



## **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety  
Washington, D.C. 20594

October 21, 2019

### **Weather Study**

# **METEOROLOGY**

CEN19FA307

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## **A. ACCIDENT**

Location: Lakeview, South Dakota  
Date: September 8, 2019  
Time: 2000 central daylight time  
0100 Coordinated Universal Time (UTC) September 9, 2019  
Aircraft: Cessna 140; Registration: N73000

## **B. METEOROLOGIST**

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

## **C. DETAILS OF THE INVESTIGATION**

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Centers for Environmental Information (NCEI). All times are central daylight time (CDT) on September 8, 2019, and are based upon the 24-hour clock, where local time is -5 hours from UTC, and UTC=Z (unless otherwise noted). Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of miles. NWS airport and 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 43.0394° N, longitude 100.8056° W at an approximate elevation of 2,910 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 Weather Prediction Center, 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 "Aviation Weather Services", AC 00-45H.<sup>1</sup>

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<sup>1</sup>

## 1.1 Surface Analysis Chart

The northcentral United States section of the NWS Surface Analysis Chart for 1900 CDT is provided as figure 1 with the location of the accident site marked with the red circle. The chart indicated a low pressure system over northern Wyoming with a pressure of 1006- hectopascals (hPa). A warm front stretched from the low pressure center southeastward into western Nebraska through northern Kansas. The accident site was located north of the warm front on the cool side of the frontal boundary.

The station models around the accident site depicted air temperatures in the low 60's degrees Fahrenheit (°F), dew point temperatures in the low to mid 50's °F with a temperature-dew point spread of 9° or less, an east to northeast wind between 5 and 10 knots, and overcast cloud cover in South Dakota, and partly cloudy skies in northcentral Nebraska.

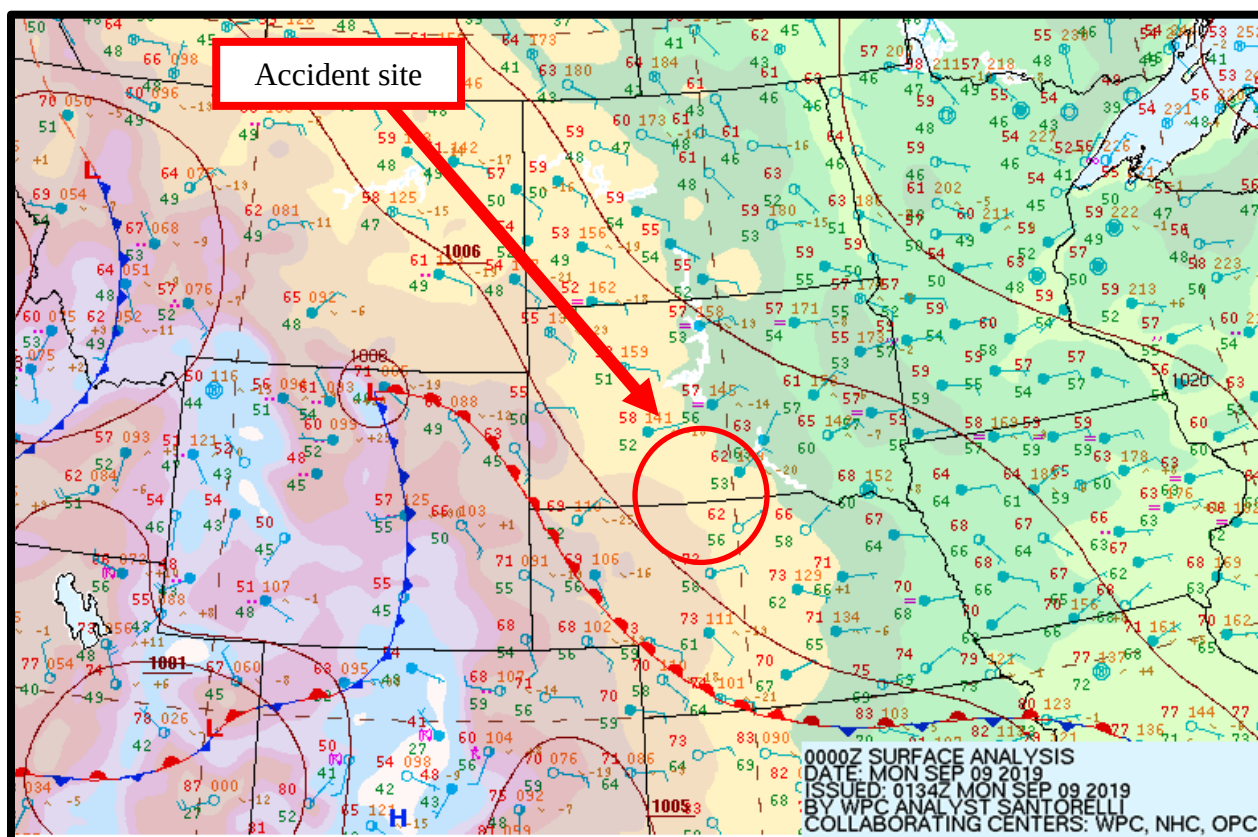


Figure 1 – NWS Surface Analysis Chart for 1900 CDT

[https://www.faa.gov/regulations\\_policies/advisory\\_circulars/index.cfm/go/document.information/documentID/1030235](https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235)

## 1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1900 CDT at 925-, 850-, 700-, 500-, and 300-hPa are presented in figures 2 through 6. There was a low- and mid-level trough<sup>2</sup> located near and above the accident site at 925-, 850-, and 700-hPa. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. The wind was from the east to southeast at 5 to 10 knots at 925-hPa with the wind becoming southwesterly at 15 to 20 knots by 700-hPa (figure 4). At 300-hPa, the wind was from the west at 30 knots (figure 6).

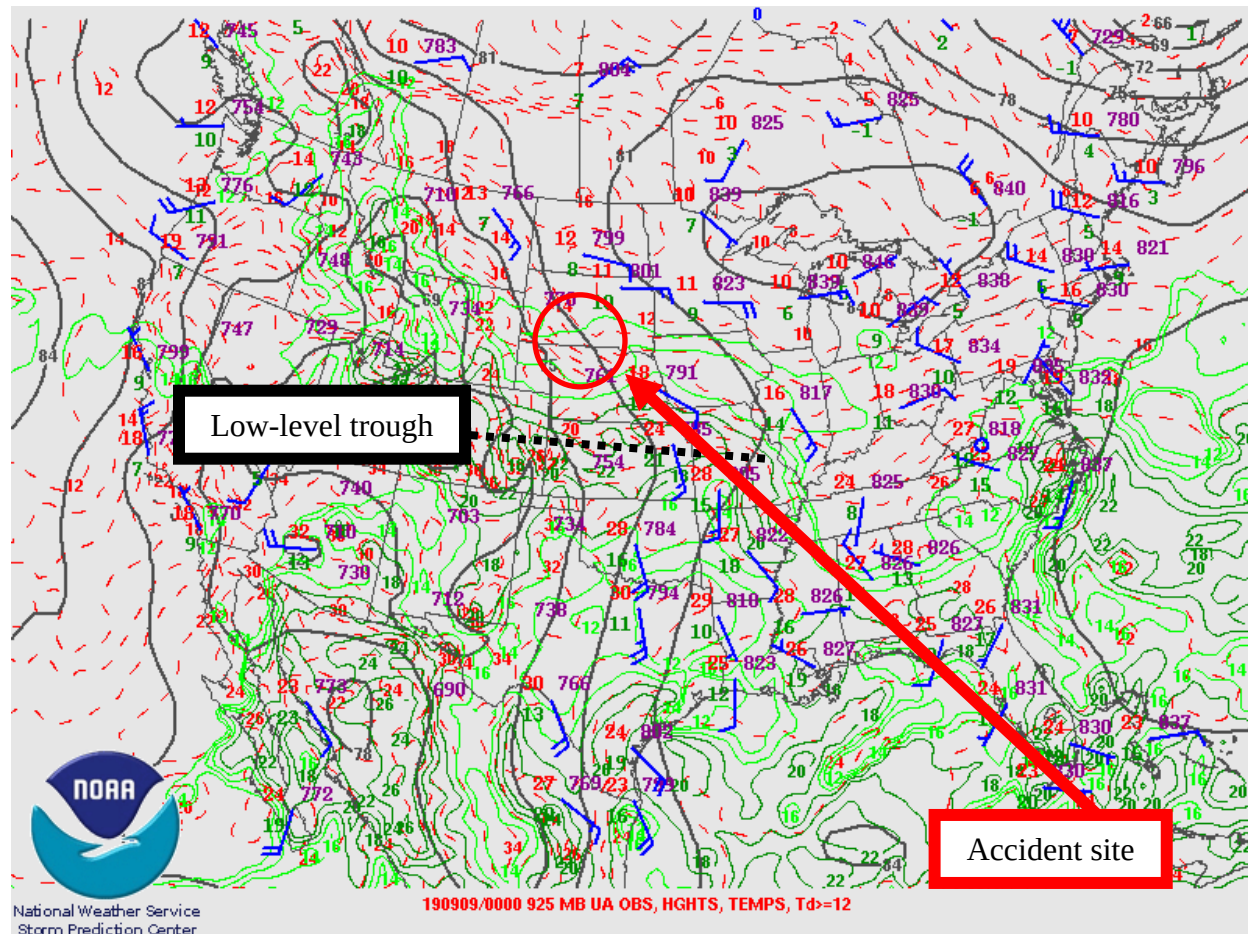


Figure 2 – 925-hPa Constant Pressure Chart for 1900 CDT

<sup>2</sup> Trough – An elongated area of relatively low atmospheric pressure or heights.



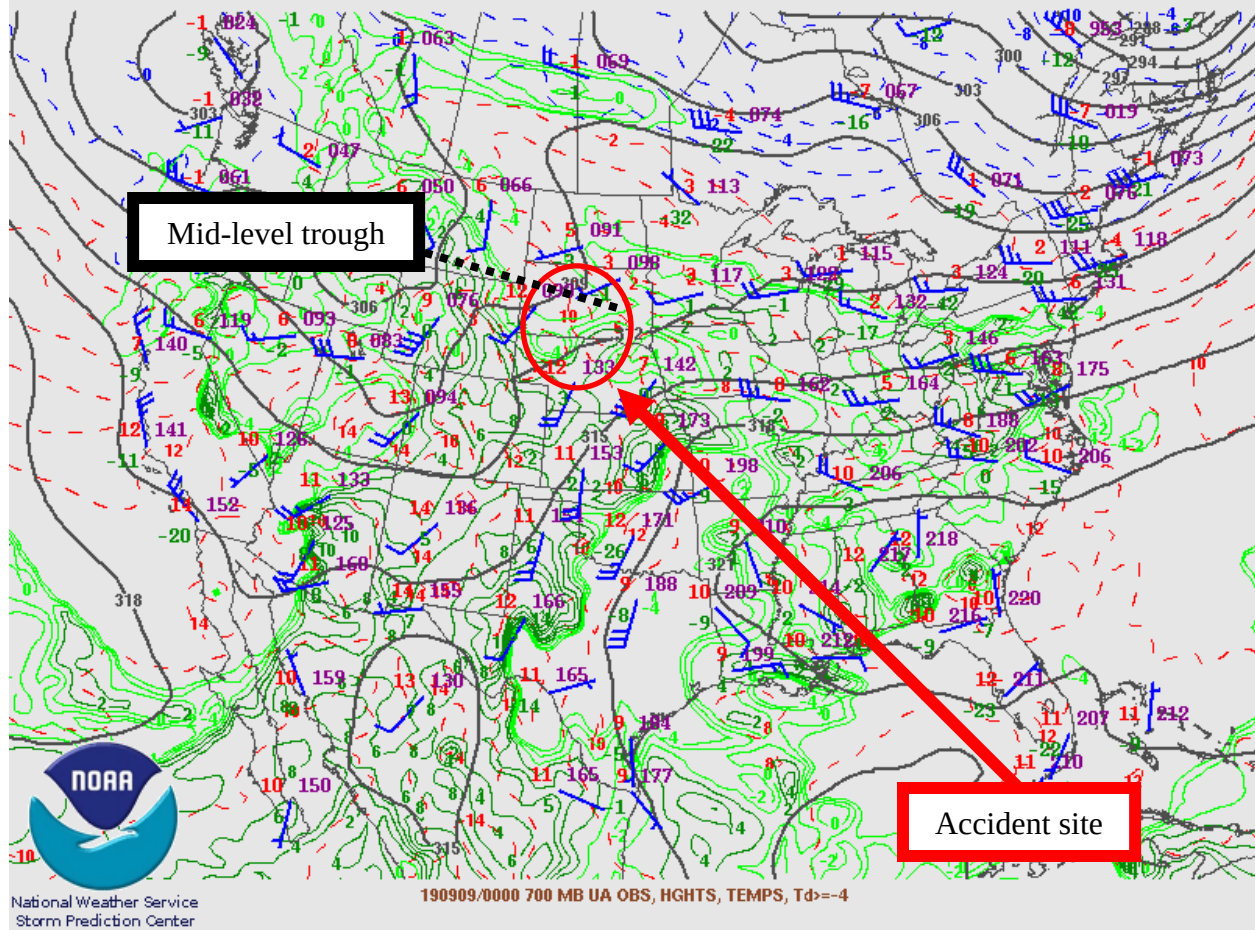


Figure 4 – 700-hPa Constant Pressure Chart for 1900 CDT

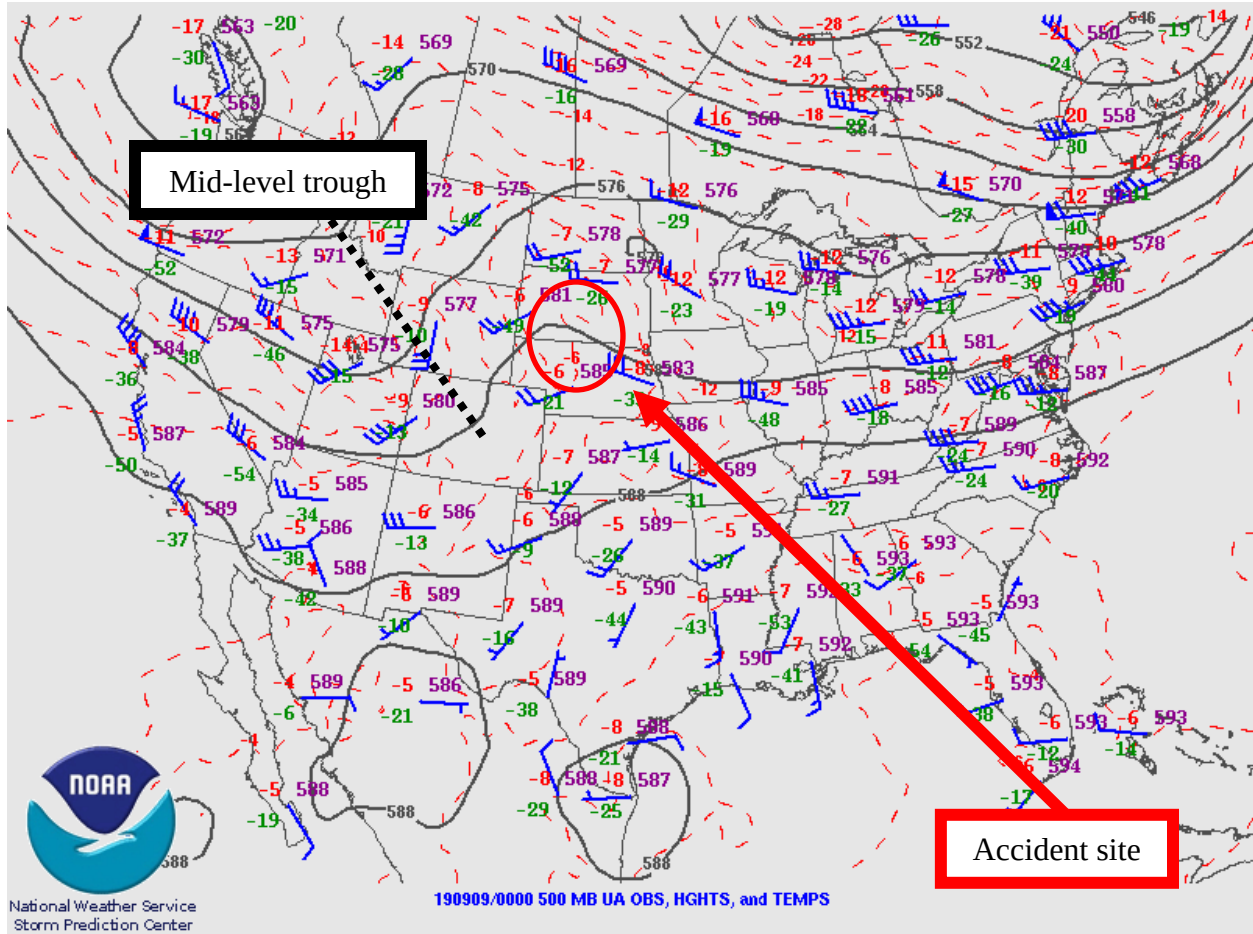
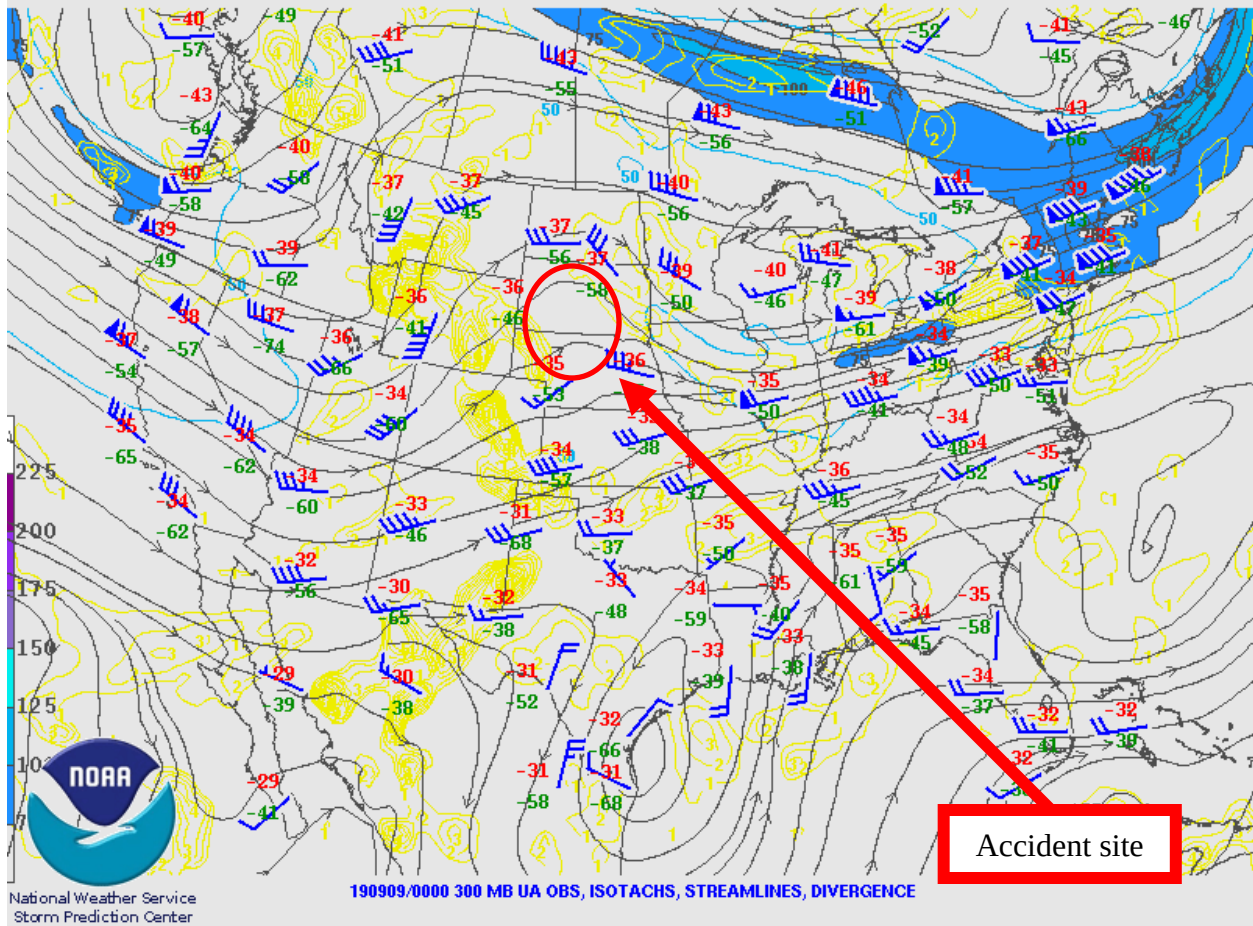


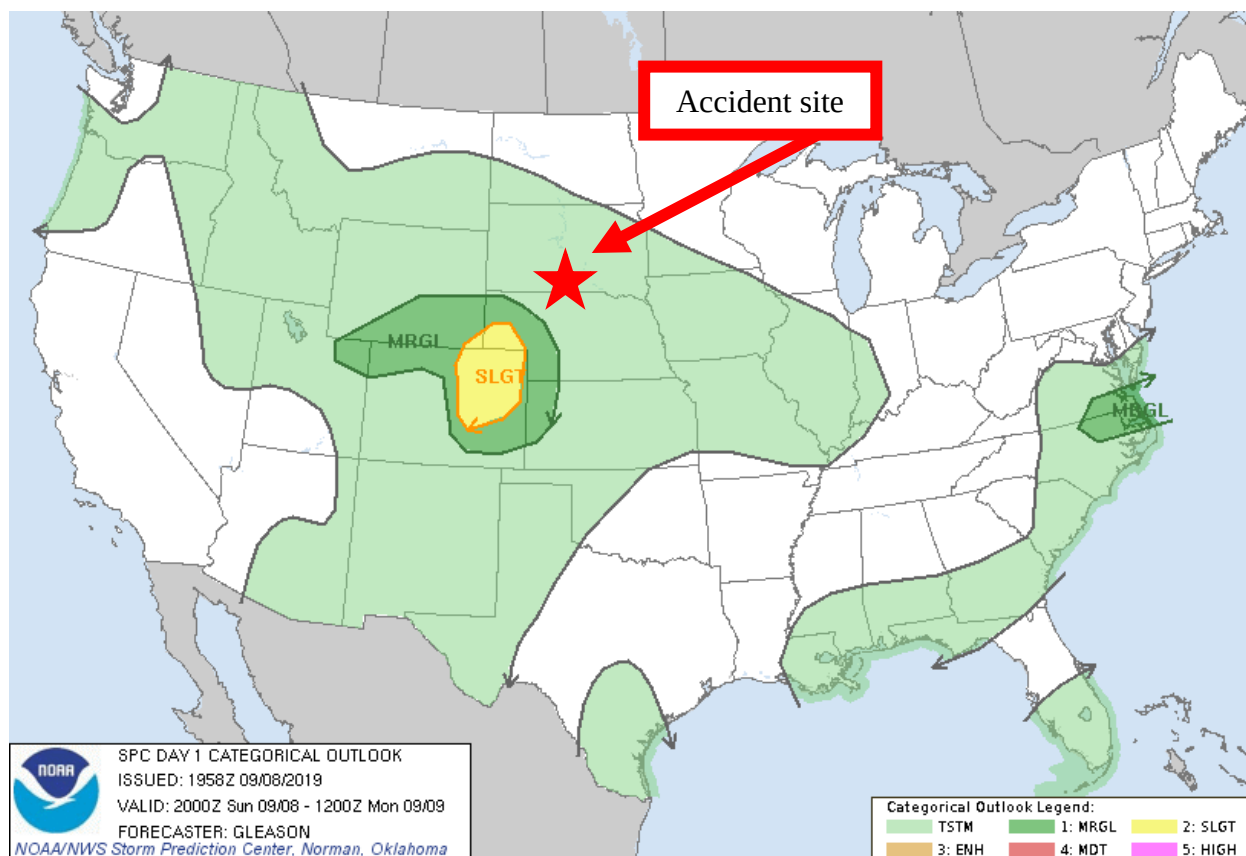
Figure 5 – 500-hPa Constant Pressure Chart for 1900 CDT



**Figure 6 – 300-hPa Constant Pressure Chart for 1900 CDT**

## 2.0 SPC Products

SPC issued the following Day 1 Convective Outlook at 1458 CDT (figure 7) with areas of general thunderstorms forecast for the accident site. SPC defines the “TSTM” area as an area that encloses where a 10% or higher probability of thunderstorms is forecast during the valid period. The SPC Day 1 Convective Outlook text follows figure 7:



**Figure 7 – SPC day 1 Convective Outlook valid at the time of the accident**

SPC AC 081958

Day 1 Convective Outlook  
NWS Storm Prediction Center Norman OK  
0258 PM CDT Sun Sep 08 2019

Valid 082000Z - 091200Z

...THERE IS A SLIGHT RISK OF SEVERE THUNDERSTORMS ACROSS PARTS OF EASTERN CO...FAR SOUTHEASTERN WY...AND THE NE PANHANDLE...

...SUMMARY...

Severe thunderstorms with strong/gusty winds and hail remain possible across parts of the central Rockies and adjacent High Plains this afternoon and evening. Other strong storms may affect parts of southeast Virginia and northeast North Carolina.

...20Z Update...

Storms have begun to increase in coverage across the higher terrain of central CO ahead of a northeastward-moving upper trough over the Great Basin. As this activity spreads eastward and encounters greater low-level moisture across northeastern CO and vicinity later this afternoon and evening, isolated severe thunderstorms may occur. Damaging winds still appear to be the main threat as storms will likely grow upscale into a small cluster this evening, but marginally severe hail may also occur early in the convective life

cycle. Ongoing forecast still appears on track, and no changes have been made to the Marginal/Slight risk areas across this region.

..Gleason.. 09/08/2019

.PREV DISCUSSION... /ISSUED 1130 AM CDT Sun Sep 08 2019/

...Central Rockies into High Plains...

Morning water vapor loop shows a strong and progressive upper trough moving across parts of NV/UT. This feature will track into WY/CO later today, with an associated zone of enhanced forcing for ascent overspreading the region. Strong daytime heating is occurring over much of the mountains and foothills of CO, where steep low-level lapse rates will develop and scattered thunderstorms are expected. As these storms move off the higher terrain late this afternoon and early evening, continued easterly low-level winds will help to establish an axis of sufficient CAPE for a few robust updrafts/downdrafts capable of damaging winds and some hail. Vertical shear profiles are sufficient for supercell/bowing structures. This activity will spread northeastward across the SLGT risk area during the evening.

...VA/NC...

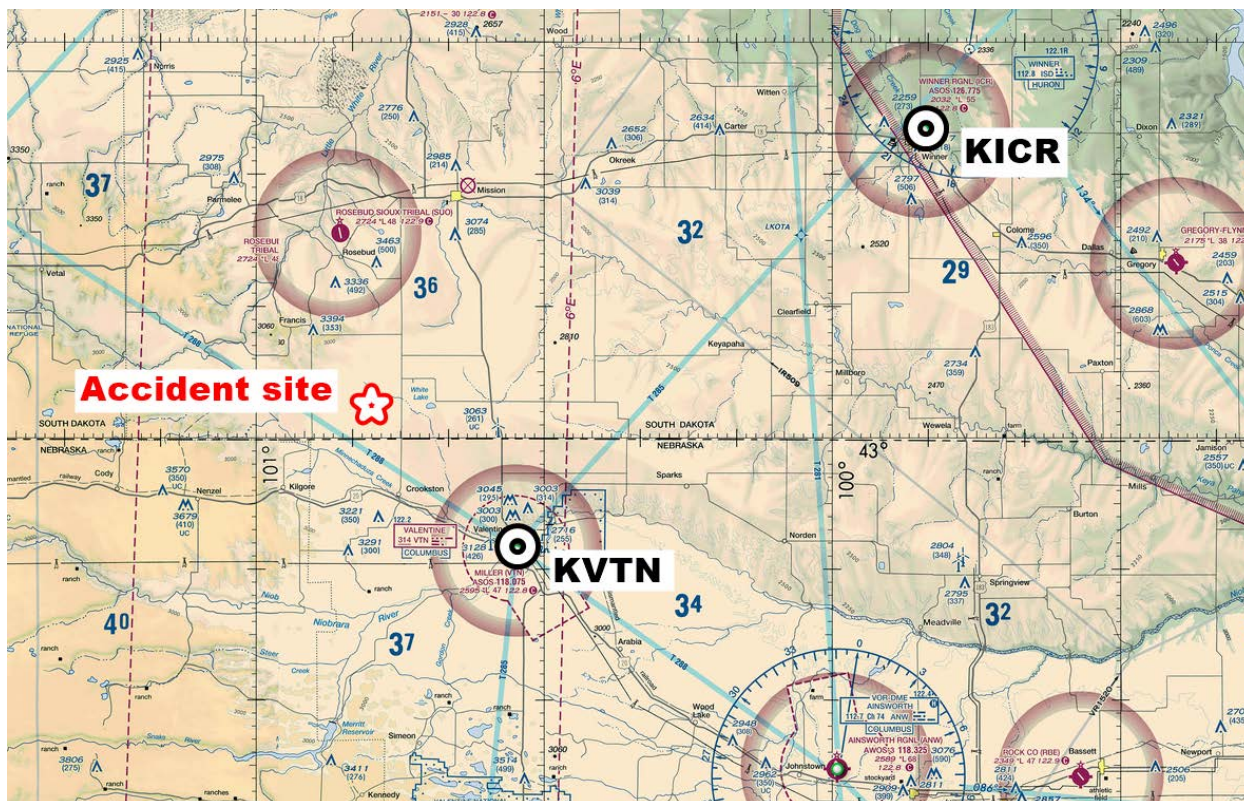
The southern fringe of stronger westerly flow aloft has sagged into southeast VA/northeast NC today, where a very moist and potentially unstable air mass is present. Dewpoints in the mid 70s and strong heating will lead to moderate CAPE values and the development of a few afternoon thunderstorms. Low-level winds are weak, suggesting that storms will be rather disorganized. However, sufficient midlevel winds and favorable thermodynamic parameters indicate a low risk of gusty winds in the stronger cells.

CLICK TO GET WUUS01 PTSDY1 PRODUCT

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 0100Z

### **3.0 Surface Observations**

The area surrounding the accident site was documented using official Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). Figure 8 is a sectional chart with the accident site and the closest weather reporting locations to the accident site marked.



**Figure 8 – Sectional chart of accident area with the location of the accident site and the closest surface observation sites**

The closest official weather reporting facility to the accident site was from Miller Field Airport equipment (KVTN), at an elevation of 2,595 ft, and was 16 miles southeast of the accident site (figure 8). KVTN had an Automated Surface Observing System (ASOS<sup>3</sup>) whose reports were not supplemented and KVTN had a 6° easterly magnetic variation<sup>4</sup>. The following observations were taken and disseminated during the times surrounding the accident:<sup>5</sup>

[1652 CDT] METAR KVTN 082152Z AUTO 02007KT 10SM SCT019 19/12 A2998 RMK AO2 SLP146 T01940117 \$=

[1752 CDT] METAR KVTN 082252Z AUTO 02010KT 10SM CLR 19/12 A2996 RMK AO2 SLP137 T01940117 \$=

[1848 CDT] SPECI KVTN 082348Z AUTO 06009KT 10SM BKN022 18/11 A2996 RMK AO2 \$=

<sup>3</sup> ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

<sup>4</sup> Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

<sup>5</sup> Bolded sections in this report highlight information that directly reference the weather conditions that affected the accident location around the accident time.

[1852 CDT] METAR KVTN 082352Z AUTO 07009KT 10SM SCT022 18/11 A2996 RMK  
AO2 SLP141 T01780111 10194 20150 56007 \$=

[1933 CDT] SPECI KVTN 090033Z AUTO 06010KT 10SM BKN022 17/11 A2997 RMK  
AO2 T01670111 \$=

**[1952 CDT] METAR KVTN 090052Z AUTO 05006KT 10SM BKN022 16/11 A2998 RMK  
AO2 SLP146 T01610111 \$=**

**ACCIDENT TIME 2000 CDT**

**[2052 CDT] METAR KVTN 090152Z AUTO 06008KT 10SM OVC023 16/11 A2999 RMK  
AO2 SLP153 T01560111 \$=**

[2117 CDT] SPECI KVTN 090217Z AUTO 06009KT 10SM SCT025 BKN040 16/11  
A2998 RMK AO2 T01560111 \$=

[2152 CDT] METAR KVTN 090252Z AUTO 07008KT 10SM OVC040 16/12 A2999 RMK  
AO2 SLP149 T01560117 50008 \$=

KVTN weather at 1952 CDT, automated, wind from 050° at 6 knots, 10 miles visibility or greater, a broken ceiling at 2,200 ft above ground level (agl), temperature of 16°Celsius (C), dew point temperature of 11°C, and an altimeter setting of 29.98 inches of mercury (inHg). Remarks: station with a precipitation discriminator, sea level pressure 1014.6 hPa, temperature 16.1°C, dew point temperature 11.1°C, maintenance is needed on the system.

KVTN weather at 2052 CDT, automated, wind from 060° at 8 knots, 10 miles visibility or greater, an overcast ceiling at 2,300 ft agl, temperature of 16°C, dew point temperature of 11°C, and an altimeter setting of 29.99 inHg. Remarks: station with a precipitation discriminator, sea level pressure 1015.3 hPa, temperature 15.6°C, dew point temperature 11.1°C, maintenance is needed on the system.

The closest official weather reporting facility to the accident site from South Dakota was from Winner Regional Airport equipment (KICR), at an elevation of 2,032 ft, and was 47 miles east-northeast of the accident site (figure 8). KICR had an ASOS whose reports were not supplemented and KICR had a 6° easterly magnetic variation. The following observations were taken and disseminated during the times surrounding the accident:

[1453 CDT] METAR KICR 081953Z AUTO 29006KT 10SM OVC016 16/12 A3003 RMK  
AO2 SLP163 T01610117=

[1553 CDT] METAR KICR 082053Z AUTO 33003KT 10SM OVC017 17/11 A3002 RMK  
AO2 SLP161 T01670111 58010=

[1653 CDT] METAR KICR 082153Z AUTO 36004KT 10SM OVC018 17/11 A2999 RMK  
AO2 SLP152 T01670111=

[1753 CDT] METAR KICR 082253Z AUTO 01006KT 10SM OVC019 17/12 A2997 RMK AO2 SLP145 T01670117=

[1853 CDT] METAR KICR 082353Z AUTO 05009KT 10SM OVC018 17/12 A2995 RMK AO2 SLP139 T01670117 10172 20150 56020=

**[1953 CDT] METAR KICR 090053Z AUTO 06004KT 10SM OVC017 16/12 A2997 RMK AO2 SLP145 T01610122=**

**ACCIDENT TIME 2000 CDT**

**[2053 CDT] METAR KICR 090153Z AUTO 13005KT 10SM OVC018 16/12 A2999 RMK AO2 SLP153 T01610122=**

[2153 CDT] METAR KICR 090253Z AUTO 11003KT 10SM OVC021 16/12 A3000 RMK AO2 SLP157 T01610122 51016=

[2253 CDT] METAR KICR 090353Z AUTO 00000KT 10SM SCT025 OVC043 16/13 A2999 RMK AO2 SLP153 T01610128=

KICR weather at 1953 CDT, automated, wind from 060° at 4 knots, 10 miles visibility or greater, an overcast ceiling at 1,700 ft agl, temperature of 16°C, dew point temperature of 12°C, and an altimeter setting of 29.97 inHg. Remarks: station with a precipitation discriminator, sea level pressure 1014.5 hPa, temperature 16.1°C, dew point temperature 12.2°C.

KICR weather at 2053 CDT, automated, wind from 130° at 5 knots, 10 miles visibility or greater, an overcast ceiling at 1,800 ft agl, temperature of 16°C, dew point temperature of 12°C, and an altimeter setting of 29.99 inHg. Remarks: station with a precipitation discriminator, sea level pressure 1015.3 hPa, temperature 16.1°C, dew point temperature 12.2°C.

The observations from KVTN and KICR surrounding the accident time indicated MVFR<sup>6</sup> ceiling conditions with the surface wind remaining from the northeast to southeast between 4 to 8 knots.

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<sup>6</sup> 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 Data

A High-Resolution Rapid Refresh (HRRR)<sup>7</sup> model sounding was created for the accident site for 2000 CDT with a station elevation of 2,887 ft.<sup>8</sup> The 2000 CDT HRRR sounding was plotted on a standard Skew-T Log P diagram<sup>9</sup> with the derived stability parameters included in figure 9 with data from the surface to 700-hPa (or approximately 10,000 ft msl). This data was analyzed using the RAOB<sup>10</sup> software package. The sounding depicted the lifted condensation level (LCL)<sup>11</sup> at 1,789 ft agl (4,676 ft msl) and the convective condensation level (CCL)<sup>12</sup> at 9,423 ft agl (12,310 ft msl). The sounding had a greater than 90% relative humidity from ~1,000 ft agl through ~4,200 ft agl. The freezing level was located at 15,837 ft msl. The precipitable water value was 0.92 inches.

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<sup>7</sup> 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.

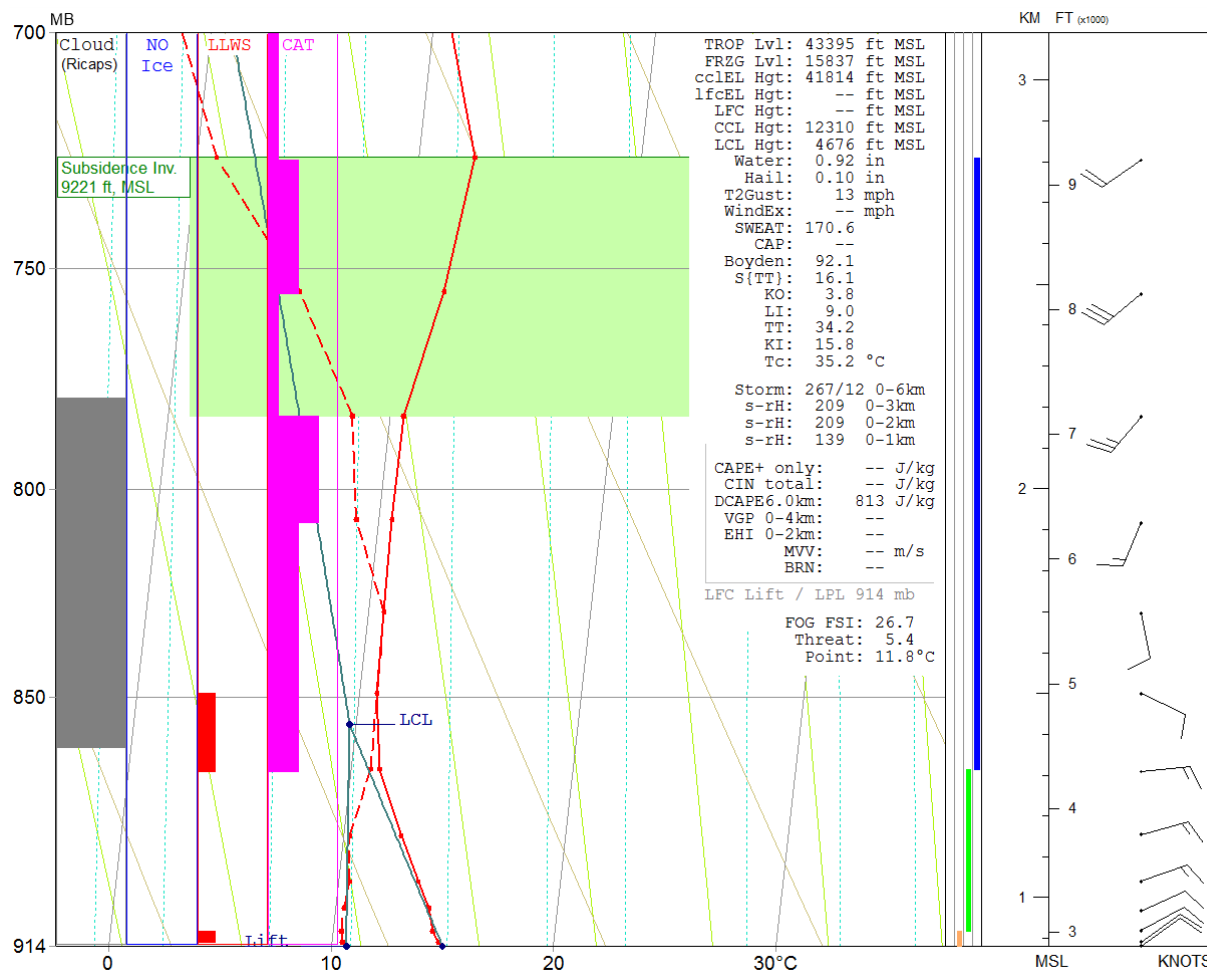
<sup>8</sup> HRRR sounding was created using NOAA Air Resource Laboratory: <https://ready.arl.noaa.gov/READYamet.php>

<sup>9</sup> 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.

<sup>10</sup> RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

<sup>11</sup> LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

<sup>12</sup> 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 9 – 2000 CDT HRRR sounding for the accident site**

The 2000 CDT HRRR sounding for the accident site indicated a conditionally unstable layer from the surface through 4,300 ft msl and then a stable layer from 4,300 ft msl through 10,000 ft msl. RAOB identified the possibility of clouds from ~1,800 ft agl (~4,700 ft msl) through ~4,600 ft agl (~7,500 ft msl). RAOB did not indicate the possibility of icing conditions below 10,000 ft msl. RAOB indicated a subsidence inversion<sup>13</sup> was in place above the accident site at 9,221 ft msl with clouds indicated below that inversion layer (figure 9).

The 2000 CDT HRRR sounding wind profile indicated a surface wind from 053° at 8 knots with the wind veering<sup>14</sup> to the southwest by 6,000 ft msl. The wind speed increased to 30 knots by 8,000 ft. RAOB indicated the possibility of light low-level wind shear (LLWS) between the surface and ~1,800 ft agl (~5,000 ft msl). RAOB indicated light to moderate clear-air turbulence (CAT) existed in several layers between ~1,600 ft agl (4,500 ft msl) and 10,000 ft msl.

<sup>13</sup> Inversion – A departure from the usual decrease of the value of an atmospheric property with increasing altitude; also, the layer through which this departure occurs (the "inversion layer"), or the lowest altitude at which the departure is found (the "base of the inversion").

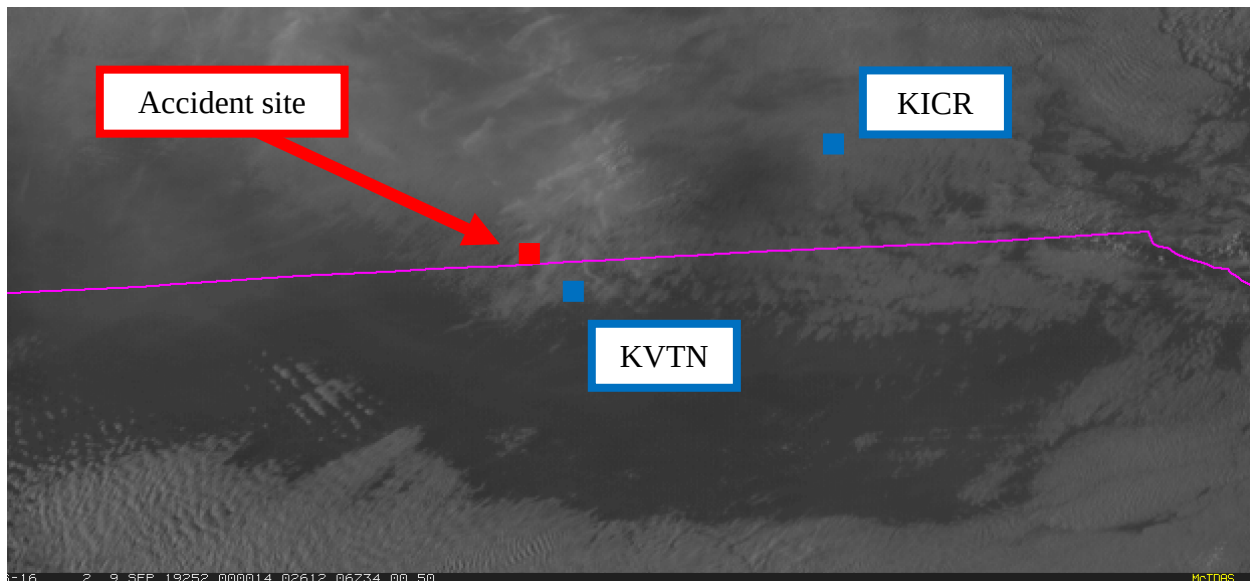
<sup>14</sup> A clockwise turning of the wind with height in the northern hemisphere.

## 5.0 Satellite Data

Data from the Geostationary Operational Environmental Satellite number 16 (GOES-16) data was 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 (band 2) and infrared (bands 13) imagery at wavelengths of 0.64 microns ( $\mu\text{m}$ ) and 10.3  $\mu\text{m}$ , respectively, were retrieved for the period. Satellite imagery surrounding the time of the accident, from 1600 CDT through 2200 CDT at approximately 5-minute intervals were reviewed, and the closest images to the time of the accident are documented here.

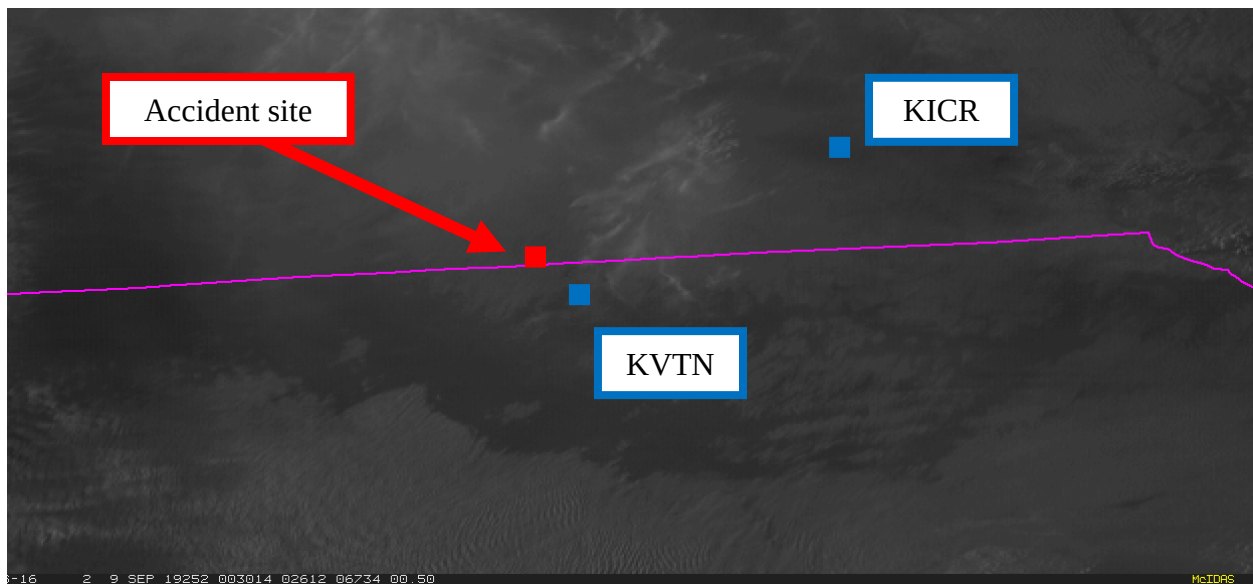
Figures 10 and 11 present the GOES-16 visible imagery from 1900 and 1930 CDT at 2X magnification with the accident site highlighted with a red square.<sup>15</sup> The GOES-16 imagery indicated cloud cover above the accident site towards KVTN and further cloud cover to the north and east continuing over KICR. The lower cloud cover was moving from south to north and the accident site region and had been more free of clouds around the time of departure (~1800 CDT) with cloud cover increasing in coverage through the accident time (attachment 1).

Figure 12 presents the GOES-16 infrared imagery from 2000 CDT at 4X magnification and with a temperature enhancement curve applied with the accident site highlighted with a red square. Inspection of the infrared imagery indicated cloud cover over the accident site at the accident time with the lowest brightness temperatures (green and yellow colors, higher clouds) located above western Nebraska and South Dakota. Based on the brightness temperatures above the accident site (281 Kelvin) and the vertical temperature profile provided by the 2000 CDT HRRR sounding, the approximate cloud-top heights over the accident site were 10,000 ft at 2000 CDT. It should be noted these figures have not been corrected for any parallax error.

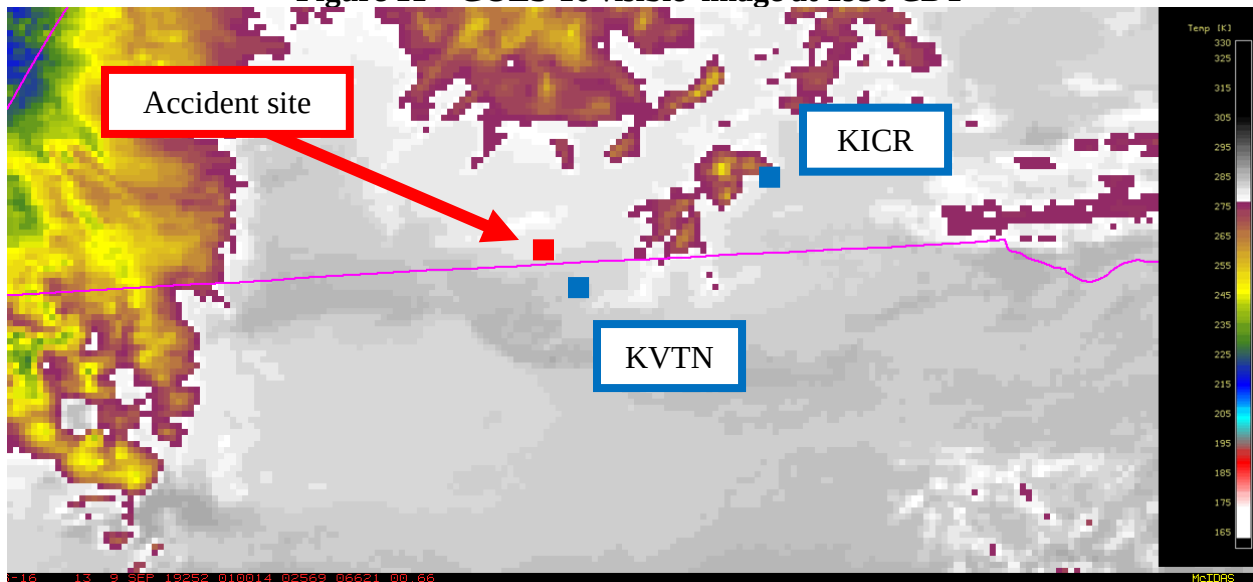


**Figure 10 – GOES-16 visible image at 1900 CDT**

<sup>15</sup> The sun angle was too low to provide light for a visible satellite image at 2000 CDT.



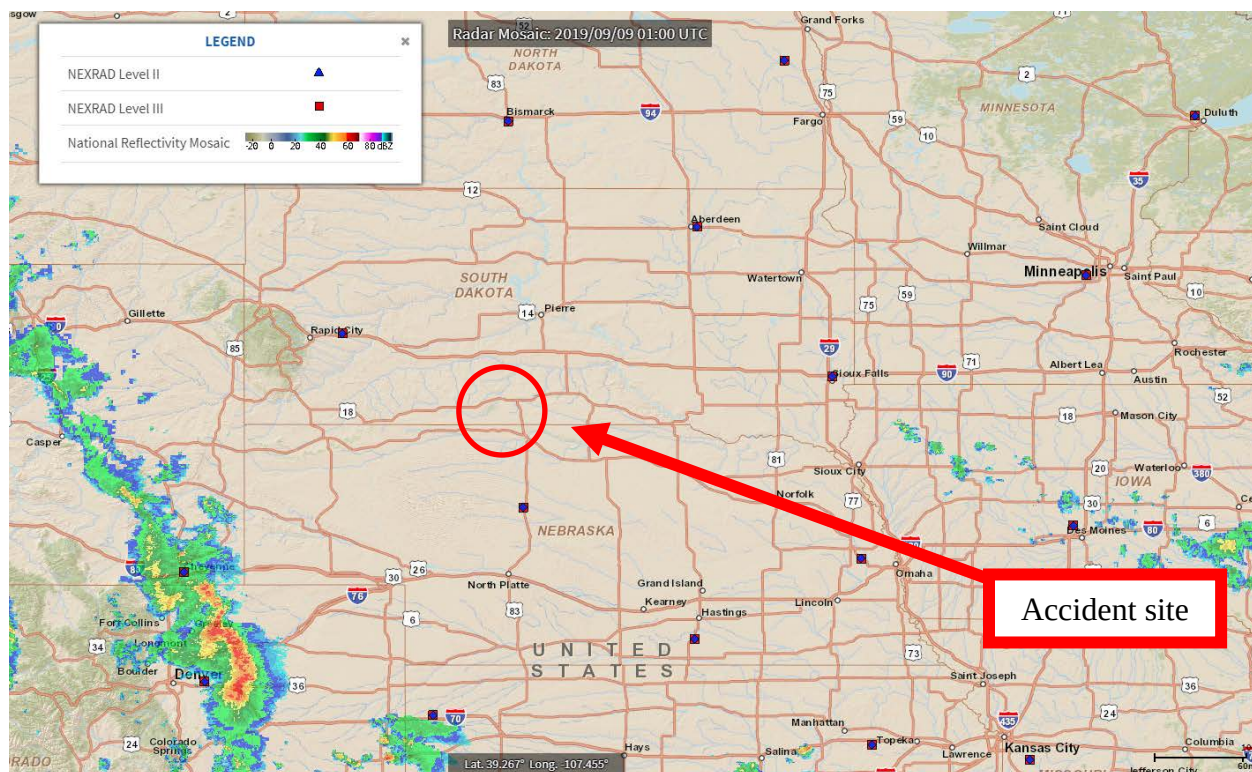
**Figure 11 – GOES-16 visible image at 1930 CDT**



**Figure 12 – GOES-16 infrared image at 2000 CDT**

## 6.0 Regional Radar Imagery Information

A regional view of the NWS National Composite Radar Mosaic is included as figure 13 for 2000 CDT with the approximate location of the accident site marked by a red circle. The image did not depict any precipitation echoes above the accident site around the accident time.



**Figure 13 – Regional Composite Reflectivity image for 2000 CDT**

## 7.0 Pilot Reports

All pilot reports (PIREPs)<sup>16</sup> within 150 miles of the accident site from about two hours prior to the accident time to about two hours after the accident time for below FL180<sup>17</sup> were reviewed and there were no PIREPs provided into the national airspace system.

## 8.0 SIGMET

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

## 9.0 CWSU Advisories

There were no Center Weather Service Unit (CWSU) Center Weather Advisories (CWA) or Meteorological Impact Statements (MIS) valid for the accident site at the accident time.

<sup>16</sup> Only pilot reports with the World Meteorological Organization (WMO) header UBSD\*\* and UBNE\*\* identifier were considered.

<sup>17</sup> Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of ft. This altitude is calculated from the International standard pressure datum of 1013.25-hPa (29.92 inHg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

## 10.0 AIRMETs

There were no 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 made available before the accident flight are shown in attachment 2. The GFA surface forecast products indicated VFR conditions would be likely for 1900 CDT with a surface wind from the east at 10 knots. The GFA cloud forecast products indicated a broken to overcast cloud ceiling at 3,000 to 6,000 ft msl with cloud tops between 7,000 and 9,000 ft msl. For more information please see attachment 2.

## 12.0 Terminal Aerodrome Forecast

KVTN was the closest site with a NWS Terminal Aerodrome Forecast (TAF) and the KVTN TAF valid at the accident time was issued at 1821 CDT and was valid for a 24-hour period beginning at 1900 CDT. The 1821 CDT TAF for KVTN was as follows:

TAF KVTN 082321Z 0900/0924 **09009KT P6SM SCT080**  
FM090400 08008KT P6SM VCSH BKN022  
FM090600 09008KT P6SM -TSRA BKN025CB  
TEMPO 0907/0911 VRB20G40KT 3SM +TSRAGS OVC015CB  
FM091200 14007KT 5SM -SHRA BR BKN005  
FM091500 19010KT P6SM SCT007=

The TAF expected a wind from 090° at 9 knots, greater than 6 miles visibility, and scattered clouds at 8,000 ft agl.

## 13.0 NWS Area Forecast Discussion

The NWS Office in Rapid City, South Dakota, issued the following Area Forecast Discussion (AFD) at 1823 CDT (closest AFD to the accident time with an aviation section). The aviation section of the AFD discussed MVFR/IFR conditions across the western South Dakota plains continuing into the evening and overnight hours:

FXUS63 KUNR 082323  
AFDUNR

Area Forecast Discussion For Western SD and Northeastern WY  
National Weather Service Rapid City SD  
523 PM MDT Sun Sep 8 2019

.DISCUSSION...(This Evening Through Sunday)  
Issued at 156 PM MDT Sun Sep 8 2019

Active and wet pattern will continue through most of the work week, with seasonal to below normal temps. Easterly, moist upslope flow continues to support low clouds and cool temps across the region ahead of the next upper trough. This system will arrive

tonight supporting a decent chance of showers, esp over western and central SD, mainly east of the Black hills. Ample moisture will again be available this system with a half inch or more of rain possible there. Dry line will progress through the FA Monday with pos theta-e adv rains shifting north. Breezy westerly winds can expected ahead of a weak cold front, with deep mixing expected to support temps well into the 70s and 80s most locations, esp over the SW 2/3. Some weak instability combined with the deep mixing could still support a few isolated showers or thunderstorms in the afternoon mainly along and north of I90. Cooler weather with periodic chances for rain is on track for the remainder of the work week, esp in the Wed period when another strong upper trough and associated sfc low will progress through the region. The track of this system looks to favor a better chance of more widespread rains than previous recent systems have produced. Thus pops are in the high likelies to cat range in this period. Much cooler conds can be expected Wed and esp Thur as a decent batch of CAA is expected on the backside of this system, possibly supporting some patchy frost at some locations Thur night. Warm and dry weather still looks to be on track for next weekend as mean ridging will setup over the eastern Rockies and Northern Plains.

&&

**.AVIATION...(For the 00Z TAFS Through 00Z Monday Evening)  
Issued At 519 PM MDT Sun Sep 8 2019**

**MVFR/IFR conditions in low clouds/fog will continue across the western SD plains tonight. A band of showers with isolated storms will cross the region this evening, gradually shifting eastward Monday morning.** Later tonight, lingering moisture and continued upslope flow will result in the development of fog, with MVFR/IFR conditions persisting across the SD plains. Mainly VFR conditions will persist across northeast WY through the period with local MVFR in any heavier shower. Conditions across the SD plains will begin to improve late Monday morning.

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.UNR WATCHES/WARNINGS/ADVISORIES...

SD...None.

WY...None.

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DISCUSSION...JC

AVIATION...15

## **14.0 Winds and Temperature Aloft Forecast**

The NWS 1453 CDT Winds and Temperature Aloft forecast valid for 1900 CDT for the closest point to the accident site is included below:

FBUS31 KWN0 081953  
FD1US1  
DATA BASED ON 081800Z  
VALID 090000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000  
ONL 2010+16 2324+12 2523+06 2829-06 2925-19 292936 303347 294058

The accident site was closest to the O'Neill, Nebraska, (ONL) forecast point. The ONL forecast for use between 1500 CDT and 2200 CDT indicated a wind at 6,000 ft from 200° at 10 knots with a temperature of 16°C and at 9,000 ft a wind from 230° at 24 knots with a temperature of 12°C.

## 15.0 Pilot Weather Briefing

The accident pilot did not request nor receive a weather briefing through Leidos.

A check of ForeFlight was done and revealed that the accident pilot did not request a weather briefing through ForeFlight. It is unknown if the accident pilot checked or received any additional weather information before or during the accident flight.

## 16.0 Astronomical Data

The astronomical data obtained for the accident site on September 8, 2019, indicated the following with the sun at an azimuth of 277.28° and altitude of 0.70° at the accident time:

|                      |                              |
|----------------------|------------------------------|
| <b>SUN</b>           |                              |
| Begin civil twilight | 0646 CDT                     |
| Sunrise              | 0715 CDT                     |
| Sun transit          | 1341 CDT                     |
| <b>Accident</b>      | <b>2000 CDT<sup>18</sup></b> |
| Sunset               | 2006 CDT                     |
| End civil twilight   | 2035 CDT                     |

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<sup>18</sup> Inserted accident time for reference and context.

## **E. LIST OF ATTACHMENTS**

Attachment 1 – GOES-16 visible animation from 1706 to 2106 CDT

Attachment 2 – GFA products available before the accident flight for around the accident time

Submitted by:

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Paul Suffern  
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