



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 20, 2022

Specialist's Factual Report

METEOROLOGY

CEN22FA096

A. ACCIDENT

Location: Defiance, Missouri

Date: January 8, 2022

Time: 1919 central standard time

0119 Coordinated Universal Time (UTC) on January 9, 2022

Aircraft: Beech B58; Registration: N585CK

B. METEOROLOGY SPECIALIST

Specialist Paul Suffern
National Transportation Safety Board
Washington, DC

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 standard time (CST) and are based upon the 24-hour clock, where local time is -6 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 38.6795° N, Longitude 90.8824° W, at an approximate elevation of 723 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

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over Missouri for 1800 CST is provided as figure 1 with the location of the accident site within the black circle. The chart depicted a low-pressure system over eastern Kansas at 1010-hectopascals (hPa). A cold front extended to the southwest of the low-pressure system and a warm front extended to the east-southeast. The warm front extended across Missouri and was depicted immediately south of the accident site. The accident site was located just to the north of the warm frontal boundary on the cool side of the front.

The station models around the accident site depicted air temperatures and dew point temperatures in the low 40's degrees Fahrenheit (°F), with temperature-dew point spreads of 1°F or less, overcast skies, and a southeast wind around 5 knots.

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

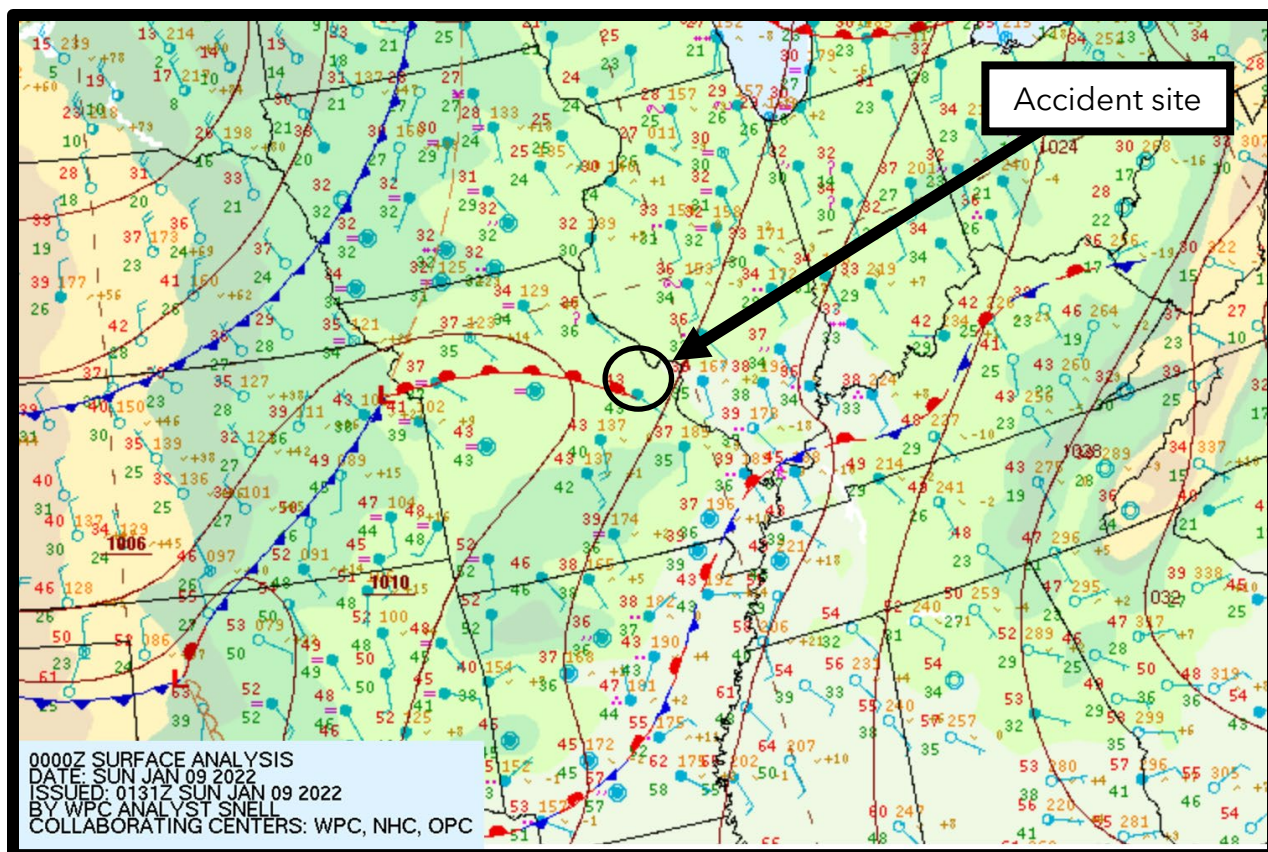


Figure 1. NWS Surface Analysis Chart for 1800 CST.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1800 CST at 925-, 850- and 700-hPa are presented in figures 2 through 4. The accident site was in the vicinity of a low- and mid-level trough². Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. The 925-hPa constant pressure chart depicted a band of 50 knots winds from eastern Texas, Louisiana, Arkansas, and into eastern Missouri and extended over the accident site. The wind remained southwesterly through 700-hPa, and the wind speed increased to 60 knots by 700-hPa. The charts also depicted temperature-dew point spreads of 4° Celsius (C) or less as green isopleths³ from the Gulf of Mexico northward into Missouri (figures 2 through 4).

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

³ Isopleth - A broad term for any line on a weather map connecting points with equal values of a particular atmospheric variable (temperature, dew point, etc.). Isotherms, isotachs, etc. are all examples of isopleths.



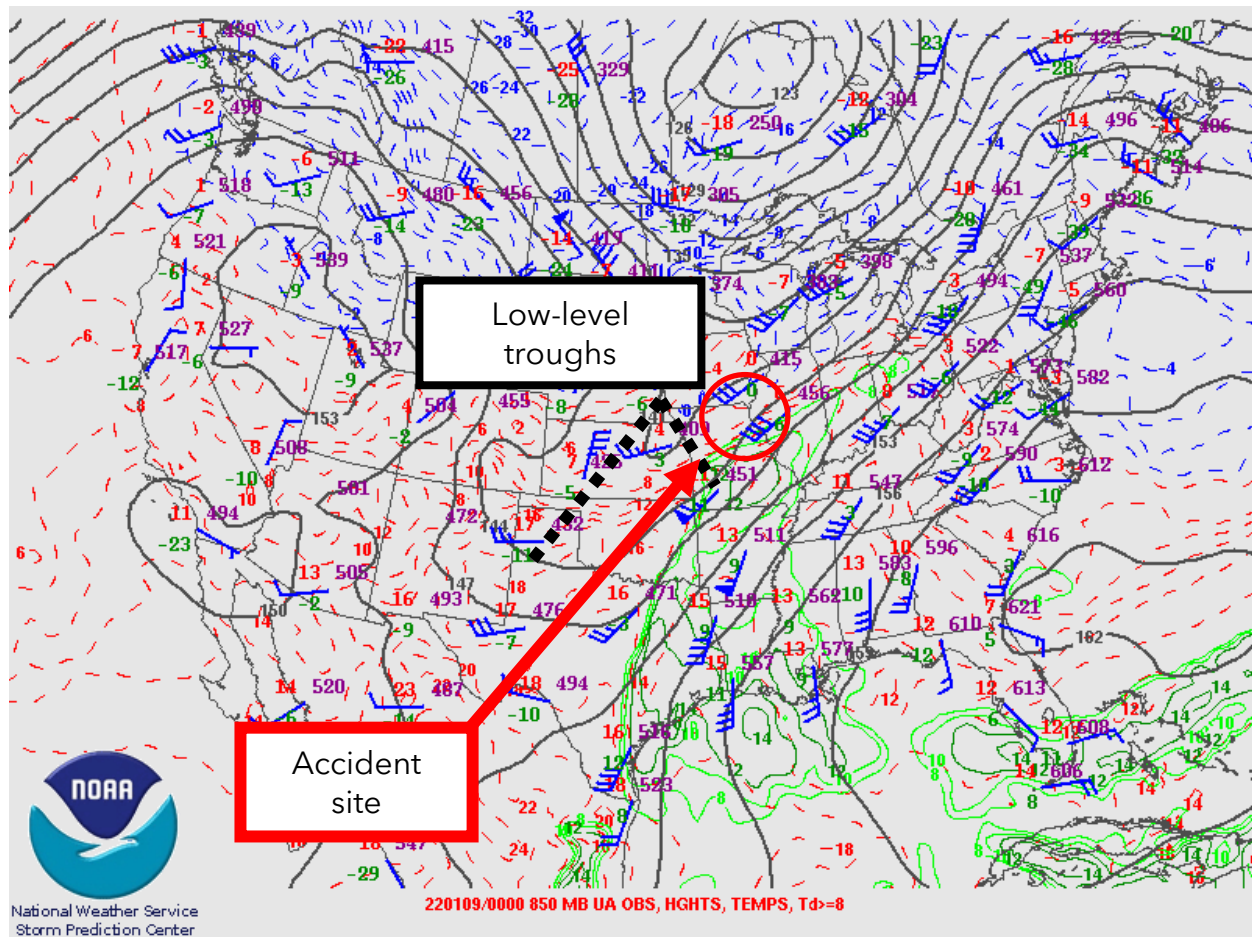


Figure 3. 850-hPa Constant Pressure Chart for 1800 CST.

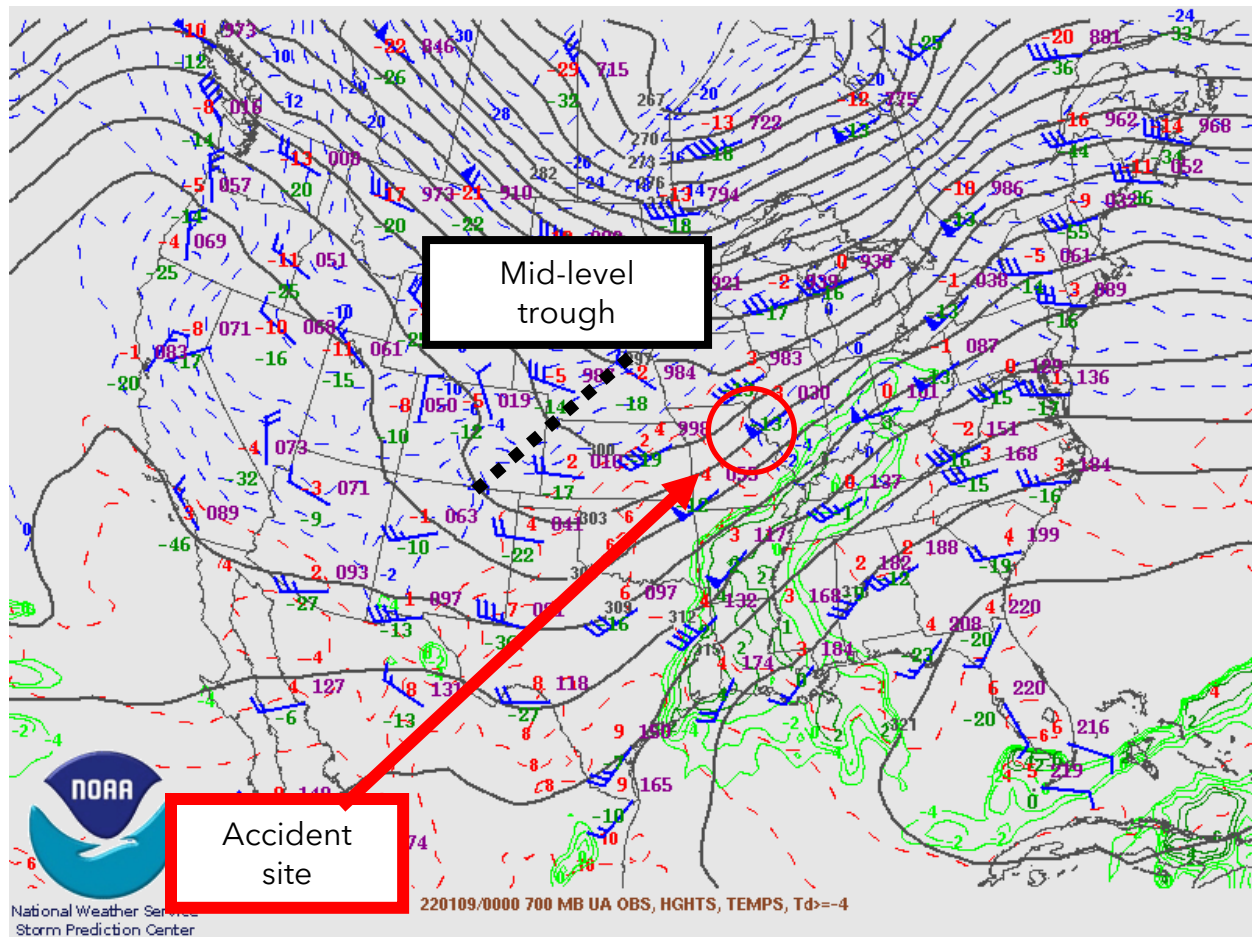


Figure 4. 700-hPa Constant Pressure Chart for 1800 CST.

2.0 Storm Prediction Center Convective Outlook

SPC issued the following Day 1 Convective Outlook at 1847 CST (figure 5) with areas of general thunderstorms forecast for the accident site. SPC defines the “TSTM” area as an area where a 10% or higher probability of thunderstorms is forecast during the valid period. The SPC Day 1 Convective Outlook text follows figure 5.

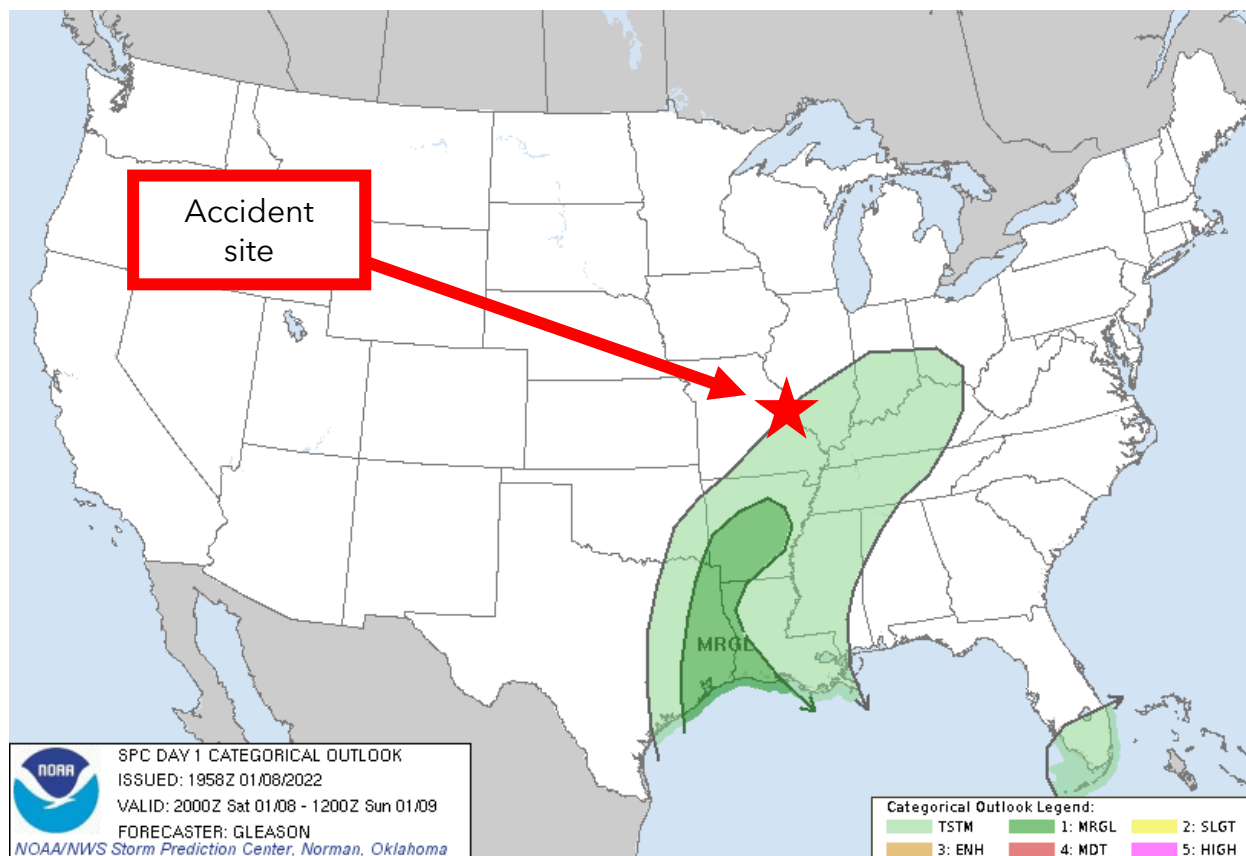


Figure 5. SPC day 1 Convective Outlook valid at the time of the accident.

SPC AC 090047

Day 1 Convective Outlook
NWS Storm Prediction Center Norman OK
0647 PM CST Sat Jan 08 2022

Valid 090100Z - 091200Z

...THERE IS A SLIGHT RISK OF SEVERE THUNDERSTORMS ACROSS PARTS OF EAST TEXAS...

...SUMMARY...

A tornado threat will continue across southeast Texas this evening. A chance of wind damage and hail will also exist across parts of the east Texas and western Louisiana. The hail threat could also affect parts of Arkansas.

...East Texas/Western Louisiana...

The latest water vapor imagery shows west to southwest flow at mid-levels across much of the central United States with a plume of mid-level moisture located from the western Gulf Coast northeastward

into mid Mississippi Valley. A cluster of strong thunderstorms is ongoing in southeast Texas within the southern part of this plume. The storms are located just to the north of Houston along the eastern edge of a corridor of moderate instability, where the RAP has MLCAPE in the 1500 to 2500 J/kg range. In addition to moderate instability, the WSR-88D VWP at Lake Charles has 0-6 km shear near 40 kt with 0-3 km storm relative helicity near 350 m²/s². This should support supercell development across southeast Texas and possibly far western Louisiana this evening. A couple brief tornadoes could occur in southeast Texas this evening. Although an isolated wind gust will also be possible, the tornado threat should be the greater of the two. The threat should remain marginal but will likely persist into the overnight period as low-level flow strengthens.

...Arkansas...

A 50 to 60 kt low-level jet is currently analyzed across the mid Mississippi Valley. The southern part of the jet extends southward into the Arklatex, where low-level moisture advection will continue this evening. Thunderstorms are expected to develop near the axis of the low-level jet later this evening with convection spreading northeastward across northeast Texas and into Arkansas late this evening into the overnight. RAP forecast soundings late this evening in the Arklatex show a sharp temperature inversion and have instability starting above 850 mb. MUCAPE is forecast to be in the 1000 to 1200 J/kg range. This combined with effective shear of 35 to 40 kt should be enough for a marginal hail threat late this evening and continuing throughout much of the night.

..Broyles.. 01/09/2022

[CLICK TO GET WUUS01 PTSDY1 PRODUCT](#)

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 0600Z

3.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials Reports (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 6 is a local sectional chart with the accident site and the closest weather reporting locations marked. The chart depicted the magnetic variation⁴ of 1° west over the area.

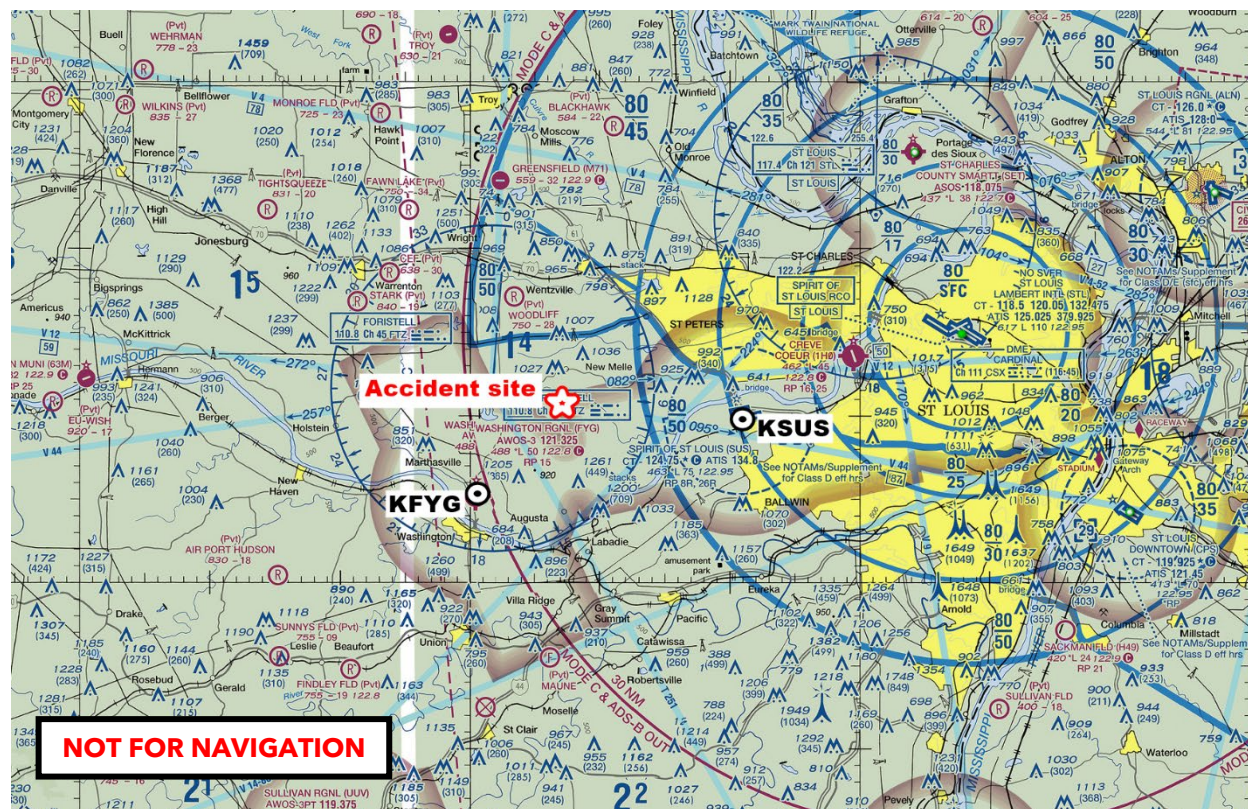


Figure 6. Sectional map of the accident area with the location of the accident site and surface observation sites.

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

Washington Regional Airport (KFYG) had the closest official weather station to the accident site. KFYG had an Automated Weather Observing System (AWOS⁵) whose longline⁶ reports were not augmented. The KFYG AWOS was located 8 miles southwest of the accident site, at an elevation of 488 ft, and issued the following observations surrounding the period of the accident:⁷

[1755 CST] METAR KFYG 082355Z AUTO 14005KT 10SM OVC010
06/06 A2995 RMK AO2=

[1815 CST] METAR KFYG 090015Z AUTO 16008KT 10SM OVC010
06/06 A2995 RMK AO2 LTG DSNT SE AND S=

[1835 CST] METAR KFYG 090035Z AUTO 16010KT 4SM BR OVC010
07/07 A2995 RMK AO2 LTG DSNT SE=

[1855 CST] METAR KFYG 090055Z AUTO 16010KT 6SM BR OVC010
07/07 A2994 RMK AO2 LTG DSNT SE=

***[1915 CST] METAR KFYG 090115Z AUTO 16008G14KT 8SM
OVC009 07/07 A2995 RMK AO2=***

ACCIDENT TIME 1919 CST

***[1935 CST] METAR KFYG 090135Z AUTO 16008KT 10SM OVC010
07/07 A2996 RMK AO2=***

[1955 CST] METAR KFYG 090155Z AUTO 18012KT 10SM OVC011
08/08 A2996 RMK AO2=

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

⁵ 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.

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 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.

KFYG weather at 1915 CST, automated, wind from 160° at 8 knots with gusts to 14 knots, visibility 8 miles, overcast ceiling at 900 ft above ground level (agl), temperature of 7°C, dew point temperature 7°C, and an altimeter setting of 29.95 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator.

KFYG weather at 1935 CST, automated, wind from 160° at 8 knots, visibility 10 miles or more, overcast ceiling at 1,000 ft agl, temperature of 7°C, dew point temperature 7°C, and an altimeter setting of 29.96 inHg. Remarks, automated station with a precipitation discriminator.

The next closest official weather station to the accident site was Spirit of St Louis Airport (KSUS) which was also the departure airport. KSUS had an Automated Surface Observing System (ASOS⁸) whose longline reports were augmented by air traffic control (ATC) when the tower was in operation⁹. The KSUS ASOS was located 11 miles east of the accident site at an elevation of 463 ft. KSUS ASOS observations surrounding the accident time are shown below:

[1654 CST] METAR KSUS 082254Z 00000KT 2SM BR OVC010 06/04
A2993 RMK AO2 RAB2155E36 SLP143 P0003 T00560044=

[1701 CST] SPECI KSUS 082301Z 08003KT 3SM BR OVC009 05/04
A2993 RMK AO2 T00500039=

[1754 CST] METAR KSUS 082354Z 18004KT 10SM OVC013 07/05
A2995 RMK AO2 SLP149 60003 T00670050 10067 20028 53002=

[1854 CST] METAR KSUS 090054Z 19005KT 10SM OVC011 07/06
A2996 RMK AO2 SLP151 T00670056=

*[1907 CST] SPECI KSUS 090107Z 19007KT 2SM BR OVC010 07/06
A2996 RMK AO2 CIG 008V013 T00670056=*

ACCIDENT TIME 1919 CST

*[1954 CST] METAR KSUS 090154Z 19007KT 10SM OVC011 07/06
A2997 RMK AO2 SLP155 T00670056=*

[2054 CST] METAR KSUS 090254Z 00000KT 8SM -RA OVC012 07/06
A2998 RMK AO2 RAB25 SLP157 P0000 60000 T00720061 52009

⁸ ASOS - Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure. ASOS are maintained by the NWS.

⁹ ATC operational hours 0600 to 2300 local time.

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

KSUS weather at 1907 CST, wind from 190° at 7 knots, visibility 2 miles, mist, overcast ceiling at 1,000 ft agl, temperature of 7°C, dew point temperature 6°C, and an altimeter setting of 29.96 inHg. Remarks, automated station with a precipitation discriminator, ceiling varying between 800 and 1,300 ft agl, temperature 6.7°C, dew point temperature 5.6°C.

KSUS weather at 1954 CST, wind from 190° at 7 knots, visibility 10 miles or greater, overcast ceiling at 1,100 ft agl, temperature of 7°C, dew point temperature 6°C, and an altimeter setting of 29.97 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure 1015.5 hPa, temperature 6.7°C, dew point temperature 5.6°C.

The observations from KFYG and KSUS surrounding the accident time indicated IFR¹⁰ to MVFR conditions due to low ceilings and visibility restricted in mist, with southerly surface wind gusting to 14 knots.

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.

4.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)¹¹ model sounding was created for the approximate accident site coordinates for 1900 CST with a surface elevation of 715 ft.¹² The 1900 CST HRRR sounding was plotted on a standard Skew-T Log P diagram¹³ with the derived stability parameters included in figure 7 with data from the surface to 600-hPa (or approximately 14,000 ft). These data were analyzed using the RAOB¹⁴ software package. The sounding depicted the lifted condensation level (LCL)¹⁵ at 1,174 ft and the convective condensation level (CCL)¹⁶ at 10,476 ft. The freezing level was located at 11,335 ft. The precipitable water value was 0.95 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 Esonde 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 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.

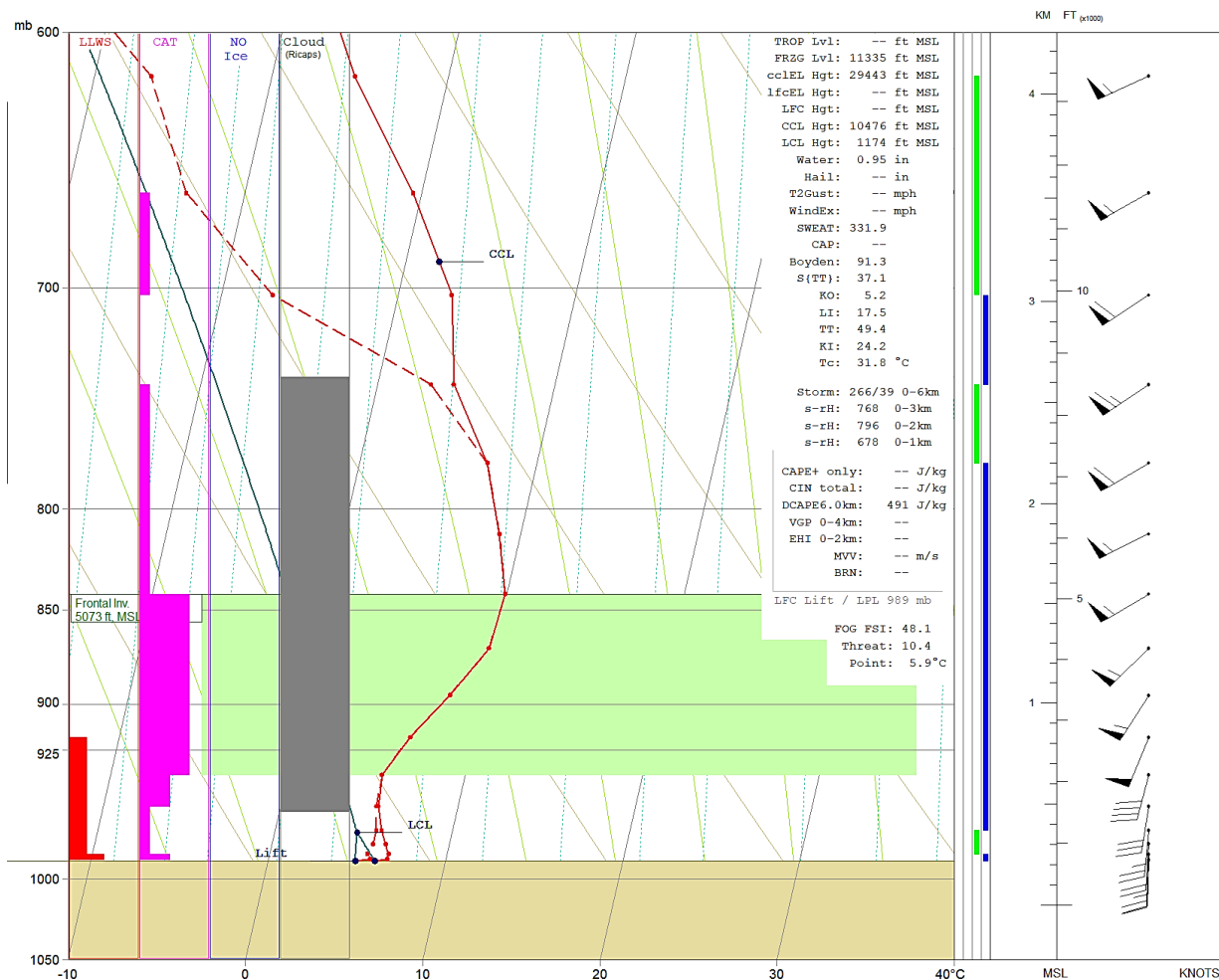


Figure 7. 1900 CST HRRR sounding.

The 1900 CST HRRR sounding for the accident site indicated a stable environment from ~300 ft agl through 7,000 ft msl and a conditionally unstable environment from 7,000 ft msl through 8,500 ft msl. Clouds were indicated by RAOB to be present from 2,000 ft msl through 8,500 ft msl. The top of a frontal inversion¹⁷ was noted at 5,073 ft msl. No icing potential was indicated by RAOB below 10,000 ft msl.

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").

The 1900 CST HRRR sounding wind profile indicated a near surface wind from 182° at 10 knots with the wind veering¹⁸ to the southwest by 3,000 ft. The wind speed increasing to 50 knots by 2,750 ft and to 65 knots above 8,000 ft. RAOB indicated the possibility of light to moderate low-level wind shear (LLWS) below 2,000 ft agl, and light to moderate clear air turbulence below 11,000 ft. At the accident aircraft's altitude before descent¹⁹, near 8,000 ft, the temperature was 5.4°C and the wind was from 236° at 63 knots.

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 1600 CST through 2200 CST and reviewed, and the closest images to the time of the accident were documented. Given the sun angle, the visible imagery (band 2) did not provide useful information.

Figure 8 presents the GOES-16 infrared imagery from 1920 CST at 4X magnification with the accident site highlighted with a red square and cloud cover indicated above the accident site. The lower brightness temperatures (green and blue colors; higher cloud tops) were located to the southeast of the accident site. The cloud cover was moving from southwest to northeast (attachment 1). The brightness temperature of about 274 Kelvin above the accident site would have been near 10,500 ft based on the vertical temperature profile provided by the 1900 CST HRRR sounding (not shown). It should be noted these figures have not been corrected for any parallax error.

¹⁸ A clockwise turning of the wind with height in the northern hemisphere.

¹⁹ See ATC data for more information.

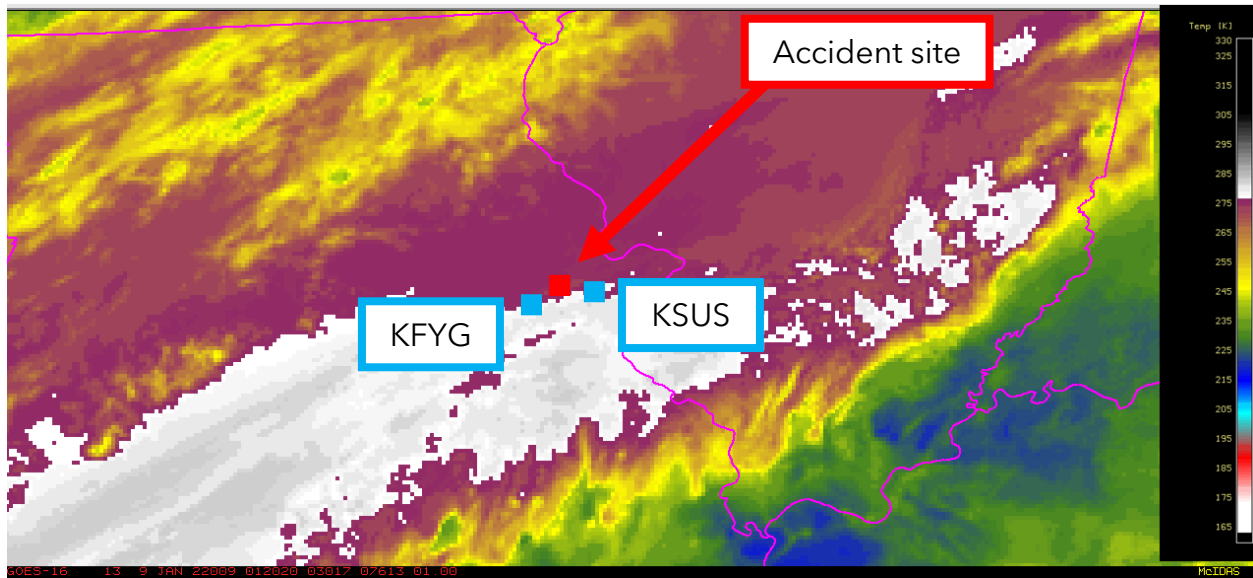


Figure 8. GOES-16 infrared image at 1920 CST.

6.0 National Radar Imagery

A regional view of the NWS National Reflectivity Mosaic is included as figure 9 for 1920 CST with the approximate location of the accident site marked by a red circle. The image depicted no echoes above the accident site.

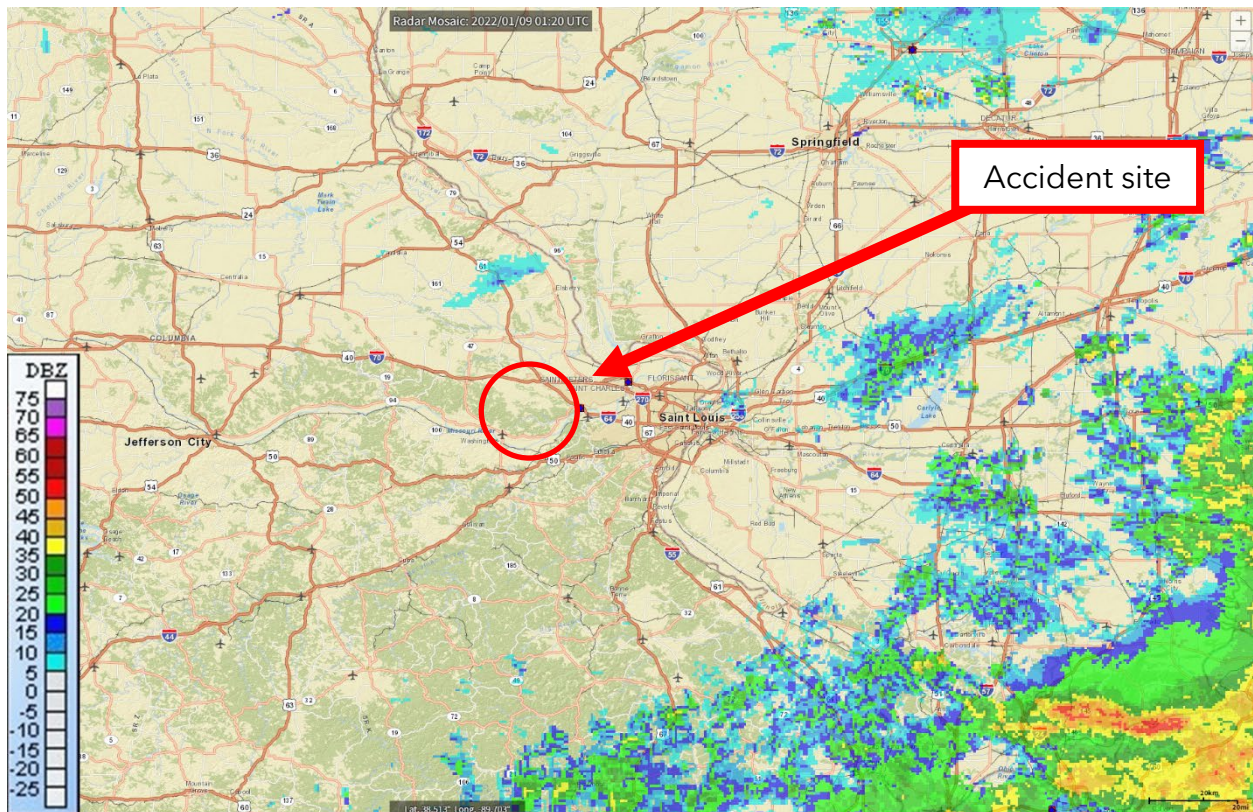


Figure 9. National Reflectivity Mosaic for 1920 CST.

7.0 Pilot Reports

The longline-disseminated pilot reports²⁰ (PIREPs) distributed into the national airspace system (NAS) were reviewed for about two hours either side of the accident time and the PIREPs within 100 miles of the accident site below 18,000 ft are shown below:

SPI UA /OV SPI040002/TM 2329/FLDURGD/TP A320/SK OVC011/RM RY 22 BA 5/5/5

SPI UA /OV SPI/TM 0008/FLDURGC/TP E145/SK OVC010-TOP075/TB LIGHT CHOP
030-060

MWA UA /OV MWA/TM 0046/FLUNKN/TP P212/SK OVC028-TOPUNKN/WX
FV05SM/RM DURD

COU UA /OV KCOU/TM 0210/FL012/TP CL35/SK OVC013/WX FV01SM/RM NEG ICE

²⁰ Only pilot reports with the World Meteorological Organization headers UBMO** and UBIL** were considered. These do not include pilot reports only broadcast via radio.

8.0 Significant Meteorological Information

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

9.0 Center Weather Service Advisories

The Kansas City (ZKC) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. There were no center weather advisories (CWA)s valid from ZKC CWSU at the accident time.

10.0 Airmen's Meteorological Information

There were Airmen's Meteorological Information (AIRMET) advisories Sierra and Tango valid for the accident site at the accident time. AIRMET Sierra issued at 1445 CST forecast IFR conditions due to ceilings below 1,000 ft agl and visibility below 3 miles in precipitation, mist, and fog beyond 2100 CST, while AIRMET Tango issued at 1819 CST (first issued at 1445 CST) forecast LLWS expected:

WAUS43 KPCI 082045
WA3S
-CHIS WA 082045
AIRMET SIERRA UPDT 4 FOR IFR VALID UNTIL 090300

.
**AIRMET IFR...NE KS MN IA MO WI LM LS MI IL IN KY OK AR TN
FROM 70SE YQT TO 50NNE SAW TO 60SW SSM TO 30SSE GRR TO 30W FWA
TO 20S BVT TO 20WNW DYR TO RZC TO OSW TO 50S ICT TO 30NW PWE TO
40S MSP TO 50E DLH TO 70SE YQT
CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS CONTG BYD 03Z THRU 09Z.**

.
AIRMET IFR...ND SD MN
FROM 70WNW INL TO 20SE BJI TO 70SW BRD TO 60SSE BIS TO 30WNW DIK
TO 50NNW ISN TO 70WNW INL
CIG BLW 010/VIS BLW 3SM BR/FG/BLSN. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
OTLK VALID 0300-0900Z...IFR KS MN IA MO WI LM LS MI LH IL IN KY
OK AR TN
BOUNDED BY 70SE YQT-50NNE SAW-50SW SSM-30SE SSM-60WNW YVW-30SE
ECK-FWA-20SSW CVG-40SW IIU-20NNW BNA-RZC-OSW-50W OSW-70ENE ICT-
50ESE OVR-40S MCW-30E MSP-50E DLH-70SE YQT
CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS CONTG THRU 09Z.

....

WAUS43 KPCI 090019 AAB
WA3T
-CHIT WA 090019 AMD
AIRMET TANGO UPDT 6 FOR TURB AND LLWS VALID UNTIL 090300

.
AIRMET TURB...ND SD MN WI LS MI
FROM 70SSE YWG TO YQT TO 70NNE SAW TO 50SW DLH TO 30N PIR TO
30SW DIK TO 70SSE YWG
MOD TURB BTN FL280 AND FL390. CONDS ENDG 21-00Z.

.
AIRMET TURB...ND SD NE MN IA
FROM 70SW YWG TO 30W INL TO 20N RWF TO 40ESE ONL TO 20SSE ANW TO
30S DPR TO 40NNW MOT TO 70SW YWG
MOD TURB BLW 050. CONDS ENDG 00-03Z.

.
AIRMET TURB...IL IN KY...UPDT
FROM FWA TO CVG TO 20NW HNN TO 20SSE BWG TO 70S AXC TO 30WNW TTH
TO FWA
MOD TURB BTN FL250 AND FL360. CONDS DVLPG 21-00Z. CONDS CONTG
BYD 03Z THRU 09Z.
...NEW AIRMET...

.
LLWS POTENTIAL...KS IA MO LM MI LH IL IN KY
BOUNDED BY DXO-FWA-CVG-HNN-50WSW BKW-20SE LOZ-RZC-OSW-50SE ICT-
20SSE MCI-30N IRK-20NNE BDF-DXO
LLWS EXP. CONDS CONTG BYD 03Z THRU 09Z.

.
LLWS POTENTIAL...MN IA WI LM LS MI
BOUNDED BY 80SE YQT-50WNW SSM-70SE GRB-50SW ODI-50ESE DLH-80SE
YQT
LLWS EXP. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
OTLK VALID 0300-0900Z
AREA 1...TURB KS OK TX
BOUNDED BY 20NW GCK-60E ICT-40NNW ABI-20S TXO-20NW GCK
MOD TURB BLW 060. CONDS DVLPG 03-06Z. CONDS CONTG THRU 09Z.

.
AREA 2...TURB MO LM MI LH IL IN...UPDT
BOUNDED BY 50SW YVV-30E ECK-FWA-30WSW FAM-60S COU-20SW COU-20SW
UIN-20WSW ORD-50SW YVV
MOD TURB BTN 040 AND 120. CONDS DVLPG 03-06Z. CONDS CONTG THRU
09Z.
...NEW OUTLOOK...

.
AREA 3...TURB MO MI IL IN KY AR TN MS AL...UPDT
BOUNDED BY FWA-CVG-HNN-40S HNN-50SE BNA-40NW SQS-20ENE LIT-30WSW
FAM-FWA
MOD TURB BTN 020 AND 070. CONDS DVLPG 03-06Z. CONDS CONTG THRU
09Z.

.
AREA 4...TURB IL IN KY...UPDT
BOUNDED BY FWA-CVG-HNN-HMV-40E VXV-50ESE BWG-30SE PXV-20SE AXC-
FWA
MOD TURB BTN FL250 AND FL360. CONDS CONTG THRU 09Z.
...NEW OUTLOOK...

....

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products issued before the accident flight and valid at 1800 CST are shown in attachment 2. The GFA surface forecast applicable to the accident region that was valid before the accident flight's departure for times surrounding the accident time indicated VFR surface visibilities and a south surface wind at 10 knots. The GFA cloud forecast applicable to the accident region that was valid before departure for times surrounding the accident time indicated overcast cloud coverage with bases at 1,700 ft and cloud tops between 7,000 and 9,000 ft. The Graphical AIRMET²¹ (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 were the G-AIRMETs. For more information, please see attachment 2.

12.0 Terminal Aerodrome Forecast

KSUS was the closest airport to the accident site with an NWS Terminal Aerodrome Forecast²² (TAF). The KSUS TAF valid at the time of the accident was issued at 1720 CST and was valid for a 24-hour period beginning at 1800 CST. The 1720 CST TAF for KSUS was as follows:

TAF KSUS 082320Z 0900/0924 17006KT 4SM -DZ BR OVC009

FM090400 20006KT 4SM -RA BR OVC008
FM090900 33009KT P6SM VCSH OVC006
FM091100 34010G20KT P6SM OVC012
FM091300 34014G24KT P6SM OVC040=

Between 1800 and 2200 CST the forecast expected a wind from 170° at 6 knots, 4 miles visibility, light drizzle, mist, and an overcast ceiling at 900 ft agl.

13.0 National Weather Service Area Forecast Discussion

The NWS office in Saint Louis, Missouri, (WFO LSX) was responsible for the public forecast in the region of the accident site. WFO LSX issued the following Area Forecast Discussion (AFD) at 1731 CST, the closest AFD to the accident time with an aviation section, that identified IFR conditions continuing overnight:

²¹ <https://aviationweather.gov/gairmet>

²² 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

FXUS63 KLSX 082331
AFDLSX

Area Forecast Discussion...Updated Aviation
National Weather Service Saint Louis MO
531 PM CST Sat Jan 8 2022

.SHORT TERM... (Through Late Tonight)
Issued at 257 PM CST Sat Jan 8 2022

Temperatures continue to warm a little ahead of schedule. At 200 PM the freezing line now extends from south of Kirksville to Quincy to Litchfield to Lawrenceville. We will therefore take several more counties south of this line out of the advisory for the 300 PM update. We expect the warming trend to continue through the afternoon, and it's likely the freezing rain threat will end by 600 PM. Since the freezing rain has been intermittent/showery rather than a steady drizzle, we've reduced overall total ice accretion amounts to 0.01-0.02 inches. Just a glaze, but still enough to cause problems on untreated surfaces.

All guidance still regenerates an area of rain ahead of the cold front late this afternoon into the evening. Additionally, short range deterministic guidance as well as the SPC HREF push ~500 J/Kg MUCAPE up into the Mid Mississippi Valley though east central and southeast Missouri as well as southwest Illinois. Have therefore kept the mention of thunder in the forecast for tonight. While there is plenty of shear, the low values of MUCAPE preclude elevated severe storms. The short wave driving this cold front will drive through the northern Plains into the Midwest by late tonight, pushing the cold front through our area, which will bring the precip to an end from northwest to southeast.

Carney

.LONG TERM... (Sunday through Next Saturday)
Issued at 257 PM CST Sat Jan 8 2022

Short range deterministic guidance is in good agreement that the front will be through our southeastern counties by 12Z Sunday morning, and all of the precip will have shifted into the Lower Mississippi and Tennessee Vallies. High pressure then builds across the Midwest Sunday, and the northwest flow across the area will suppress temperatures into the mid 20s in northeast Missouri and west central Illinois to around 40 in southeast Missouri. Another weak short wave will move quickly through the area Monday, bringing little more than a brief wind shift back to the west-southwest. However, this should allow temperatures across most of the area to warm up further than they otherwise would under the influence of a strong high pressure system in deep northwest flow this time of year.

Dry weather and warming temperatures will be the story of next week

as the upper level flow shifts from persistent northwesterly to more zonal with progressive short waves. Medium range deterministic guidance is in good agreement through the week, even to the end of the forecast next Saturday. The next chance for measurable precipitation looks like it will be on Friday ahead of a cold front which will usher in another strong high pressure system next weekend.

Carney

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**.AVIATION... (For the 00z TAFs through 00z Sunday Evening)
Issued at 528 PM CST Sat Jan 8 2022**

The main focus for this forecast period will be impacts from rain and low stratus. Currently, all local terminals have either low MVFR or IFR ceilings, and these ceilings are expected to drop more through the evening with all sites expected to experience IFR conditions overnight. Confidence is greatest in the values currently in the TAFs, but I can't rule out ceilings dropping another hundred feet or two from the current forecast. While the onset of rain for some terminals has been delayed this evening, rain is still expected to spread over the region this evening, bringing reductions in visibility. An isolated thunderstorm or two is also possible near KSUS, KSTL, and KCPS, but confidence in these storms' occurrence is low enough to leave out of the TAFs for now. As a cold front pushes over the terminals early tomorrow morning, rain chances will dwindle, ceilings will gradually improve, and winds will shift to out of the northwest and gust.

Elmore

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.LSX WATCHES/WARNINGS/ADVISORIES...

MO...Winter Weather Advisory until 9 PM CST this evening for Knox MO-Lewis MO.

IL...Winter Weather Advisory until 9 PM CST this evening for Adams IL-Brown IL-Fayette IL-Macoupin IL-Montgomery IL.

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14.0 Winds and Temperature Aloft Forecast

The NWS 1357 CST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

FBUS31 KWNO 081957

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
STL 2260 2461+07 2451+06 2452-02 2459-15 2460-29 255443 256747 258049

The closest forecast point to the accident site was Saint Louis, Missouri (STL). The 1357 CST STL forecast for use between 1400 CST and 2100 CST indicated a wind at 3,000 ft from 220° at 60 knots, a wind at 6,000 ft from 240° at 61 knots with a temperature of 7°C, and a wind at 9,000 ft from 240° at 51 knots with a temperature of 6°C.

15.0 Pilot Weather Briefing

The accident pilot did not request weather information²³ from Leidos Flight Service.

A search of archived ForeFlight information indicated that the accident pilot did have a ForeFlight account and requested and received a ForeFlight weather briefing at 1815 CST. The weather briefing contained all the standard official weather information valid at 1815 CST. With no internet access while in flight, ForeFlight is still able to access weather information directly from the FAA, but leaving no remote record of such access. For more information please see attachment 3.

16.0 Astronomical Data

The astronomical data obtained for the accident site on January 8, 2022, indicated the following:

SUN

Begin civil twilight	0652 CST
Sunrise	0721 CST
Sun transit	1210 CST
Sunset	1700 CST
End civil twilight	1729 CST
Accident time	1919 CST²⁴

²³ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

²⁴ Inserted accident time for reference and context.

MOON

Moonrise	1125 CST
Moon transit	1732 CST
Accident time	1919 CST
Moonset	2347 CST

At the time of the accident the Moon was located at an altitude of 44.37° and azimuth of 218.49° with 43.1% of the Moon's disk illuminated.

E. LIST OF ATTACHMENTS

Attachment 1 - GOES-16 Infrared satellite imagery from 1806 to 2006 CST

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

Attachment 3 - ForeFlight correspondence

Submitted by:

Paul Suffern
Senior Meteorologist