



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

July 14, 2021

Specialist's Report

METEOROLOGY

CEN21FA300

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A. ACCIDENT

Location: Roff, Oklahoma
Date: July 2, 2021
Time: 0225 central daylight time (0725 UTC)¹
Aircraft: Type – Beech 35-33; Registration – N302Z

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 July 2, 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: 34.60822222° north latitude; 96.78144444° west longitude at an elevation of about 1,175 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 Ada Regional Airport (ADH²), which was located about 12 miles north-northeast of the accident location at an elevation of 1,015 feet and had a magnetic variation of about 3° east. Automated longline³ reports from the ADH AWOS during the times surrounding the accident time are presented here.

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

[0135 CDT] METAR KADH 020635Z AUTO 01004KT 10SM SCT006 BKN090 22/22 A3001 RMK AO2=

[0155 CDT] METAR KADH 020655Z AUTO 00000KT 7SM SCT090 22/22 A3001 RMK AO2=

[0215 CDT] METAR KADH 020715Z AUTO 01003KT 5SM BR SCT003 BKN090 22/22 A3001 RMK AO2=

[0235 CDT] METAR KADH 020735Z AUTO 02003KT 7SM SCT003 BKN090 22/22 A3001 RMK AO2=

[0255 CDT] METAR KADH 020755Z AUTO 36004KT 7SM SCT003 SCT090 22/22 A3001 RMK AO2=

[0315 CDT] METAR KADH 020815Z AUTO 00000KT 2 1/2SM BR BKN003 OVC012 22/22 A3001 RMK AO2=

At 0215 CDT, the ADH AWOS reported a wind from 010° at 3 knots, visibility 5 statute miles, mist, scattered clouds at 300 feet above ground level (agl), ceiling broken at 9,000 feet agl, temperature of 22° Celsius (C) and dew point temperature of 22°C, altimeter setting of 30.01 inches of mercury; Remarks: station with a precipitation discriminator.

At 0235 CDT, the ADH AWOS reported a wind from 020° at 3 knots, visibility 7 statute miles, scattered clouds at 300 feet agl, ceiling broken at 9,000 feet agl, temperature of 22°C and dew point temperature of 22°C, altimeter setting of 30.01 inches of mercury; Remarks: station with a precipitation discriminator.

An AWOS was located at Pauls Valley Municipal Airport (PVJ), which was located about 23 miles west-northwest of the accident location at an elevation of 970 feet and had a magnetic variation of about 3° east. Automated longline reports from the PVJ AWOS during the times surrounding the accident time are presented here.

[0135 CDT] METAR KPVJ 020635Z AUTO 00000KT 10SM BKN075 OVC095 A3000 RMK AO2=

[0155 CDT] METAR KPVJ 020655Z AUTO 00000KT 10SM BKN065 BKN080 OVC100 A3000 RMK AO2 LTG DSNT W=

[0215 CDT] METAR KPVJ 020715Z AUTO 00000KT 10SM SCT009 BKN065 OVC100 A3000 RMK AO2=

[0235 CDT] METAR KPVJ 020735Z AUTO 00000KT 5SM RA SCT031 BKN055 OVC065 A2999 RMK AO2 P0004=

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.

[0255 CDT] METAR KPVJ 020755Z AUTO 01004KT 5SM -RA SCT007 BKN036
OVC060 A3000 RMK AO2 P0010=

[0315 CDT] METAR KPVJ 020815Z AUTO 00000KT 10SM -DZ BKN007 OVC019
A3000 RMK AO2=

At 0215 CDT, the PVJ AWOS reported a calm wind, visibility 10 statute miles or greater, scattered clouds at 900 feet agl, ceiling broken at 6,500 feet agl, overcast clouds at 10,000 feet agl, altimeter setting of 30.00 inches of mercury; Remarks: station with a precipitation discriminator.

At 0235 CDT, the PVJ AWOS reported a calm wind, visibility 5 statute miles, moderate rain, scattered clouds at 3,100 feet agl, ceiling broken at 5,500 feet agl, overcast clouds at 6,500 feet agl, altimeter setting of 29.99 inches of mercury; Remarks: station with a precipitation discriminator, 0.04 inches of liquid equivalent precipitation since 0155 CDT.

2.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-16 infrared ($10.3\mu\text{m}$) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. An image from 0226 CDT is presented in figure 1. The $10.3\mu\text{m}$ brightness temperatures above the accident location were about -7°C , which, when considering the HRRR model sounding (-7°C is not shown in Figure 2), corresponded to cloud top heights of over 20,000 feet.

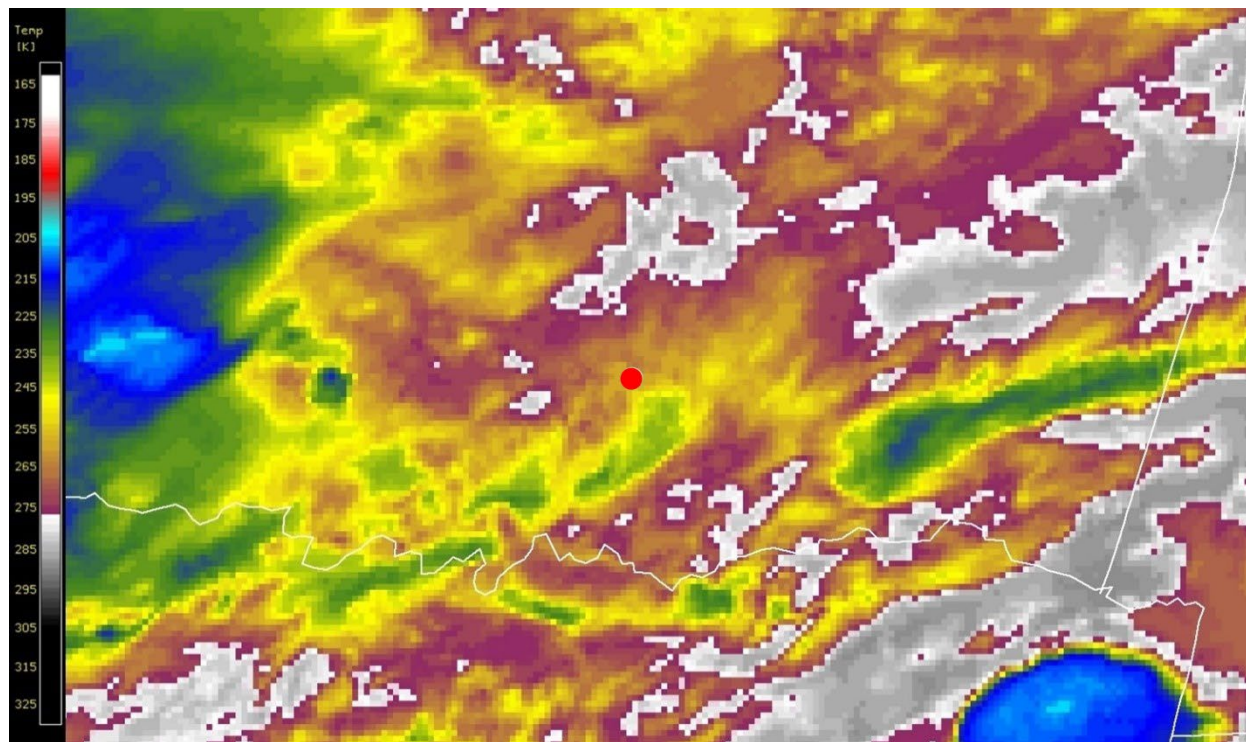


Figure 1 – GOES-16 $10.3\mu\text{m}$ brightness temperature imagery from 0226 CDT. Accident location is denoted by the red circle. This image has not been corrected for any parallax error.

3.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁴ sounding (figure 2) for the accident site at 0200 CDT using an elevation of about 107 meters was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory. The relative humidity was 99 percent or greater below 2,400 feet. The RAwinsonde OBservation Program (RAOB) identified wet fog between the surface and about 1,350 feet and overcast clouds between the top of the wet fog layer and about 2,400 feet. The wind below 3,000 feet was from the east at magnitudes of 6 knots or less.

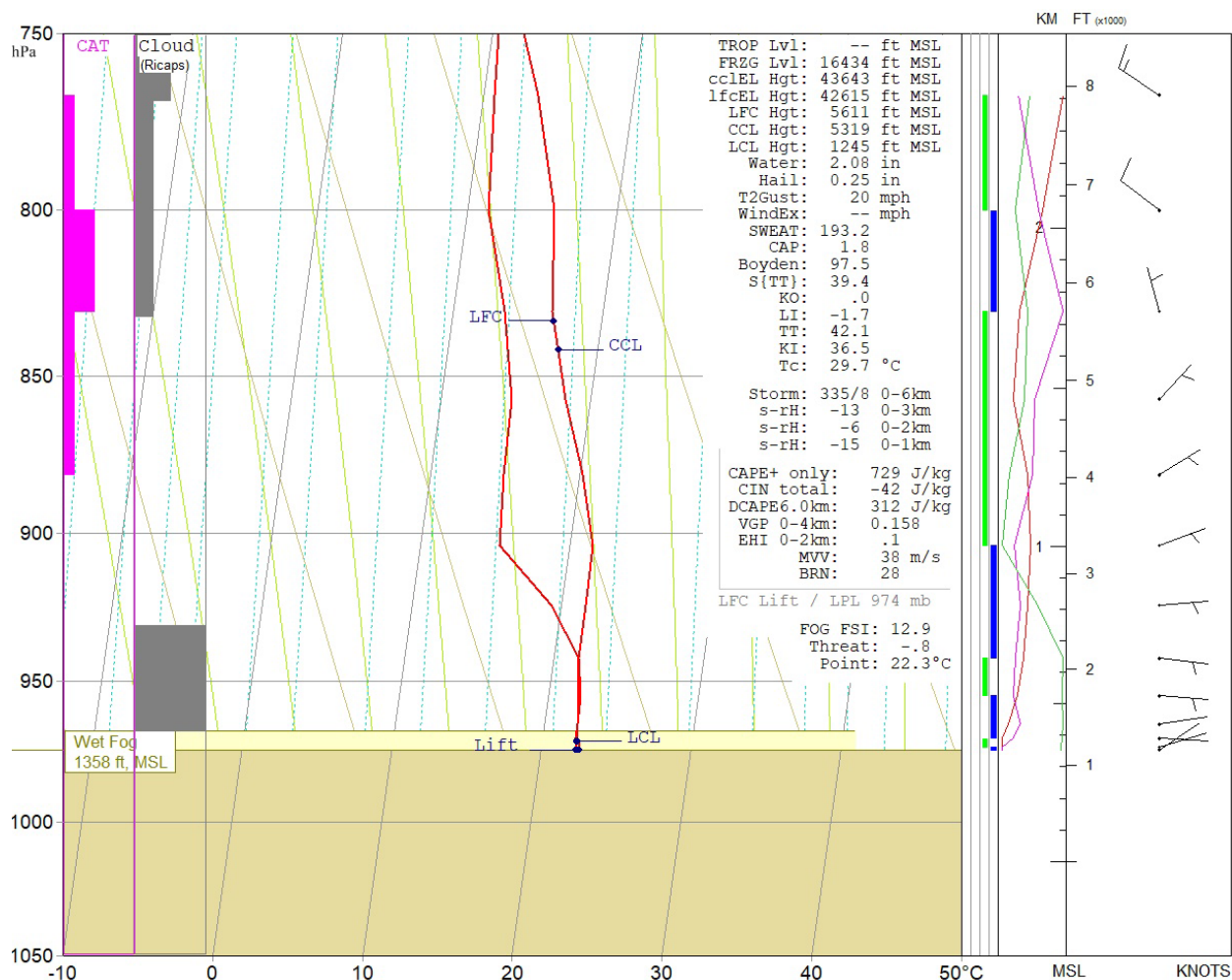


Figure 2 – HRRR model sounding data in SkewT/LogP format for 0200 CDT at the accident site, surface to 750 hectopascals (hPa).

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.

4.0 Weather Radar

WSR-88D⁵ Level-II base reflectivity weather radar imagery from the Oklahoma City, Oklahoma, site (KTLX) is presented in figure 3. KTLX was located approximately 50 miles north-northwest of the accident location at an elevation of about 1,275 feet. Assuming standard refraction and considering the 0.95° beam width⁶ for the WSR-88D radar beam, the KTLX 0.440° tilt would have “seen” altitudes above the accident location of between about 2,750 and 7,800 feet above msl. The image revealed small areas of light reflectivity within about 5 miles of the accident location, with larger areas of light to heavy reflectivity farther to the west and northwest of the accident location.

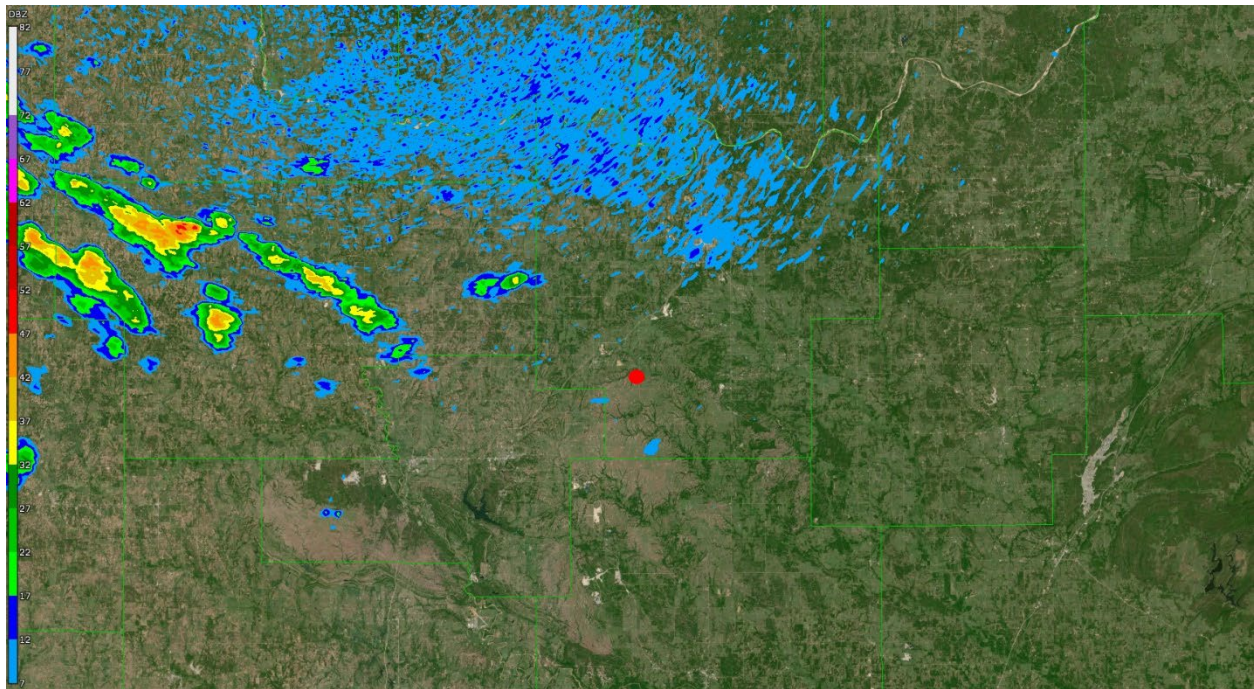


Figure 3 – KTLX 0.440° Level-II base reflectivity product from a sweep initiated at 0223:41 CDT. Accident location marked by the red circle. Reflectivity has been “smoothed” and values less than 7.5 dBZ have been masked out.

5.0 Pilot Reports

There were no publicly longline-disseminated pilot reports⁷ (PIREPs) within 100 miles of the accident location between 0000 and 0400 CDT.

⁵ Weather Surveillance Radar 88 Doppler (WSR-88D)

⁶ 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.

⁷ These do not include pilot reports only broadcast via radio.

6.0 Area Forecast Discussion

The National Weather Service (NWS) Weather Forecast Office (WFO) in Norman, Oklahoma, issued the following “Aviation” section of the Area Forecast Discussion at 1743 CDT the night before the accident, which stated, “...Mostly MVFR conditions will persist through the period, with some chance at IFR cigs as storms move through...”

FXUS64 KOUN 012251

AFDOUN

Area Forecast Discussion

National Weather Service Norman OK

551 PM CDT Thu Jul 1 2021

.AVIATION...

(00Z TAFS)

Issued at 543 PM CDT Thu Jul 1 2021

*Scattered showers and thunderstorms will continue to move across the area and affect most sites. **Mostly MVFR conditions will persist through the period, with some chance at IFR cigs as storms move through.** Expect these showers and storms to move out of northern and central OK by midday Friday. Showers will linger in southwest OK and western north TX through the morning, potentially into the afternoon. Winds will remain light and will transition from northerly to northeasterly by the end of the period.*

7.0 Hazardous Weather Outlook

At 0436 CDT, the NWS WFO in Norman, Oklahoma, issued the following Hazardous Weather Outlook, which advised for a region that included the accident location: “Areas of fog will be seen across portions of northern, central, and southeast Oklahoma this morning. Some visibilities may be reduced to less than one mile.”

FLUS44 KOUN 020936

HWOOUN

Hazardous Weather Outlook

National Weather Service Norman OK

436 AM CDT Fri Jul 2 2021

OKZ004>048-050>052-TXZ083>090-030945-

Harper- Woods- Alfalfa- Grant- Kay- Ellis- Woodward- Major- Garfield- Noble- Roger Mills- Dewey- Custer- Blaine- Kingfisher- Logan- Payne- Beckham- Washita- Caddo- Canadian- Oklahoma- Lincoln- Grady- McClain- Cleveland- Pottawatomie- Seminole- Hughes- Harmon- Greer- Kiowa- Jackson- Tillman- Comanche- Stephens- Garvin- Murray- Pontotoc- Coal- Cotton- Jefferson- Carter- Johnston- Atoka- Love- Marshall- Bryan- Hardeman- Foard- Wilbarger- Wichita- Knox- Baylor- Archer- Clay-

436 AM CDT Fri Jul 2 2021

This hazardous weather outlook is for portions of northern...western...central...and southern Oklahoma...and western north Texas.

.DAY ONE...Today and Tonight...

.Thunderstorms...

Scattered thunderstorms are expected again today, mainly across southern Oklahoma and western north Texas. No severe storms are expected, but any thunderstorm that develops will likely produce very heavy rain.

.Heavy Rain...

Thunderstorms with heavy rain, especially in areas where the ground is saturated, could lead to flooding. A Flood Watch is in effect for southwest Oklahoma and adjacent portions of northern Texas.

.Fog...

Areas of fog will be seen across portions of northern, central, and southeast Oklahoma this morning. Some visibilities may be reduced to less than one mile.

8.0 AIRMETs SIERRA

An Airmen's Meteorological Information (AIRMET) SIERRA advisory for instrument flight rule conditions, identifying ceilings below 1,000 feet, visibility below 3 statute miles, precipitation and mist, was issued at 2145 CDT the evening prior to the accident and was valid for the accident site at the accident time.

WAUS44 KKCI 020245

WA4S

-DFWS WA 020245

AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 020900

*.
AIRMET IFR...OK TX AR SD NE KS MO*

*FROM 40ESE RAP TO 40SE GLD TO 40SW ICT TO RZC TO TXK TO 50NE MAF TO
60SSW TXO TO 30ESE TBE TO 50W LBL TO GLD TO 50NNW BFF TO 40ESE RAP
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 09Z ENDG 12-15Z.*

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 Units (CWSU) at the Fort Worth Air Route Traffic Control Center that were active for the accident location at the accident time.

11.0 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.

The following images (Figures 4-7) depict GFA forecast information on sky condition, icing, mountain obscuration, IFR condition and surface wind Graphical-AIRMET (G-AIRMET) advisories, surface visibility, surface wind, precipitation, and other obscurations and hazards, valid for a time near the accident time.

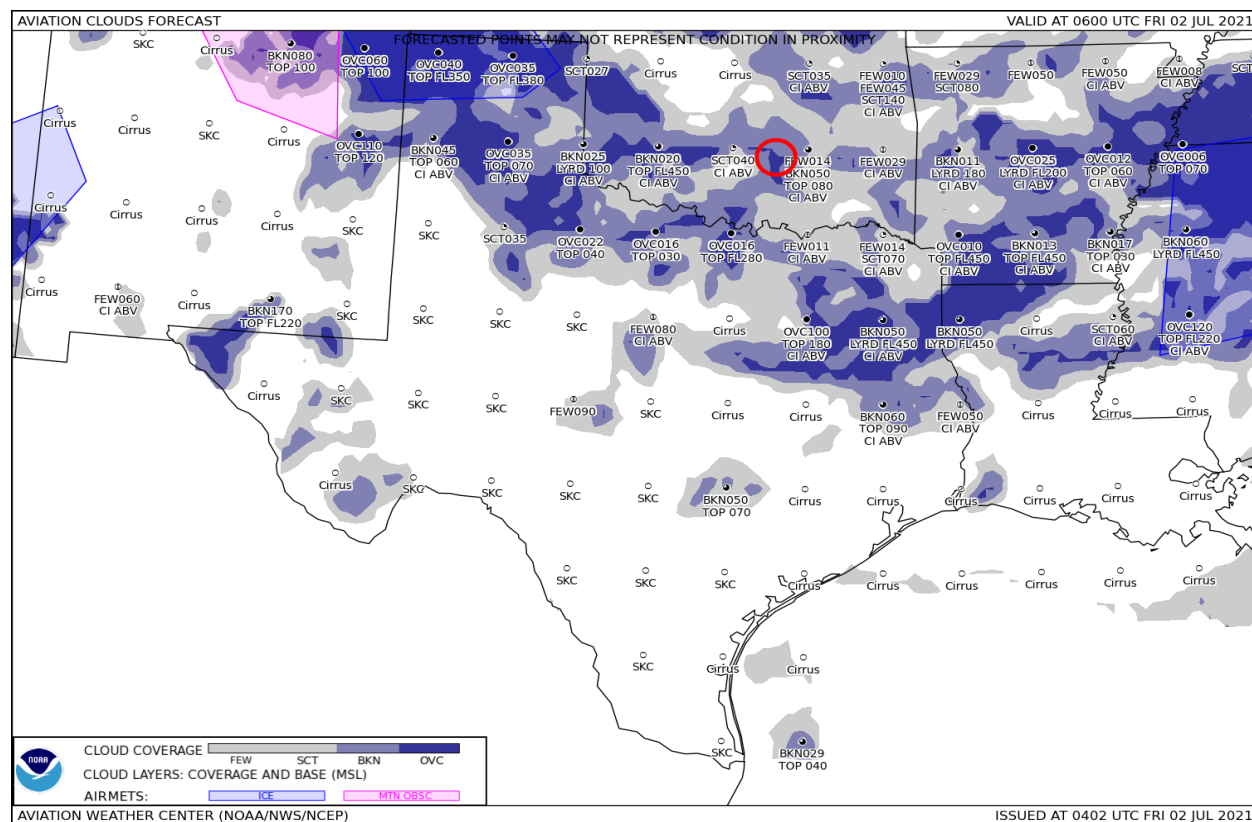


Figure 4 – GFA forecast imagery depicting sky condition and icing and mountain obscuration G-AIRMETs. Issued about 2300 CDT the night before the accident and valid for 0100 CDT on the day of the accident. This GFA forecast imagery depicted broken to overcast clouds at or near the accident location with various cloud level heights noted at nearby data points. The accident location is located within the red circle.

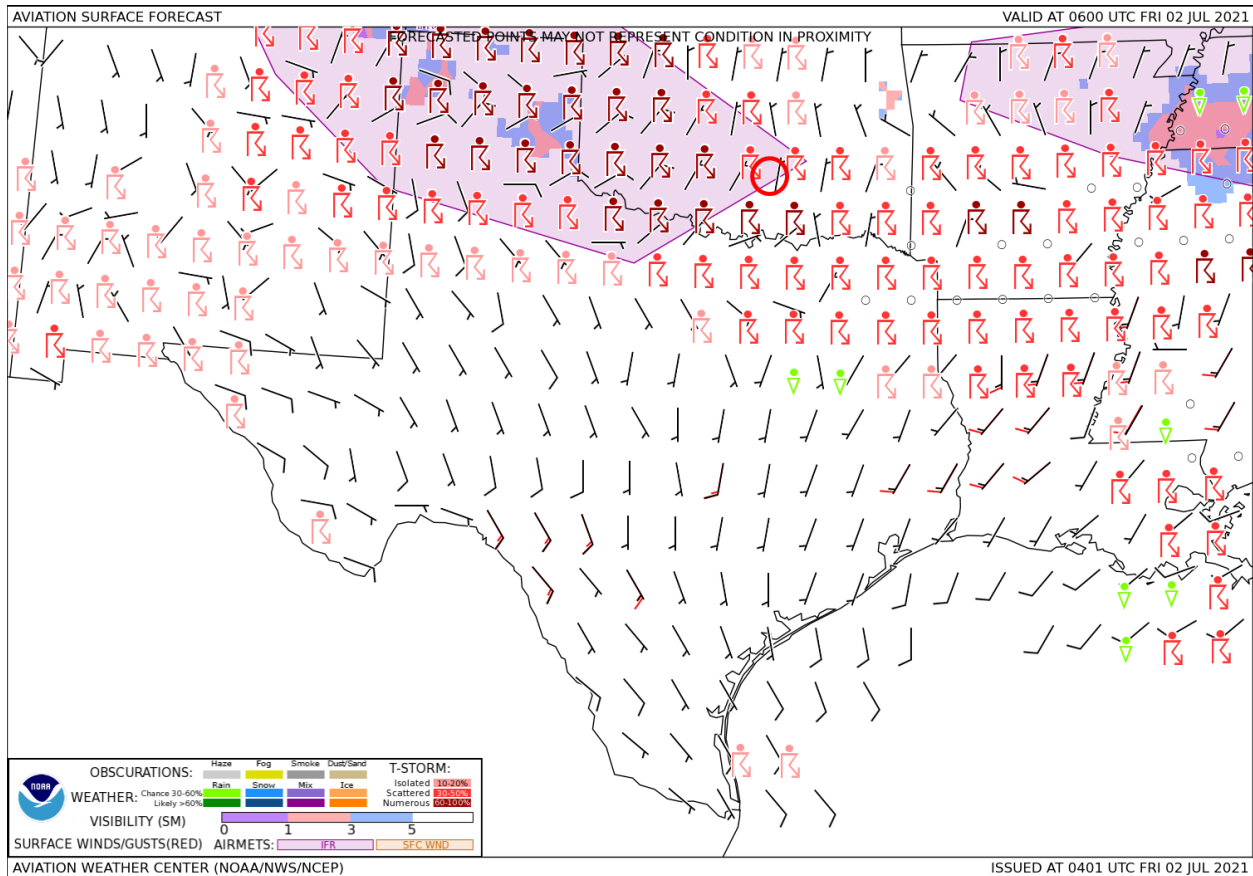


Figure 5 – GFA forecast imagery depicting IFR conditions and surface wind G-AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 2300 CDT the night before the accident and valid for 0100 CDT on the day of the accident. This GFA forecast imagery depicted surface visibilities as being greater than 5 statute miles, with light northerly winds, at the accident location. Scattered to numerous thunderstorms were noted near the accident site. A G-AIRMET for instrument flight rule conditions was present at or near the accident location. The accident location is located within the red circle.

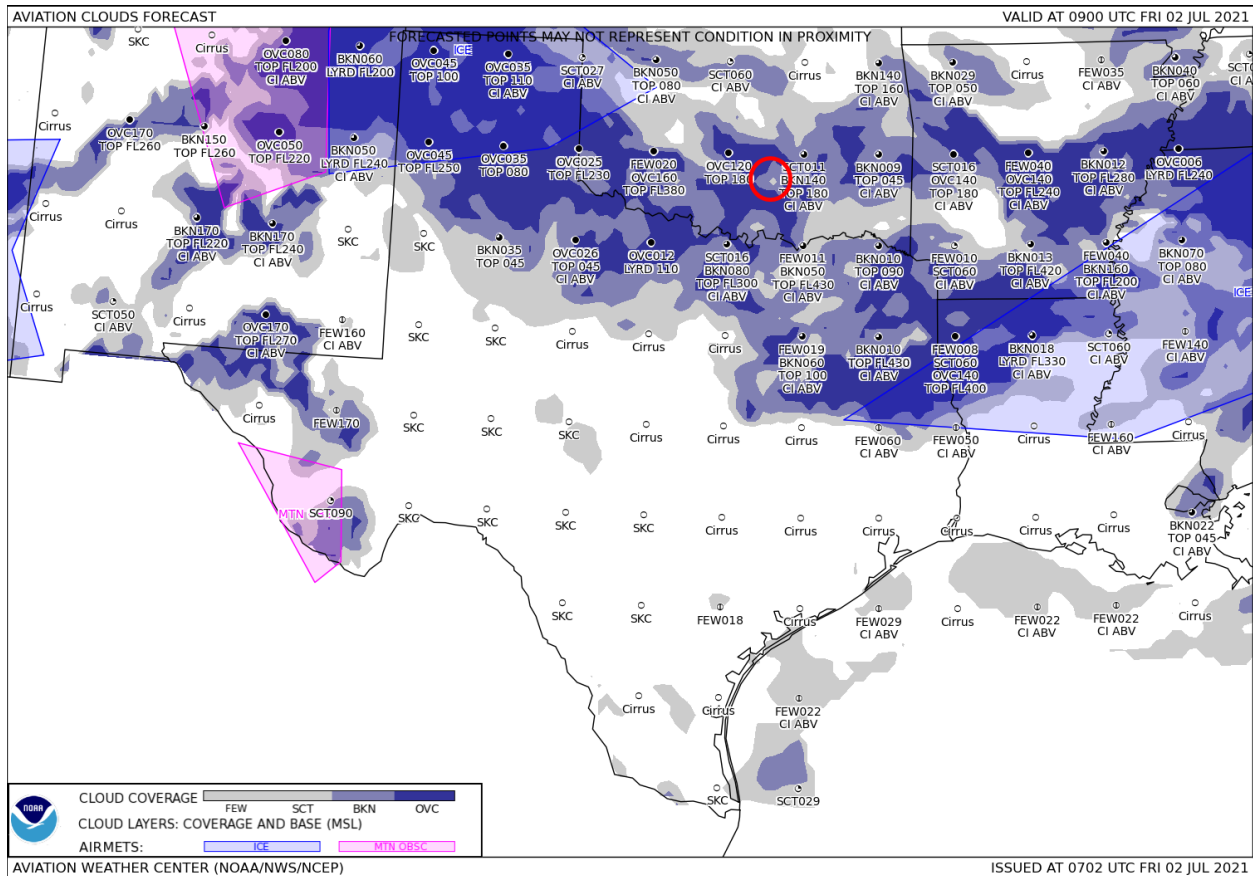


Figure 6 – GFA forecast imagery depicting sky condition and icing and mountain obscuration G-AIRMETs. Issued about 0200 CDT and valid for 0400 CDT on the day of the accident. This GFA forecast imagery depicted broken to overcast clouds at or near the accident location with various cloud level heights noted at nearby data points. The accident location is located within the red circle.

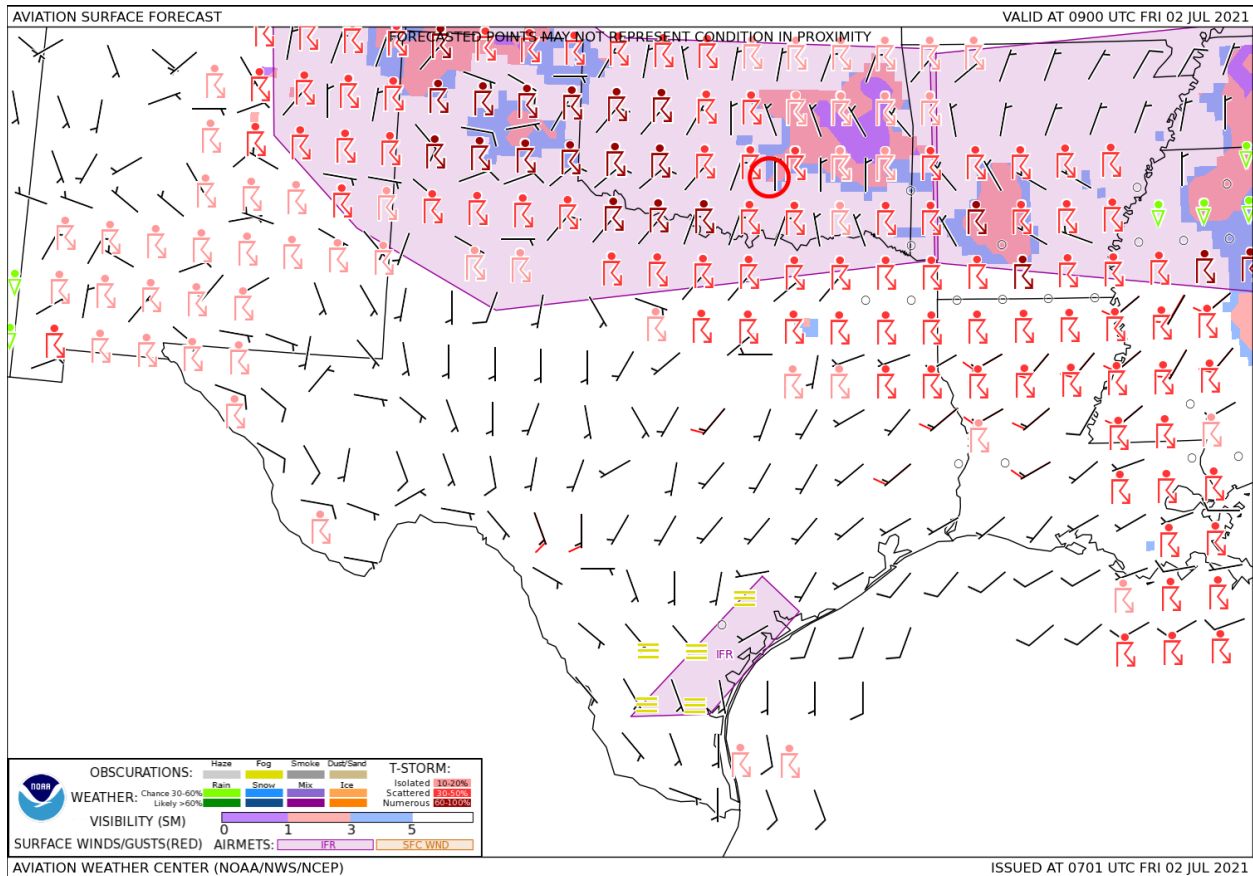


Figure 7 – GFA forecast imagery depicting IFR conditions and surface wind G-AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 2300 CDT the night before the accident and valid for 0100 CDT on the day of the accident. This GFA forecast imagery depicted surface visibilities as being between 1 to 3 statute miles, 3 to 5 statute miles, and greater than 5 statute miles, with light northerly winds, at or near the accident location. Scattered thunderstorms were noted near the accident site. A G-AIRMET for instrument flight rule conditions was present at the accident location. The accident location is located within the red circle.

12.0 Astronomical

According to the Federal Aviation Administration⁸, on the day prior to the accident, sunset occurred at 2044 CDT and civil twilight ended at 2113 CDT. On the day of the accident civil twilight began at 0549 CDT and sunrise occurred at 0618 CDT. According to mooncalc.org⁹, at the time of the accident and relative to the accident location, the moon was at an azimuth of 165° and an elevation of 57° with 44 percent of its disk illuminated.

⁸ https://avcams.faa.gov/sunrise_sunset.php

⁹ <https://www.mooncalc.org/>

Submitted by:

Mike Richards
Senior Meteorologist