



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 27, 2022

Specialist's Factual Report

METEOROLOGY

CEN22FA013

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A. ACCIDENT

Location: Waukesha, Wisconsin
Date: October 12, 2021
Time: 0930 central daylight time
1430 Coordinated Universal Time (UTC)
Aircraft: Glasair Glastar; Registration: N628RS

B. METEOROLOGIST

Paul Suffern
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 and also from the National Centers 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 latitude 42.934475° N, Longitude 88.231420° W, at an approximate elevation of 940 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.¹

¹

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over the southeastern United States for 1000 CDT is provided as figure 1 with the location of the accident site within the red circle. The chart depicted an occluded² low-pressure system just north-northeast of the accident site with a low-pressure center of 1006-hectopascals (hPa). A triple point³ low-pressure center with a pressure of 1005-hPa was located over northern Michigan with an occluded front stretching between both low-pressure centers. The accident site was located west of the former low-pressure center on the cool side of the frontal system.

The station models around the accident site depicted air temperatures in the mid 60's degrees Fahrenheit (°F), dew point temperatures in the low 60's °F with temperature-dew point spreads of 7°F or less, a westerly wind at 5 to 10 knots, cloudy skies, and mist reported at the airport near the accident site.

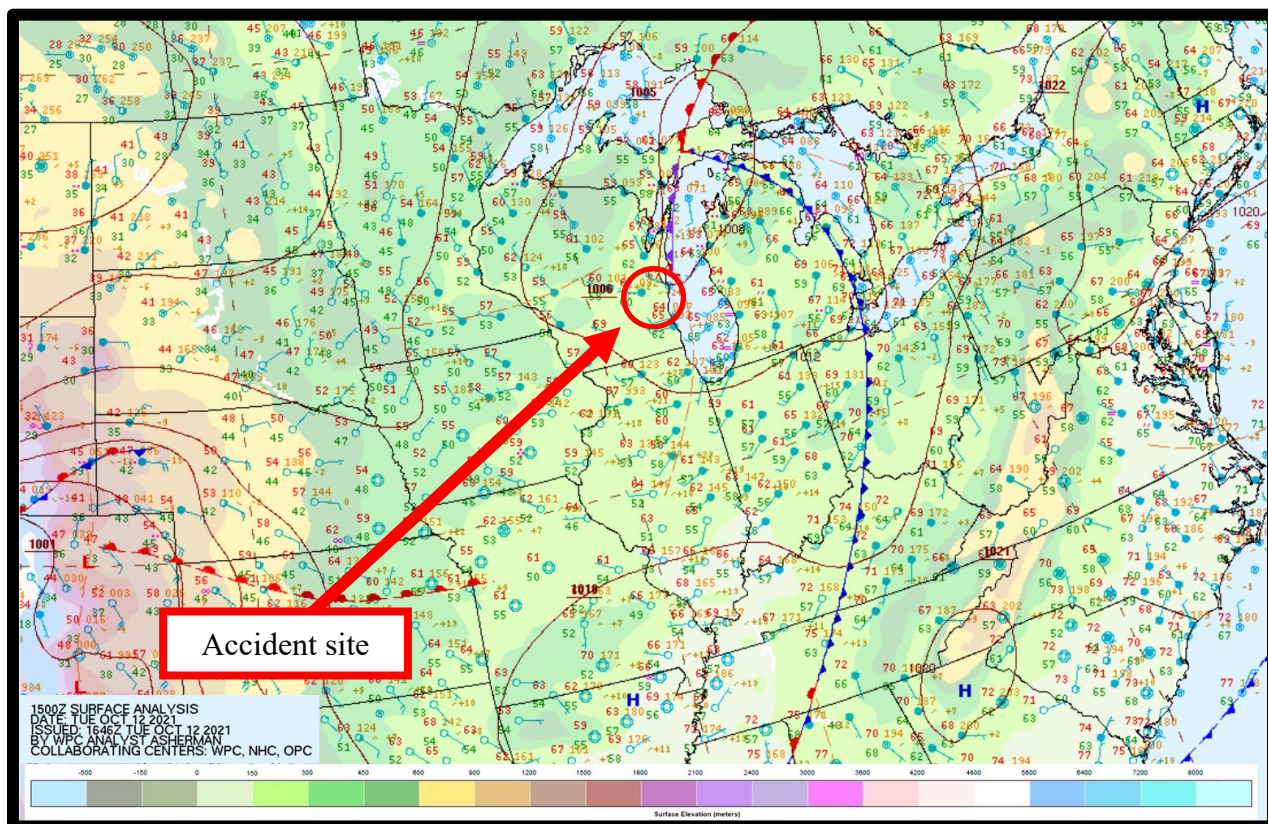


Figure 1 – NWS Surface Analysis Chart for 1000 CDT.

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² NWS JetStream - How to read 'Surface' weather maps

³ NOAA's National Weather Service - Glossary

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 CDT at 925-, 850- and 700- hectopascals (hPa) are presented in figures 2 through 4. The accident site was located in the immediate vicinity of the low-pressure system center. Low pressure systems and fronts can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. There was a west wind at 925-hPa with the wind remaining westerly through 700-hPa. The wind speed increased to 25 knots by 700-hPa.

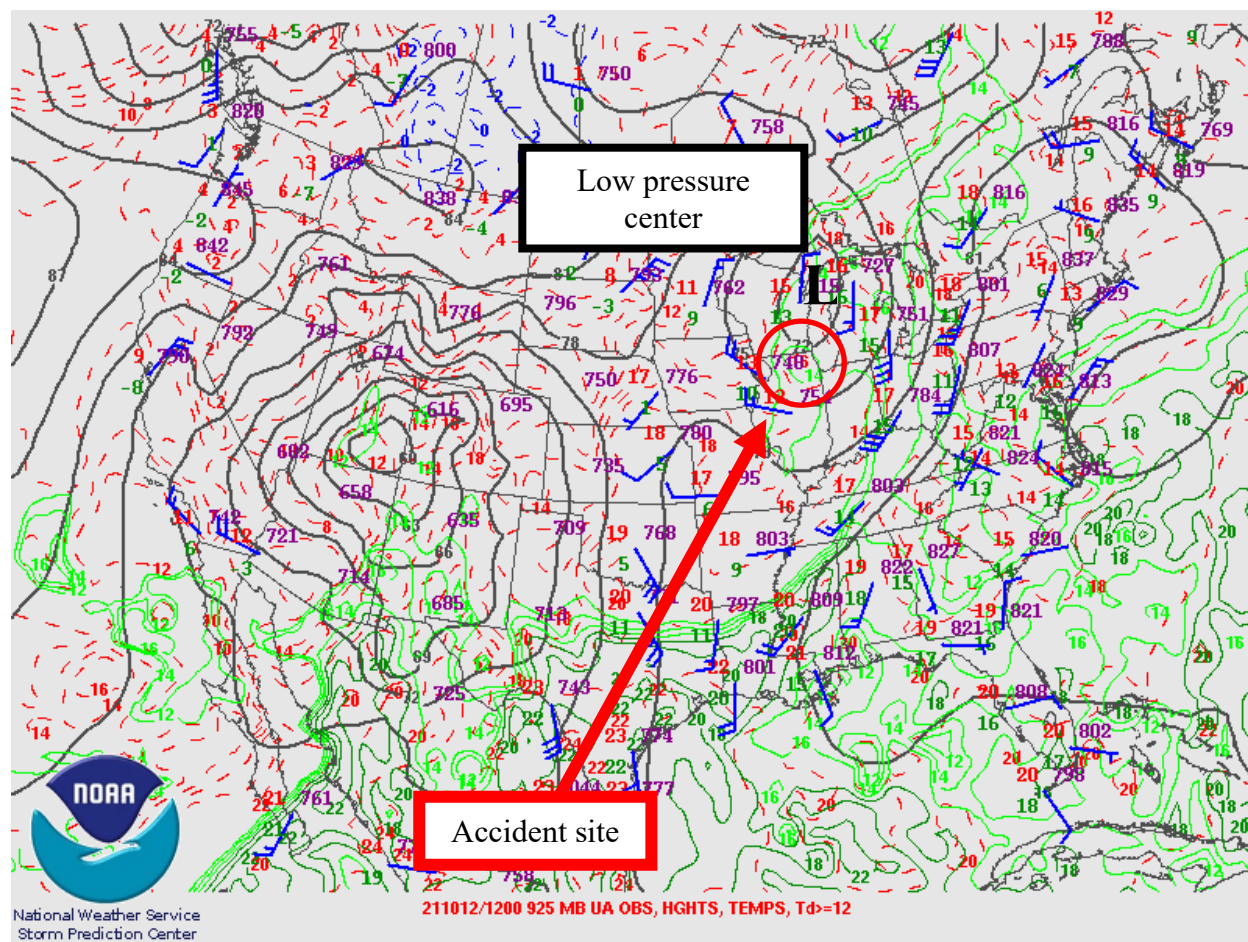


Figure 2 – 925-hPa Constant Pressure Chart for 0700 CDT.

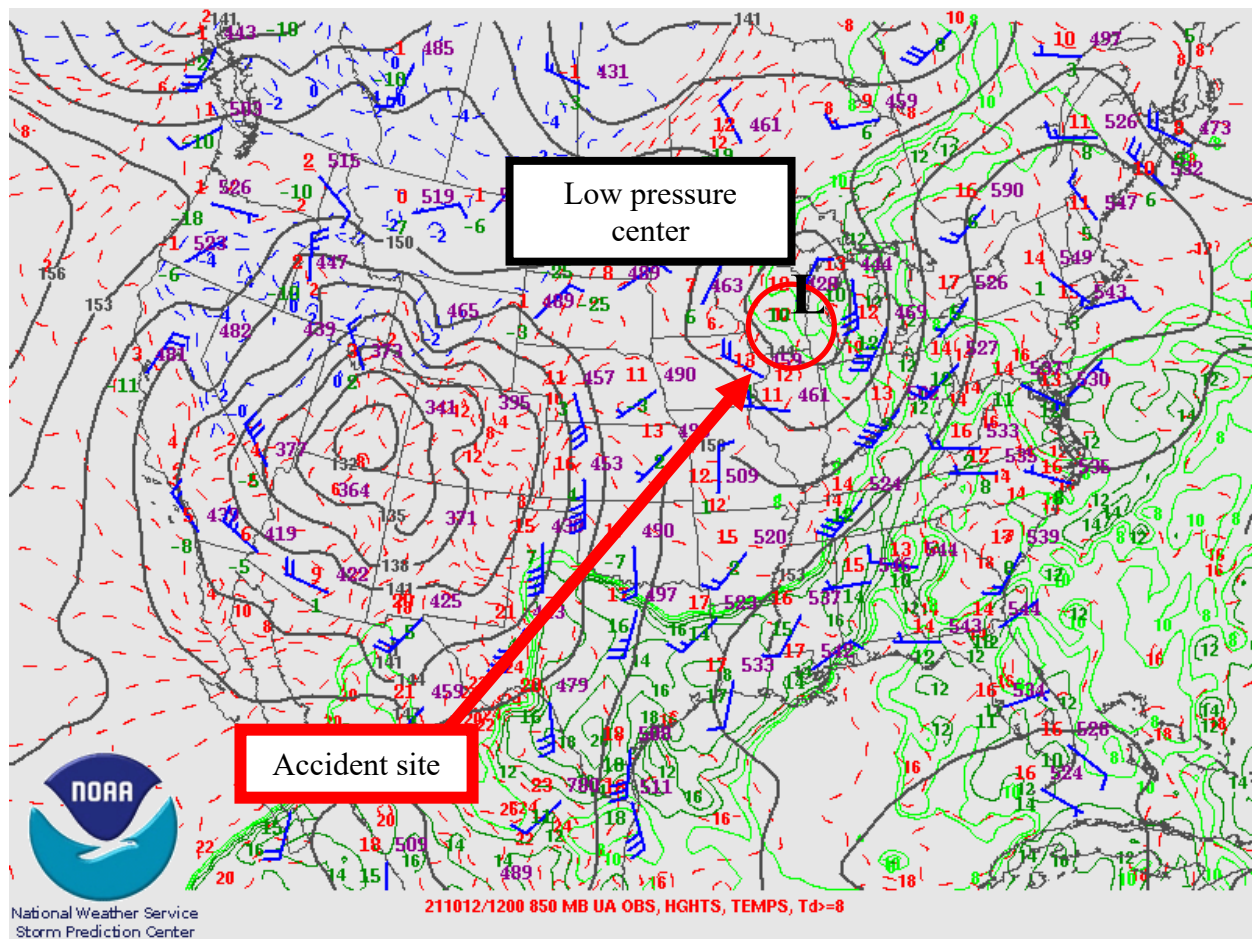


Figure 3 – 850-hPa Constant Pressure Chart for 0700 CDT.

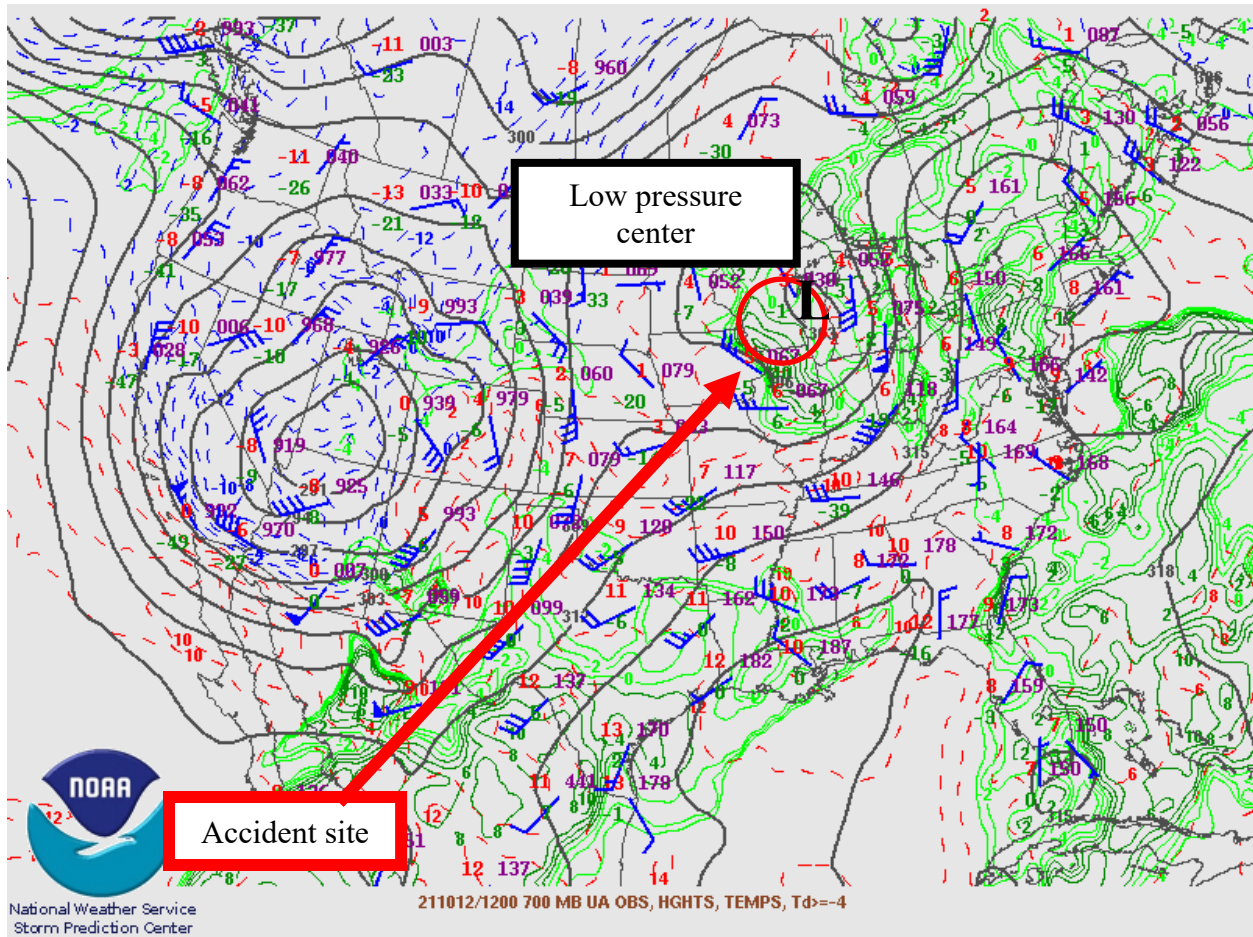


Figure 4 – 700-hPa Constant Pressure Chart for 0700 CDT.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 5 is a local sectional chart with the accident site and the closest weather reporting locations marked.

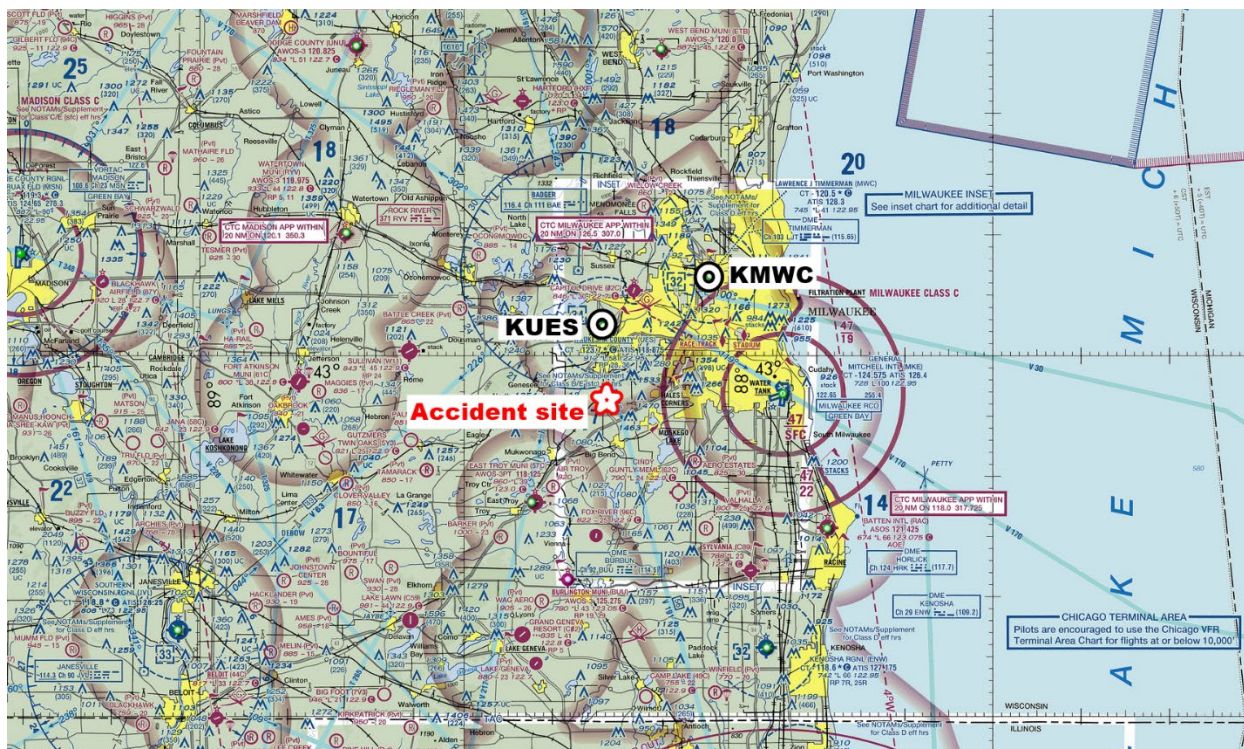


Figure 5 – Sectional map of the accident area with the locations of the accident site and surface observation sites.

Waukesha County Airport (KUES) had the closest official weather station to the accident site. KUES had an Automated Weather Observing System (AWOS⁴) whose longline⁵ reports were augmented by air traffic control (ATC) when the tower was in operation⁶. The KUES AWOS was located 6 miles north of the accident site, at an elevation of 912 ft, and had a 4° westerly magnetic variation⁷ (figure 5). The KUES AWOS observations surrounding the accident time are shown below:⁸

[0535 CDT] METAR KUES 121035Z AUTO 23005KT 5SM BR OVC004 15/15 A2972 RMK AO2

⁴ AWOS – Automated Weather Observing System is equipped with meteorological instruments to 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.

⁵ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station’s Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

⁶ Between 0600 and 2100 local.

⁷ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

⁸ 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.

[0545 CDT] METAR KUES 121045Z 23005KT 7SM BR OVC004 16/16 A2972

[0645 CDT] METAR KUES 121145Z 26006KT 5SM BR OVC004 16/16 A2975

[0745 CDT] METAR KUES 121245Z 27009KT 3SM BR OVC004 16/16 A2978

[0845 CDT] METAR KUES 121345Z 25009KT 2 1/2SM BR OVC004 15/15 A2982

ACCIDENT TIME 0930 CDT

[0945 CDT] METAR KUES 121445Z 27007KT 5SM BR OVC004 15/15 A2983

[1045 CDT] METAR KUES 121545Z 25008KT 5SM BR OVC004 15/15 A2984

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

KUES weather at 0845 CDT, wind from 250° at 9 knots, visibility 2.5 miles, mist, overcast ceiling at 400 ft above ground level (agl), temperature of 15° Celsius (C), dew point temperature of 15°C, and an altimeter setting of 29.82 inches of mercury (inHg).

KUES weather at 0945 CDT, wind from 270° at 7 knots, visibility 5 miles, mist, overcast ceiling at 400 ft agl, temperature of 15°C, dew point temperature of 15°C, and an altimeter setting of 29.83 inHg.

Lawrence J Timmerman Airport (KMWC) was the departure airport. KMWC had an AWOS whose longline reports were augmented by ATC when the tower was in operation⁹. The KMWC AWOS was located 14 miles northeast of the accident site (figure 5), at an elevation of 745 ft, and had a 4° westerly magnetic variation. KMWC AWOS observations surrounding the accident time are shown below:

[0655 CDT] METAR KMWC 121155Z AUTO 25007KT 7SM OVC005 16/15 A2974 RMK
AO2

[0715 CDT] METAR KMWC 121215Z AUTO 26007KT 7SM OVC005 17/15 A2974 RMK
AO2

[0745 CDT] METAR KMWC 121245Z 27006KT 10SM BKN007 OVC022 17/16 A2976

[0845 CDT] METAR KMWC 121345Z 25011KT 10SM OVC009 17/15 A2979

[0930 CDT] METAR KMWC 121430Z 27008KT 5SM BR OVC005 17/14 A2981

ACCIDENT TIME 0930 CDT

⁹ Between 0700 and 2100 local.

[0945 CDT] METAR KMWC 121445Z 26009KT 10SM OVC005 17/14 A2982

[1045 CDT] METAR KMWC 121545Z 29010KT 10SM OVC007 17/14 A2982

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

KMWC weather at 0930 CDT, wind from 270° at 8 knots, visibility 5 miles, mist, overcast ceiling at 500 ft agl, temperature of 17°C, dew point temperature of 14°C, and an altimeter setting of 29.81 inHg.

KMWC weather at 0945 CDT, wind from 260° at 9 knots, visibility 10 miles, overcast ceiling at 500 ft agl, temperature of 17°C, dew point temperature of 14°C, and an altimeter setting of 29.82 inHg.

The observations from KUES and KMWC surrounding the accident time indicated IFR¹⁰ to LIFR conditions with a cloud ceiling at 400 ft agl (~1,300 ft msl).

¹⁰ 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.

3.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)¹¹ model sounding was created for the accident site for 0900 CDT utilizing a surface elevation of 928 ft.¹² The 0900 CDT HRRR sounding was plotted on a standard Skew-T Log P diagram¹³ with the derived stability parameters included in figure 6 with data from the surface to 600-hPa (or approximately 14,000 ft msl). These data were analyzed using the RAOB¹⁴ software package. The sounding depicted the lifted condensation level (LCL)¹⁵, the level of free convection (LFC)¹⁶ at 254 ft agl (1,182 ft msl) and the convective condensation level (CCL)¹⁷ at 1,860 ft agl (2,788 ft msl). The freezing level was located at 11,694 ft msl. The precipitable water value was 1.25 inches.

¹¹ 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.

¹² HRRR sounding was created using NOAA Air Resource Laboratory: <https://ready.arl.noaa.gov/READYamet.php>

¹³ 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.

¹⁴ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.

¹⁵ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁶ 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.

¹⁷ 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.

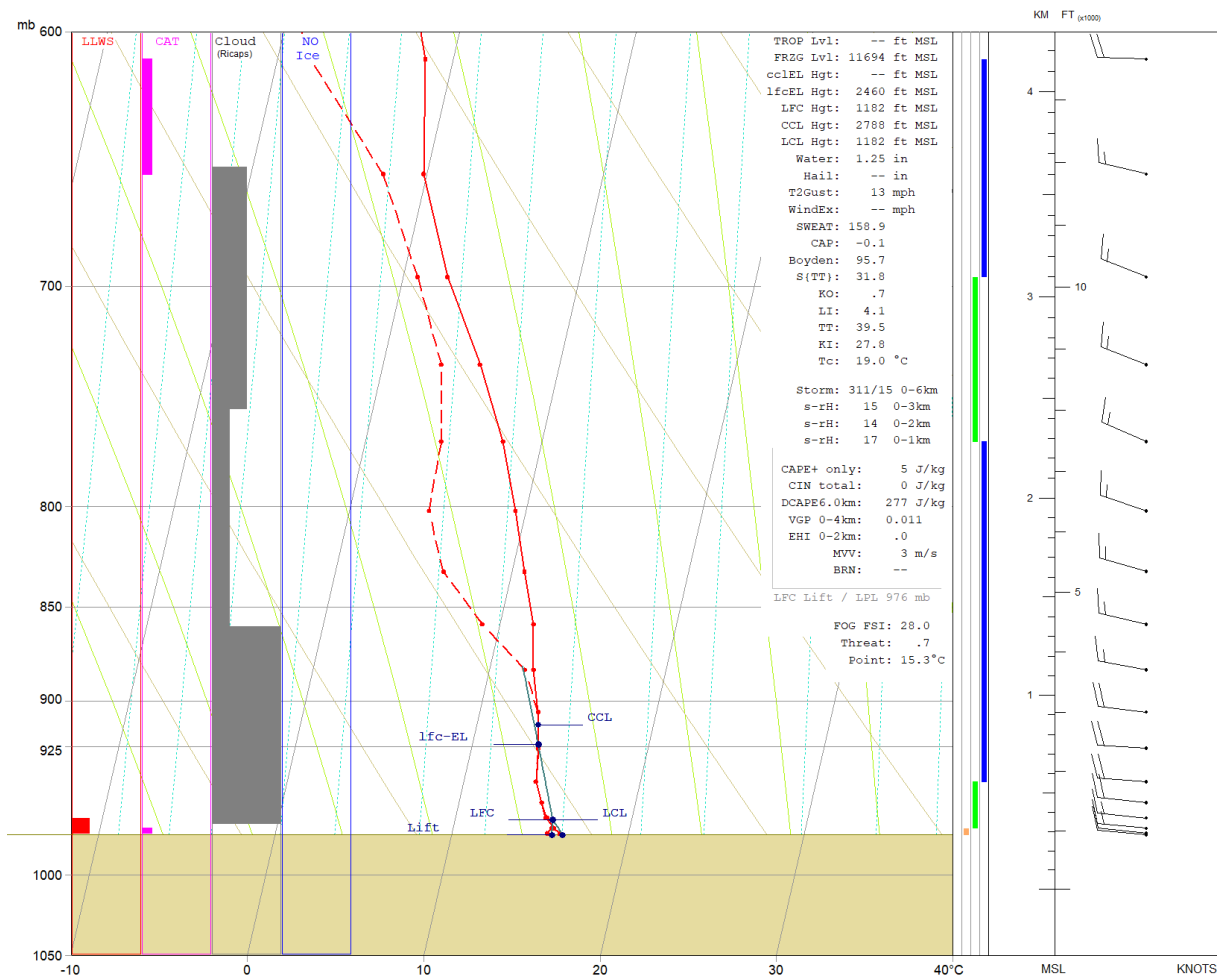


Figure 6 – 0900 CDT HRRR sounding.

The 0900 CDT HRRR sounding for the accident site indicated a conditionally unstable environment from the surface through 2,000 ft msl (~1,100 ft agl), then a stable environment from 2,000 ft to 7,000 ft msl. Clouds were indicated by RAOB to be present from 300 ft agl (~1,200 ft msl) through 12,000 ft msl. No icing potential was indicated by RAOB below 12,000 ft msl.

The 0900 CDT HRRR sounding wind profile indicated a near surface wind from 276° at 11 knots with the wind remaining out of the west through 14,000 ft msl. The wind speed increased to 20 knots by 2,000 ft msl (~1,100 ft agl). RAOB indicated the possibility of light low-level wind shear (LLWS) between the surface and 200 ft agl. RAOB indicated the possibility of light clear-air turbulence in two layers between the surface and 14,000 ft msl.

4.0 Satellite Data

The 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 0700 CDT through 1500 CDT and reviewed, and the closest images to the time of the accident were documented.

Figure 7 presents the GOES-16 visible imagery from 0930 CDT at 2X magnification with the accident site highlighted with a red square. There was abundant cloud cover across the accident region with the cloud cover moving from west to east (attachment 1). Figure 8 presents the GOES-16 infrared imagery from 0930 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 east of the accident site. The brightness temperature of about 282 Kelvin above the accident site would have been near 7,000 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.

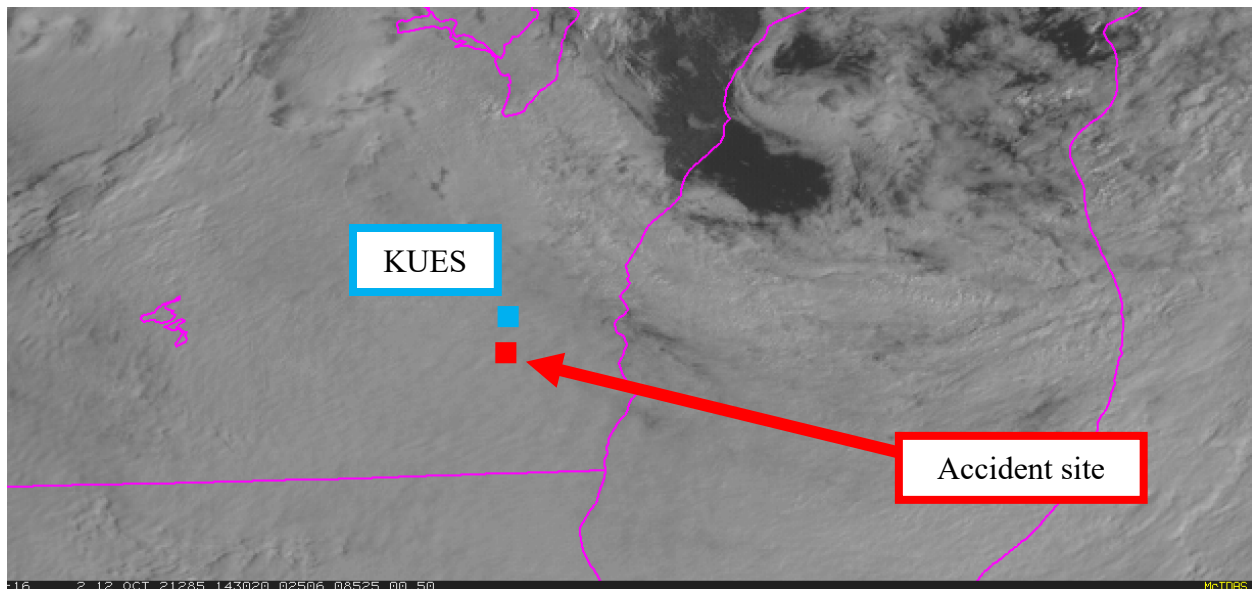


Figure 7 – GOES-16 visible image at 0930 CDT.

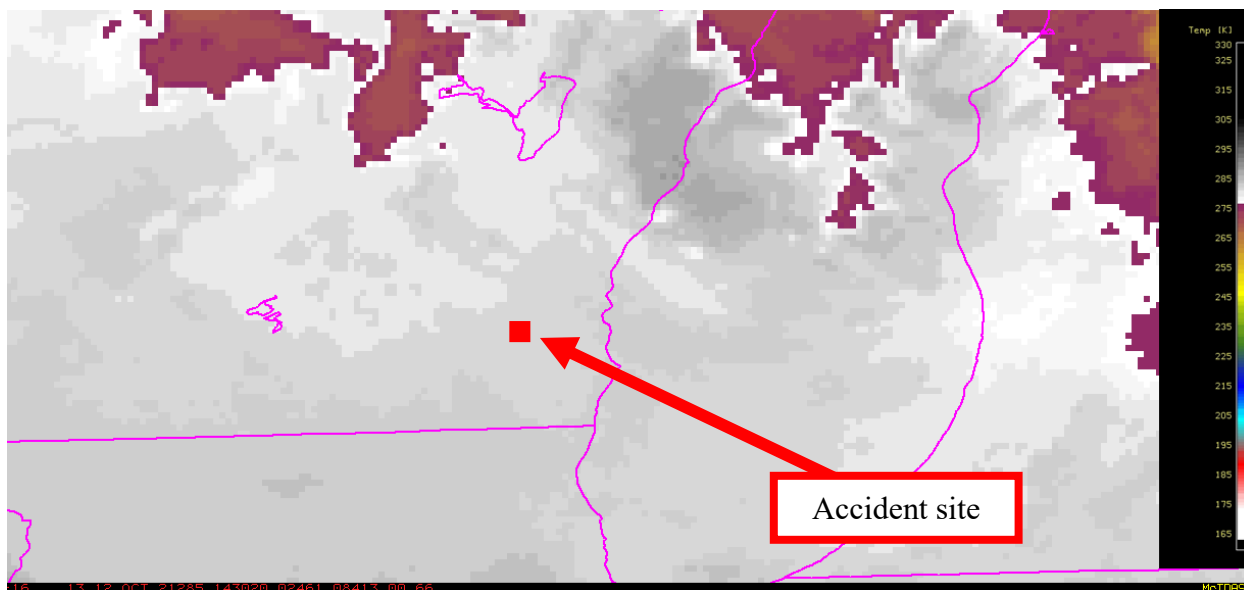


Figure 8 – GOES-16 infrared image at 0930 CDT.

5.0 Regional Radar Imagery Information

A regional view of the NWS National Reflectivity Mosaic is included as figure 9 for 0930 CDT with the approximate location of the accident site marked within a red circle. The image depicted no echoes above the accident site at the accident time.

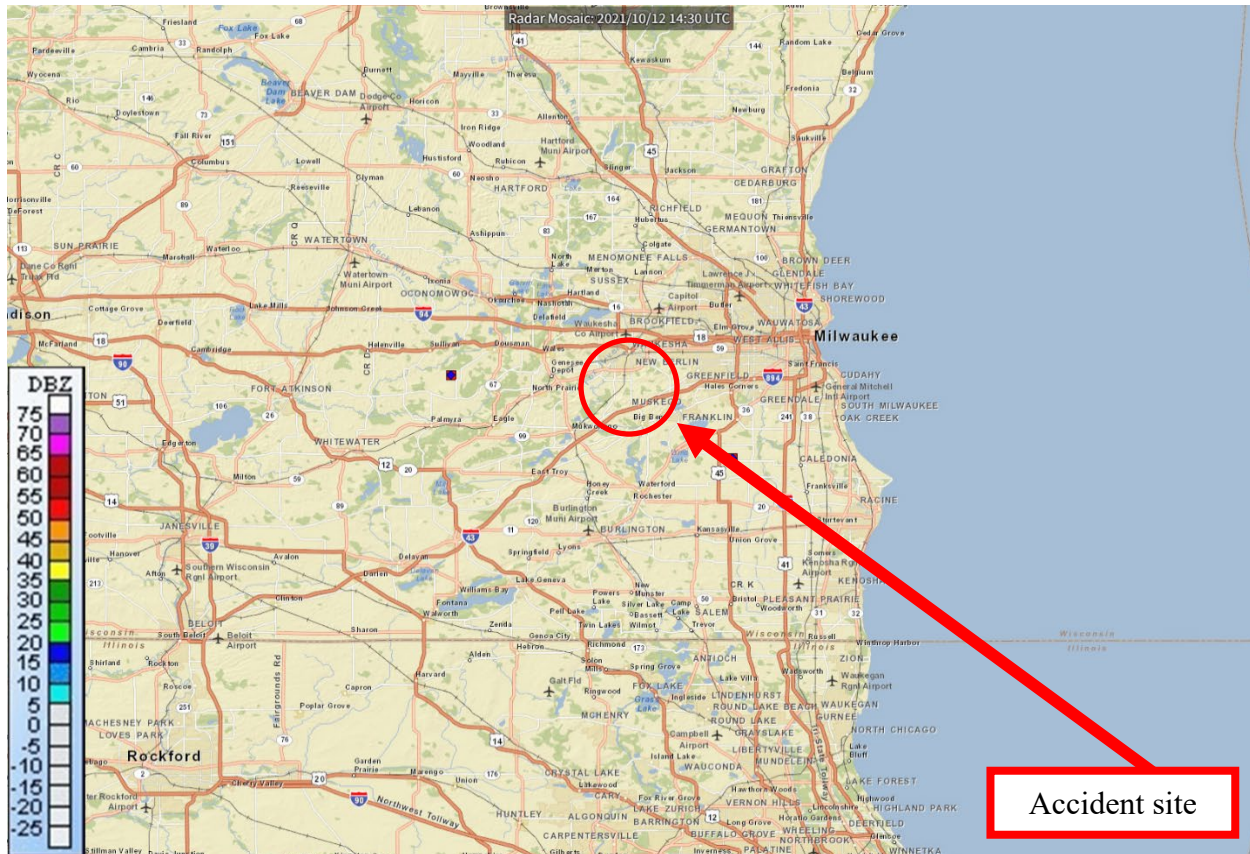


Figure 9 – Regional National Reflectivity Mosaic image for 0930 CDT.

6.0 Pilot Reports

The longline-disseminated pilot reports¹⁸ (PIREPs) distributed into the national airspace (NAS) were reviewed from about two hours prior to the accident time to two hours after the accident time and the PIREPs within 100 miles of the accident site below 18,000 ft msl are shown below:

MDW UA /OV KMDW/TM 1232/FLSFC/TP B737/SK CIG OVC010 MSL

ENW UA /OV KENW/TM 1237/FL011/TP PA31/RM BASES 1100 MSL

PWK UA /OV PWK/TM 1246/FLDURGD/TP BE20/RM BE20 REPORTED BASES AT 007 AGL

ORD UA /OV ORD180005/TM 1251/FL150/TP A321/WX TOPS 053/TB NEG/IC NEG

ORD UA /OV ORD090002/TM 1255/FL011/TP E175/SK TOP011

ARR UA /OV ARR090001/TM 1300/FL011/TP LJ60/SK BKN011/RM DURD

ORD UA /OV ORD360010/TM 1307/FL047/TP PAY2/SK BASES006 TOPS047

PWK UA /OV OBK161004/TM 1318/FLDURGD/TP LJ40/RM B006 RWY 16 ARRIVAL

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

ARR UA /OV ARR270001/TM 1335/FL011/TP C172/SK OVC011-TOPUNKN
ENW UA /OV KENW/TM 1336/FL012/TP SF50/RM BASES 1200 MSL
ORD UA /OV ORD/TM 1341/FL058/TP E170/SK TOP050
ORD UA /OV GYY/TM 1400/FL060/TP B738/SK 056/TB LGT CHOP/RM FROM 040-060
ARR UA /OV ARR270001/TM 1404/FL010/TP C172/SK OVC010/RM DURC
PWK UA /OV OBK161004/TM 1409/FLDURGD/TP C56X/RM B007 RWY 16 ARRIVAL
OSH UA /OV OSH/TM 1430/FL011/TP C172/SK OVC011-TOP019/OVC028-TOP045/RM DURD
MSN UA /OV MSN320004/TM 1434/FLDURGC/TP LJ75/SK OVC017-TOP055
PWK UA /OV OBK161004/TM 1441/FLDURGD/TP C560/RM B006 RWY 16 ARRIVAL
ORD UA /OV ORD/TM 1456/FL060/TP C402/SK TOP035
ARR UA /OV ARR090001/TM 1459/FL010/TP C172/SK OVC010/RM DURD
MDW UA /OV KMDW/TM 1514/FLSFC/TP B737/SK CIG OVC012 MSL
ORD UA /OV ORD/TM 1520/FL040/TP CRJ7/TB SMOOTH
UGN UA /OV KUGN/TM 1523/FLDURGD/TP CL30/RM LANDING RWY23 BASES 1200MSL/500 AGL
ATW UA /OV KATW/TM 1600/FL012/TP E75L
MDW UA /OV MDW/TM 1609/FL010/TP C25B/SK OVC010
ARR UA /OV ARR/TM 1616/FL011/TP PA44/SK OVC011
PWK UA /OV OBK161004/TM 1617/FLDURGD/TP SR20/RM B014 MSL RWY 16 ARRIVAL

7.0 Significant Meteorological Information

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

8.0 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 were no Center Weather Advisories (CWA) valid at the accident time.

9.0 Airmen's Meteorological Information

There was an Airmen's Meteorological Information (AIRMET) advisory Sierra valid for the accident site at the accident time. AIRMET Sierra issued at 0645 CDT forecast IFR conditions due to precipitation and mist:

WAUS43 KPCI 121115 AAB
WA3S
-CHIS WA 121115 AMD
AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 121500
.
AIRMET IFR...NE KS MO
FROM 50SE OVR TO 40SW IRK TO 20WNW MCI TO 60SW MCI TO 30SSE PWE
TO 50SE OVR
CIG BLW 010/VIS BLW 3SM BR. CONDS ENDG BY 06Z.
.
AIRMET IFR...MN LS
FROM 60E INL TO 20SSW YQT TO 30ENE DLH TO 30NNW DLH TO 60E INL
CIG BLW 010/VIS BLW 3SM BR. CONDS CONTG BYD 09Z ENDG 12-15Z.
.
AIRMET IFR...IA WI LM LS MI LH IL IN
FROM 30ESE YQT TO 50SE SSM TO 30NNW TVC TO 20ENE GRR TO 30SW FWA
TO 20W TTH TO 30SSW AXC TO 50WSW BDF TO 40SSE ODI TO 50SE DLH TO
30ESE YQT
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 21Z.
.
AIRMET IFR...ND...UPDT
FROM 50SW ISN TO 20NNW DIK TO 80SW DIK TO 50SW ISN
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG BY 15Z.
.
AIRMET MTN OBSCN...KY TN
FROM HNN TO HNV TO 20SE VXV TO GQO TO 50E BWG TO HNN
MTNS OBSC BY CLDS/BR. CONDS CONTG BYD 15Z THRU 21Z.
.
OTLK VALID 1500-2100Z...IFR SD NE...UPDT
BOUNDED BY 70WSW DIK-40NW DPR-50SSE RAP-BFF-70SW RAP-70WSW DIK
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS DVLPG AFT 15Z. CONDS
CONTG THRU 21Z.
....

10.0 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 valid before departure for around the accident time indicated VFR to MVFR surface visibilities and a surface wind from the west at 10 knots with gusts to 15 knots. The GFA cloud forecast valid before departure for around the accident time indicated overcast clouds between 1,200 and 1,500 ft msl with cloud tops at 5,000 ft msl. The Graphical AIRMET¹⁹ (G-AIRMET) Sierra for IFR conditions was overlaid on the GFA surface forecast imagery. The only human-generated information reflected in the two GFA products are the G-AIRMETs. For more information, please see attachment 2.

¹⁹ <https://aviationweather.gov/gairmet>

11.0 Terminal Aerodrome Forecast

KUES was the closest airport to the accident site with an NWS Terminal Aerodrome Forecast²⁰ (TAF). The KUES TAF valid at the time of the accident was issued at 0631 CDT and was valid for a 24-hour period beginning at 0700 CDT. The 0631 CDT TAF for KUES was as follows:

```
FTUS43 KMKX 121131
TAFUES
TAF
KUES 121131Z 1212/1312 23005KT 6SM BR OVC004
FM121400 26007KT P6SM OVC006
FM121700 27010KT P6SM OVC012
FM122200 28008KT P6SM BKN025
FM130100 27004KT P6SM BKN035
FM130800 00000KT 4SM BR BKN025=
```

Between 0900 and 1200 CDT the forecast expected a wind from 260° at 7 knots, greater than 6 miles visibility, and an overcast ceiling at 600 ft agl.

12.0 NWS Area Forecast Discussion

The NWS office in Milwaukee/Sullivan, Wisconsin, (WFO MKX) was responsible for the public forecast and TAFs in the region of the accident site. WFO MKX issued the following Area Forecast Discussion (AFD) at 0341 CDT:

FXUS63 KMKX 120841
AFDMKX

Area Forecast Discussion
National Weather Service Milwaukee/Sullivan WI
341 AM CDT Tue Oct 12 2021

.SHORT TERM...
(Issued 341 AM CDT Tue Oct 12 2021)

Today and Tonight:

Tis the season of closed upper lows. They act like pin balls and are driven by upper level winds and pushed out by the next low.

A closed upper low and associated surface low are spinning over southern WI early this morning. The low was slower to progress to this point and will be slower to move out than previous forecasts. The low will gradually lift northeast today and take the showers and drizzle with it. Clouds are the big uncertainty for today. We should see some clearing toward the IL border by midday. Models are showing moisture lingering in the low levels, but with steady westerly winds this afternoon in the wake of the low, we should see some breaks in the clouds.

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

If we only see sparse breaks in the clouds, then there is a good chance they will fill back in as stratus, at least toward central WI. Light winds and recent precip should allow for fog to develop across southern WI later tonight. Where skies manage to clear, we could see dense fog.

Wednesday and Wednesday Night:

A strong low developing in the Plains today will strengthen as it lifts into eastern North Dakota Wednesday night and becomes a closed upper low/occluded surface low. The associated cold front will swing across Iowa Wednesday morning and through Wisconsin Wednesday afternoon and evening. The instability over southern WI when the system passes through will be weak due to clouds and weak lapse rates, but deep layer shear and low level helicity near the triple point and within the warm sector of this system support the brief potential for a few severe storms, with wind the main threat and a tornado possible. Most of WI and IL remain in a broad Marginal Risk for severe by SPC.

Gusty southeast winds are expected ahead of this front on Wednesday. Highs should manage to reach the upper 60s to around 70.

Cronce

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.LONG TERM...

(Issued 341 AM CDT Tue Oct 12 2021)

Thursday through Friday Night:

The occluded front that will be passing through southern WI Wednesday night is expected to slow down and become nearly stationary across the central MS Valley into the southern Plains on Thursday. The front will stall to the south due to persistent southwest winds at the steering levels of the atmosphere as upstream long wave low pressure trough continues over the western CONUS. A mid-level short wave digging into the base of this trough will push into the central Plains Thursday night and further sharpen the main trough as it moves east across the central MS Valley into the OH Valley Friday and Friday night. At the same time, west to southwest winds in the lower levels of the atmosphere will pull cooler air into the Upper Midwest and western Great Lakes. This will result in a tightening low level thermal gradient or baroclinic zone setting up in the low levels north of the surface front. This thermal gradient will be draped from southern WI into the central/southern Plains for a time from late Thursday night into Friday night. The latest GFS deterministic run continues to move weak low pressure along this low level boundary during this period, but has trended weaker in the last several model runs. The ECMWF and GEM had been the drier, flatter solutions the past several days, but the latest runs are trending

toward weak low pressure and a period of isentropic lift moving along this boundary. About half of the ECMWF ensembles are now showing some light QPF affecting southern WI in the Fri/Fri night period while most GEFS ensembles are showing light QPF. Enough low to mid level moisture looks available to warrant continuing chance Pops from later Thu night into Fri night.

Saturday through Monday:

The low pressure trof is expected to move east of the area by Saturday with more west to northwest steering flow winds expanding from the northwest CONUS into the Great Lakes for the bulk of the weekend. The GFS and GEM are showing a compact short wave trof moving across northern WI later Saturday night into Sunday but low level moisture looks limited. Hence expecting dry conditions for now over the weekend into Monday.

Cooler air will be settled over the region with 925H temperatures in the 6 to 10C range by the weekend. Pending cloud cover Saturday night and Sunday night, temperatures will fall anywhere from the mid 30s to mid 40s. If the surface winds diminish enough, some patchy late night frost will be possible in parts of south central WI. Daytime temperatures will be much more seasonal for mid-October, reaching the mid 50s to low 60s. A slight moderation in temperature is expected on Monday as winds become more southerly, before colder air returns on Tuesday.

Kavinsky

&&

.AVIATION...

(Issued 341 AM CDT Tue Oct 12 2021)

Ceilings and visibilities are all over the place under this low pressure system that is spinning over southern WI early this morning and producing scattered showers. This system will very slowly exit to the northeast today through tonight. Expect mostly cloudy skies across southern WI today with some scattering out of clouds near the IL border. There is a lot of uncertainty about clouds clearing tonight. If we can get any clearing, dense fog is a concern.

Cronce

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.MARINE...

(Issued 341 AM CDT Tue Oct 12 2021)

Low pressure over southern WI will reach the Straits of Mackinac around midday and exit the region overnight. Expect steady west winds over Lake Michigan this afternoon and evening. The next low developing in the Plains will deepen as it tracks into eastern North Dakota Wednesday afternoon. Look for stronger southerly winds over Lake Michigan Wednesday afternoon and evening. A few

gale force gusts are possible over the south half during this period.

No change to the timing of the Small Craft Advisory. Waves will linger longer toward Sheboygan this morning. Another advisory will be needed Wednesday afternoon and night.

Cronce

&&

.MKX WATCHES/WARNINGS/ADVISORIES...

WI...None.

LM...Small Craft Advisory...LMZ644-LMZ645-LMZ646 until 5 AM Tuesday.

Small Craft Advisory...LMZ643 until 8 AM Tuesday.

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13.0 Winds and Temperature Aloft Forecast

The NWS 0859 CDT Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

FBUS31 KWN0 121359

FD1US1

DATA BASED ON 121200Z

VALID 121800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
JOT	2821	2822+13	2925+08	2929+05	2844-10	2757-21	278336	278246	266054

The closest forecast point to the accident site was Joliet, Illinois (JOT). The 0859 CDT JOT forecast for use between 0900 CDT and 1600 CDT indicated a wind at 3,000 ft from 280° at 21 knots and a wind at 6,000 ft from 280° at 22 knots with a temperature of 13°C.

14.0 Pilot Weather Briefing

The accident pilot requested weather information²¹ from Leidos Flight Service starting around 0731 CDT on the accident day (attachments 3 through 6). The Leidos Flight Service specialist provided all the standard weather information for the proposed accident flight to the accident pilot valid at 0731 CDT (attachment 5). For more information please see attachments 3 through 6.

²¹ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

A search of archived ForeFlight information indicated that the accident pilot did not request a weather briefing from ForeFlight, however, the accident pilot did enter several flight routes into the ForeFlight App (attachment 7). The search of archived ForeFlight information indicated that prior to the flight no weather imagery was viewed in the ForeFlight App by the accident pilot. For more information see attachment 7.

15.0 Astronomical Data

The astronomical data obtained for the accident site on October 12, 2021, indicated the following:

SUN	
Begin civil twilight	0635 CDT
Sunrise	0703 CDT
Accident time	0930 CDT²²
Sun transit	1239 CDT
Sunset	1815 CDT
End civil twilight	1843 CDT

E. LIST OF ATTACHMENTS

Attachment 1 – GOES-16 visible imagery animation from 0906 to 1026 CDT

Attachment 2 – GFA valid for the accident site at accident time

Attachment 3 – Leidos contact information

Attachment 4 – Leidos text weather information provided to accident pilot

Attachment 5 – Leidos audio data

Attachment 6 – Leidos provided GFA provided to accident pilot

Attachment 7 – ForeFlight Information

Submitted by:

Paul Suffern
Senior Meteorologist

²² Inserted accident time for reference and context.