



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

September 8, 2022

Specialist's Factual Report

METEOROLOGY

ERA22LA348

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A. ACCIDENT

Location: Raeford, North Carolina
Date: July 29, 2022
Time: 1404 eastern daylight time (1804 UTC¹)
Aircraft: Type – Casa 212-200; Registration – N497CA

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 eastern daylight time (EDT) for July 29, 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: 35.030556° north latitude; 79.236667° west longitude at an elevation of about 280 feet.

This report provides information on low-level wind shear (LLWS) conditions at the accident site around the accident time.

D. WEATHER INFORMATION

1.0 Surface Observations

Unofficial meteorological reporting station E4349 (data courtesy of MesoWest²) was located about 3 miles south of the accident site at an elevation of 259 feet. Type, calibration, maintenance, and siting standards of this instrument, as well as the overall quality of the data, are not known. Reporting of wind and temperature parameters³ from E4349 during the times surrounding the accident time are presented here (values rounded to nearest whole number):

¹ UTC – abbreviation for Coordinated Universal Time

² <https://mesowest.utah.edu>

³ Temp=temperature (Fahrenheit); W_Mag=average wind magnitude (miles-per-hour[mph]); W_Dir=average wind direction (true); G_Mag=gust wind magnitude (mph)

<u>Time</u>	<u>Temp</u>	<u>W_Mag</u>	<u>W_Dir</u>	<u>G_Mag</u>
1350	96°	6	248°	17
1351	95°	7	251°	17
1352	95°	7	269°	16
1353	95°	7	219°	16
1354	96°	7	229°	16
1355	96°	7	302°	16
1357	96°	7	300°	16
1358	96°	7	225°	16
1359	96°	7	248°	16
1400	96°	6	207°	16
1401	96°	6	238°	16
1402	96°	5	261°	14
1403	96°	5	242°	14
1404	96°	5	252°	14
1405	96°	5	206°	14
1406	96°	5	211°	14
1407	96°	5	255°	14
1408	97°	4	279°	14
1409	97°	4	290°	14
1411	97°	4	250°	14
1412	97°	4	297°	12
1413	97°	5	228°	17
1414	96°	5	221°	17
1415	96°	5	225°	17
1416	96°	6	300°	17
1417	96°	6	219°	17
1418	96°	6	217°	17
1419	96°	6	238°	17
1420	96°	6	238°	17

An Automated Surface Observing System (ASOS) was located at Fayetteville Regional Airport (FAY⁴) which was in Fayetteville, North Carolina, and was located 17 miles east of the accident location at an elevation of about 190 feet and had a magnetic variation of about 9° west. Augmented longline⁵ reports from the FAY ASOS during times surrounding the accident time are presented here.

⁴ 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.

⁵ “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 many 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

- [1253] METAR KFAY 291653Z 21012G21KT 170V250 10SM SCT049 34/23 A2999
RMK AO2 SLP149 T03440228=
- [1353] METAR KFAY 291753Z 24011G19KT 10SM FEW055 FEW075 36/22 A2998
RMK AO2 SLP144 T03610222 10367 20272 58011=**
- [1453] METAR KFAY 291853Z 21011G20KT 10SM SCT060 36/22 A2996 RMK AO2
SLP136 T03610222=
- [1553] METAR KFAY 291953Z 25011KT 10SM SCT060 SCT080 BKN100 36/22
A2994 RMK AO2 SLP130 T03560222=
- [1653] METAR KFAY 292053Z VRB03KT 10SM BKN055 OVC070 34/24 A2993 RMK
AO2 LTG DSNT W AND NW SLP126 T03440239 56018=

At 1353, the FAY ASOS reported a wind from 240° at 11 knots with gusts to 19 knots, visibility 10 statute miles or greater, few clouds at 5,500 feet above ground level (agl), few clouds at 7,500 agl, temperature of 36° Celsius (C) and dew point temperature of 22°C, altimeter setting of 29.98 inches of mercury; Remarks included: station with a precipitation discriminator, sea level pressure of 1014.4 hectopascals (hPa), temperature of 36.1°C and dew point temperature of 22.2°C.

2.0 Weather Radar

Data from the Integrated Terminal Weather System (ITWS) focusing on the Raleigh, North Carolina, region, were provided by the Federal Aviation Administration. Figure 1 presents the “100nm” window from this ITWS Situation Display (SD) from 1404. The accident site was located on the edge of a cellular-shaped area of light values of vertically integrated liquid. Additional regional ITWS SD images, Low-Level Wind Shear Alert System-Relocation and Sustainment (LLWAS-RD) anemometer data and ribbon display data from the Raleigh-Durham International Airport (RDU) air traffic control tower, for times surrounding the accident time, are presented in Attachment 1.

outside of the aviation community.

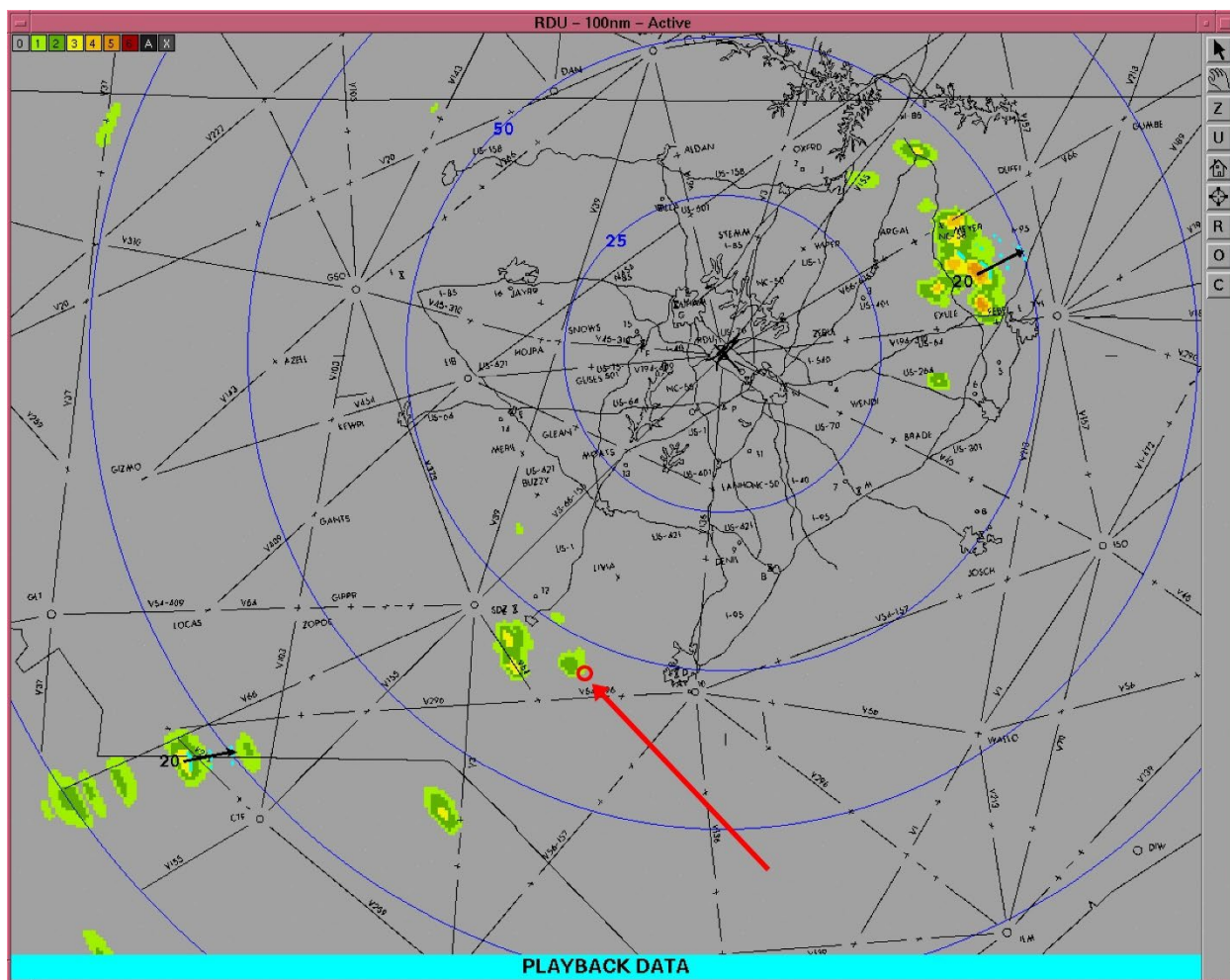


Figure 1 – “100nm” window from the RDU ITWS SD from 1404. Accident location is marked by the red circle.

WSR-88D⁶ Level-II base reflectivity weather radar imagery from the Raleigh, North Carolina, site (KRAX) is presented in figures 2-7. KRAX was located approximately 55 miles northeast of the accident location at an elevation of about 460 feet. Assuming standard refraction and considering the 0.95° beam width⁷ for the WSR-88D radar beam, the KRAX 0.216° tilt would have “seen” altitudes above the accident location of between about 950 and 6,500 feet. An image from about the accident time (Figure 2) revealed that an area of light to heavy reflectivity in a cellular pattern was adjacent to the accident location. Vertical cross-sections of the Level-II base reflectivity weather radar imagery through this cellular reflectivity feature surrounding the accident time revealed a suspended area of higher reflectivity descending and increasing in intensity immediately prior to the accident time.

⁶ Weather Surveillance Radar 88 Doppler (WSR-88D)

⁷ 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.

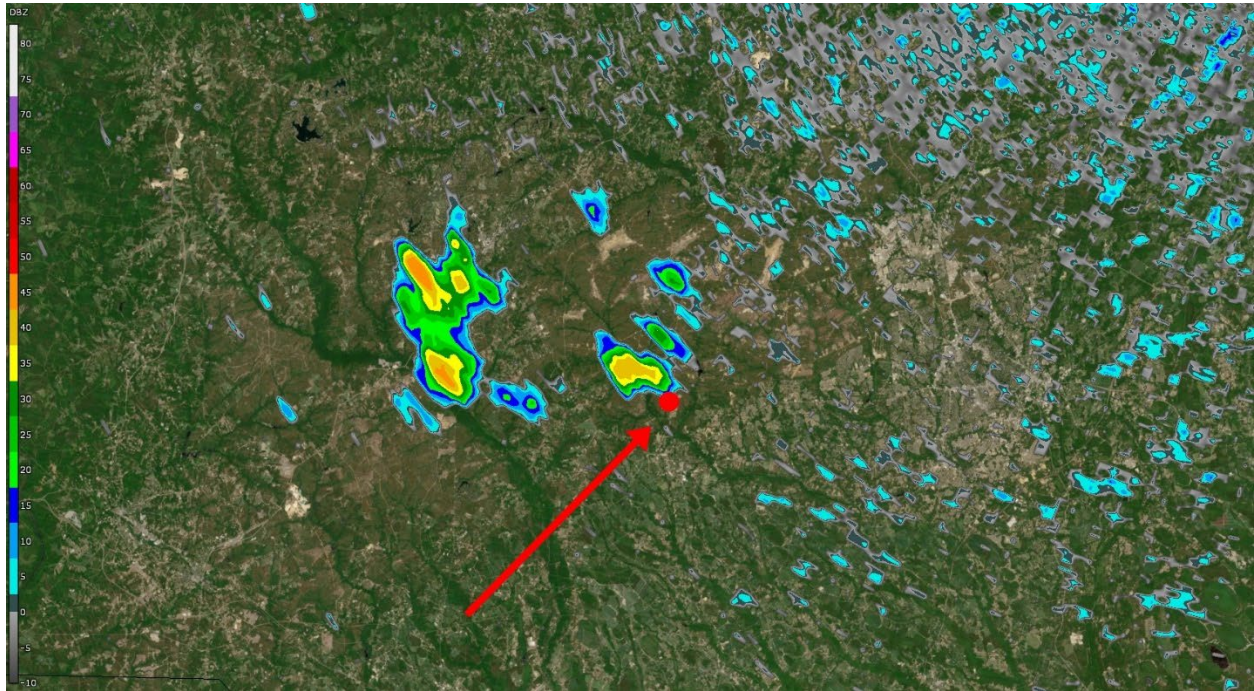


Figure 2 – KRAX 0.216° Level-II base reflectivity product from a sweep initiated at 1404:03. Accident location marked by the red circle. Reflectivity has been “smoothed.”

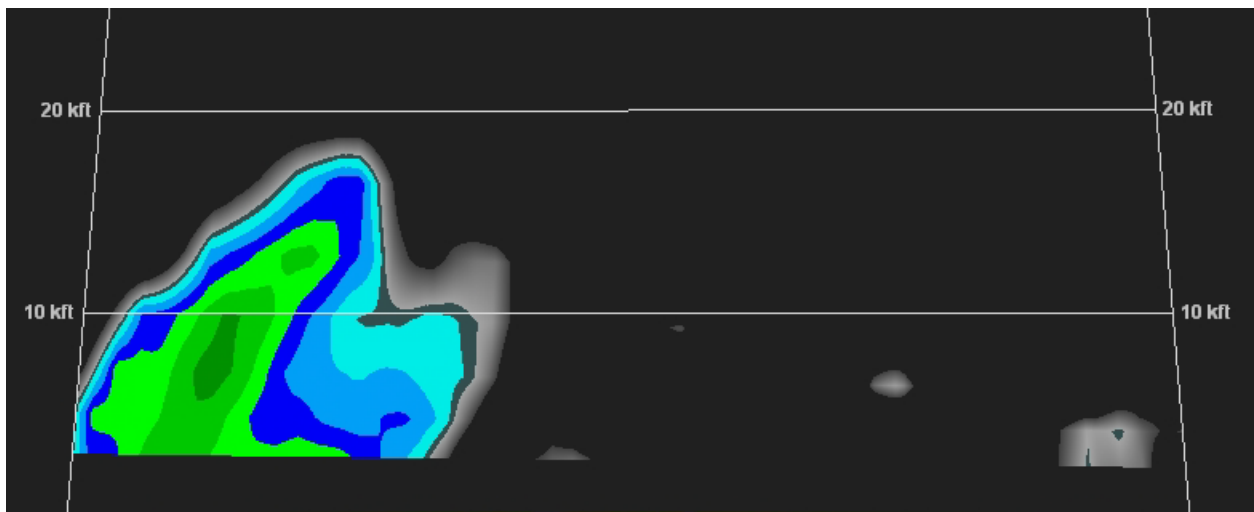


Figure 3 – Vertical cross-section of the KRAX Level-II base reflectivity weather radar imagery for the volume scan initiated at 1350:58. Color table is as presented in figure 1. The left-hand-side surface coordinates are 35.050003° latitude, -79.376747° longitude; the right-hand-side surface coordinates are 35.065723° latitude, -79.200020° longitude. Height scale is approximate.

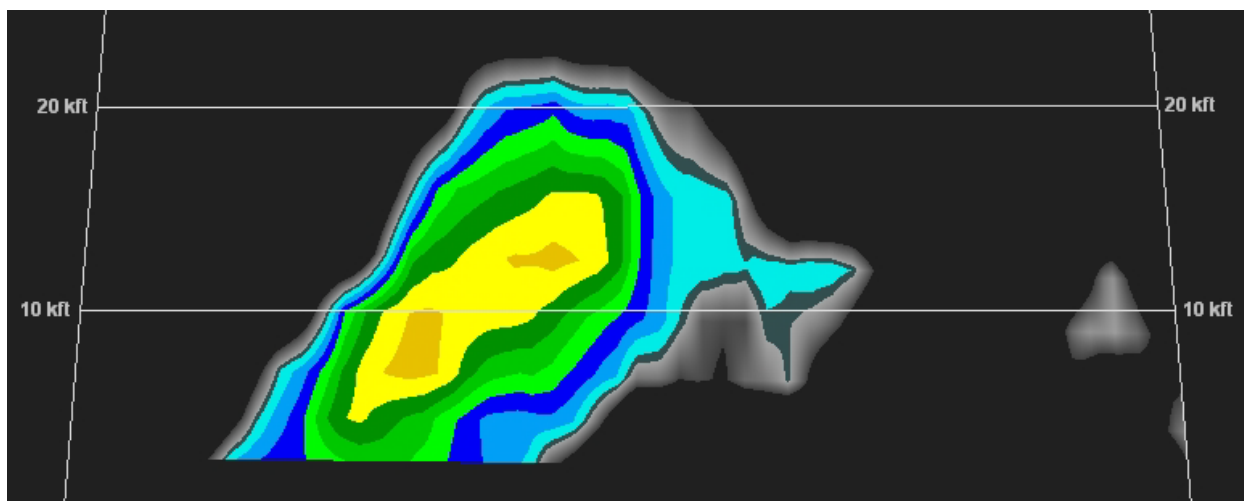


Figure 4 – Vertical cross-section of the KRAX Level-II base reflectivity weather radar imagery for the volume scan initiated at 1356:17. Color table is as presented in figure 1. The left-hand-side surface coordinates are 35.050003° latitude, -79.376747° longitude; the right-hand-side surface coordinates are 35.065723° latitude, -79.200020° longitude. Height scale is approximate.

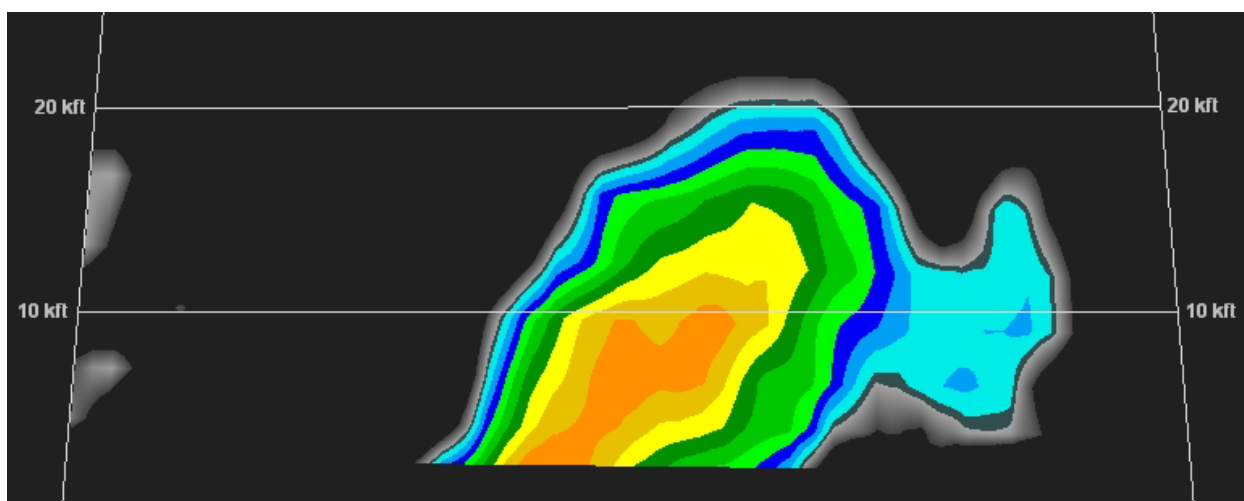


Figure 5 – Vertical cross-section of the KRAX Level-II base reflectivity weather radar imagery for the volume scan initiated at 1401:28. Color table is as presented in figure 1. The left-hand-side surface coordinates are 35.050003° latitude, -79.376747° longitude; the right-hand-side surface coordinates are 35.065723° latitude, -79.200020° longitude. Height scale is approximate.

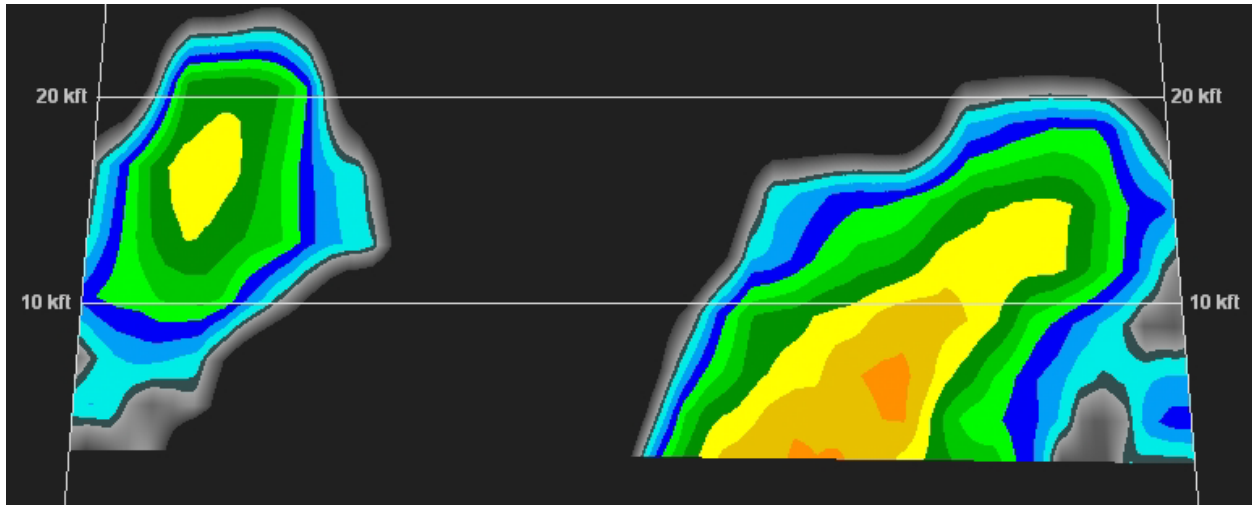


Figure 6 – Vertical cross-section of the KRAX Level-II base reflectivity weather radar imagery for the volume scan initiated at 1406:38. Color table is as presented in figure 1. The left-hand-side surface coordinates are 35.050003° latitude, -79.376747° longitude; the right-hand-side surface coordinates are 35.065723° latitude, -79.200020° longitude. Height scale is approximate.

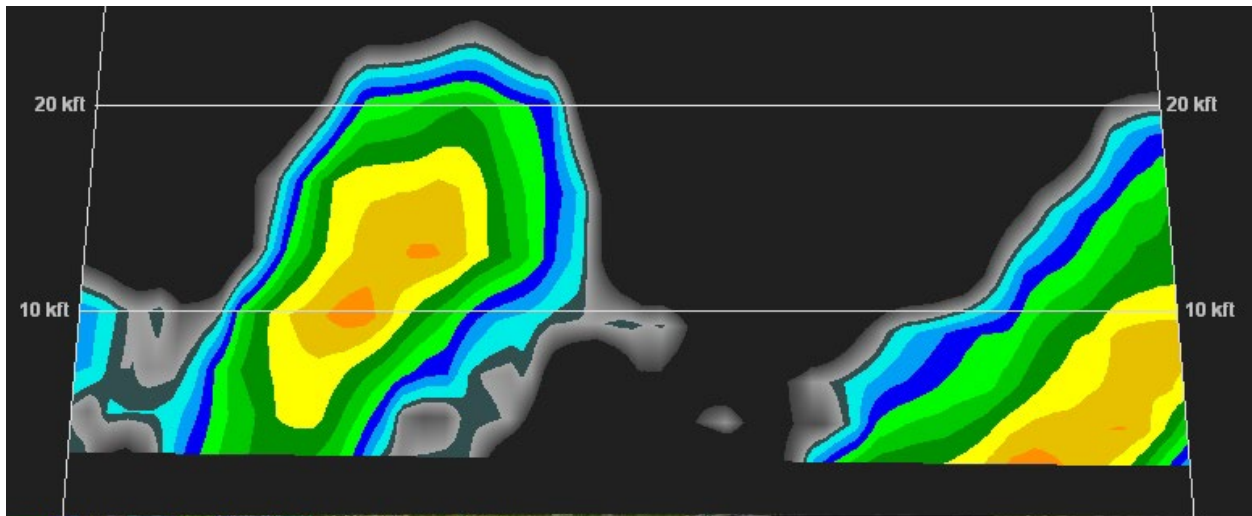


Figure 7 – Vertical cross-section of the KRAX Level-II base reflectivity weather radar imagery for the volume scan initiated at 1411:49. Color table is as presented in figure 1. The left-hand-side surface coordinates are 35.050003° latitude, -79.376747° longitude; the right-hand-side surface coordinates are 35.065723° latitude, -79.200020° longitude. Height scale is approximate.

3.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁸ sounding (figure 8) for near the accident site⁹ at 1400 using an elevation of 278 feet was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory and analyzed by the RAwinsonde OBservation (RAOB) program. Below 3,000 feet the wind was from the west-southwest at about 10-15 knots. Light low-level wind shear was identified around 300 feet. No clouds were identified below 15,000 feet. The downdraft convective available potential energy (DCAPE; 6 kilometers above ground level; density weighted average method) was measured at 1,000 Joules/kilogram which was considered a moderate value by RAOB.¹⁰ The T2Gust ("Severe Weather Gust Potential") and WindEx ("Microburst Gust Potential") parameters were 50 knots (a moderate value) and 57 knots (a strong value), respectively.

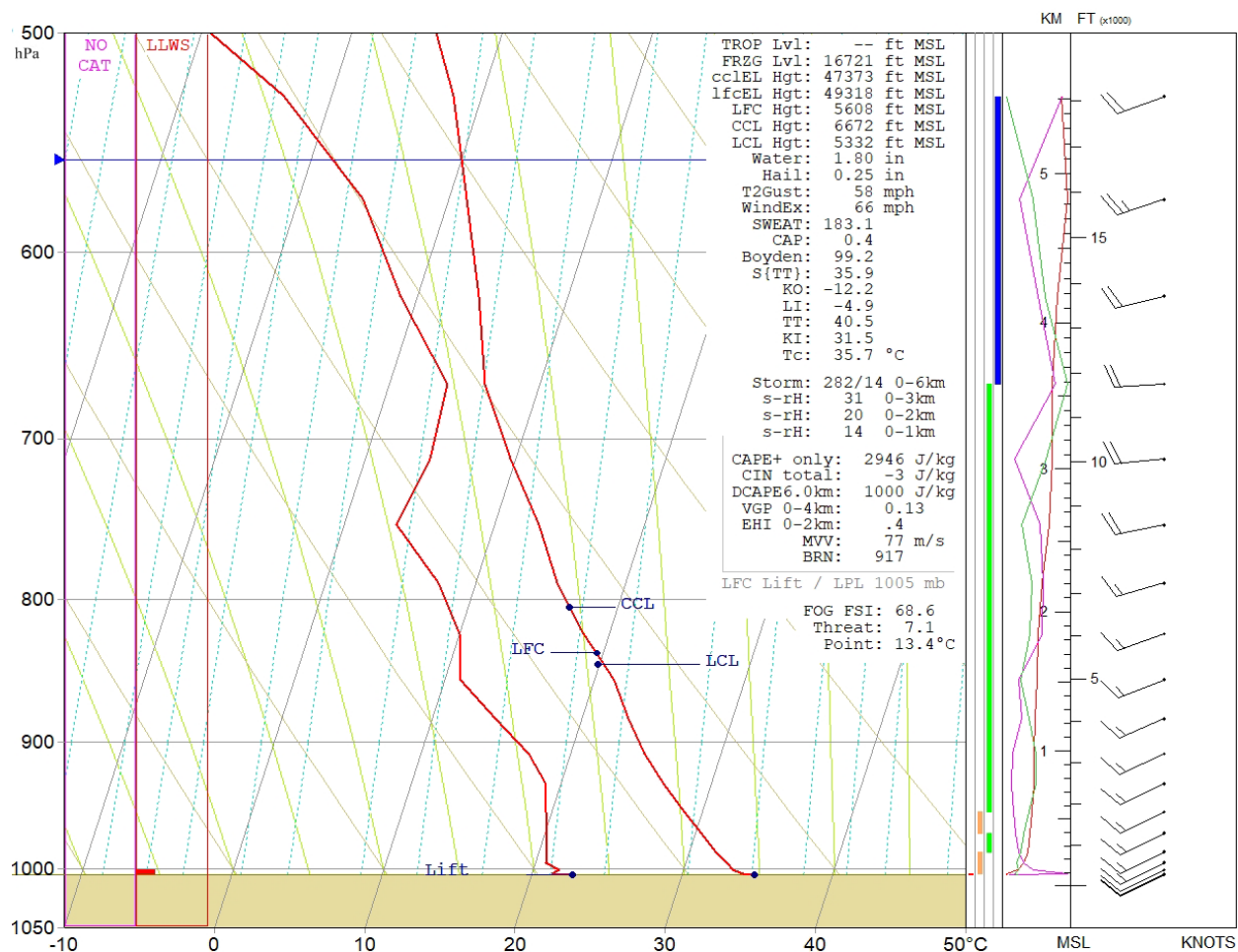


Figure 8 – HRRR model sounding data in SkewT/LogP format for 1400 near the accident site, surface to 500 hectopascals.

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

⁹ Coordinates used for the model were 35.03, -79.24.

¹⁰ The DCAPE can be used to estimate the potential strength of rain-cooled downdrafts within thunderstorm convection.

4.0 Pilot Reports

There were no longline-disseminated pilot reports¹¹ (PIREPs) recorded within 2 hours and 75 miles of the accident location.

5.0 Area Forecast Discussion

The National Weather Service (NWS) Raleigh, North Carolina, Weather Forecast Office issued the following “Near Term” and “Aviation” sections of an Area Forecast Discussion at 1114.

FXUS62 KRAH 291514

AFDRAH

AREA FORECAST DISCUSSION

National Weather Service Raleigh NC

1114 AM EDT Fri Jul 29 2022

NEAR TERM /THROUGH TONIGHT/...

As of 1110 AM Friday...

Persistently hot and humid today, with scattered afternoon-evening showers and storms for cntl NC.

12Z RAOB data across the srn Mid-Atlantic depict 850 and 925 mb temperatures within a degree C of previous days; and the observed 1000-850 mb thickness at GSO was identical (1423 meters) to the past three days. With another day of abundant early day sunshine that will yield to a developing and deepening cumulus field with daytime heating of a moist boundary layer characterized by surface dewpoints in the low-mid 70s F), high temperatures today should be within a degree or two of those from Thu throughout cntl NC: low 90s across the nrn Piedmont to upr 90s to around 100 in the Sandhills. Associated HI values will also be very similar to Thu, or a degree or three higher owing to slightly higher afternoon dewpoints.

The greatest severe weather threat should remain across n-cntl VA today, where enhanced mid-level flow at the base of an MCV over the WV panhandle this morning and downstream of a shortwave trough that will pivot from the upr MS Valley ewd across the OH Valley today, will maintain unseasonably strong mid-level flow/effective shear ~50 kts. A risk for a few supercells will result there, while weaker, 15-30 kts of mid-level flow from south to north across cntl NC will favor a pulse/multi-cell storm mode capable of a widely scattered damaging downburst wind gusts mostly over the Piedmont this afternoon-evening.

.AVIATION /12Z FRIDAY THROUGH TUESDAY/...

As of 650 AM Friday...

¹¹ These do not include pilot reports only broadcast via radio.

Overnight showers in the Piedmont have diminished or moved off to the NE, and other than some patchy IFR/LIFR vsbys in the Foothills, conditions are VFR across the area.

Much of the morning and early afternoon are expected to be dry across most of central NC, with the bulk of showers and storms today expected to be focused closer to a cold front that will be moving toward the TN valley. However, scattered storms will be possible across central NC with the higher probabilities and confidence at GSO and INT. Showers and storms may continue overnight as the cold front slips into the region, though there may also be a lull around 06Z before the front pushes south into the area and provides a focus for showers and storms on Saturday.

6.0 SIGMETs

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

7.0 CWSU Products

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

E. LIST OF ATTACHMENTS

Attachment 1 - Regional Integrated Terminal Weather System Situation Display imagery, as well as Low-Level Wind Shear Alert System-Relocation and Sustainment anemometer data and ribbon display data from the Raleigh-Durham International Airport air traffic control tower for times surrounding the accident time.

Submitted by:

Mike Richards
Senior Meteorologist