Oklahoma, about 16 miles south-southeast of the accident location at an elevation of about 1,165 feet and had a magnetic variation of about 4° east. Augmented longline reports from the WDG AWOS during the times surrounding the accident time are presented here, and the observation closest in time to the accident time is highlighted by bold text.

[1445 CDT] METAR KWDG 171945Z 16009KT 10SM OVC150 21/06 A2964=

[1545 CDT] METAR KWDG 172045Z 20003KT 10SM BKN110 OVC150 20/06
A2965=

**[1645 CDT] METAR KWDG 172145Z 19004KT 10SM SCT050 SCT070 OVC090
21/07 A2964=**

[1745 CDT] METAR KWDG 172245Z 32009KT 10SM OVC070 18/08 A2965=

At 1645 CDT, the WDG AWOS reported a wind from 190° at 4 knots, visibility of 10 statute miles or greater, scattered clouds at 5,000 feet agl, scattered clouds at 7,000 feet agl, ceiling overcast at 9,000 feet agl, temperature of 21°C and dew point temperature of 7°C, altimeter setting of 29.64 inches of mercury.

3.0 Weather Radar

WSR-88D⁴ Level-II base reflectivity weather radar imagery from the Van Air Force Base site (KVNK) in Oklahoma is presented in figures 2-3 and 5-7. KVNK was located about 13 miles northwest of the accident location at an elevation of about 1,260 feet. Assuming standard refraction and considering the 0.95° beam width⁵ for the WSR-88D radar beam, the KVNK 0.4° tilt would have “seen” altitudes over the accident location of between about 1,270 and 2,580 feet, and the

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.

10.0° tilt would have “seen” altitudes over the accident location of between about 14,400 and 15,700 feet. The imagery revealed that at the accident time there were light values of reflectivity⁶ along the final portion of the accident aircraft’s flight path and in the immediate vicinity of the accident location.

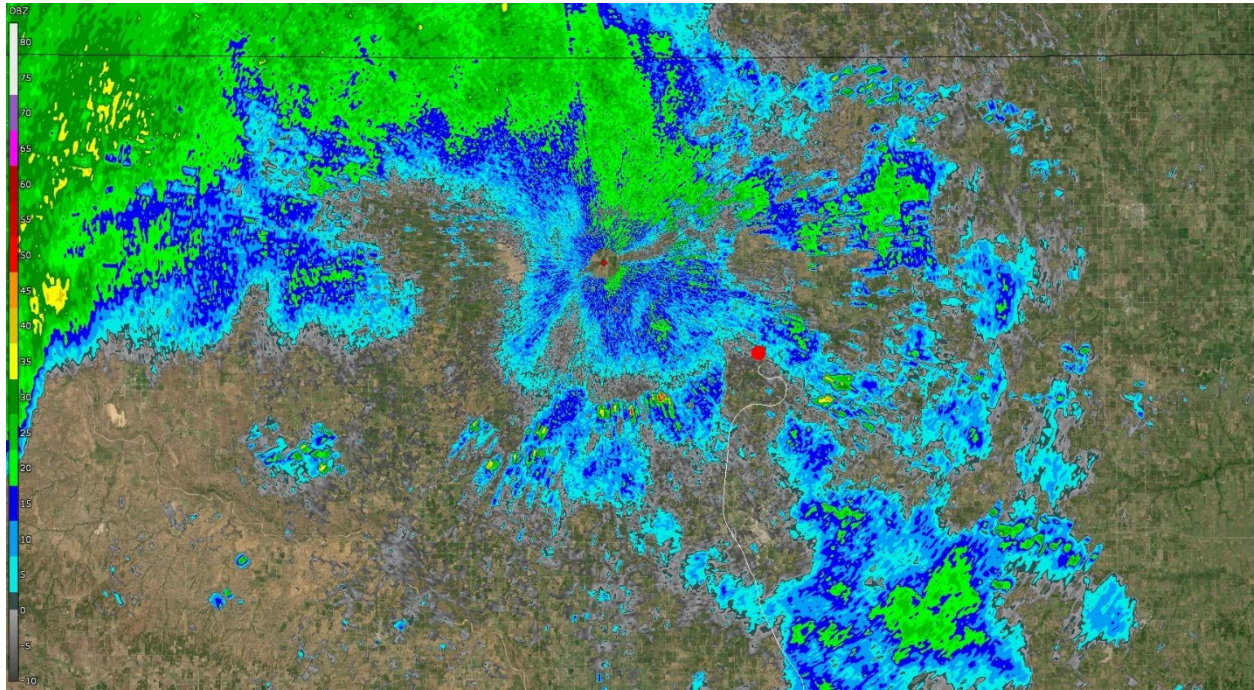


Figure 2 – KVNx 0.4° Level-II base reflectivity product from a sweep initiated at 1629:35 CDT. Accident aircraft flight path marked by thin white line. Accident location denoted by the red circle.

⁶ According to the Federal Aviation Administration’s Advisory Circular 00-24C, a reflectivity intensity of “light” is dBZ values less than 30, “moderate” is dBZ values between 30 and 40, “heavy” is dBZ values greater than 40 and less than or equal to 50, and “extreme” is dBZ values greater than 50.
(https://www.faa.gov/documentlibrary/media/advisory_circular/ac%2000-24c.pdf)

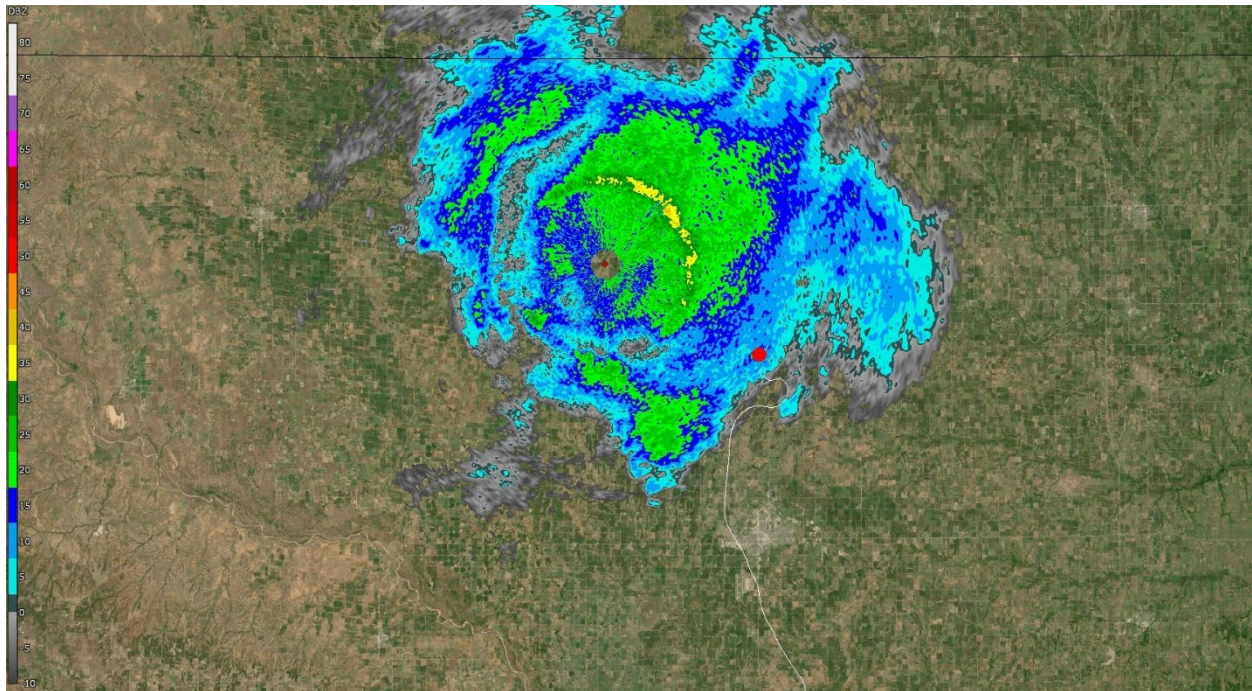


Figure 3 – KVNK 10.0° Level-II base reflectivity product from a sweep initiated at 1628:34 CDT. Accident aircraft flight path marked by thin white line. Accident location denoted by the red circle.

Figures 5-7 present a 3D “volume” of KRGX radar data⁷ from about 1635 CDT, which considers all tilts available. The isosurfaces depicted are 0, +10 and +20 dBZ, which would generally identify light values of precipitation or suspended hydrometeors. The volumes presented in figures 5-7 do not explicitly depict cloud boundaries. Generally speaking, reflectivity values (expressed in units of dBZ) express the amount of transmitted power returned to the radar receiver after hitting objects, as compared to a reference power density. According to these figures, the entire portion of the flight that occurred within the inspected volume of radar data took place within the 0 dBZ volume, and a portion of that did occur within the +10 dBZ volume.

⁷ The volume’s boundaries are approximated by latitudes 36.64° and 36.45° and longitudes -98.06° and -97.71°.



Figure 4 - Accident aircraft flight path without weather radar data depicted.

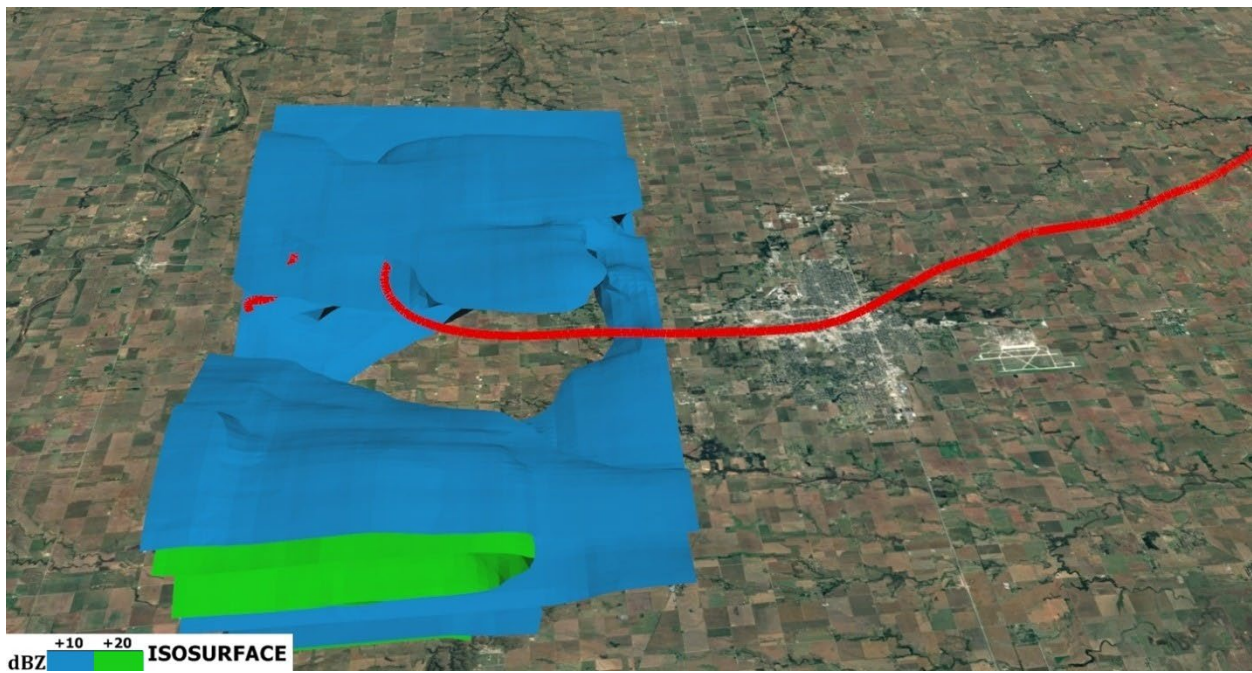


Figure 5 - Accident aircraft flight path with 3D +10 and +20 dBZ isosurfaces overlaid.



Figure 6 - Accident aircraft flight path with 3D 0, +10 and +20 dBZ isosurfaces overlaid.

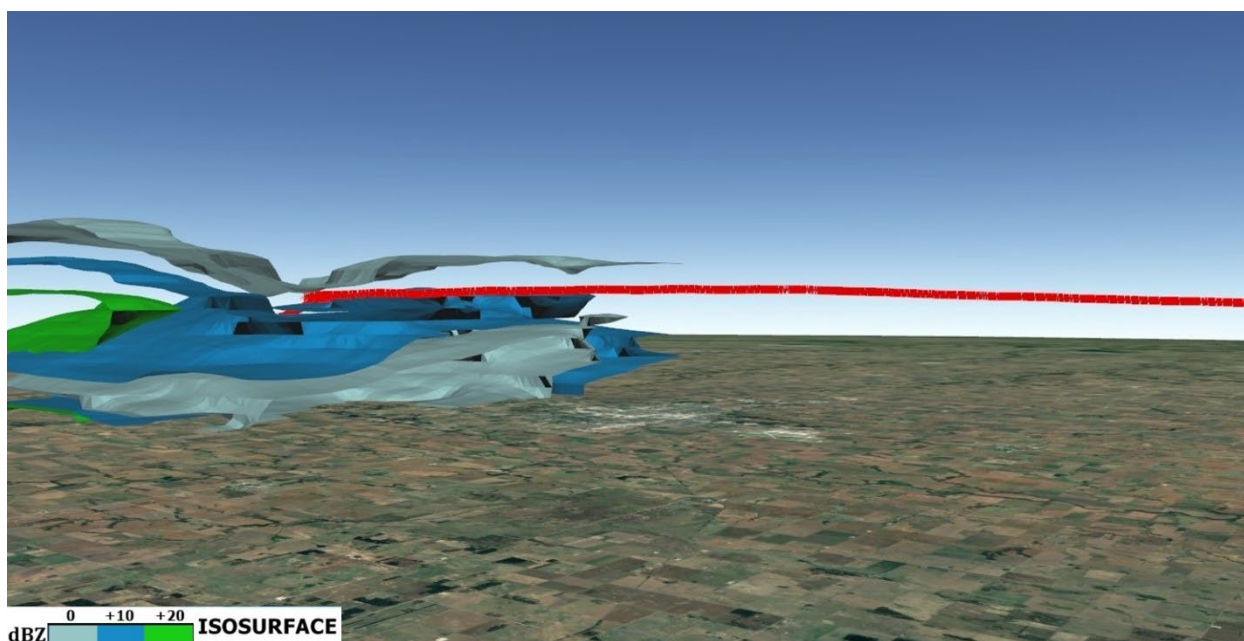


Figure 7 - Accident aircraft flight path with 3D 0, +10 and +20 dBZ isosurfaces overlaid.

4.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁸ sounding (figure 8) for near the accident site⁹ at 1600 CDT using an elevation of 1,092 feet was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory and analyzed by the RAwinsonde OBservation (RAOB) program. The potential for clouds were identified by RAOB for altitudes above about 9,000 feet. The freezing level was noted at about 8,800 feet. RAOB identified the potential for significant turbulence between about 15,400 and 17,400 feet, and light rime icing between about 15,400 and 19,400 feet.

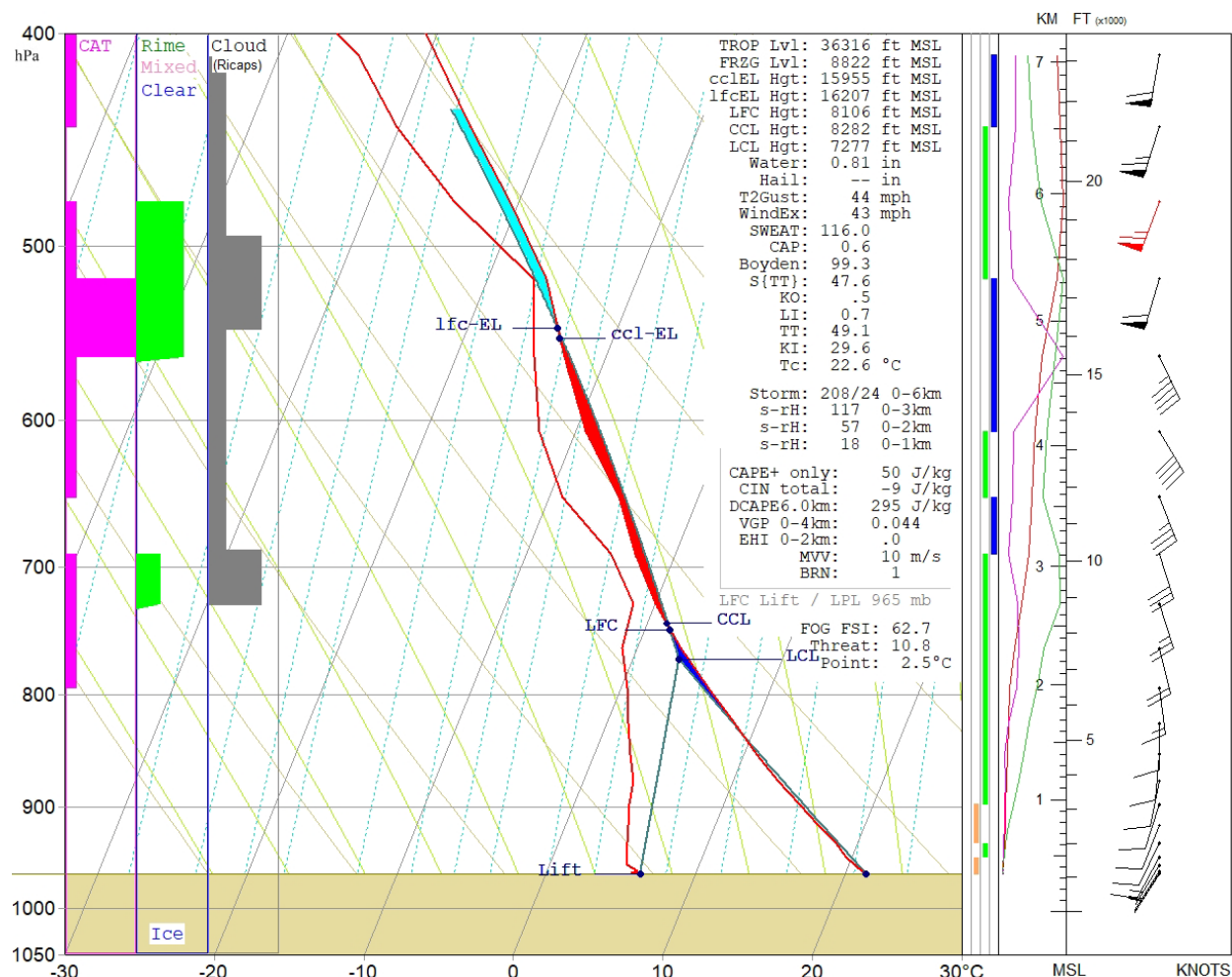


Figure 8 – HRRR model sounding data in SkewT/LogP format for 1600 CDT near the accident site, surface to 400 hPa.

⁸ 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 are assimilated in the HRRR every 15 minutes over a one-hour period.

⁹ Coordinates used for the model were 36.62, -97.89.

5.0 Satellite Imagery

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. Imagery from 1636 CDT is presented in figures 9 and 10. The visible imagery identified cloudy conditions across the accident region. Infrared imagery depicted minimum brightness temperatures over the accident location of about -25°C , which, when considering the HRRR sounding, corresponded to cloud top heights near 21,000 feet.

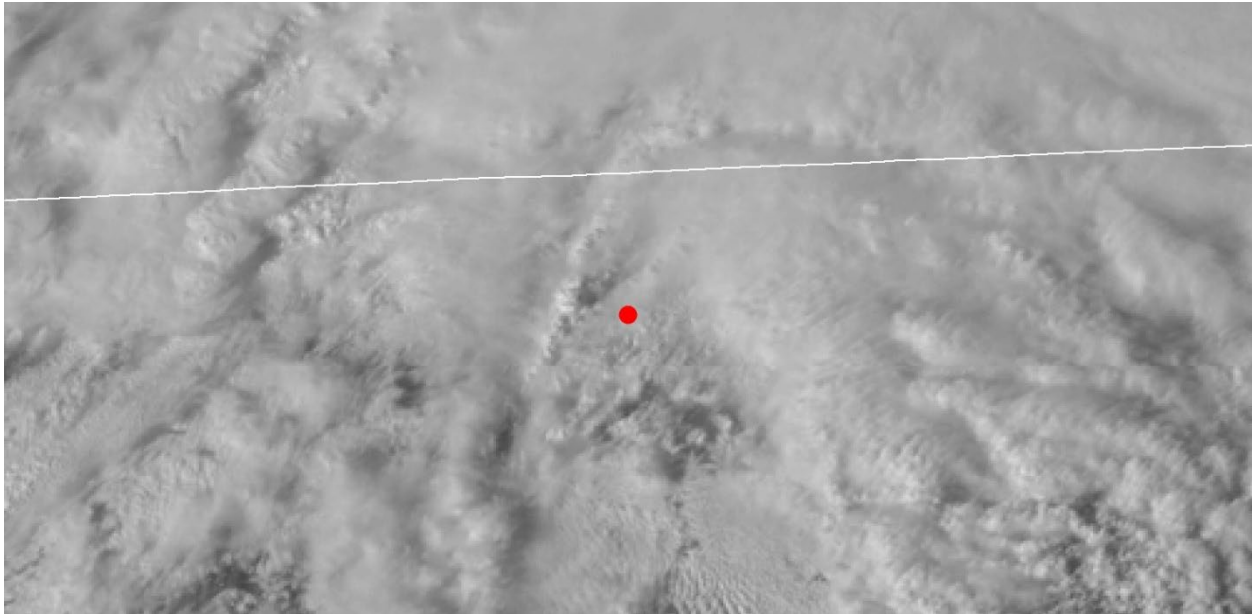


Figure 9 – GOES-16 visible imagery from 1636 CDT. Accident location denoted by the red dot. Image is not corrected for parallax error.

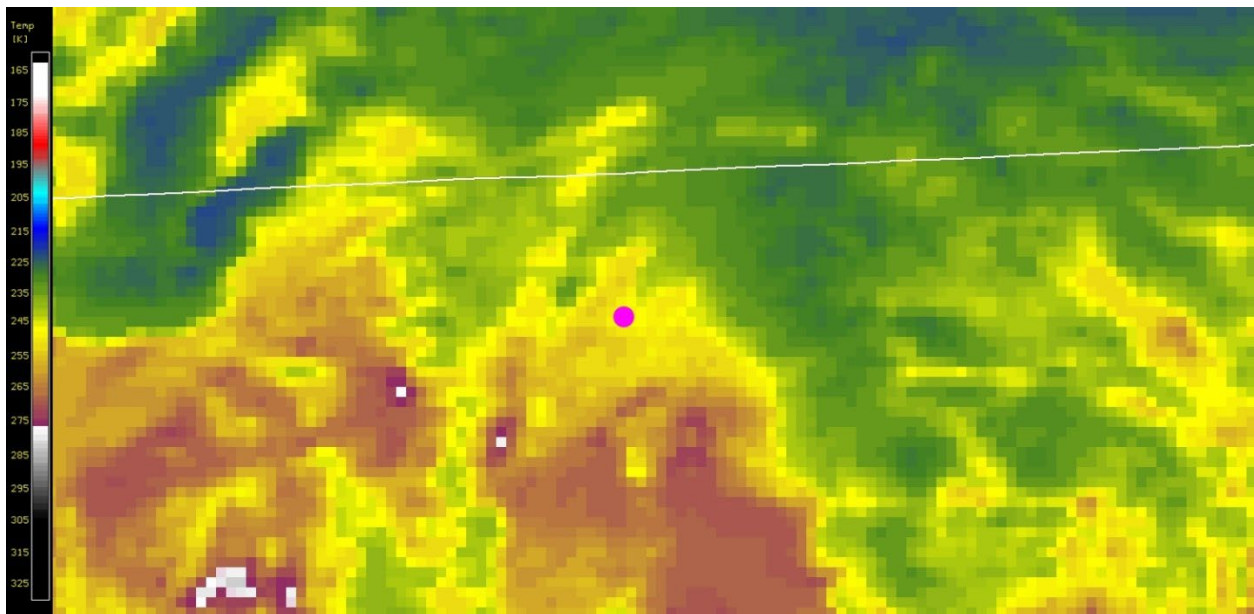


Figure 10 – GOES-16 infrared imagery from 1636 CDT. Accident location denoted by the purple dot. Image is not corrected for parallax error.

6.0 Pilot Reports

The following longline-disseminated pilot reports¹⁰ (PIREPs) were issued within 50 miles of the accident location between 1500 and 1800 CDT.

SPS UA /OV SPS020140 /TM 2125 /FL180 /TP A319 /TB LGT-MOD FL180-160 /RM
CONS LGT OCNL MOD TURB DURD FL180-160 ZFW AWC-WEB

ICT UA /OV ICT240025/TM 2209/FL150/TP BE9L/TA -04/IC LGT RME/RM DURD

7.0 Area Forecast Discussion

The National Weather Service (NWS) Norman, Oklahoma, Weather Forecast Office issued the following Aviation section of an Area Forecast Discussion at 1600 CDT.

FXUS64 KOUN 172100

AFDOUN

Area Forecast Discussion

National Weather Service Norman OK

400 PM CDT Thu Mar 17 2022

.AVIATION...

(18Z TAFS)

Issued at 1126 AM CDT Thu Mar 17 2022

A cold front will slowly cross the region today into tonight with a strong north wind expected behind the front. Ahead of the front thunderstorms will impact most of our central and northern Oklahoma sites this evening. Rain will mix with snow at KWWR after midnight tonight but little to no accumulation of snow is expected.

8.0 G-AIRMETs

There were two Graphical Airmen's Meteorological Information (G-AIRMET)¹¹ advisories that were active for the accident location at 1600 CDT; both had been issued at 1545 CDT. One advised of moderate turbulence between 16,000 feet and FL360¹² and the other advised of moderate icing between the freezing level (between 4,000 and 10,000 feet) and FL220.

¹⁰ These do not include pilot reports only broadcast via radio.

¹¹ See the Federal Aviation Administration's Aeronautical Information Manual section 7-1-6 for further information on G-AIRMETs (https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap7_section_1.html)

¹² Flight Level (FL) - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the international standard pressure datum of 1013.25 hPa (29.92 inches of mercury), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

9.0 SIGMETs

There were no non-convective or 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 Kansas City Air Route Traffic Control Center that were active for the accident location at the accident time.

Submitted by:

Mike Richards
Senior Meteorologist