

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



CEN23FA239

METEOROLOGY

Specialist's Factual Report

September 8, 2023

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A. ACCIDENT

Location: Watertown, Wisconsin
Date: June 14, 2023
Time: 0903 central daylight time
1403 coordinated universal time (UTC)
Airplane: Mooney M20R; Registration: N1025C

B. METEOROLOGY SPECIALIST

Paul Suffern
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's Senior Meteorologist did not travel for this investigation but gathered all data remotely. Data for this investigation were collected 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 accident time. 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 approximate latitude 43.208247° N, longitude 88.748909° W, and elevation of 855 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 Federal Aviation Administration (FAA) "Aviation Weather Handbook", FAA-H-8083-28.¹

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over the Great Lakes 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 at 1003-hectopascals (hPa) located in southern Lake Superior with frontal boundaries stretched east to west from Ontario, Canada into South Dakota. Fronts can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present.

The station models closest to the accident site depicted air temperatures of 62 to 72 degrees Fahrenheit (°F), dew point temperatures of 56 to 57°F, broken to overcast cloud cover, with calm to light and variable wind of 5 knots or less.

¹ [FAA-H-8083-28](https://www.faa.gov/handbook/aviation-weather-handbook/FAA-H-8083-28)

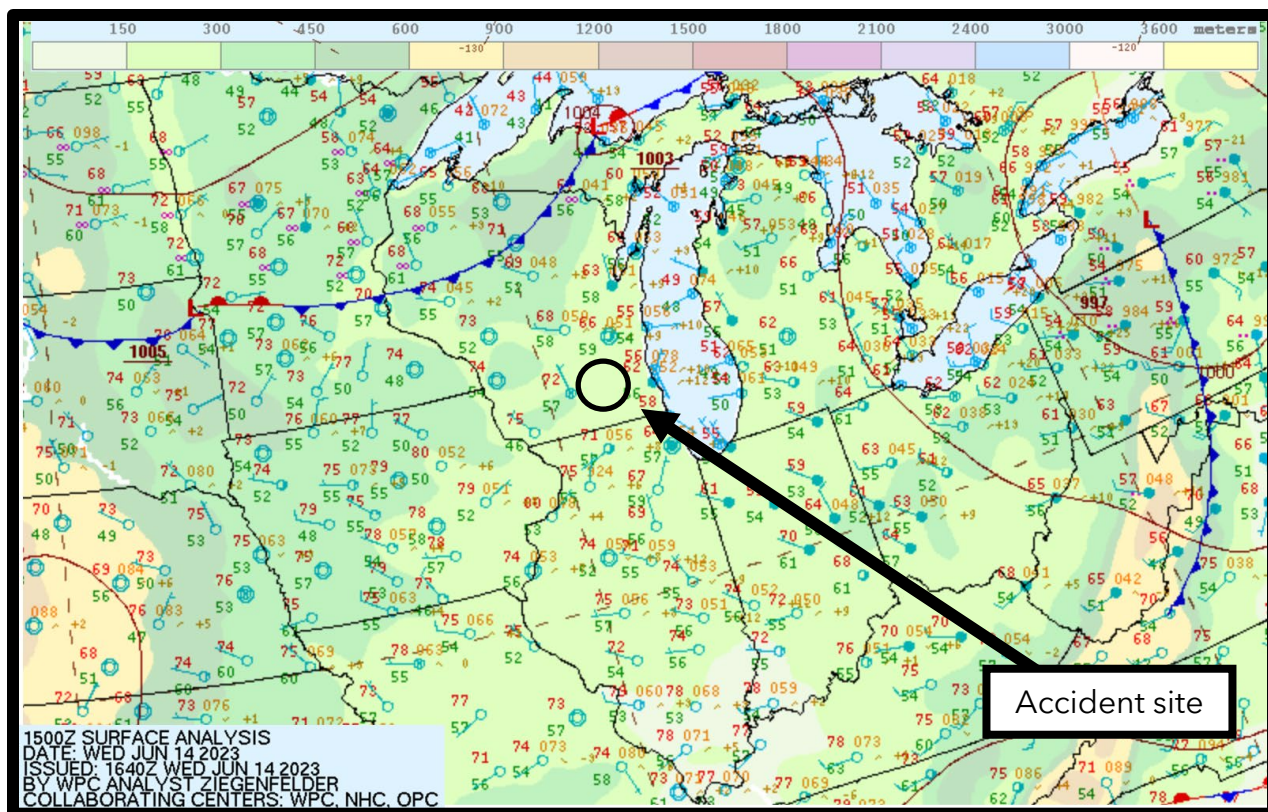


Figure 1. NWS Surface Analysis Chart for 1000 CDT.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 CDT at 925-, 850-, and 700-hPa are presented in figures 2 through 4. The charts indicated that the accident site was located in between 2 low-level troughs² at 925-hPa (figure 2). The 925-hPa constant pressure chart depicted a north wind around 10 knots (figure 2) increasing to 25 knots by 700-hPa (figure 4).

² Trough - An elongated area of relatively low atmospheric pressure or heights.

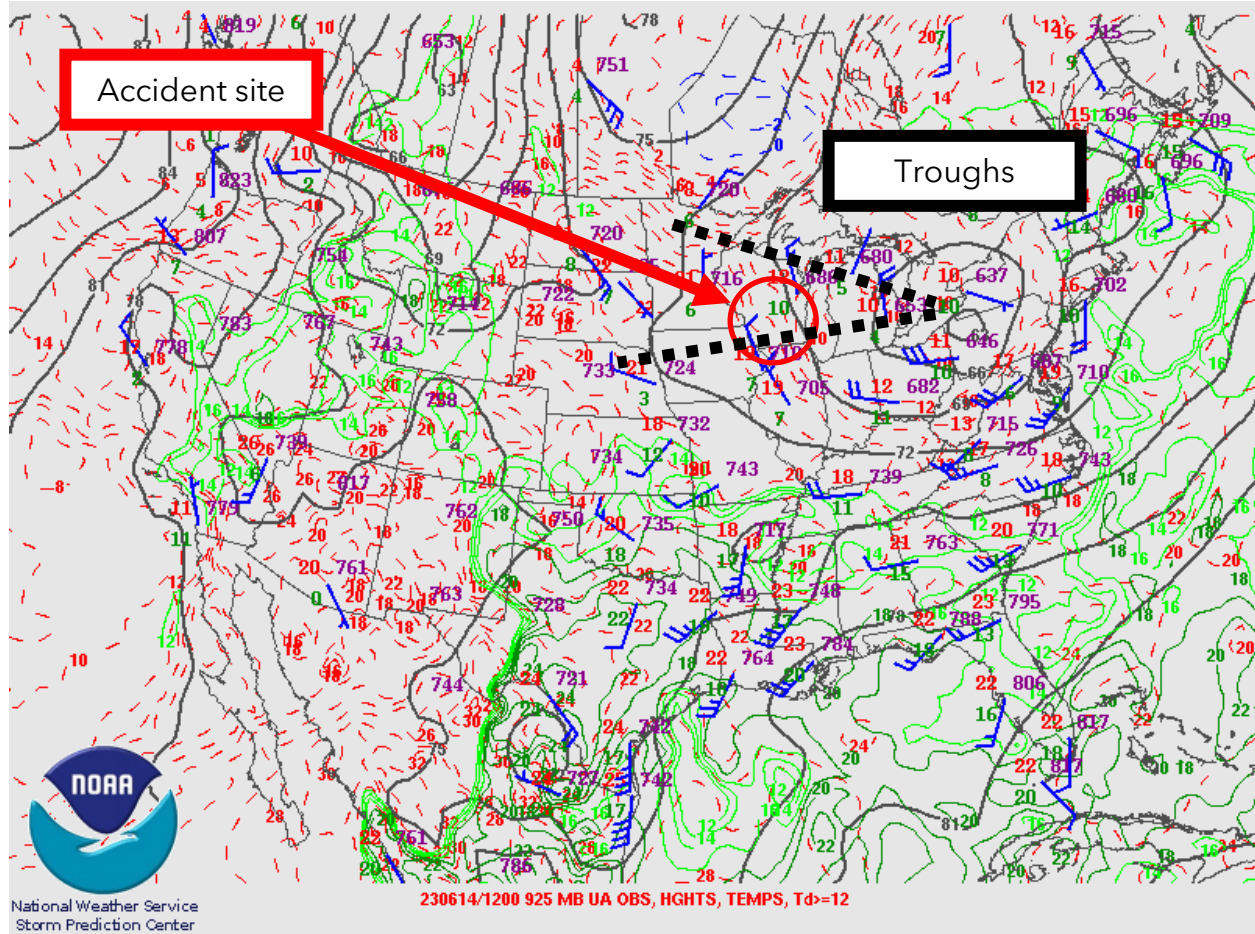


Figure 2. 925-hPa Constant Pressure Chart for 0700 CDT.

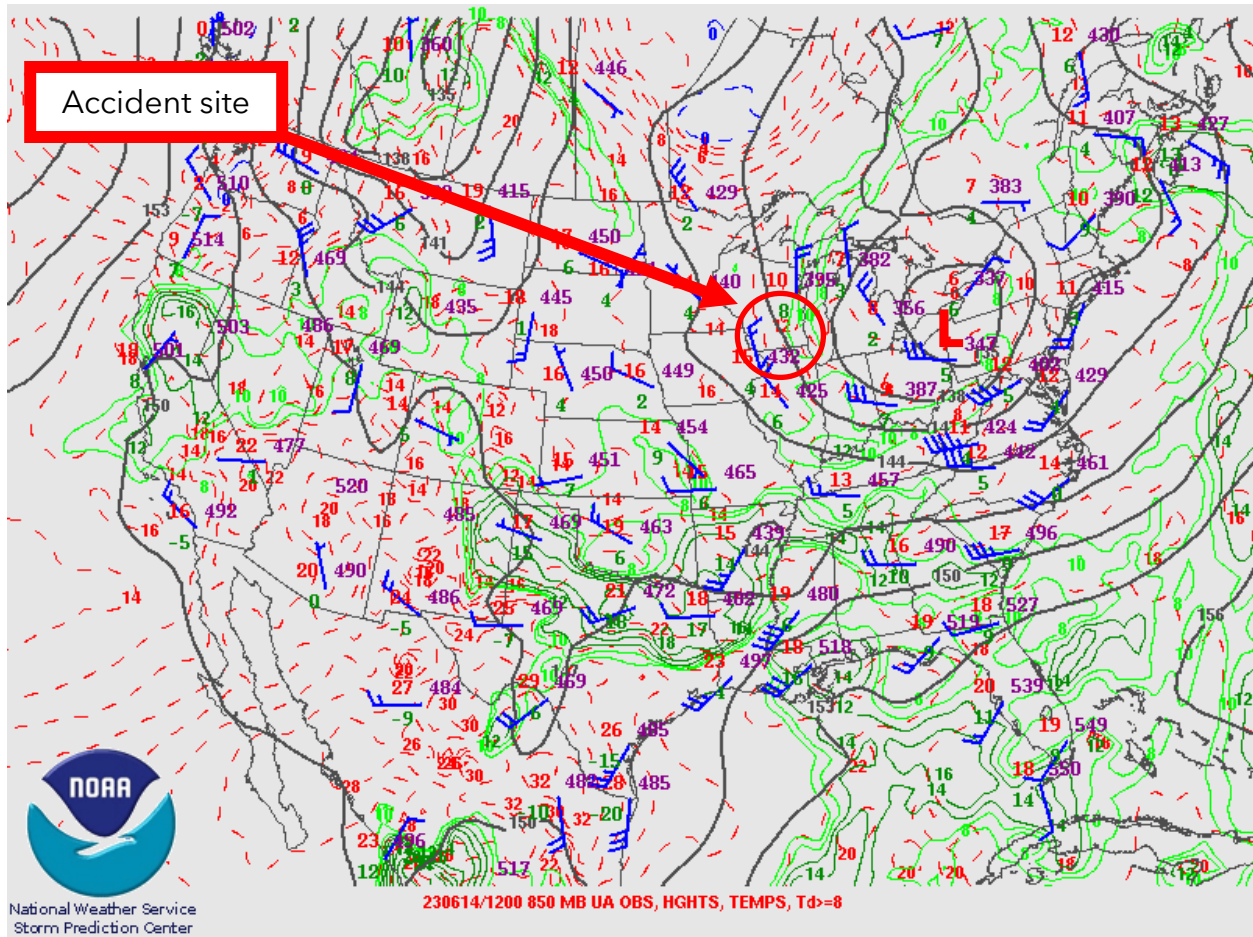


Figure 3. 850-hPa Constant Pressure Chart for 0700 CDT.

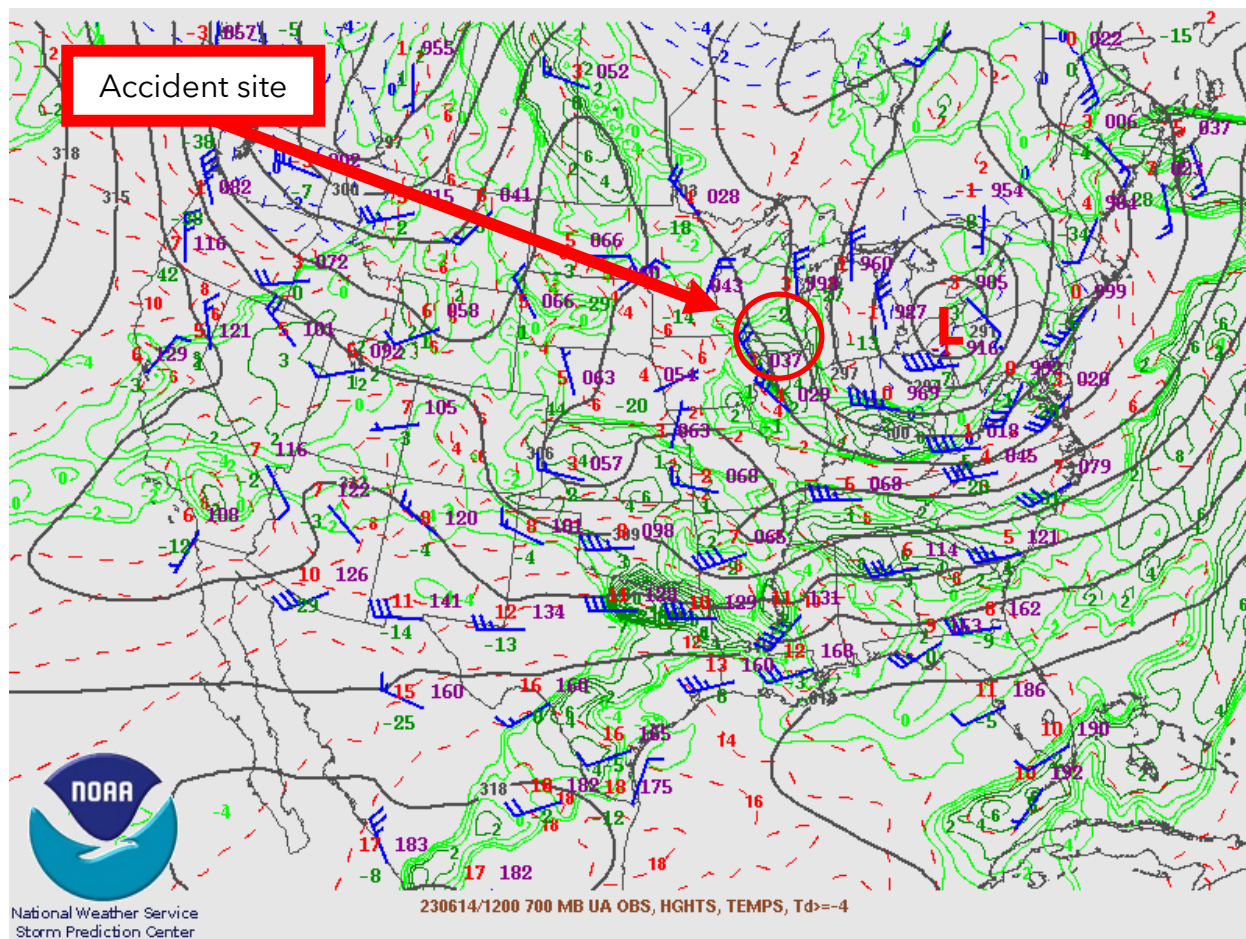


Figure 4. 700-hPa Constant Pressure Chart for 0700 CDT.

2.0 Storm Prediction Center Convective Outlook

The SPC issued a Day 1 Convective Outlook at 0754 CDT (figure 5) with areas of general thunderstorms forecast for the accident site. The SPC defines the "TSTM" area as an area where a 10% or higher probability of thunderstorms is forecast during the valid period.

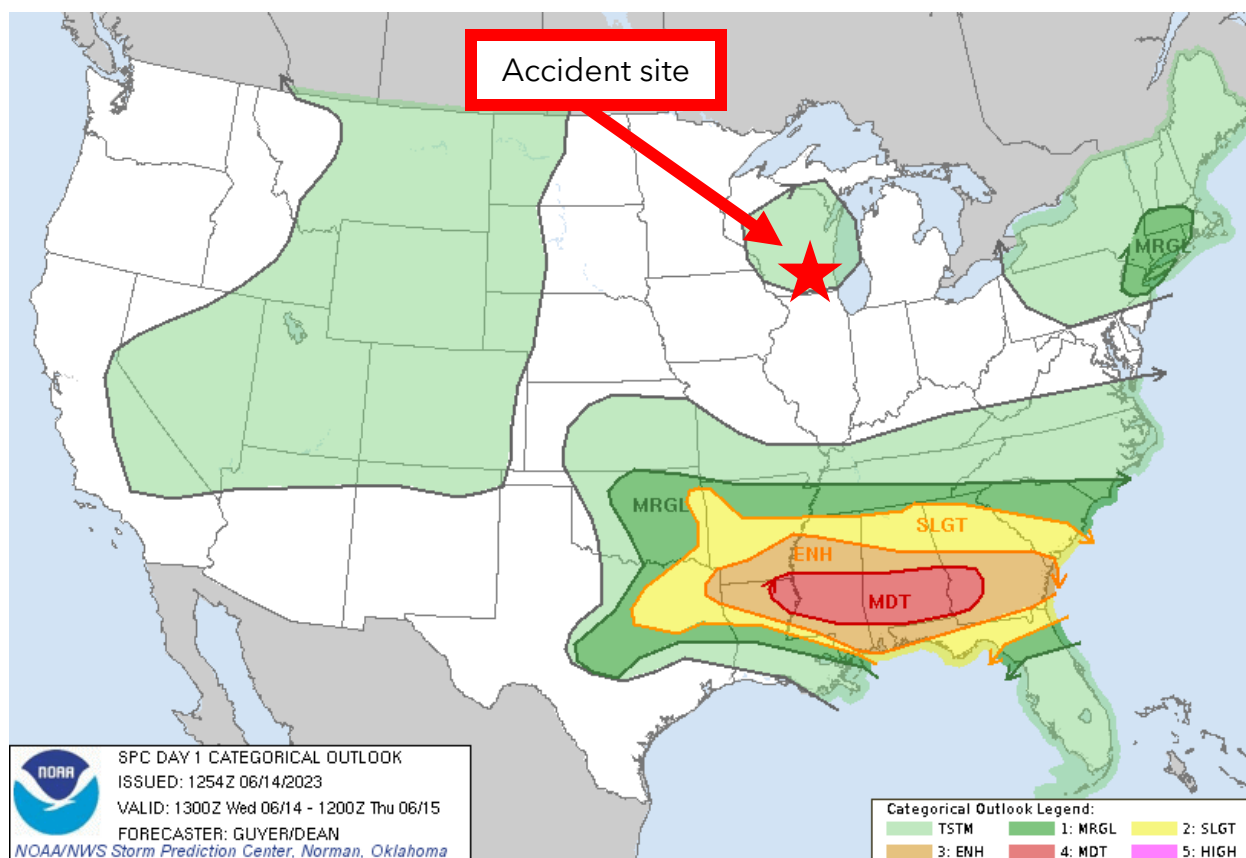


Figure 5. SPC day 1 Convective Outlook valid at the time of the accident.

3.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Special Reports (SPECIs)³. 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. A magnetic variation⁴ of 3° west was indicated over the area.

³ Latest criteria for SPECIs can be found in the Federal Meteorological Handbook: [Federal Meteorological Handbook Number 1, Surface Weather Observations and Reports \(icams-portal.gov\)](https://www.federalmeteorologicalhandbook.com/)

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

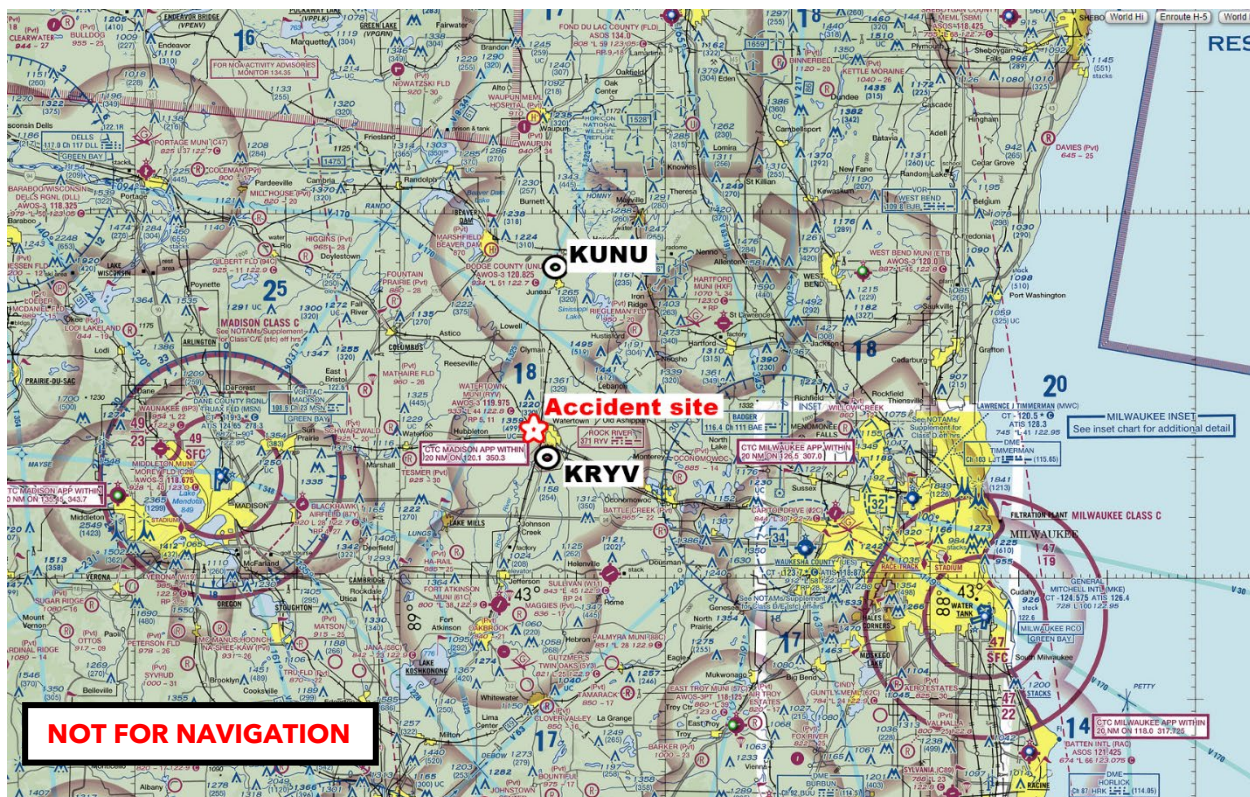


Figure 6. FAA sectional aeronautical chart of the accident area with the location of the accident site and surface observation sites noted.

Watertown Municipal Airport (KRYV) had the closest official weather station to the accident site and was also the departure airport. KRYV had an Automated Weather Observing System (AWOS⁵) and its longline⁶ reports were not augmented. The KRYV AWOS was located 3 miles southeast of the accident site (figure 6) at an elevation of 833 ft. The KRYV AWOS was stuck by lightning around a month prior to the accident timeframe and therefore its archived reports⁷ were not available within the national airspace (NAS). The NTSB investigation was able to retrieve the raw internally archived KRYV AWOS information surrounding the accident timeframe and that information can be found in attachment 1. Surrounding the accident timeframe the KRYV AWOS reported a calm wind, visibility of 5 miles, and an overcast ceiling at 300 ft above ground level (agl).

⁵ 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.

⁶ "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.

⁷ KRYV AWOS information was still available via VHF and phone line in real-time.

Dodge County Airport (KUNU) had the second closest official weather station to the accident site. KUNU also had an AWOS and its longline reports were not augmented. The KUNU AWOS was located 13 miles north of the accident site (figure 6), at an elevation of 934 ft, and issued the following observations surrounding the accident time:⁸

[0735 CDT] METAR KUNU 141235Z AUTO 00000KT 3/4SM BR OVC003
14/14 A2968 RMK AO2 T01350135

[0755 CDT] METAR KUNU 141255Z AUTO 00000KT 1SM BR OVC003
14/14 A2969 RMK AO2 VIS 1/2V2 T01360136

[0815 CDT] METAR KUNU 141315Z AUTO 00000KT 3SM BR OVC003
14/14 A2970 RMK AO2 T01370137

[0835 CDT] METAR KUNU 141335Z AUTO 00000KT 3SM BR OVC003
14/14 A2970 RMK AO2 T01400140

**[0855 CDT] METAR KUNU 141355Z AUTO 00000KT 5SM BR
OVC003 14/14 A2970 RMK AO2 T01420142**

ACCIDENT TIME 0903 CDT

**[0915 CDT] METAR KUNU 141415Z AUTO 00000KT 7SM OVC005
15/15 A2970 RMK AO2 T01450145**

[0935 CDT] METAR KUNU 141435Z AUTO 00000KT 10SM OVC005
15/15 A2970 RMK AO2 T01480148

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

KUNU weather at 0855 CDT, automated, wind calm, visibility 5 miles, mist, overcast ceiling at 300 ft agl, temperature of 14° Celsius (C), dew point temperature of 14°C, and an altimeter setting of 29.70 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator, temperature 14.2°C, dew point temperature 14.2°C.

KUNU weather at 0915 CDT, automated, wind calm, visibility 7 miles, overcast ceiling at 500 ft agl, temperature of 15°C, dew point temperature of 15°C, and an altimeter setting of 29.70 inHg. Remarks, automated station with a precipitation discriminator, temperature 14.5°C, dew point temperature 14.5°C.

⁸ The bold sections of products in this report are intended to highlight the text that directly reference the weather conditions that affected the accident region around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times.

The observations from the KRYV and KUNU AWOSs around the accident time identified LIFR to IFR⁹ conditions.

4.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)¹⁰ model sounding was created¹¹ for the approximate accident site coordinates for 0900 CDT. The HRRR sounding was plotted on a standard Skew-T Log P diagram¹² from the surface to 700-hPa (or approximately 10,000 ft) using the RAOB¹³ software package and is included as figure 7. The sounding depicted an elevation of 840 ft over the grid point with a near surface temperature of 17.6°C, a dew point temperature of 15.9°C, and a relative humidity of 90%. The sounding depicted the lifted condensation level (LCL)¹⁴ and the level of free convection (LFC)¹⁵ at 714 ft agl (1,554 ft msl), and the convective condensation level (CCL)¹⁶ at 5,904 ft msl. The freezing level was located at 11,664 ft. The precipitable water value at 1.21 inches.

⁹ 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.

¹⁰ 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.

¹¹ HRRR sounding was created using NOAA Air Resource Laboratory: [READY Archived Meteorology \(noaa.gov\)](https://ready.noaa.gov/).

¹² 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.

¹³ RAOB - (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Esonde Research Services, The Villages, Florida.

¹⁴ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁵ 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.

¹⁶ 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.

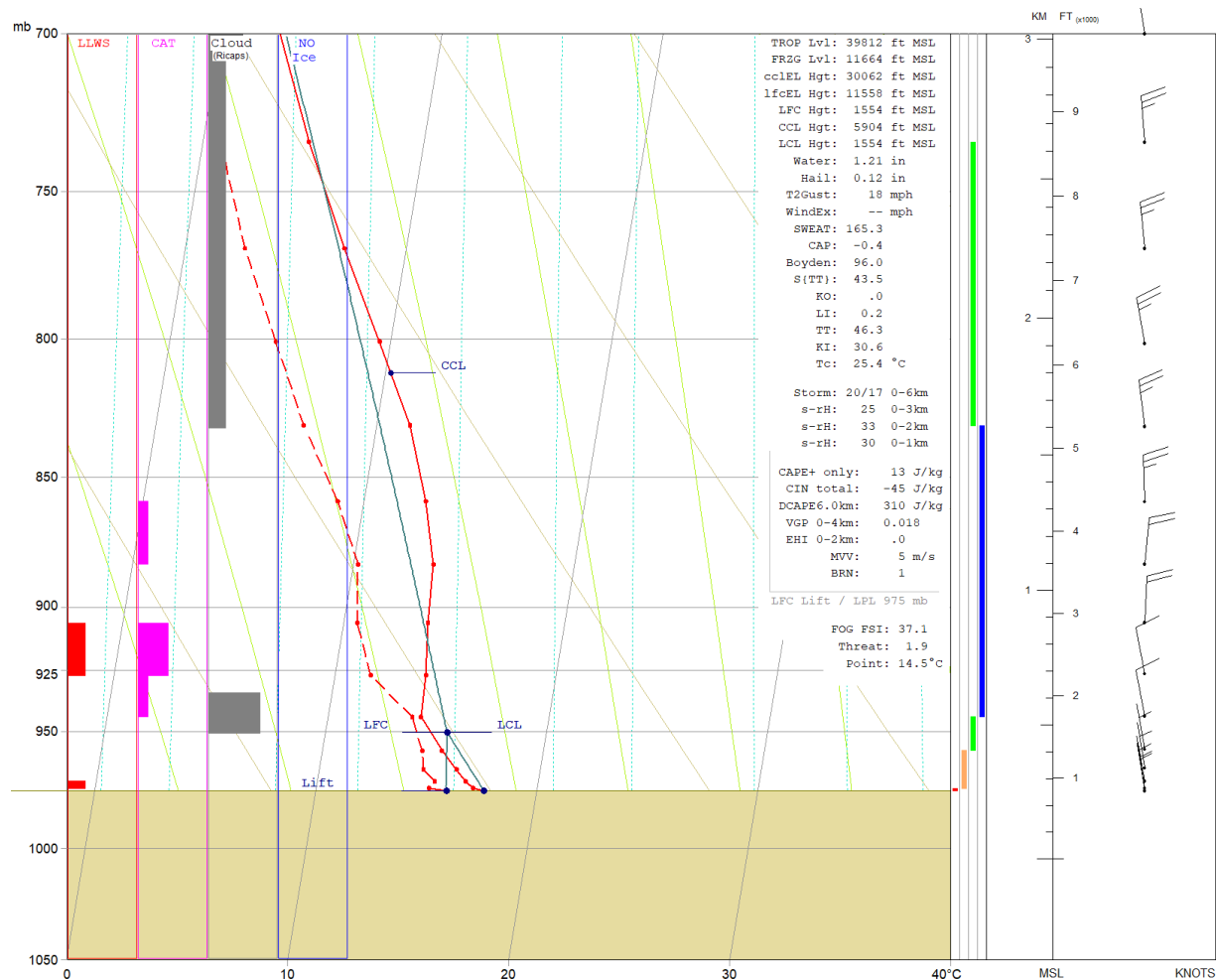


Figure 7. 0900 CDT HRRR sounding.

The 0900 CDT HRRR sounding indicated an unstable to conditionally unstable environment from the surface through 1,750 ft then a stable environment from 1,750 ft through 5,000 ft. RAOB indicated a cloud layer between 1,750 and 2,250 ft with another cloud layer above 5,500 ft. No icing was indicated below 10,000 ft. No inversions¹⁷ were noted by 0900 CDT on the HRRR sounding below 10,000 ft.

The 0900 CDT HRRR sounding wind profile indicated a near-surface wind from 352° at 5 knots with the wind remaining northerly through 10,000 ft. The wind speed increased to 20 knots by 3,000 ft and to 25 knots by 10,000 ft. RAOB indicated the possibility of light low-level wind shear (LLWS) in two layers between the surface and 2,000 ft agl. RAOB also indicated light clear air turbulence (CAT) in two layers between 2,000 ft and 4,500 ft.

¹⁷ 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").

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 1200 CDT and reviewed, and the closest images to the time of the accident were documented.

Figure 8 presents the GOES-16 visible image at 0906 CDT at 2X magnification with the accident site highlighted with a red square. The visible imagery indicated cloud cover above the accident site at the accident time with the cloud cover moving from north to south (attachment 2). Figure 9 presents the GOES-16 infrared image at 0906 CDT at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (red colors; higher cloud tops) were located north and south of the accident site at the accident time. The brightness temperature of 282 Kelvin above the accident site would have been near 6,500 ft based on the vertical temperature profile provided by the 0900 CDT HRRR sounding. It should be noted these figures have not been corrected for any parallax error.

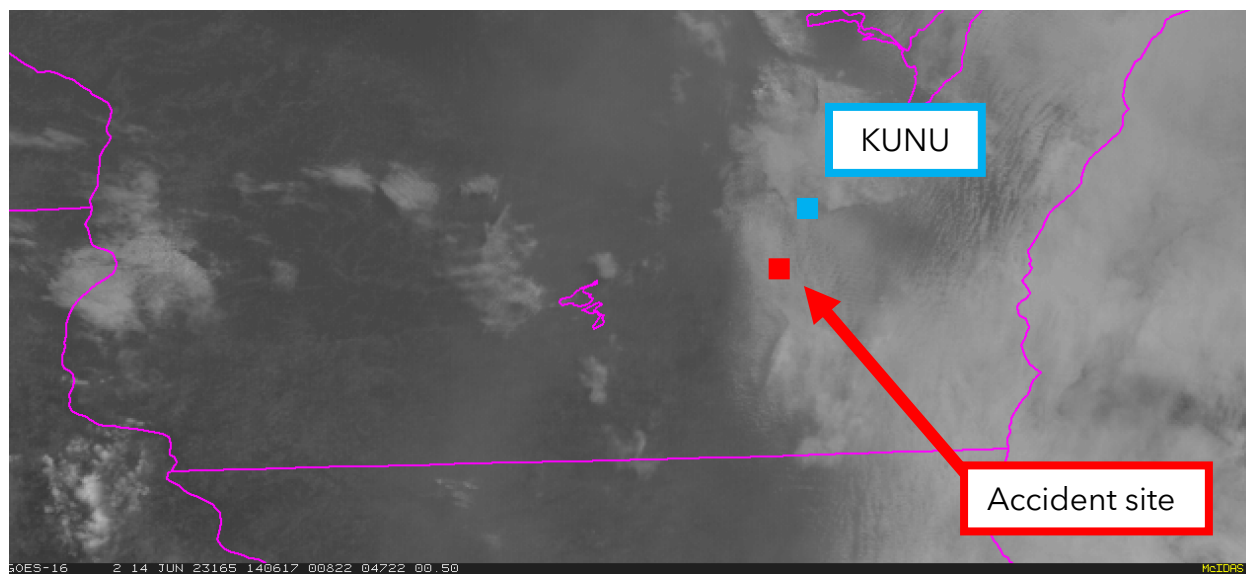


Figure 8. GOES-16 visible image at 0906 CDT.

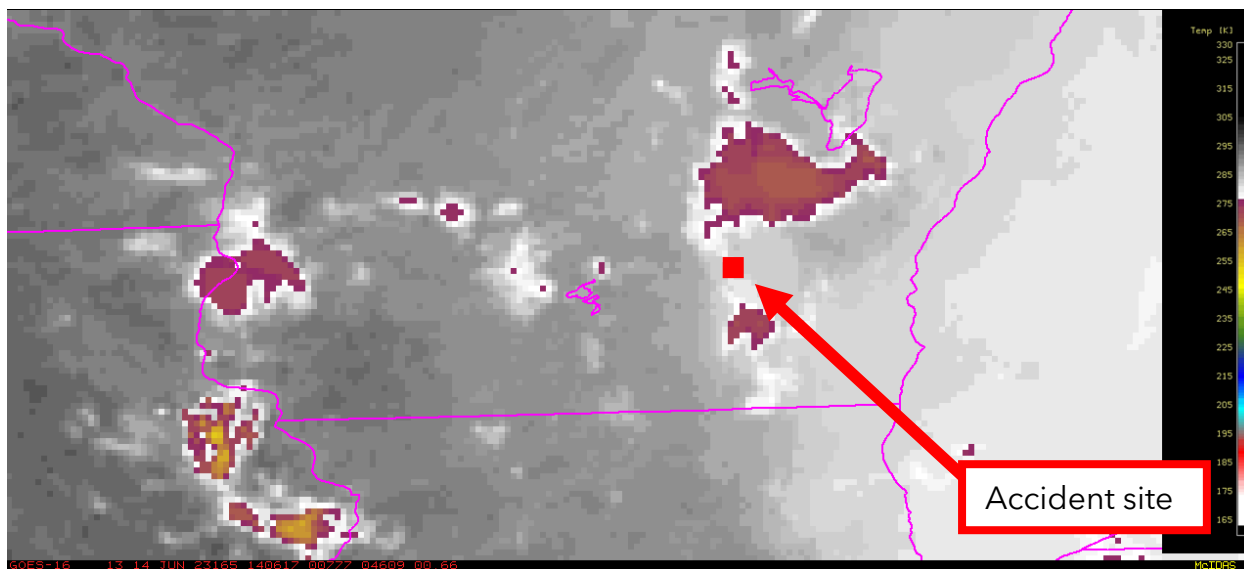


Figure 9. GOES-16 infrared image at 0906 CDT.

6.0 National Radar Imagery

A regional view of the NWS National Reflectivity Mosaic is included as figure 10 for 0905 CDT with the approximate location of the accident site marked by a red circle. The image depicted no echoes above the accident site.

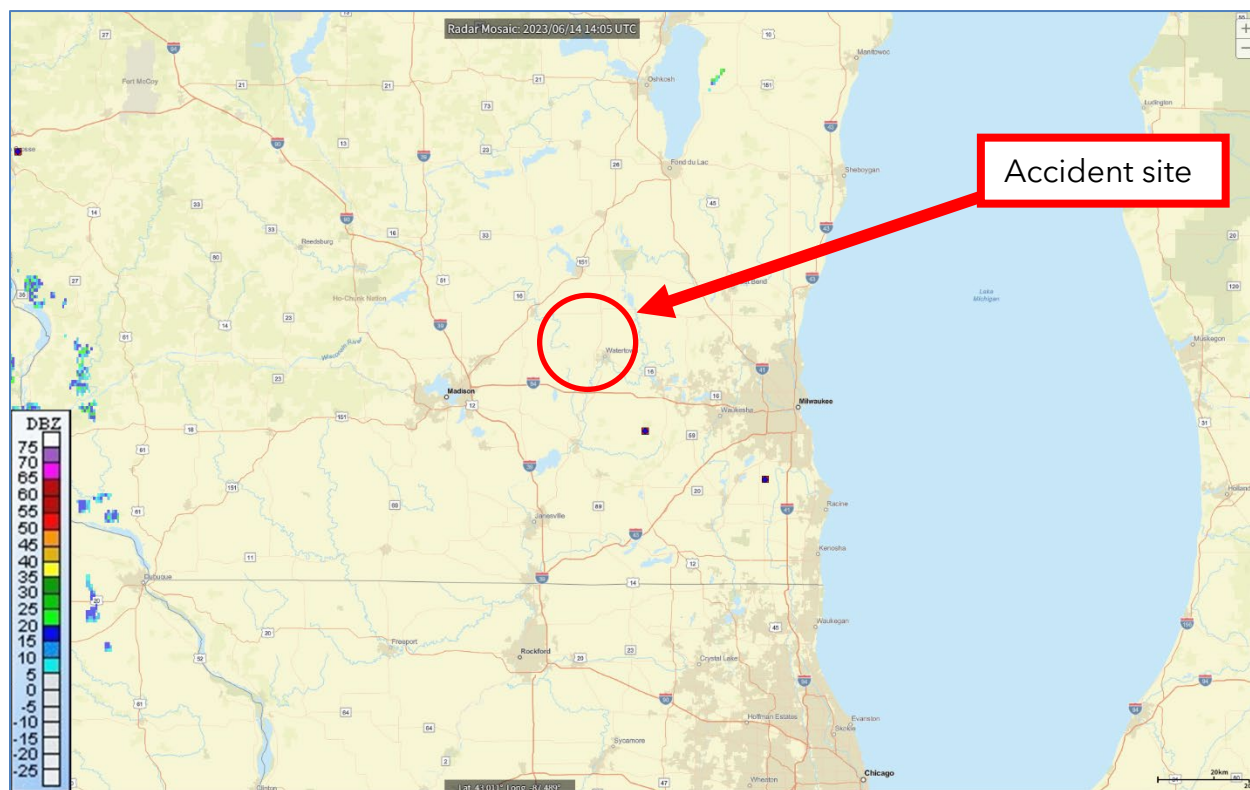


Figure 10. National Reflectivity Mosaic for 0905 CDT.

7.0 Pilot Reports

The longline-disseminated pilot reports¹⁸ (PIREPs) distributed into the national airspace system (NAS) within 90 minutes before and after the accident time and within 100 miles of the accident site at altitudes below 18,000 ft are shown here:

ENW UA /OV KENW/TM 1228/FL012/TP LJ45/RM BASES 1200 MSL
ORD UA /OV ORD045020/TM 1235/FL110/TP CRJ/TB SMOOTH
ORD UA /OV PWK045010/TM 1235/FL020/TP CL35/SK VFR
ORD UA /OV ORD170002/TM 1237/FL027/TP E75L/SK TOP027/RM DURC
DPA UA /OV KDPA/TM 1240/FL016/TP C56X/SK OVC016
MDW UA /OV MDW/TM 1240/FL016/TP B737/SK BKN016
ARR UA /OV ARR270004/TM 1250/FL034/TP DA42/WX FV05SM
MKE UA /OV SBM/TM 1252/FLDURGC/TP LJ75/SK B013 T030
PWK UA /OV PWK/TM 1305/FL015/TP CL35/SK 015OVCUNKN/RM DURD
DPA UA /OV KDPA/TM 1310/FL018/TP BE20/SK OVC018-TOP030
ARR UA /OV ARR/TM 1310/FL040/TP C185/RM CLEAR
PWK UA /OV OBK360020/TM 1310/FL180/TP C68A/TA 03/TB NEG/IC NEG
ARR UA /OV ARR/TM 1312/FL020/TP C550/WX FV06SM
MDW UA /OV MDW/TM 1315/FL016/TP B38M/SK OVC016
DPA UA /OV 10 S DPA/TM 1329/FL040/TP M20P/SK BASES 028
ORD UA /OV ORD090015/TM 1330/FL080/TP E170/SK BASES 010 TOPS 030/TB SMOOTH
MDW UA /OV MDW/TM 1332/FL060/TP SR22/SK TOPS EST 050/TB NEG/IC NEG
ORD UA /OV ORD270020/TM 1345/FL050/TP E170/SK VMC
ORD UA /OV ORD310020/TM 1347/FL030/TP SR20/SK VMC/TB SMOOTH
ORD UA /OV ORD270040/TM 1347/FL110/TP B738/SK IMC/WV 35434KT/TB SMOOTH
ORD UA /OV ORD270005/TM 1350/FL030/TP E75L/TB OCNL LGT CHOP/IC NEG
ENW UA /OV KENW/TM 1352/FL015/TP C172/RM BASES 1500 MSL
PWK UA /OV 2MF/TM 1359/FL015/TP FA50/SK 015OVCUNKN/RM DURD
MDW UA /OV MDW/TM 1400/FLDURGD/TP C560/SK OVC018
MKE UA /OV FINAL RWY1L /TM 1406/FLDURD/TP A320/RM B005 AGL

¹⁸ Only PIREPs with the World Meteorological Organization headers UBWI**, UBIL**, and UBMI** were considered. These do not include pilot reports only broadcast via radio.

ORD UA /OV ORD270002/TM 1408/FL018/TP B738/SK OVC018/RM FINAL RWY 10C
ORD UA /OV ORD090002/TM 1422/FL018/TP E175/SK OVC018/RM RWY 10L DEP
MKE UA /OV SBM/TM 1425/FLDURGD/TP TBM9/SK T030 BKN019
PWK UA /OV PWK/TM 1430/FL017/TP PC24/SK 017OVCUNKN/RM DURD
ORD UA /OV ORD 300/010/TM 1448/FL090/TP B739/TB NEG/RM SMOOTH RIDE IN
CLIMB
ORD UA /OV ORD180005/TM 1453/FL038/TP B737/SK TOP038/TB SMOOTH
ORD UA /OV ORD360015/TM 1506/FL100/TP E145/SK IMC/TB SMOOTH
ORD UA /OV ORD270005/TM 1510/FL023/TP A320/SK OVC023
ORD UA /OV ORD270002/TM 1512/FL020/TP A21N/SK OVC020/RM FINAL RWY 10C
PWK UA /OV PWK100003/TM 1515/FL017/TP P28R/SK BKN017

8.0 Significant Meteorological Information

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

9.0 Center Weather Service Advisories

The Chicago (ZAU) 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 for the accident site at the accident time.

10.0 Airmen's Meteorological Information

The NWS Aviation Weather Center (AWC) had text Airmen's Meteorological Information (AIRMET) advisory Sierra valid for the accident site at the accident time for below 8,000 ft. The text AIRMET Sierra was issued at 0753 CDT and forecast IFR conditions due to precipitation and mist:

WAUS43 KKCI 141253 AAB
WA3S
-CHIS WA 141253 AMD
AIRMET SIERRA UPDT 4 FOR IFR VALID UNTIL 141500

AIRMET IFR...MN WI LM LS MI LH IL IN...UPDT
FROM 50ESE YQT TO 60SE SSM TO 30SE ECK TO FWA TO 40NNW CVG TO
30ESE BVT TO 20WNW DLL TO RHI TO 50ESE DLH TO 30SW BRD TO 50SSW
BJI TO 20N BJI TO 70SSE YQT TO 50ESE YQT
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.

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11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products issued by the AWC before the accident flight and valid at 0700 and 1000 CDT are shown in attachment 3. The GFA surface forecasts applicable to the accident site that were valid before the accident flight's departure at 0700 CDT indicated LIFR to IFR conditions with a north wind of 5 knots. By 1000 CDT the GFA surface forecasts indicated VFR conditions. The Graphical AIRMET¹⁹ (G-AIRMET) Sierra was valid for the accident site at 0700 and 1000 CDT. The GFA cloud forecast applicable to the accident site that was valid at 0700 CDT indicated broken to overcast clouds at the accident site with bases at 1,000 ft tops between 2,400 ft and 3,000 ft. By 1000 CDT, the GFA cloud forecast indicated scattered to overcast cloud coverage with bases at 2,400 ft and tops to 4,000 ft. The only human-generated information reflected in the two GFA products were the G-AIRMETs.

12.0 Terminal Aerodrome Forecast

There were no airports with an NWS Terminal Aerodrome Forecast²⁰ (TAF) within 20 miles of the accident site.

13.0 National Weather Service Area Forecast Discussion

The NWS weather forecast office in Milwaukee/Sullivan, Wisconsin, (WFO MKX) was responsible for the public forecast in the region of the accident site. WFO MKX issued the following Area Forecast Discussion (AFD) at 0256 CDT, the AFD issued closest to the accident time with an aviation section:

FXUS63 KMKX 140756
AFDMKX

Area Forecast Discussion
National Weather Service Milwaukee/Sullivan WI
256 AM CDT Wed Jun 14 2023

¹⁹ 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). 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.

²⁰ According to NWS Instruction 10-813: "An NWS 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."
www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

.SHORT TERM...

(Issued 256 AM CDT Wed Jun 14 2023)

Today and Tonight:

Today we will start off mostly cloudy, with a mix of mid/high clouds and stratus. This morning the stratus is tied to the east-central and southeast Wisconsin, which will take some time to mix out later this morning. Once this stratus mixes out, there will still be some passing mid and high clouds. Will need to monitor Canadian wildfire smoke that is progged to move back into the region from western/central Canada. Today, most of the smoke looks to be elevated, so did keep around 30% cloud cover in the grids (even after the clouds clear today).

The pressure gradient has relaxed nicely and will lead to light winds, and the development of the lake breeze this afternoon. If we end up seeing more sunshine this afternoon, we may see the lake breeze move further inland than currently forecast. The lingering cloud cover near Lake Michigan and the lake breeze will help keep temperatures a bit cooler closer to the big lake, mainly in the mid/upper 60s immediately along the shoreline. As we head inland, temperatures warm into the 70s, and eventually mid/upper 80s across far south-central Wisconsin.

We may see an isolated shower or two develop across east-central and southeast Wisconsin this afternoon, as the atmosphere destabilized this afternoon. Upon coordination with LOT, did add some slight chance PoPs for this afternoon. Otherwise, a weak surface trough sets up across northern Wisconsin this afternoon will gradually sink south this evening and into the overnight hours. This boundary will be the main focus for additional development of some showers and thunderstorms. Initially, the main area of focus remains north, but as this boundary sags south we may still see some thunderstorm activity move into central Wisconsin late this evening. With dewpoints in the 50s and even lower 60s this afternoon along/ahead of the boundary and PWATs pushing 1 inch or more, thunderstorms will be capable of producing locally heavy downpours and gust winds. HRRR/RAP both show some smoke surfacing along and behind this weak boundary later today/tonight. Upstream in northern Minnesota, there are a few pockets of haze early this morning, just behind the weak boundary. Thus, will need to keep an eye on trends and add haze into the forecast if it looks like some of this surface-based smoke will make it this far south.

Tonight the main threat of any thunderstorm activity will wind down around/after midnight. Lingering cloud cover and low-level moisture will lead to mild overnight lows, mainly in the 50s and 60s.

Anderson

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.LONG TERM...

(Issued 256 AM CDT Wed Jun 14 2023)

Thursday through Friday night:

A backdoor cold front drops south across the area on Thursday morning, ushering in some cooler air. Ensembles and CONS guidance has come down a bit with temperatures behind the front, thus have lowered daytime highs as well. By Thursday afternoon, the cold front will be south of the area, thus the focus for afternoon showers and thunderstorms appears to be just south of Wisconsin, down into Illinois. The cooler, drier post frontal air mass moves across the area and a gradually clearing trend will lead chilly temperatures Thursday night into Friday, with overnight lows expected to fall into the 40s.

Large-scale subsidence takes over on Friday as high pressure build south into the Great Lakes region. This will lead to a dry, pleasant day and night across the area with light easterly winds.

Saturday through Wednesday:

Upper-level ridging will build across the northern CONUS this weekend, with deterministic guidance showing a few shortwaves trying to undercut this upper-level ridge. The NBM continued to insert PoPs that seemed a bit to high through the weekend, so upon coordination with neighbors we opted to cut back on PoPs and keep the forecast a bit drier.

Early to mid next week, high pressure continues to dominate across the region, bringing more dry weather as the main upper-level ridge builds eastward. Ensembles support a warming trend through mid next week, with highs in the 80s, maybe even a few days with highs in the 90s across south-central Wisconsin. Easterly winds will help keep temperatures locally cooler near Lake Michigan.

Anderson

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.AVIATION...

(Issued 256 AM CDT Wed Jun 14 2023)

Eastern terminals (KUES/KSBM/KMKE/KUES) will continue to see MVFR ceilings, potentially even some IFR ceilings this morning, then ceilings steadily lift through mid to late morning. KMSN/KJVL look to remain VFR. Winds will be light today with the lake breeze pushing inland towards KSBM/KMKE, and maybe KUES/KENW. There remains a small chance for a few scattered storms this afternoon through tonight, especially up near KSBM.

Anderson

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.MARINE...

(Issued 256 AM CDT Wed Jun 14 2023)

Areas of fog remain possible over Lake Michigan this morning. Winds across Lake Michigan will remain light today as low pressure exits over the eastern Great Lakes. On Thursday, a backdoor cold front drop south across the lake, bringing an uptick in northerly winds. Then high pressure dominates late this week and into the weekend with lighter winds.

Anderson

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.MKX WATCHES/WARNINGS/ADVISORIES...

WI...None.

LM...None.

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14.0 Winds and Temperature Aloft Forecast

The NWS 0900 CDT, Winds and Temperature Aloft forecast valid for the closest points to the accident site are included below:

FBUS31 KWNO 141400

FD1US1

DATA BASED ON 141200Z

VALID 141800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
DBQ	9900	3410+12	3315+04	3413+00	3512-13	3512-25	292340	302750	292257
GRB	9900	3520+11	3621+04	3521-01	3521-13	3519-25	352242	332451	312858
JOT	3408	3526+10	3424+05	3423-01	3321-13	3318-25	303040	293150	292558
MKG	3105	3515+08	3620+03	3521-01	3531-12	3429-25	323741	313850	313457

The 0900 CDT forecast was for use between 0900 CDT and 1600 CDT.

15.0 Pilot Weather Information

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.²¹

A search of archived information indicated that the accident pilot did not request weather information from Leidos Flight Service, however the accident pilot did file a flight plan that was taken by Leidos and that information is found in attachment 4. The accident pilot did have an account through ForeFlight, however, no activity was noted through ForeFlight on June 13 or 14. It is unknown what weather information, if any, the accident pilot checked or received before or during the accident flight.

16.0 Additional Information

A GoPro Hero 8, serial number C3334253122258, was recovered from the wreckage and sent to the NTSB Vehicle Recorder Laboratory in Washington, D.C. for readout. The camera contained a 128 GB microSD card. The last file written to the microSD card was file GOPR0426.JPG. This file is included in the report below as figure 11. Metadata for the image showed it was captured on June 14, 2023, at 14:03:01 UTC. The file’s associated GPS metadata show that the image was captured at a location of 43.20281 degrees N, 88.75213 degrees W at an altitude of approximately 2,297 ft. This position is approximately 0.35 nautical miles southwest of the recorded wreckage location. A forensic search of the microSD card’s contents were undertaken by the lab in an attempt to recover any corrupted videos or photos. The 128 GB memory device was searched for other metadata recorded around the time or location of the accident. No additional data consistent with the accident was found. The microSD card was also processed through a commercial software that allows recovery of corrupted or deleted files. Over 16,000 files were produced, and no additional accident-related data was discovered. Figure 11 shows the weather conditions outside of the right side of the accident airplane with cloud cover in the image.

²¹ 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.



Figure 11. Image from 0903:01 CDT out of the right side of the accident airplane.

17.0 Astronomical Data

The astronomical data obtained for the accident site on June 14, 2023, indicated the following:

SUN

Begin civil twilight 0439 CDT

Sunrise 0514 CDT

Accident time 0903 CDT²²

Sun transit 1255 CDT

Sunset 2037 CDT

End civil twilight 2112 CDT

At the time of the accident the Sun was had an altitude of 38.68° and azimuth of 93.28°.

²² Inserted accident time for reference and context.

E. LIST OF ATTACHMENTS

Attachment 1 - KRYV AWOS METAR information surrounding the accident timeframe

Attachment 2 - GOES-16 Visible imagery animation from 0831 to 1001 CDT

Attachment 3 - GFA information valid at the accident time

Attachment 4 - Leidos information

Submitted by:

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