National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

WPR22FA266

METEOROLOGY

Specialist's Factual Report

September 1, 2022

TABLE OF CONTENTS

A. ACCIDENT

Location: Tryon, Nebraska
Date: July 25, 2022
Time: 0839 central daylight time
1339 coordinated universal time (UTC)
Airplane: Vans RV-9A; Registration: N192MH

B. METEOROLOGY SPECIALIST

Specialist Paul Suffern
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's senior meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation remotely, collecting data from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). This Specialist's Factual Report contains the meteorological factors pertinent to the weather surrounding the time of the accident. All times are central daylight time (CDT) and are based upon the 24-hour clock, where local time is -5 hours from UTC. Directions are referenced to true north and distances are in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports.

The accident site was located at latitude 41.6686° N, Longitude 100.7953° W, at an elevation of approximately 3,140 feet (ft).

D. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large-scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction and the WPC, located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular (AC) 00-45H "Aviation Weather Services".[1]

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over the Midwest region of the United States for 1000 CDT is provided as figure 1 with the location of the accident site within the black circle. The chart depicted a low-pressure system in the Oklahoma Panhandle with a pressure of 1010-hectopascals (hPa) and high pressure systems in Colorado at 1021- and 1020-hPa, respectively. A stationary frontal boundary stretched from eastern Wyoming southward into northeastern New Mexico, then the frontal boundary stretched eastward through Oklahoma and Arkansas. A surface trough[2] stretched from eastern South Dakota westward into Montana.

The closest station model near the accident site depicted a southeast wind at 10 knots, an air temperature of 66° Fahrenheit (°F), with a dew point temperature of 64°F, light rain, and overcast clouds. Numerous station models to the east and southeast of the accident site over Nebraska, Kansas, and Missouri depicted overcast clouds with rain.

[1] https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

[2] Trough – An elongated area of relatively low atmospheric pressure or heights.

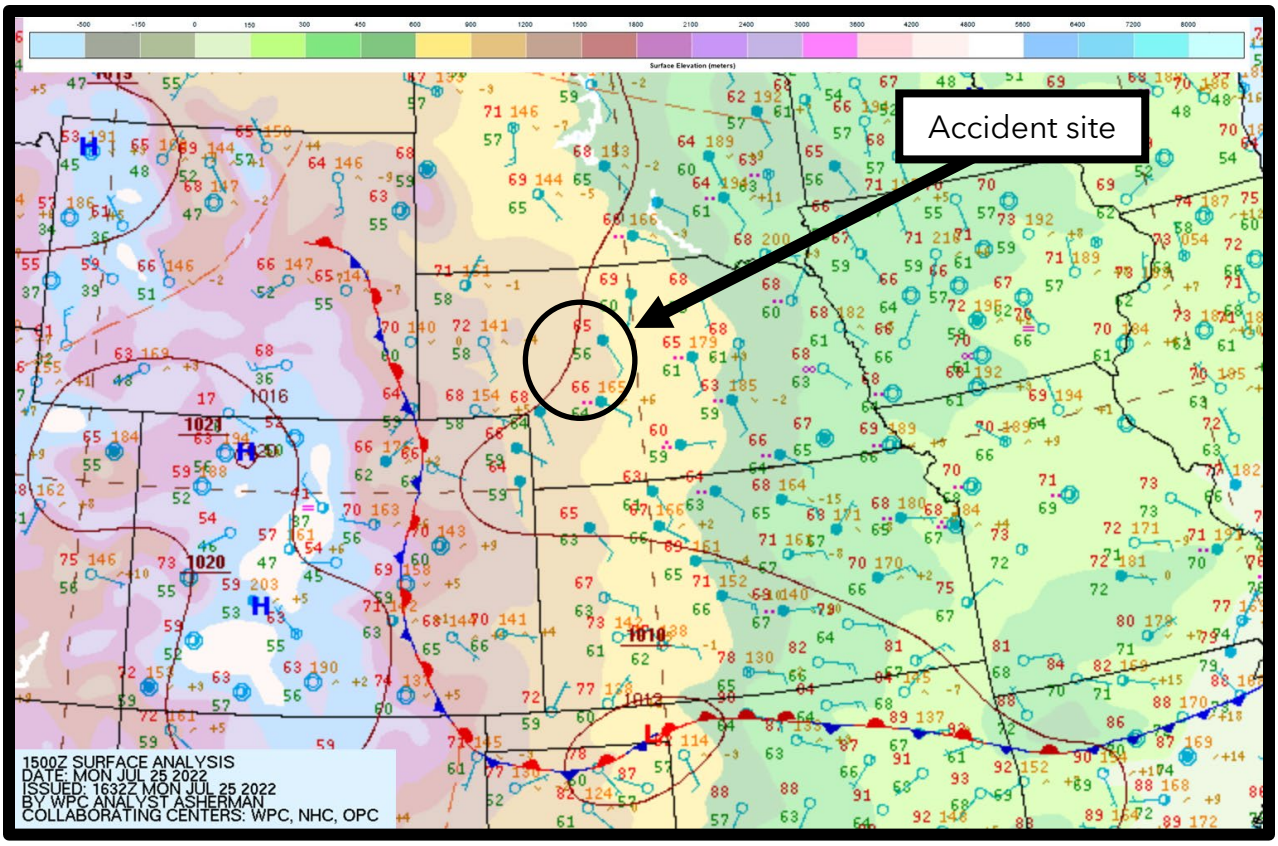

Figure 1. NWS Surface Analysis Chart for 1000 CDT.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 CDT at 850-, 700- and 500-hPa are presented in figures 2 through 4. A mid-level trough was located immediately west of the accident at 700- and 500-hPa (figures 3 and 4). Troughs and fronts can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. The 850-hPa constant pressure chart depicted a southeast wind around 15 knots with the wind becoming southwesterly by 700-hPa. The wind remained consistent through 500-hPa from the southwest near 10 to 15 knots (figure 4).

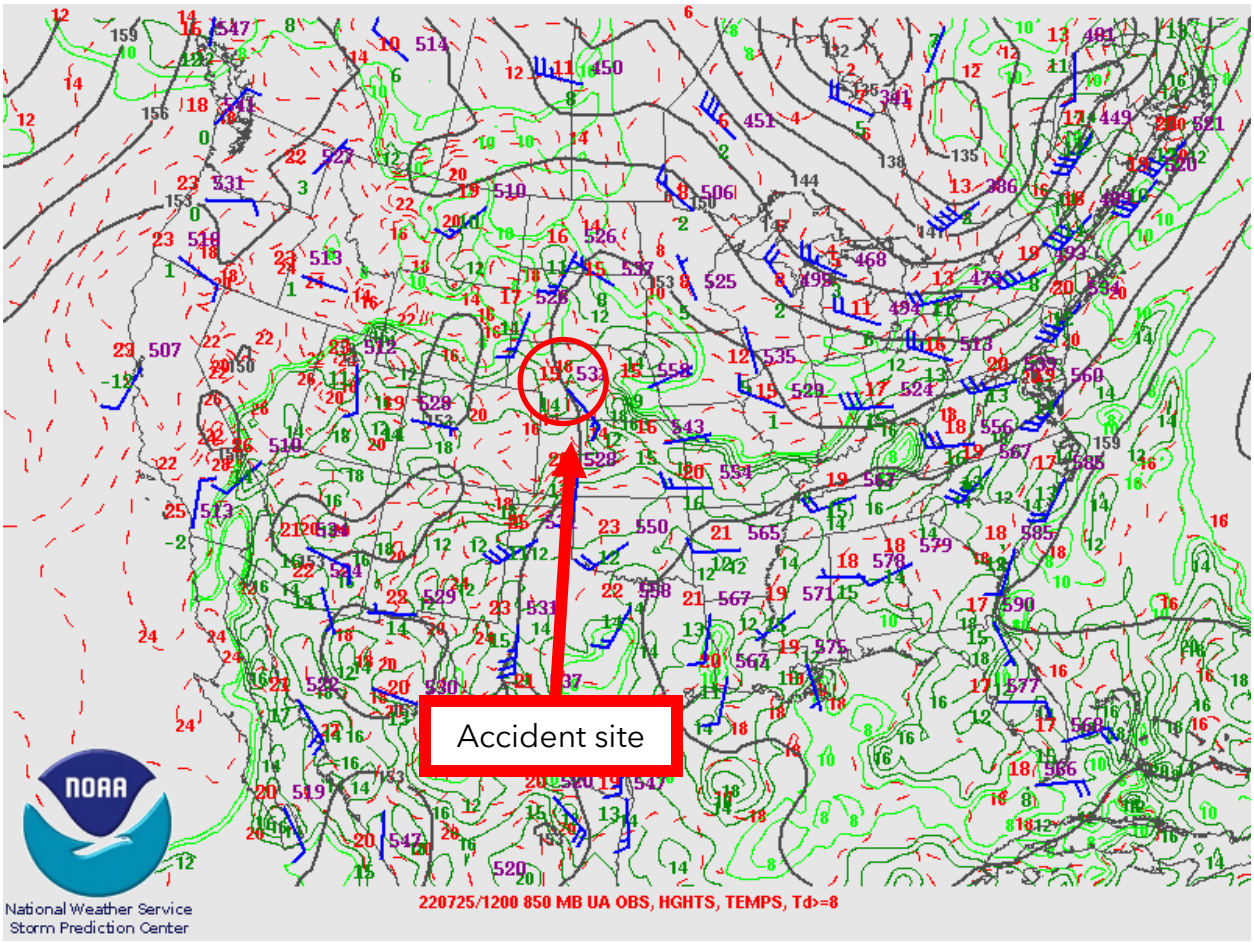

Figure 2. 850-hPa Constant Pressure Chart for 0700 CDT.

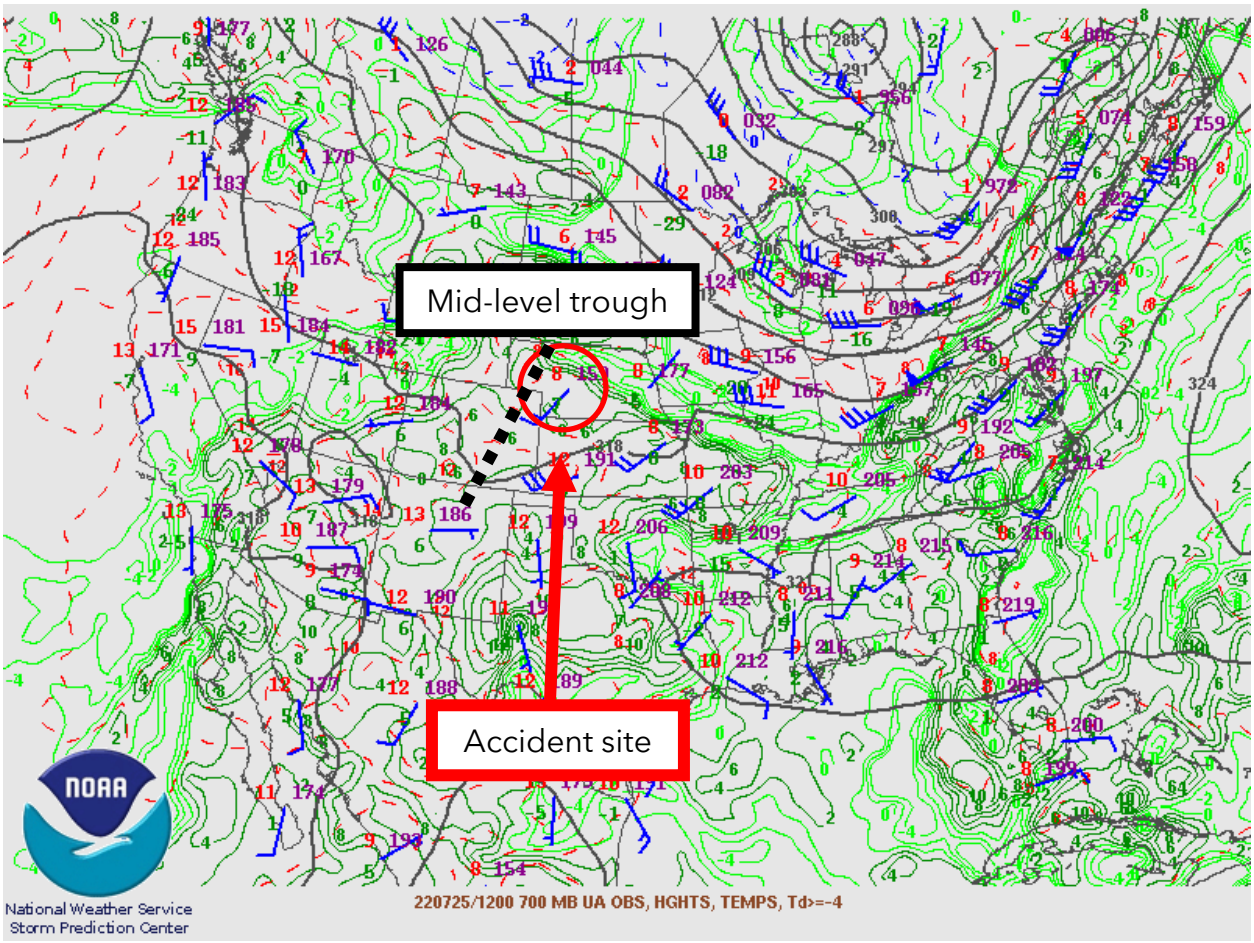

Figure 3. 700-hPa Constant Pressure Chart for 0700 CDT.

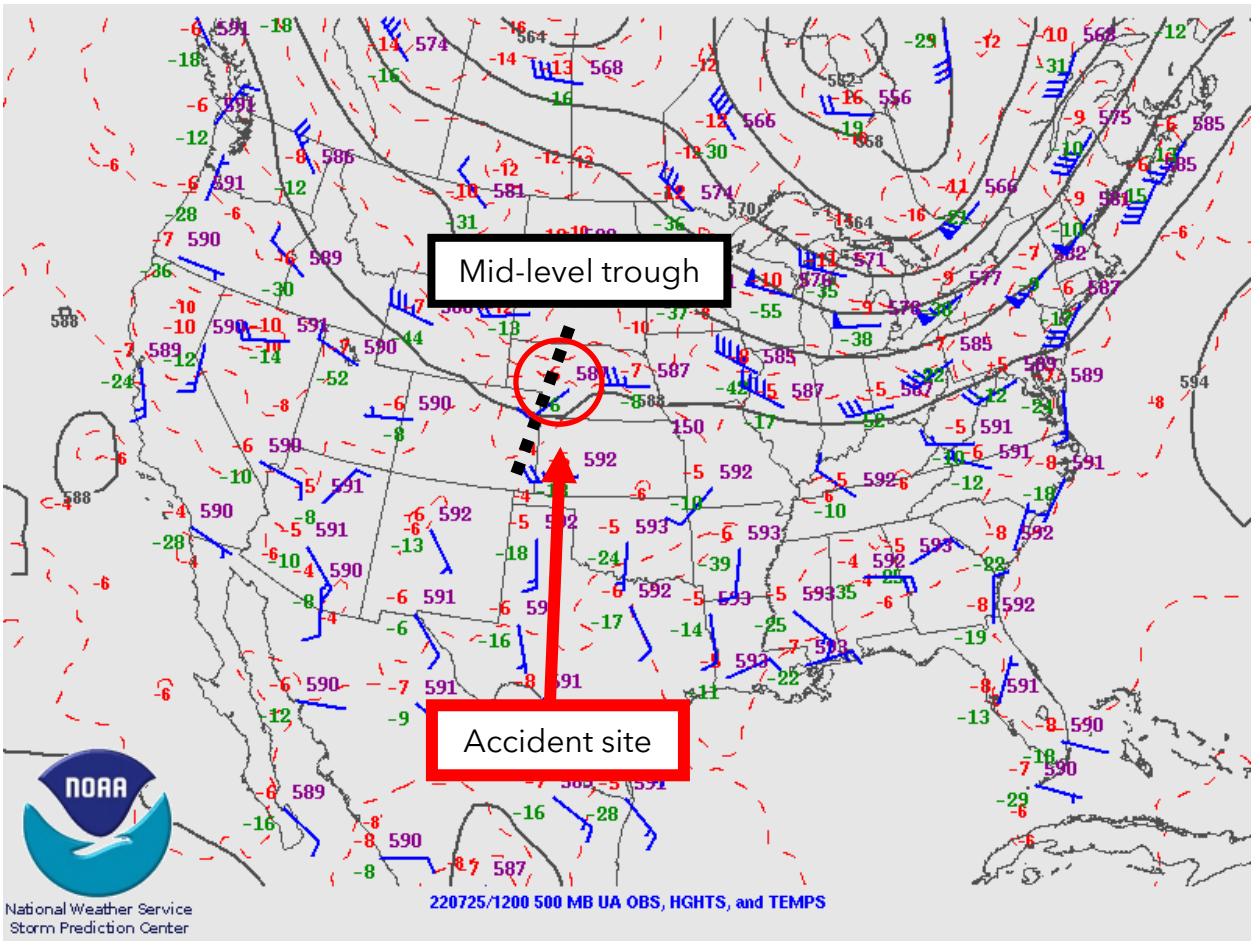

Figure 4. 500-hPa Constant Pressure Chart for 0700 CDT.

2.0 Storm Prediction Center Convective Outlook

The SPC issued a Day 1 Convective Outlook at 0753 CDT (figure 5) with areas of general thunderstorms forecast for the accident site. The SPC defines the "TSTM" area as an area that encloses where a 10% or higher probability of thunderstorms is forecast during the valid period.

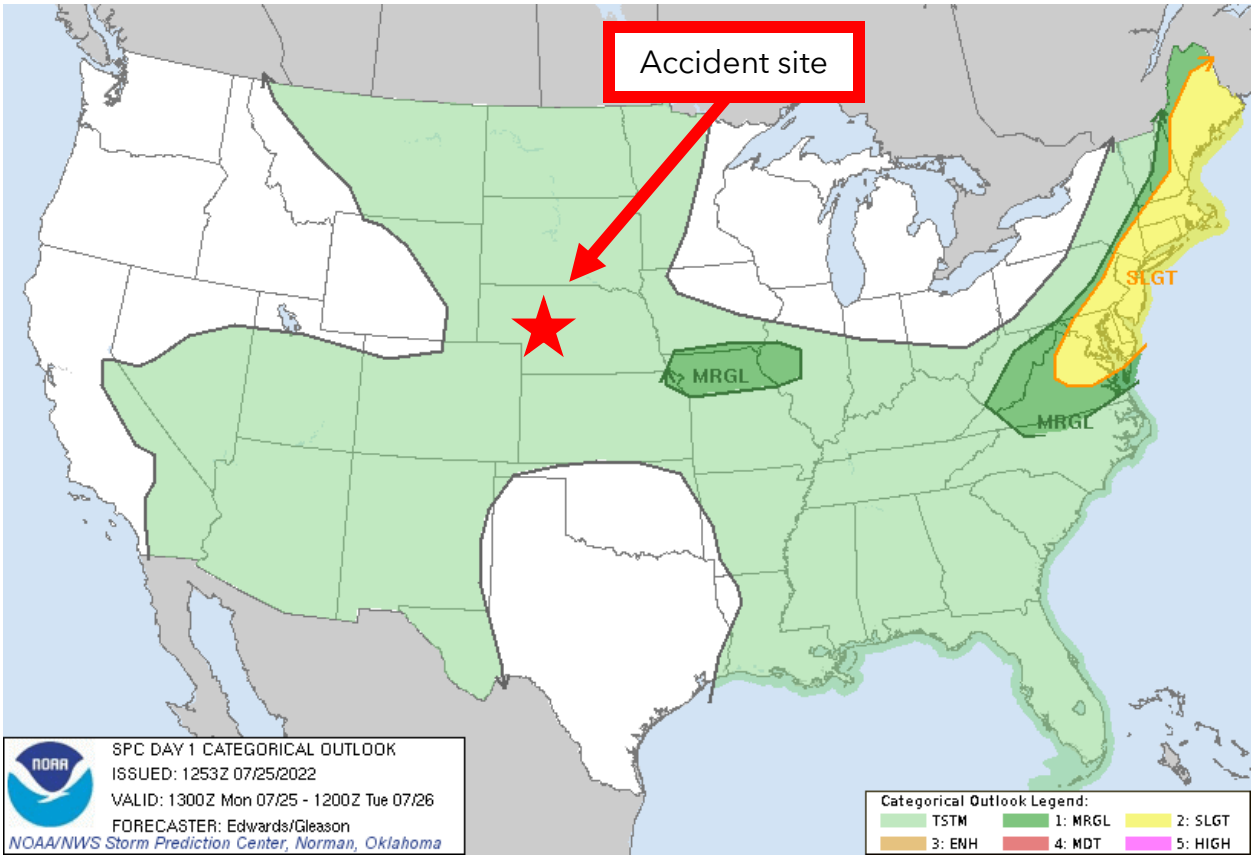

Figure 5. SPC Day 1 Convective Outlook valid at the time of the accident.

3.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials Reports (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 6 is a local sectional chart with the accident site and the closest weather reporting locations marked. The chart depicted the magnetic variation of 6° east over the area.[3]

[3] Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from https://skyvector.com/.

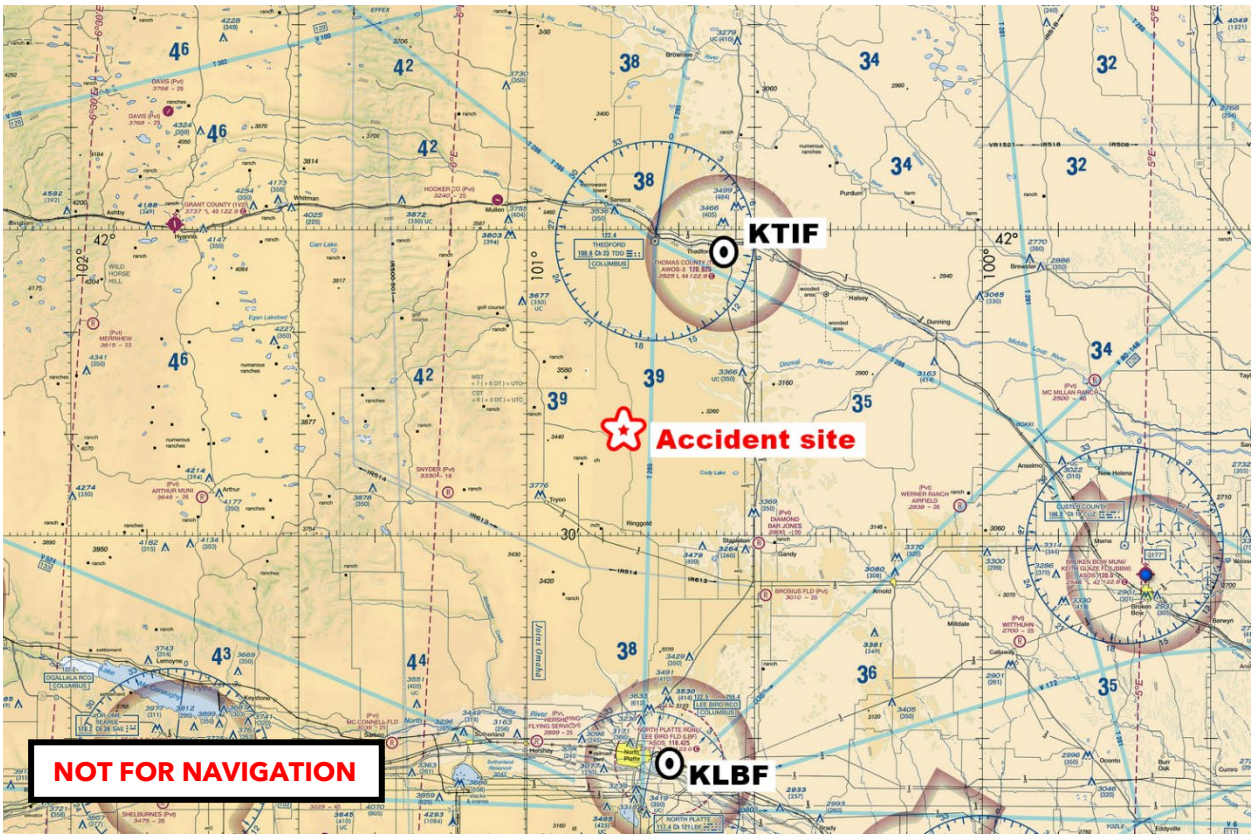

Figure 6. FAA sectional aeronautical chart of the accident area with the location of the accident site and surface observation sites.

The closest official weather station to the accident site was from Thomas County Airport (KTIF), Thedford, Nebraska, located 20 miles northeast of the accident site at an elevation of 2,925 ft (figure 6). KTIF had an Automated Weather Observing System (AWOS) whose longline reports were not augmented, and issued the following observations surrounding the time of the accident: [4] [5] [6]

[4] AWOS – Automated Weather Observing System is equipped with meteorological instruments to typically observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to 12,000 feet, and altimeter setting. AWOS are maintained by the FAA. Certain AWOS may have different reporting or observational equipment.

[5] "Longline" refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases 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 weather observations are distributed.

[6] The bold sections in this NWS product and the rest of the products in this report are intended to highlight the text that directly reference the weather conditions that affected the accident location around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times around the accident time.

[0715 CDT] METAR KTIF 251215Z AUTO 15006KT 10SM SCT080 BKN120 19/15 A3008 RMK AO2 T01920151

[0735 CDT] METAR KTIF 251235Z AUTO 15006KT 10SM OVC110 19/16 A3008 RMK AO2 T01920155

[0755 CDT] METAR KTIF 251255Z AUTO 16006KT 10SM OVC100 19/16 A3009 RMK AO2 T01900156

[0815 CDT] METAR KTIF 251315Z AUTO 17008KT 10SM SCT012 OVC100 19/16 A3009 RMK AO2 T01900163

[0835 CDT] METAR KTIF 251335Z AUTO 16009G15KT 10SM BKN012 OVC090 19/16 A3010 RMK AO2 T01900163

ACCIDENT TIME 0839 CDT

[0855 CDT] METAR KTIF 251355Z AUTO 16014KT 10SM BKN012 BKN065 OVC090 19/16 A3010 RMK AO2 T01910159

[0915 CDT] METAR KTIF 251415Z AUTO 15008KT 10SM SCT012 OVC065 19/15 A3011 RMK AO2 T01860147

The bold type observations decoded in plain language were as follows:

KTIF weather at 0835 CDT, automated, wind from 160° at 9 knots with gusts to 15 knots, visibility 10 miles or greater, broken ceiling at 1,200 ft above ground level (agl), overcast skies at 9,000 ft agl, temperature of 19° Celsius (C), dew point temperature 16°C, and an altimeter setting of 30.10 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator, temperature 19.0°C, dew point temperature 16.3°C.

KTIF weather at 0855 CDT, automated, wind from 160° at 14 knots, visibility 10 miles or greater, broken ceiling at 1,200 ft agl, broken clouds at 6,500 ft agl, overcast skies at 9,000 ft agl, temperature of 19°C, dew point temperature 16°C, and an altimeter setting of 30.10 inHg. Remarks, automated station with a precipitation discriminator, temperature 19.1°C, dew point temperature 15.9°C.

The next closest weather reporting station was from North Platte Regional Airport/Lee Bird Field (KLBF), North Platte, Nebraska, at an elevation of 2,777 ft and located 33 miles south of the accident site (figure 6). KLBF had an Automated Surface Observing System (ASOS) whose longline reports were not augmented, and the following observations were issued surrounding the period of the accident:[7]

[0653 CDT] METAR KLBF 251153Z AUTO 10007KT 10SM BKN012 BKN020 OVC024 19/18 A3008 RMK AO2 RAE21 SLP158 P0001 60017 70017 T01940178 10222 20189 58000

[0700 CDT] SPECI KLBF 251200Z AUTO 10006KT 10SM SCT006 BKN012 OVC021 19/18 A3008 RMK AO2 T01940178

[0705 CDT] SPECI KLBF 251205Z AUTO 10008KT 10SM BKN004 OVC013 19/18 A3008 RMK AO2 T01940178

[0753 CDT] METAR KLBF 251253Z AUTO 10014KT 4SM -RA BR OVC004 19/17 A3007 RMK AO2 RAB28 CIG 003V008 SLP157 P0000 T01890172

[0805 CDT] SPECI KLBF 251305Z AUTO 11012G18KT 9SM -RA OVC006 19/17 A3007 RMK AO2 CIG 003V008 P0000 T01890172

ACCIDENT TIME 0839 CDT

[0853 CDT] METAR KLBF 251353Z AUTO 11009KT 2 1/2SM -RA BR BKN005 BKN015 OVC023 18/17 A3008 RMK AO2 SLP163 P0001 T01830172

[0901 CDT] SPECI KLBF 251401Z AUTO 11011KT 4SM -RA BR BKN005 BKN017 OVC023 18/17 A3008 RMK AO2 P0001 T01830172

The bold type observations decoded in plain language were as follows:

KLBF weather at 0805 CDT, automated, wind from 110° at 12 knots with gusts to 18 knots, visibility 9 miles, light rain, overcast ceiling at 600 ft agl, temperature of 19°C, dew point temperature 17°C, and an altimeter setting of 30.07 inHg. Remarks, automated station with a precipitation discriminator, ceiling varying between 300 and 800 ft agl, a trace of precipitation since 0753 CDT, temperature 18.9°C, dew point temperature 17.2°C.

[7] ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure. ASOS are maintained by the NWS.

KLBF weather at 0853 CDT, automated, wind from 110° at 9 knots, visibility 2 ½ miles, light rain, mist, broken ceiling at 500 ft agl, broken clouds at 1,500 ft agl, overcast skies at 2,300 ft agl, temperature of 18°C, dew point temperature 17°C, and an altimeter setting of 30.08 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure 1016.3 hPa, 0.01 inches of precipitation since 0753 CDT, temperature 18.3°C, dew point temperature 17.2°C.

The observations from KTIF and KLBF surrounding the accident time indicated MVFR to LIFR conditions with precipitation near KLBF.[8]

[8] As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

4.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR) model sounding was created for the approximate accident site coordinates for 0900 CDT.[9][10] The HRRR sounding was plotted on a standard Skew-T Log P diagram from the surface to 400-hPa (or approximately 25,000 ft) using the RAOB software package and is included as figure 7.[11][12] The sounding depicted an elevation of 3,182 ft over the grid point with a near surface temperature of 18.0°C and a dew point temperature of 16.7°C, with a relative humidity of 93%. The sounding depicted the lifted condensation level (LCL) and the level of free convection (LFC) at 3,730 ft (548 ft agl), and the convective condensation level (CCL) at 4,890 ft.[13][14][15] The freezing level was located at 14,915 ft. The precipitable water value at 1.52 inches.

[9] 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.
[10] HRRR sounding was created using NOAA Air Resource Laboratory: https://ready.arl.noaa.gov/READYamet.php.
[11] Skew T log P diagram – is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.
[12] RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.
[13] LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.
[14] LFC – The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.
[15] CCL – The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.

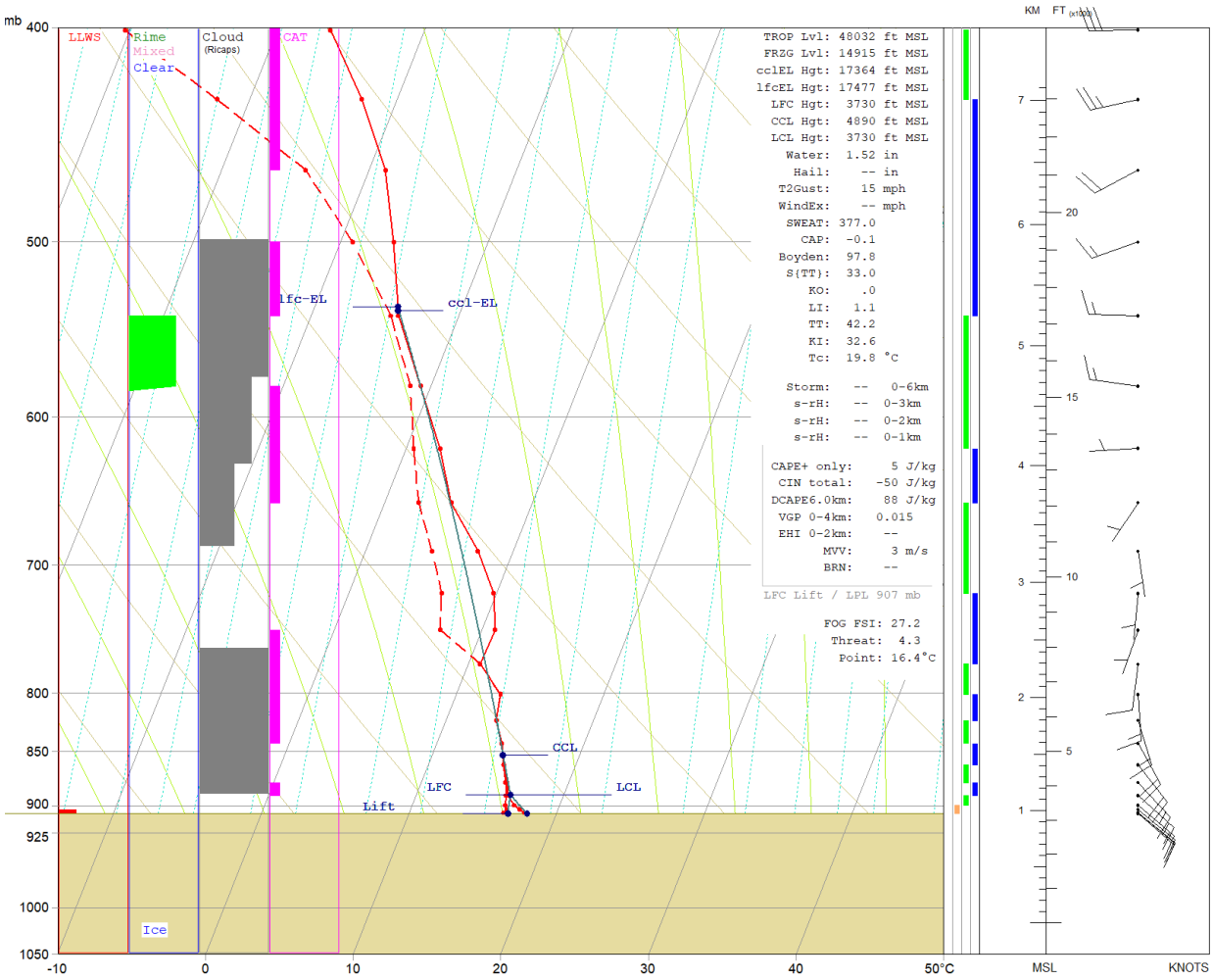

Figure 7. 0900 CDT HRRR sounding.

The 0900 CDT HRRR sounding indicated alternating layers of a conditional unstable to stable environment from the surface through 23,000 ft. Moderate rime icing was indicated by RAOB between 15,000 and 17,500 ft. RAOB indicated cloud cover from 3,700 to 8,000 ft and between 11,000 and 19,500 ft.

The 0900 CDT HRRR sounding wind profile indicated a near surface wind from 132° at 11 knots with the wind veering to the west through 15,000 ft. The wind speed remained below 20 knots under 20,000 ft. RAOB indicated the possibility of very light low-level wind shear (LLWS) below 100 ft agl. Several areas of very light clear air turbulence (CAT) were indicated by RAOB between the surface and 25,000 ft. At the airplane's altitude before descent[16], near 12,700 ft, the temperature was 3.7°C and a dew point temperature of 1.6°C, with a relative humidity of 86%, a wind from about 210° at 4 knots.

[16] See air traffic control (ATC) data in the docket for this investigation.

5.0 Satellite Data

Geostationary Operational Environmental Satellite number 16 (GOES-16) visible and infrared data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System software. Visible and infrared imagery (GOES-16 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm, respectively, were retrieved for the period from 0600 CDT through 1100 CDT and reviewed, and the closest images to the time of the accident were documented.

Figure 8 presents the GOES-16 visible imagery from 0840 CDT at 2X magnification with the accident site highlighted with a red square and cloud cover indicated above the accident site. The cloud cover was moving from west to east with several layers of clouds noted (attachment 1). Figure 9 presents the GOES-16 infrared imagery from 0840 CDT at 6X magnification with the accident site highlighted with a red square. The lower cloud top temperatures (green and blue colors; higher cloud tops) were located south through east of the accident site at the accident time. The cloud cover had a radiative cloud top temperature of 275 Kelvin above the accident site would have been near 14,000 ft based on the vertical temperature profile provided by the HRRR sounding. It should be noted these figures have not been corrected for any parallax error.

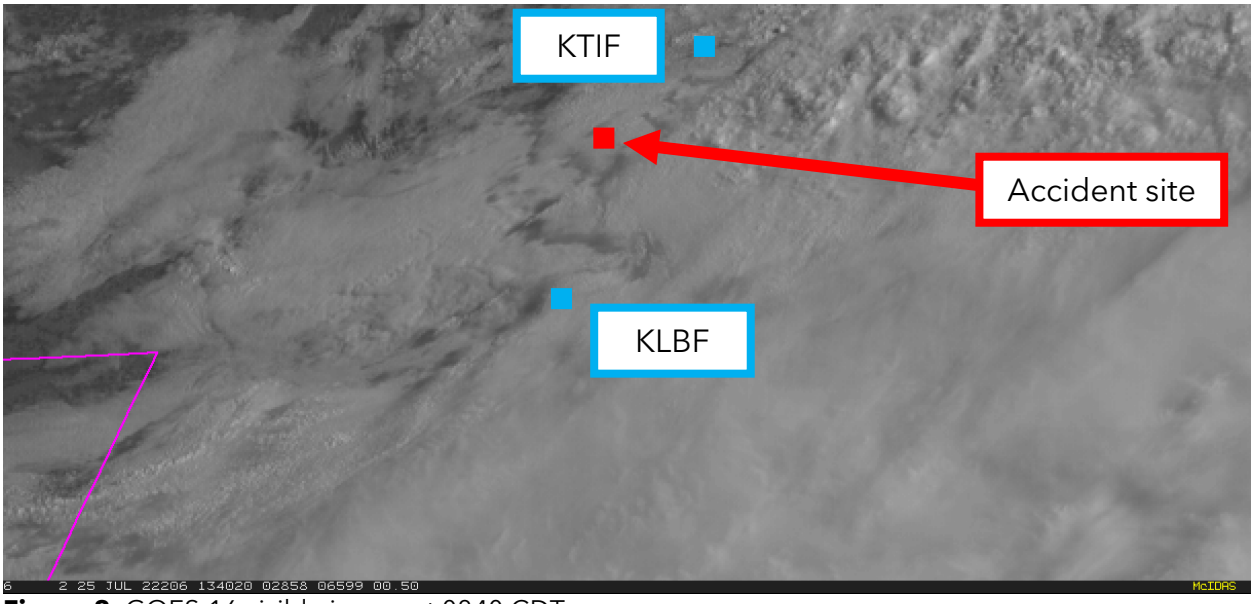

Figure 8. GOES-16 visible image at 0840 CDT.

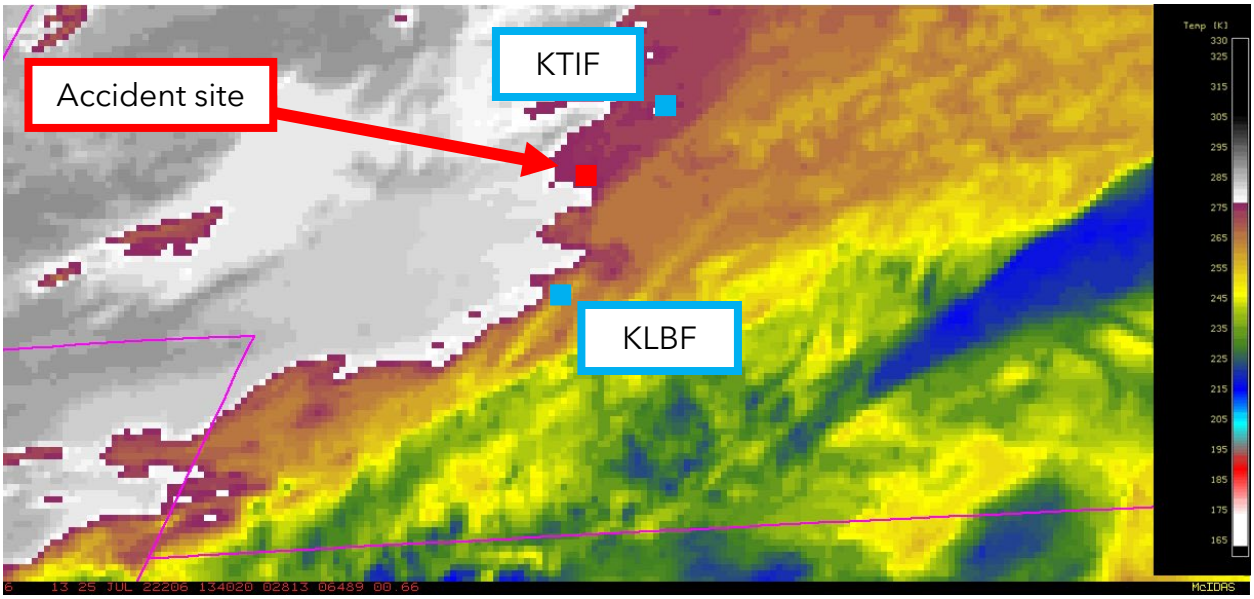

Figure 9. GOES-16 infrared image at 0840 CDT.

6.0 National Radar Imagery

A regional view of the NWS National Reflectivity Mosaic is included as figure 10 for 0840 CDT with the approximate location of the accident site marked by a red circle. The image depicted no precipitation echoes above the accident site at the accident time.

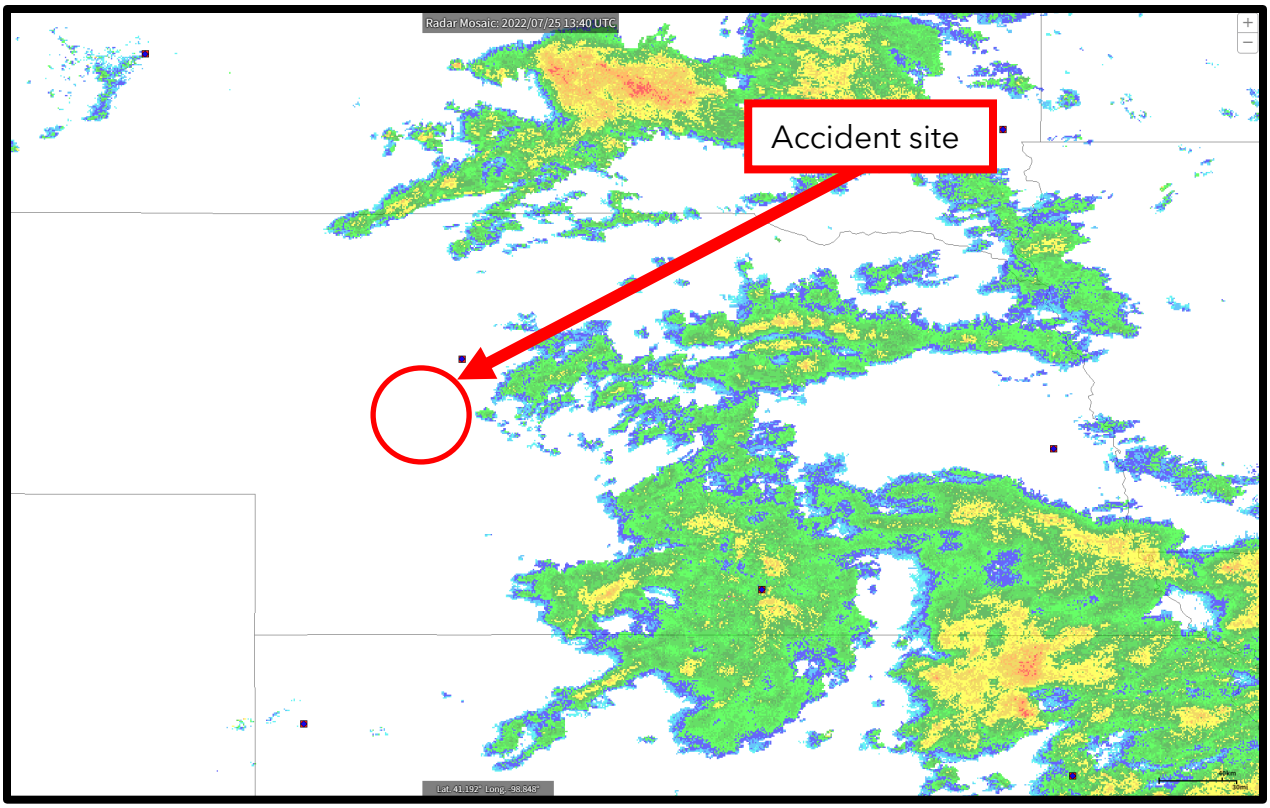

Figure 10. National Reflectivity Mosaic for 0840 CDT.

7.0 Pilot Reports

The longline-disseminated pilot reports (PIREPs) distributed into the national airspace (NAS) were reviewed for about two hours on either side of the accident time and the PIREPs issued into the NAS within 100 miles of the accident site for below 19,000 ft are shown below:[17]

EAR UA /OV EAR/TM 1210/FL050/TP LJ75/SK BASE020/TB LGT CHOP/IC NEG/RM DURD

8.0 Significant Meteorological Information

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

[17] Only pilot reports with the World Meteorological Organization headers UBNE**, UBCO**, UBKS**, and UBSD** were considered. These do not include pilot reports only broadcast via radio.

9.0 Center Weather Service Advisories

The Denver (ZDV) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. There was no Center Weather Advisory (CWA) valid from ZDV CWSU at the accident time.

10.0 Airmen's Meteorological Information

There were no text Airmen's Meteorological Information (AIRMET) advisories valid for the accident site at the accident time.

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products issued before the accident flight and valid at 1000 CDT are shown in attachment 2. The GFA surface forecast applicable to the accident site that was valid before the accident flight's departure for times surrounding the accident time indicated VFR surface visibilities, a chance (between 30 to 60 percent) of rain, and a southeast surface wind at 10 knots. The GFA cloud forecast applicable to the accident site that was valid before departure for times surrounding the accident time indicated scattered clouds at 4,500 ft to overcast clouds at 4,000 ft with clouds layered through 17,000 ft. Additional and higher cloud cover was forecast for eastern Nebraska and southeastern South Dakota. The Graphical AIRMETs (G-AIRMETs) valid for the accident time are shown on the GFA cloud forecast figures in attachment 2.[18] No G-

[18] **Graphical AIRMETs (G-AIRMETs)**, found on the Aviation Weather Center webpage at http://aviationweather.gov, are graphical forecasts of en-route weather hazards valid at discrete times no more than 3 hours apart for a period of up to 12 hours into the future (for example, 00, 03, 06, 09, and 12 hours). Additional forecasts may be inserted during the first 6 hours (for example, 01, 02, 04, and 05). 00 hour represents the initial conditions, and the subsequent graphics depict the area affected by the particular hazard at that valid time. Forecasts valid at 00 through 06 hours correspond to the text AIRMET bulletin. Forecasts valid at 06 through 12 hours correspond to the text bulletin outlook.

G-AIRMETs are snap shots at discrete time intervals as defined above. The text AIRMET is the result of the production of the G-AIRMET but provided in a time smear for a 6hr valid period. G-AIRMETs provide a higher forecast resolution than text AIRMET products. Since G-AIRMETs and text AIRMETs are created from the same forecast "production" process, there exists perfect consistency between the two. Using the two together will provide clarity of the area impacted by the weather hazard and improve situational awareness and decision making. Interpolation of time periods between G-AIRMET valid times: Users must keep in mind when using the G-AIRMET that if a 00 hour forecast shows no significant weather and a 03 hour forecast shows hazardous weather, they must assume a change is occurring during the period between the two forecasts. It should be taken into consideration that the hazardous weather starts immediately after the 00 hour forecast unless there is a defined initiation or ending time for the hazardous weather. The same would apply after the 03 hour forecast. The user should assume the hazardous weather condition is occurring between the snap shots unless informed

AIRMETs were valid for the accident site. The only human-generated information reflected in the two GFA products were the G-AIRMETs. For more information, please see attachment 2.

12.0 Terminal Aerodrome Forecast

KLBF was the closest site with a Terminal Aerodrome Forecast (TAF) current at the time of the accident.[19] The KLBF amended TAF was issued 0724 CDT and was valid for a 24-hour period beginning at 0700 CDT. The 0724 CDT TAF for KLBF was as follows:

FTUS43 KLBF 251224 AAA
TAFLBF
TAF AMD
KLBF 251224Z 2512/2612 12007KT P6SM OVC004
FM251600 14009KT P6SM BKN012
FM260500 13006KT P6SM BKN011
FM261000 VRB04KT 5SM BR BKN004=

Between 0700 CDT and 1100 CDT, the forecast expected a wind from 120° at 7 knots, greater than 6 miles visibility, an overcast ceiling at 400 ft agl.

13.0 National Weather Service Area Forecast Discussion

The NWS weather forecast office in North Platte, Nebraska, (WFO LBF) was responsible for the public forecast in the region of the accident site. WFO LBF issued the following Area Forecast Discussion (AFD) at 0637 CDT, the closest AFD to the accident time with an aviation section:

FXUS63 KLBF 251137
AFDLBF

Area Forecast Discussion
National Weather Service North Platte NE
637 AM CDT Mon Jul 25 2022

.SHORT TERM...(Today through Tuesday)
Issued at 422 AM CDT Mon Jul 25 2022

The main concern in the short term will be precipitation chances

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otherwise. For example, if a 00 hour forecast shows no hazard, a 03 hour forecast shows the presence of hazardous weather, and a 06 hour forecast shows no hazard, the user should assume the hazard exists from the 0001 hour to the 0559 hour time period.

[19] A TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex.

today through Tuesday and temperatures. Showers and embedded scattered isolated thunderstorms will continue through the morning hours. There is a little more uncertainty with development through the daytime hours, there is some indication that showers may linger into the afternoon hours, however instability may be limited. A few of the ensemble members continue to indicate development across western Nebraska in the late afternoon and early evening, likely associated with the shortwave to the west. Any isolated showers/thunderstorms that form will move east into the Sandhills and north central Nebraska, so put some low chances in during that time period.

As for high temperatures on Monday, kept temperatures on the cooler side, with the coolest temperatures across north central Nebraska into central Nebraska, where cloud cover and lingering showers will keep temperatures even cooler in this location. Temperatures across this area will range from around 5 to 10 degrees below normal for this time of year.

For Tuesday shower and thunderstorm chances. A weak disturbance moves through Tuesday afternoon and will become the focus for thunderstorm development through the afternoon and evening. Sufficient instability across western and southwest Nebraska with CAPE values around 1000 J/kg should support a few isolated storms. A few could be strong to severe.

.LONG TERM...(Tuesday night through Sunday)
Issued at 422 AM CDT Mon Jul 25 2022

Northwesterly flow will continue through the weekend giving a more active pattern as multiple disturbances will translate through the region over the long term period. The northwest flow will also keep temperatures near to below normal, with Thursday being one of the cooler days as temperatures will range from 5 to 10 degrees below normal, which is typically upper 80s to around 90 degrees. Towards the end of the forecast period, the ridge across western CONUS will make a shift eastward and temperatures are expected to rise into the 90s by Sunday.

&&

.AVIATION...(For the 12Z TAFS through 12Z Tuesday morning)
Issued at 632 AM CDT Mon Jul 25 2022

Isolated showers and thunderstorms are expected across both the north and south through the morning hours. Heavy rainfall and light fog may result in some brief reductions in visibility. Another round of showers and thunderstorms will be possible again this evening, but confidence remains low in development and therefore is not in the prevailing forecast at this time. However, plenty of low level moisture from recent rainfall could cause some patchy fog to develop. Have included some light fog at KLBF where the river valley may help enhance development.

&&

.LBF WATCHES/WARNINGS/ADVISORIES...
None.
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14.0 Winds and Temperature Aloft Forecast

The NWS 0259 CDT Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

FBUS31 KWNO 250759
FD1US1
DATA BASED ON 250600Z
VALID 251200Z FOR USE 0800-1500Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BFF		1915	2508+13	2509+06	2007-06	2732-16	265531	266141	266753
GRI		1217+14	1512+12	1911+07	2326-04	2529-14	263930	254341	265254
ONL		1707+15	9900+09	1812+04	2540-06	2738-16	276131	276841	277353

The closest forecast points to the accident site were Scottsbluff, Nebraska (BFF), Grand Island, Nebraska (GRI), and O'Neill, Nebraska (ONL) with the wind and temperature forecast for use between 0300 and 1000 CDT.

15.0 Pilot Weather Briefing

Title 14 CFR 91.103 states that "Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight." FAA AC 91-92 "Pilot's Guide to a Preflight Planning" (dated March 15, 2021) provided pilot guidance on preflight self-briefings, including planning, weather interpretation, and risk identification/mitigation skills. The AC further stated in part:

> Pilots adopting these guidelines will be better prepared to interpret and utilize real-time weather information before departure and en route, in the cockpit, via technology like Automatic Dependent Surveillance-Broadcast (ADS-B) and via third-party providers. [20]

[20] https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf. The AC also listed multiple online FAA resources for aviation flight planning services for adverse weather.

The accident pilot did not request weather information from Leidos Flight Service or ForeFlight. A search of archived ForeFlight information indicated that the student pilot-rated passenger did review ForeFlight information for a potential flight through the accident region five days prior to the accident. For more information please see attachment 3. It is unknown what, if any, weather information the accident pilot viewed before or during the accident flight.

16.0 Astronomical Data

The astronomical data obtained for the accident site on July 25, 2022, indicated the following:

SUN	
Begin civil twilight	0559 CDT
Sunrise	0630 CDT
Accident time	**0839 CDT**[21]
Sun transit	1350 CDT
Sunset	2108 CDT
End civil twilight	2140 CDT

At the time of the accident the Sun was located at an altitude of 21.93° and azimuth of 82.77°.

E. LIST OF ATTACHMENTS

Attachment 1 – GOES-16 visible satellite animation from 0741 and 0921 CDT

Attachment 2 – GFA information valid at the accident time

Attachment 3 – ForeFlight information

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[21] Inserted accident time for reference and context.