



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 4, 2021

Specialist's Factual Report

METEOROLOGY

CEN21FA320

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A. ACCIDENT

Location: Muscatine, Iowa
Date: July 14, 2021
Time: 1238 central daylight time (1738 UTC)¹
Aircraft: Type – Piper PA-28-180; Registration – N2801T

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 central daylight time (CDT) for July 14, 2021 (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: 41.493333° north latitude; 91.049722° west longitude at an elevation of about 710 feet.

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

D. WEATHER INFORMATION

1.0 Weather Radar

WSR-88D² Level-II base reflectivity weather radar imagery from the Quad Cities, Iowa, site (KDVN) is presented in figure 1. KDVN was located approximately 22 miles east-northeast of the accident location at an elevation of about 850 feet. Assuming standard refraction and considering the 0.95° beam width³ for the WSR-88D radar beam, the KDVN 0.440° tilt would have “seen” altitudes above the accident location of between about 1,100 and 3,300 feet above msl. The imagery revealed extreme values of reflectivity coincident with the accident location at the

¹ UTC – abbreviation for Coordinated Universal Time

² Weather Surveillance Radar 88 Doppler (WSR-88D)

³ 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.

accident time. Evaluation of the radar data by the GR2Analyst software also identified hail of 0.85 inches in the immediate vicinity of the accident location at accident time.

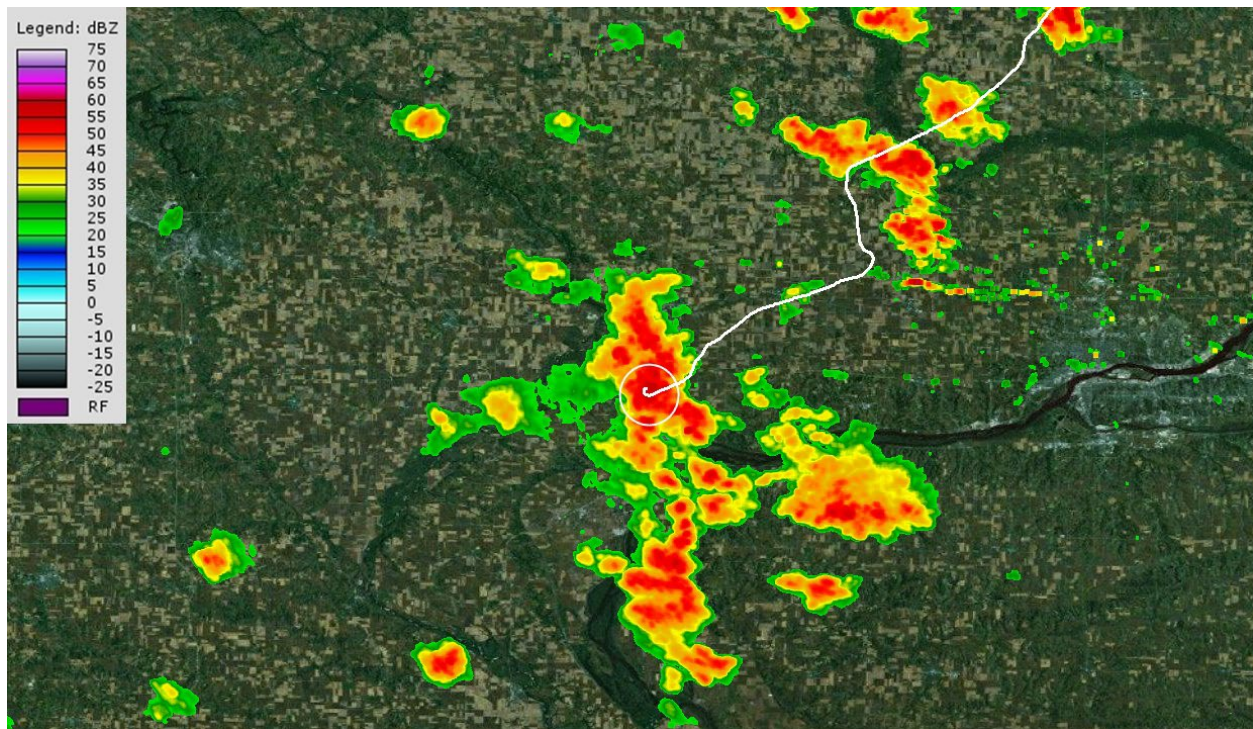


Figure 1 – KDVN 0.440° Level-II base reflectivity product from a sweep initiated at 1238 CDT. Accident flight path is identified by the white line. Accident location marked by the white circle. Reflectivity has been “smoothed” and values less than 22 dBZ have been masked out.

2.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁴ sounding (figure 2) for the accident site at 1200 CDT using the elevation of the accident site was retrieved from the National Oceanic and Atmospheric Administration’s Air Resources Laboratory. The wind and turbulence data likely does not reflect conditions experienced in convection. Calculations made by the Rawinsonde OBservation Program indicated that the most-unstable Convective Available Potential Energy (CAPE) parameter was 2,216 Joules/kilogram (from 992 hectopascals [hPa]). The Lifting Condensation Level (LCL) was calculated to 3,105 feet and Level of Free Convection (LFC) for this scenario was calculated to be 7,111 feet. Maximum vertical velocity⁵ for the most-unstable atmosphere was calculated as 67 meters/second (about 13,200 feet per minute).

⁴ 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.

⁵ MVV is not usually considered a realistic estimate for maximum vertical velocity in a storm. Anecdotes suggest considering a value of MVV/2, however it is not well understood when or where such a half-value should be applied.

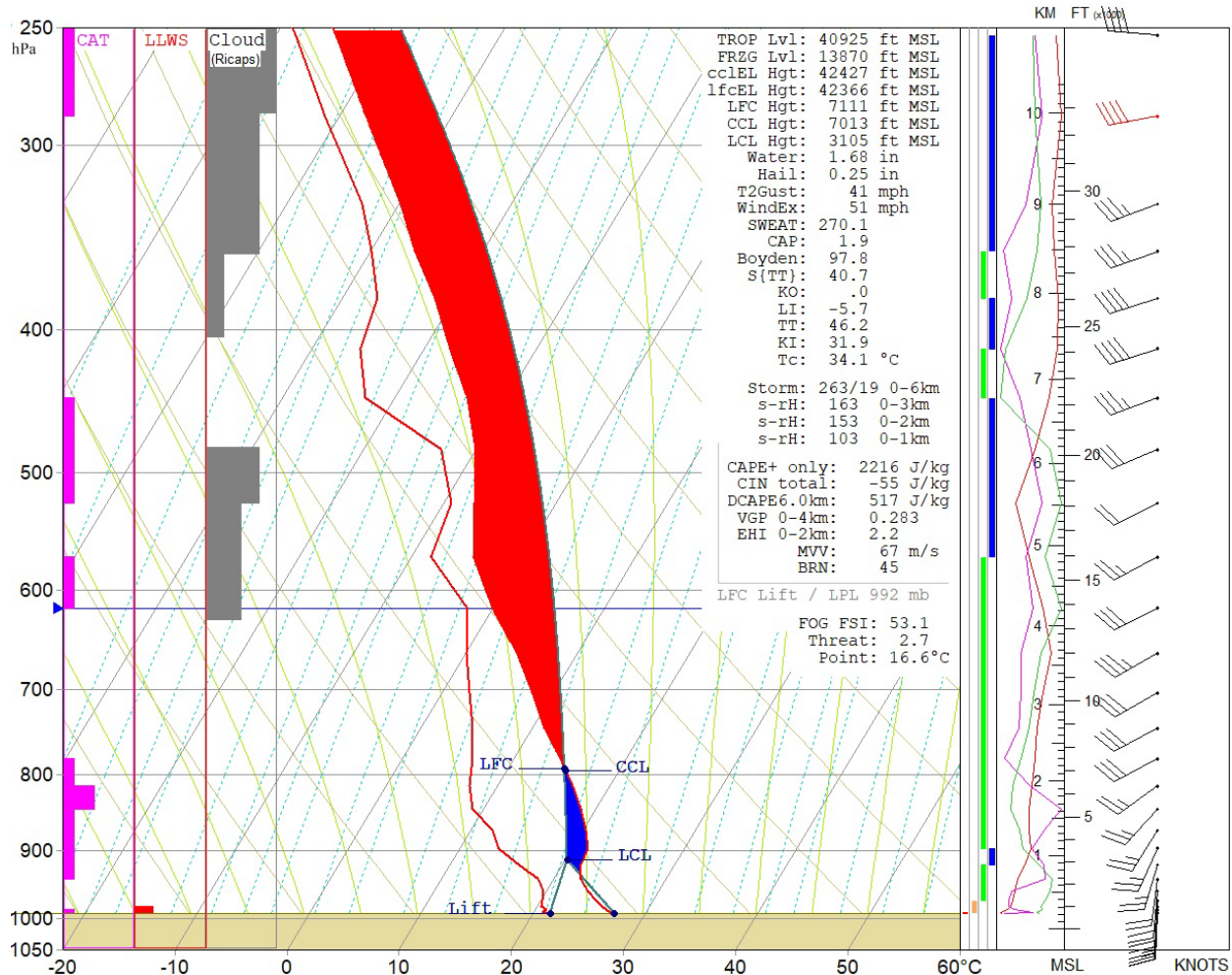


Figure 2 – HRRR model sounding data in SkewT/LogP format for 1200 CDT at the accident site, surface to 250 hPa.

3.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-16 visible (0.64 μ m) and infrared (10.3 μ m) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Images from 1236 CDT are presented in figures 3 and 4. The GOES-16 visible imagery depicted cloudy conditions over the accident region. Infrared cloud-top temperatures over the accident site varied between -45°C and -63°C, which, when considering the 1200 CDT HRRR sounding, corresponded to cloud top heights greater than 35,000 feet.

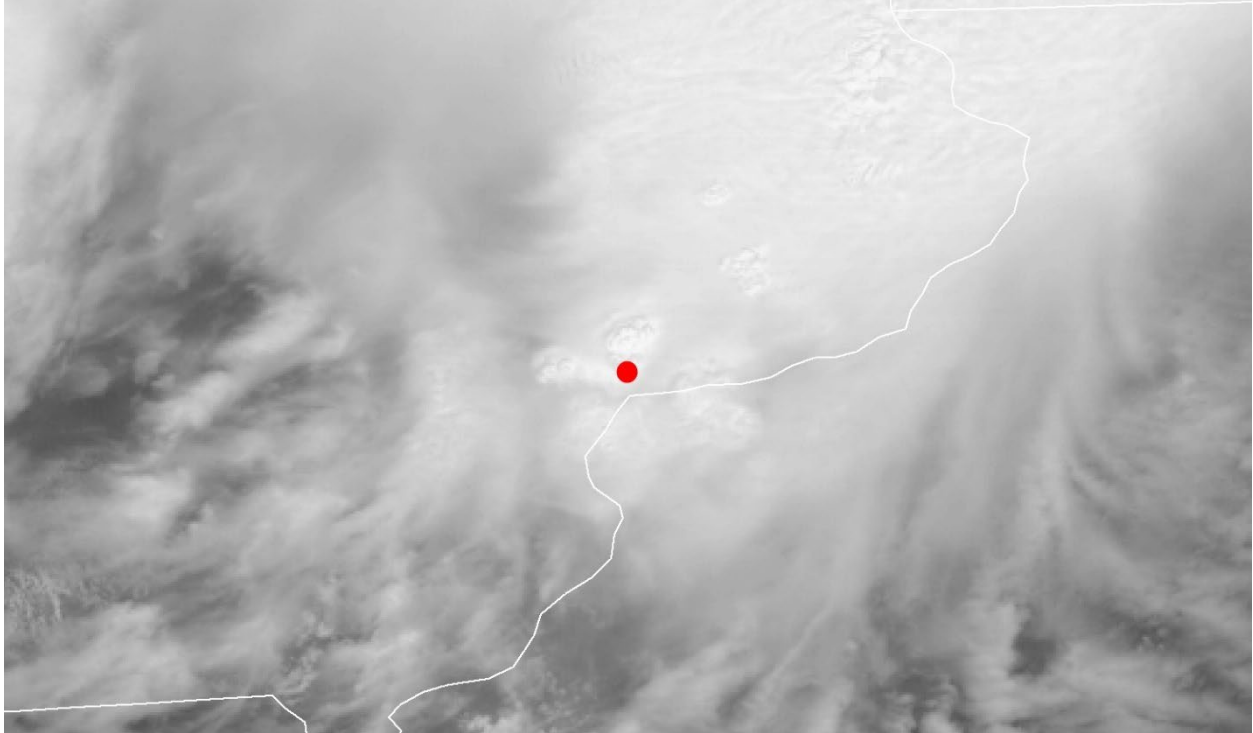


Figure 3 – GOES-16 visible imagery from 1236 CDT. Accident location denoted by the red dot. Image is not corrected for parallax error.

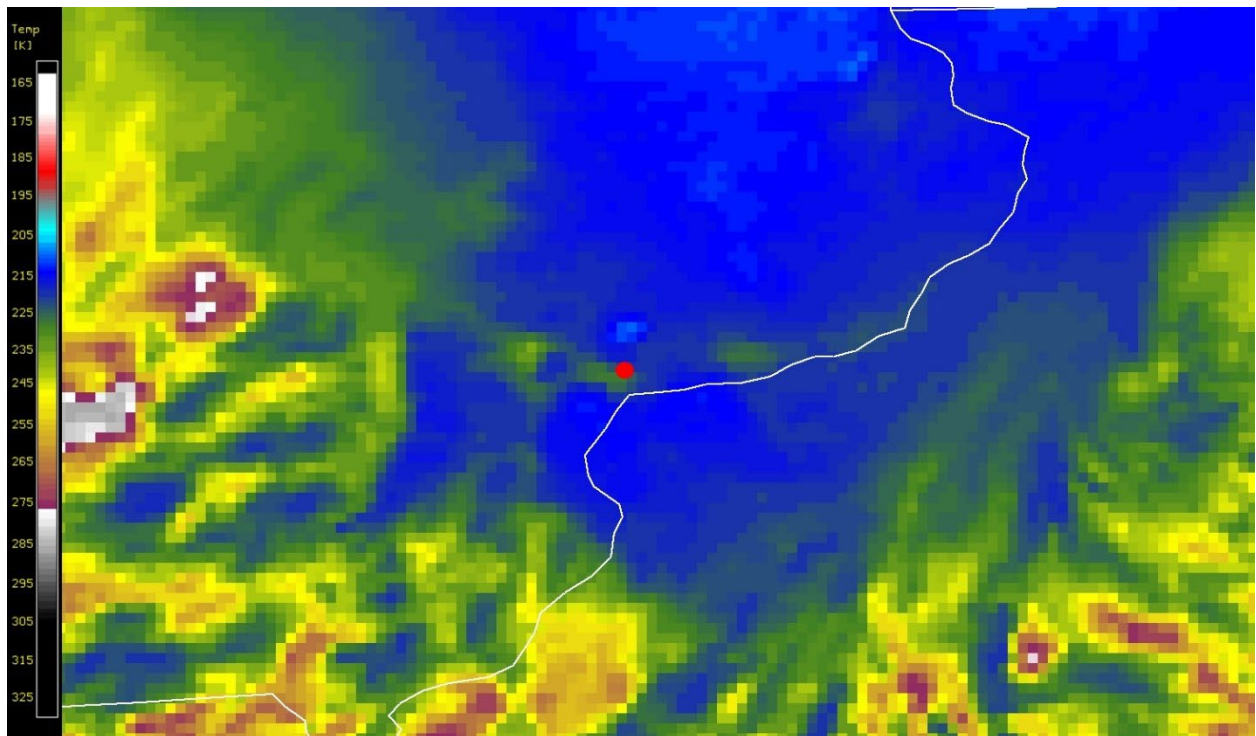


Figure 4 – GOES-16 infrared imagery from 1236 CDT. Accident location denoted by red dot. Image is not corrected for parallax error.

4.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at Muscatine Municipal Airport (MUT⁶), which was located in Muscatine, Iowa, about 9 miles southwest of the accident location at an elevation of about 550 feet and had a magnetic variation of about 1° west. Automated longline⁷ reports from the MUT AWOS during the times surrounding the accident time are presented here.

[1155 CDT] METAR KMUT 141655Z AUTO 17005KT 10SM BKN060 BKN070
BKN080 25/23 A3003 RMK AO2=

[1215 CDT] METAR KMUT 141715Z AUTO 18006KT 10SM BKN060 BKN080 25/23
A3004 RMK AO2=

[1235 CDT] **METAR KMUT 141735Z AUTO 22004G10KT 6SM BR BKN065
OVC080 25/23 A3005 RMK AO2=**

[1255 CDT] METAR KMUT 141755Z AUTO 15005KT 10SM BKN065 BKN075 25/24
A3004 RMK AO2=

[1315 CDT] METAR KMUT 141815Z AUTO 13005KT 10SM BKN070 BKN085 25/24
A3004 RMK AO2=

At 1235 CDT, the MUT AWOS reported a wind from 220° at 4 knots with gusts to 10 knots, visibility of 6 statute miles, mist, ceiling broken at 6,500 feet above ground level (agl), overcast clouds at 8,000 feet agl, temperature of 25° Celsius (C) and dew point temperature of 23°C, altimeter setting of 30.05 inches of mercury; Remarks: automated station with a precipitation discriminator.

5.0 Pilot Reports

There were no publicly longline-disseminated pilot reports⁸ (PIREPs) within 50 miles of the accident location below 10,000 feet between 1000 and 1500 CDT.

⁶ 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.

⁷ “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.

⁸ These do not include pilot reports only broadcast via radio.

6.0 SIGMETs

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

At 1155 CDT, the National Weather Service (NWS) Aviation Weather Center issued the following Convective SIGMET that was active for the accident location at the accident time that advised of an area of severe thunderstorms with hazards that included one-inch hail.

*WSUS32 KKCI 141655
SIGC
-MKCC WST 141655
CONVECTIVE SIGMET 62C
VALID UNTIL 1855Z
WI IL MN IA
FROM 20N MSP-50SW RHI-30WSW BDF-30SW IOW-20N MSP
AREA SEV TS MOV FROM 27030KT. TOPS ABV FL450.
HAIL TO 1 IN...WIND GUSTS TO 50KT POSS.*

7.0 CWSU Products

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

8.0 Area Forecast Discussion

The NWS Quad Cities, Iowa, Weather Forecast Office (WFO) issued the following "Aviation" section of an Area Forecast Discussion at 0557 CDT.

*FXUS63 KDVN 141057
AFDDVN
Area Forecast Discussion
National Weather Service Quad Cities IA IL
557 AM CDT Wed Jul 14 2021
.
AVIATION...(For the 12Z TAFS through 12Z Thursday Morning)
ISSUED AT 555 AM CDT Wed Jul 14 2021

Chances for thunderstorms will begin at the TAF sites later this morning, especially DBQ. After 00z, some of these storms could be capable of 50kt gusts and some gr. The threat will start north and eventually affect all TAF sites towards the end of the current period. MVFR and IFR vsbys are possible with these storms as well.*

The Quad Cities, Iowa, WFO issued the following “Aviation” section of an Area Forecast Discussion at 1221 CDT.

FXUS63 KDVN 141721

AFDDVN

Area Forecast Discussion

National Weather Service Quad Cities IA IL

1221 PM CDT Wed Jul 14 2021

.AVIATION...(For the 18Z TAFS through 18Z Thursday Afternoon)

ISSUED AT 1214 PM CDT Wed Jul 14 2021

Showers and thunderstorms are ongoing as of 18Z, impacting near DBQ and MLI. These will continue through 20Z, with a break until this evening. These storms are bringing along MVFR conditions, with IFR in some of the heavier storms. Also, some of the storms this evening can lead to gusts up to 50 KTs and hail. Winds will stay from the south through tonight and tomorrow morning, with gust upwards to 20-25 KTs. Again tomorrow, widespread showers and storms are expected.

Submitted by:

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