



## **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety  
Washington, D.C. 20594

March 30, 2020

### **Weather Study**

# **METEOROLOGY**

CEN20FA070

## Table Of Contents

|      |                                           |    |
|------|-------------------------------------------|----|
| A.   | ACCIDENT .....                            | 3  |
| B.   | METEOROLOGIST .....                       | 3  |
| C.   | SUMMARY .....                             | 3  |
| D.   | DETAILS OF THE INVESTIGATION .....        | 3  |
| E.   | WEATHER INFORMATION .....                 | 4  |
| 1.0  | Synoptic Conditions.....                  | 4  |
| 1.1  | Surface Analysis Chart .....              | 4  |
| 1.2  | National Composite Radar Mosaic .....     | 5  |
| 2.0  | Observations .....                        | 6  |
| 2.1  | Springfield, Illinois .....               | 6  |
| 2.2  | METAR Display .....                       | 7  |
| 3.0  | Sounding .....                            | 8  |
| 4.0  | Satellite Imagery .....                   | 10 |
| 5.0  | Pilot Reports.....                        | 12 |
| 6.0  | Current Icing Products .....              | 14 |
| 7.0  | NWS Forecasts.....                        | 16 |
| 7.1  | Terminal Aerodrome Forecasts.....         | 16 |
| 7.2  | Area Forecast Discussion.....             | 16 |
| 7.3  | Graphic Forecast for Aviation .....       | 17 |
| 7.4  | Winds and Temperature Aloft Forecast..... | 19 |
| 8.0  | NWS Inflight Weather Advisories.....      | 19 |
| 9.0  | Preflight Weather Briefing.....           | 21 |
| 10.0 | Astronomical Conditions .....             | 22 |
| F.   | LIST OF ATTACHMENTS .....                 | 22 |

## **A. ACCIDENT**

Location: Springfield, Illinois  
Date: January 28, 2020  
Time: 1503 central standard time  
2103 Universal Coordinated Time (UTC)  
Airplane: Piper Aerostar PA-60-601P; Registration: N6071R

## **B. METEOROLOGIST**

Donald Eick  
Meteorology Specialist  
Operational Factors Division (AS-30)  
National Transportation Safety Board

## **C. SUMMARY**

On January 28, 2020, about 1503 central standard time, a Piper PA-60-601P airplane, N6071R, collided with terrain while on an instrument approach to Abraham Lincoln Capital Airport (KSPI), Springfield, Illinois. The airline transport pilot, 2 passengers, and a dog were fatally injured. The airplane was destroyed during a postimpact fire. The airplane was owned by LKJ Properties, LLC, and operated under Title 14 *Code of Federal Regulations* Part 91 on an instrument flight rules (IFR) flight plan. Day instrument meteorological conditions (IMC) prevailed at the accident site. The personal cross-country flight departed Huntsville International Airport (KHSV), Huntsville, Alabama, at 1301.

## **D. DETAILS OF THE INVESTIGATION**

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are central standard time (CST) based upon the 24-hour clock, local time is -6 hours from UTC, and UTC=Z. NWS airport and station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site was located at latitude 39.76239° N and longitude 089.57219° W, at an elevation of approximately 582 ft.

## E. WEATHER INFORMATION

### 1.0 Synoptic Conditions

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 (NCEP) and the WPC located in College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45H change 2.

#### 1.1 Surface Analysis Chart

The central section of the NWS Surface Analysis Chart for 1500 CST is included as figure 1 with the approximate accident site marked by a red star.

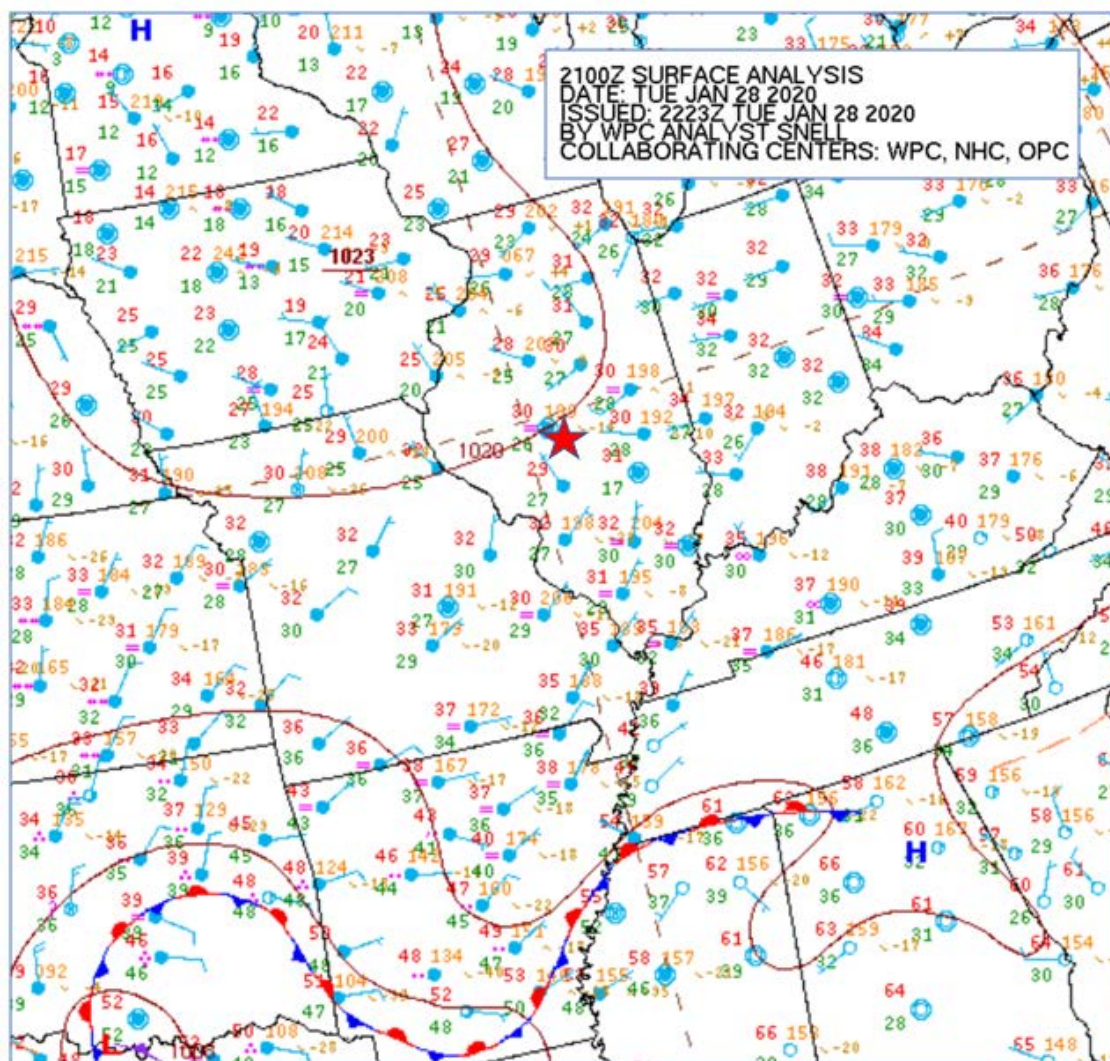


Figure 1 - NWS Surface Analysis Chart for 1500 CST with the accident site marked by a red star

The chart depicted a cold core high pressure system<sup>1</sup> over Minnesota at 1023- hectopascals (hPa)<sup>2</sup> with a ridge of high pressure extending southeast across Iowa into Illinois. A developing low pressure system with an associated occluded frontal system was located along the Texas and Oklahoma border, with an extensive area of precipitation. A stationary front extended immediately north of the low pressure system and extended across Oklahoma, Arkansas, into northern Mississippi and Alabama.

The station models across Illinois depicted light northwest to north winds, overcast cloud cover with visibility restricted in mist. The temperatures were in the high 20's to low 30's degrees Fahrenheit (F), with dew point temperatures a few degrees below the air temperature.

## 1.2 National Composite Radar Mosaic

The National Composite Radar Mosaic for 1500 CST centered over Springfield, Illinois is included as figure 2. The chart depicted no significant echoes associated with any areas of organized precipitation or any boundaries. Several false echoes or ground clutter were identified in the vicinity of the accident site and to the northeast over northern Illinois, which did not move with time. The false echoes were also confirmed by reviewing data from the closest NWS regional weather surveillance radar for the period.

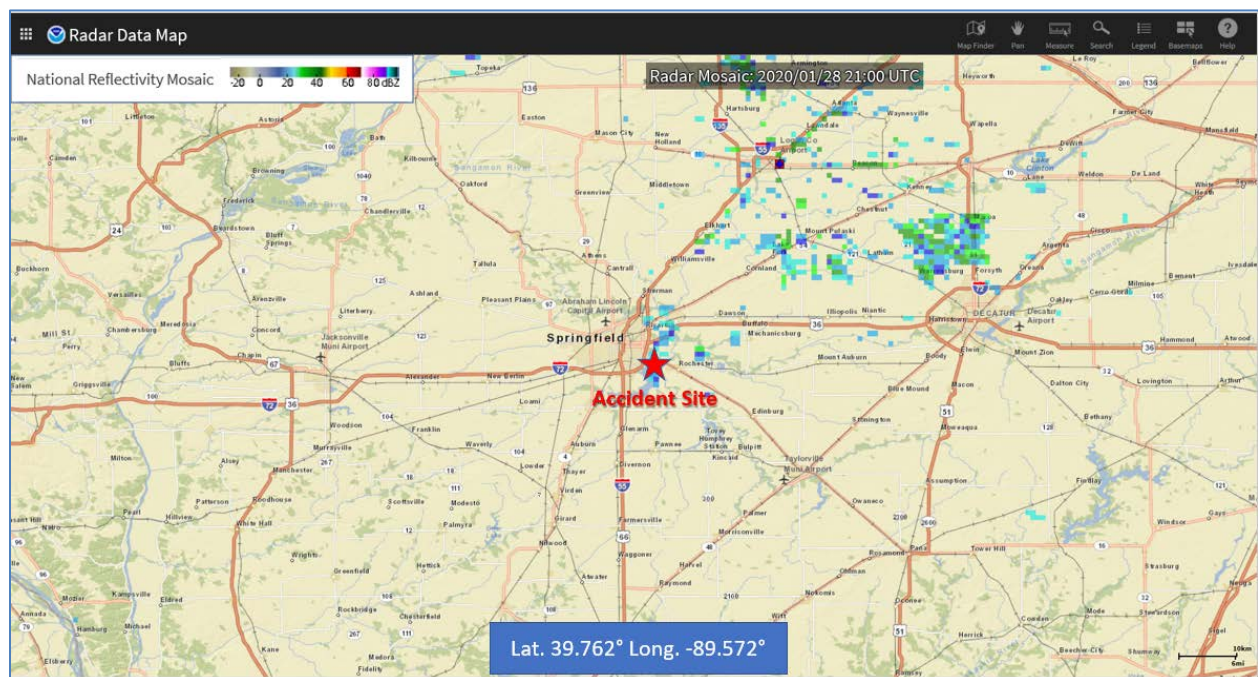


Figure 2 - National Composite Radar Mosaic for 1500 CST

<sup>1</sup> A cold core high pressure system weakens rapidly with height due to the cold dense air and will be weak or be replaced by an upper level trough at high altitudes.

<sup>2</sup> Hectopascals is the new NWS reference for reporting sea level pressure and is interchangeable with the former term millibar (mb) with the same units. Standard sea-level pressure is 1013.25-hPa at 59° Fahrenheit (F) or 15° Celsius (C).

## 2.0 Observations

The official observations issued surrounding the accident site were documented using standard meteorological aerodrome reports (METARs) and specials (SPECI). Cloud heights are reported above ground level (agl) in the following section, and the magnetic variation was estimated at 2° west based on the latest sectional chart for the area.

### 2.1 Springfield, Illinois

The accident site was located approximately 7 miles southeast of Abraham Lincoln Capital Airport (KSPI), Springfield, Illinois, the planned destination, at an elevation of 598 ft. The airport had a federally installed and maintained Automated Surface Observation System (ASOS), which was augmented by air traffic control personnel. The following conditions were being reported at the time of the accident:

*Weather observation for KSPI at 1452 CST, wind calm, visibility 5 miles in mist, ceiling overcast at 700 ft agl, temperature -1° C, dew point -3° C, altimeter 30.10 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1019.9-hPa, temperature -1.1° C, dew point -3.3° C, 3-hour pressure tendency decreasing and then increasing 1.4-hPa.*

The general flight categories<sup>3</sup> and raw observations from approximately 0815 through 1800 CST for KSPI were as follows:

**IFR** METAR KSPI 281652Z 32003KT 4SM BR OVC005 M02/M03 A3014 RMK AO2 SLP212 T10171033=

**IFR** METAR KSPI 281752Z 22004KT 5SM BR OVC005 M02/M03 A3014 RMK AO2 SLP213 I6000 T10221033  
11017 21022 57001=

**IFR** METAR KSPI 281852Z 26005KT 5SM BR OVC006 M02/M03 A3013 RMK AO2 SLP209 T10171033=

**IFR** METAR KSPI 281952Z 28004KT 4SM BR OVC005 M02/M03 A3011 RMK AO2 SLP202 T10171033=

**IFR** METAR KSPI 282052Z 00000KT 5SM BR OVC007 M01/M03 A3010 RMK AO2 SLP199 T10111033  
56014=

#### **Accident 2103Z**

**IFR** METAR KSPI 282152Z 35004KT 5SM BR OVC008 M01/M03 A3010 RMK AO2 SLP198 T10111033=

---

<sup>3</sup> As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories based on weather conditions reported:

- 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.

*IFR METAR KSPI 282252Z 35003KT 5SM BR OVC009 M01/M03 A3011 RMK AO2 SLP201 T10111033=*

*MVFR SPECI KSPI 282322Z 00000KT 9SM OVC010 M01/M04 A3011 RMK AO2 T10111039=*

*MVFR METAR KSPI 282352Z 00000KT 7SM OVC011 M01/M04 A3012 RMK AO2 SLP205 T10111039 11011  
21022 53006*

The observations indicated that IFR conditions prevailed surrounding the period of the accident with a ceiling overcast from 500 ft to 800 ft agl with visibility 4 to 5 miles in mist. A further review of the past 24 hours indicated the minimum temperature reported on January 28<sup>th</sup> was 28° F (-2° C) with a high temperature of 30° F (-1° C). No precipitation was recorded in the 24-hour period leading to the time of the accident.

## **2.2 METAR Display**

The NWS Aviation Weather Center's (AWC) display of METARs for 1500 CST from their website<sup>4</sup> is included as figure 3 with the approximate accident site marked by the red star. The temperatures and dew point temperatures are in °F and the ceiling heights are in 100's ft agl. The image depicted the majority of the stations reporting IFR to MVFR conditions across the region with overcast cloud cover and visibility restricted in mist or haze. No precipitation was reported in the surrounding area.

---

<sup>4</sup> <https://aviationweather.gov/metar>

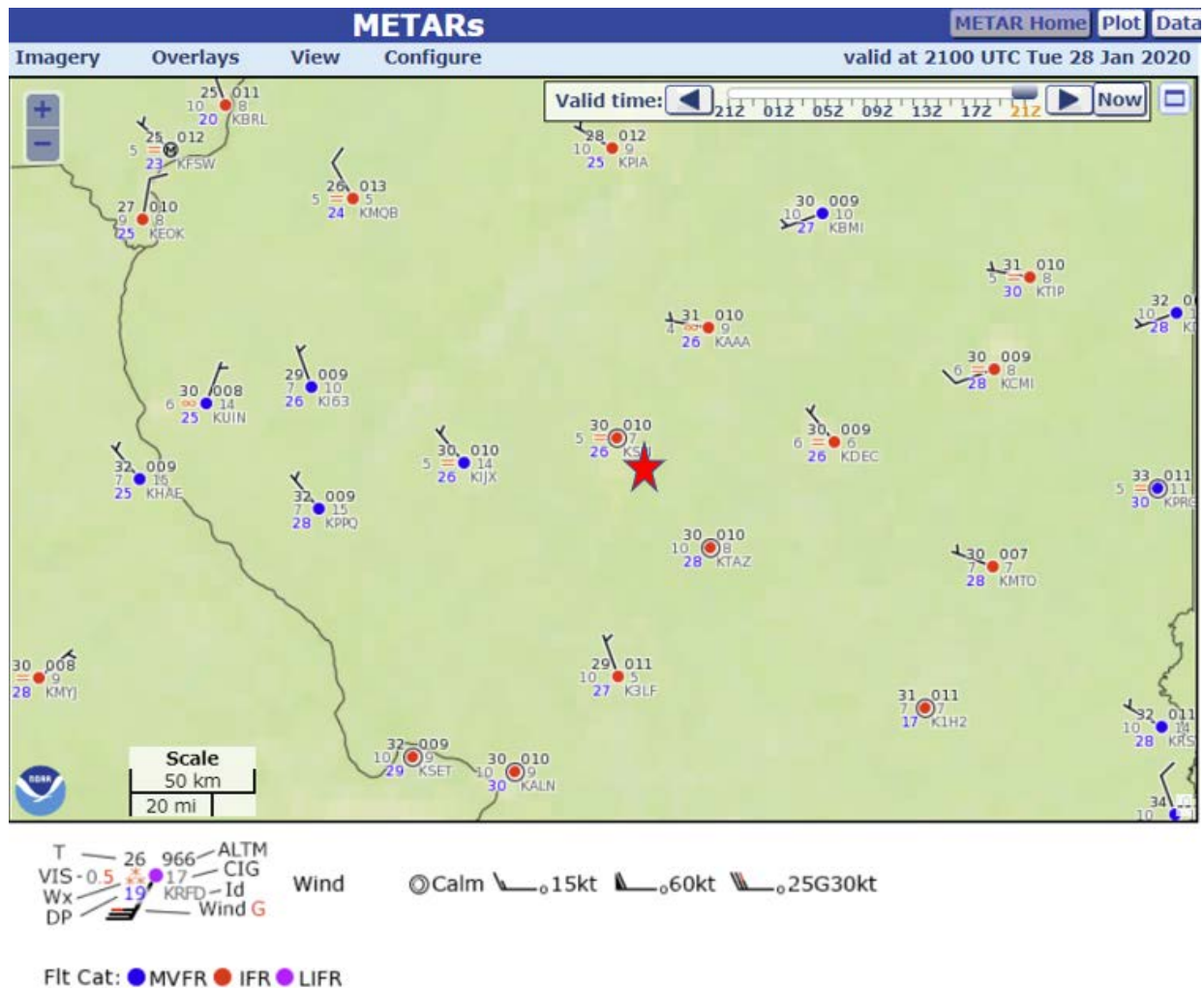


Figure 3 - NWS Aviation Weather Center's METAR display at 1500 CST with accident site marked by a star

### 3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site a High-Resolution Rapid Refresh (HRRR)<sup>5</sup> numerical model data was retrieved from the NOAA Air Resources Laboratory and plotted on a standard Skew T log P diagram<sup>6</sup> using the complete Rawinsonde Observation RAOB program software<sup>7</sup>. Figure 4 is the 1500 CST HRRR numerical model sounding over the accident site from the surface to approximately 450-hPa or 21,000 ft.

<sup>5</sup> The HRRR is a National Oceanic and Atmospheric Administration (NOAA) real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.

<sup>6</sup> Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

<sup>7</sup> RAOB software – The complete RAWinsonde OBservation program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data

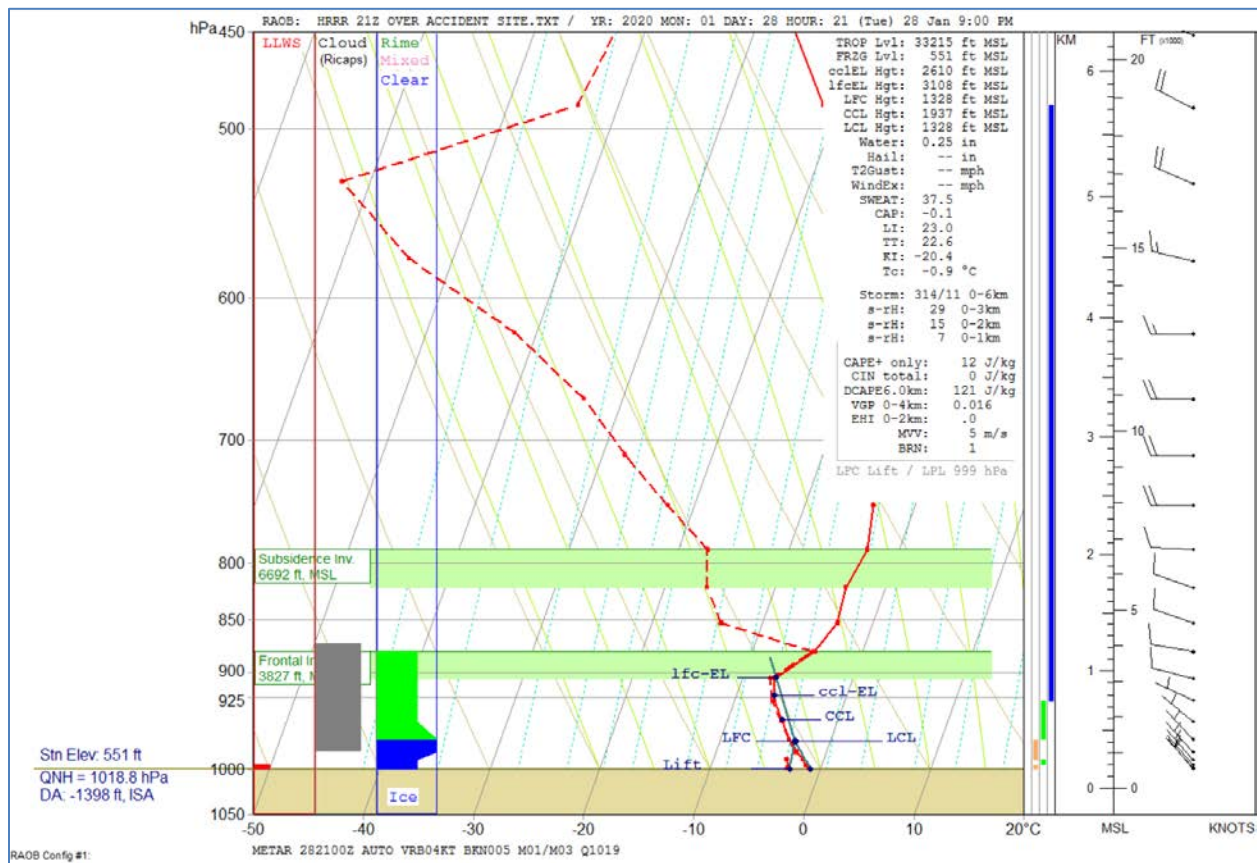


Figure 4 - HRRR numerical model for 1500 CST over the accident site

The HRRR 1500 CST sounding depicted a surface temperature of  $-0.9^{\circ}\text{C}$  ( $30^{\circ}\text{F}$ ), a dew point temperature of  $-2.8^{\circ}\text{C}$  ( $27^{\circ}\text{F}$ ) and a relative humidity of 87%. The lifted condensation level (LCL)<sup>8</sup> and level of free convection (LFC)<sup>9</sup> were identified at 777 ft agl, with the convective condensation level (CCL)<sup>10</sup> at 1,386 ft agl. The sounding supported clouds between 800 ft agl and 4,000 ft (the layer where the relative humidity exceeded 97%) and is indicated by the gray shading on the left side of the sounding plot. The precipitable water<sup>11</sup> content was 0.25 inches. An inversion was noted between 3,200 ft and 6,692 ft where temperature increased or remained constant with altitude, and with defined drier air above. The freezing level was at the surface with the entire sounding remaining below freezing. The atmosphere was characterized as stable based on the Lifted Index<sup>12</sup> of 23. The RAOB program identified the potential for light rime type icing in the clouds below 4,000 ft with the risk of clear type ice near the cloud bases.

<sup>8</sup> Lifting Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

<sup>9</sup> Level of Free Convection (LFC) - the last level where a parcel becomes buoyant, or "warmer" than the environmental temperature at the same level. The LFC represents the bottom of the layer containing CAPE.

<sup>10</sup> Convective Condensation Level (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.

<sup>11</sup> Precipitable Water (PW) - The total amount of (condensed) water available within the lowest 400 mb of the sounding.

<sup>12</sup> Lifted Index (LI) - the difference between the lifted parcel temperature at 500 hPa and the 500 hPa temperature in the sounding. Negative values denote parcels that are warmer than the background 500 hPa temperatures and are thus

The HRRR wind profile indicated a light and variable near-surface wind at 3 knots with wind from the northwest immediately above the surface and backing<sup>13</sup> to the west through 6,000 ft with wind speed below 10 knots. Winds gradually increased in speed above 10,000 ft to above 20 knots. The mean 0 to 6 kilometer or 18,000 ft wind was from 284° at 15 knots. No strong vertical wind shears were noted in the winds below 10,000 ft other than near the inversions, which suggests any turbulence would have been of light intensity.

Figure 5 is a table of the HRRR model parameters of height, pressure (Pres), temperature (T), dew point (Td), relative humidity (RH), wind direction and speed (DD/FF), and RAOB derived clear air turbulence (CAT), low-level wind shear (LLWS), and potential icing conditions from the surface through 10,000 ft.

| Height<br>(ft-MSL) | Pres<br>(hPa) | T<br>(C) | Td<br>(C) | RH<br>(%) | DD / FF<br>(deg / kts) | CAT<br>(FAA) | LLWS  | Icing - Type<br>(AFGWC method) |
|--------------------|---------------|----------|-----------|-----------|------------------------|--------------|-------|--------------------------------|
| 551                | 999           | -0.9     | -2.8      | 87        | 322 / 4                |              | LIGHT | LGT Clear                      |
| 577                | 998           | -1.1     | -3.1      | 86        | 320 / 3                |              | LIGHT | LGT Clear                      |
| 656                | 995           | -1.5     | -3.0      | 89        | 321 / 4                |              |       | LGT Clear                      |
| 814                | 989           | -1.9     | -3.4      | 89        | 321 / 4                |              |       | LGT Clear                      |
| 1026               | 981           | -2.7     | -2.9      | 99        | 320 / 5                |              |       | MDT Clear                      |
| 1373               | 968           | -3.8     | -3.8      | 100       | 319 / 5                |              |       | MDT Clear                      |
| 1886               | 949           | -5.0     | -5.1      | 99        | 312 / 6                |              |       | LGT Rime                       |
| 2462               | 928           | -6.4     | -6.6      | 98        | 297 / 7                |              |       | LGT Rime                       |
| 3077               | 906           | -7.1     | -7.5      | 97        | 285 / 9                |              |       | LGT Rime                       |
| 3827               | 880           | -4.3     | -4.5      | 99        | 281 / 9                |              |       | LGT Rime                       |
| 4635               | 853           | -3.2     | -13.8     | 44        | 291 / 9                |              |       |                                |
| 5627               | 821           | -3.6     | -16.2     | 37        | 291 / 8                | LGT          |       |                                |
| 6692               | 788           | -2.9     | -17.4     | 32        | 273 / 11               | LGT          |       |                                |
| 7940               | 751           | -3.8     | -22.5     | 22        | 270 / 18               |              |       |                                |
| 9353               | 711           | -5.5     | -28.0     | 15        | 270 / 21               |              |       |                                |
| 10910              | 669           | -8.6     | -33.6     | 11        | 270 / 20               |              |       |                                |

Figure 5 - HRRR model sounding parameters from the surface through 10,000 ft

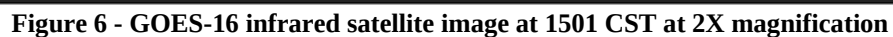
#### 4.0 Satellite Imagery

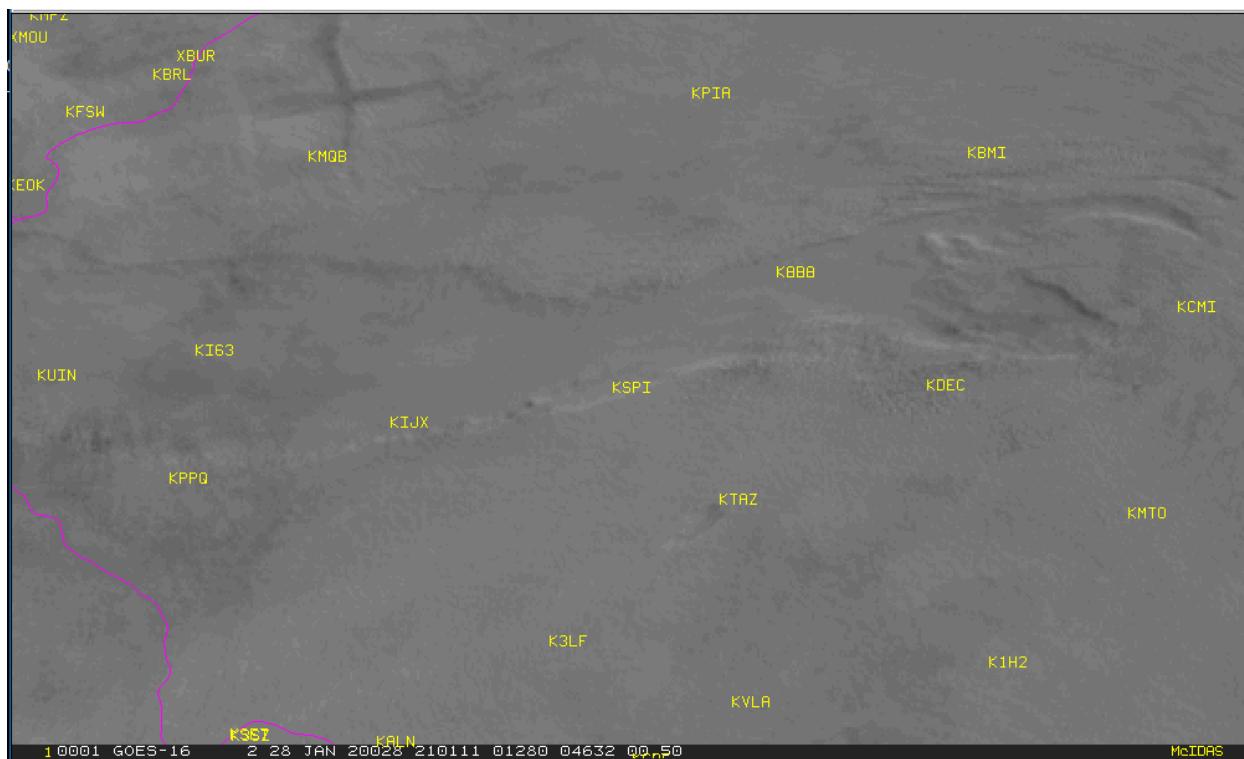
The Geostationary Operational Environmental Satellite number 16 (GOES-16) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. The infrared long wave and visible imagery were obtained surrounding the time of the accident, with the images closest to the time of the accident documented below. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (µm) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km. The visible (band 2) at a wavelength of 0.64 µm provided images at a resolution of 0.5 km.

buoyant or "unstable".

<sup>13</sup> Backing wind is one that changes counter-clockwise direction with increasing height in the Northern Hemisphere, and typically indicates cold air advection. Opposite of veering wind.

Figure 7 is the GOES-16 visible image for the same time period at 2X magnification providing higher resolution of the low stratiform clouds over the area.





**Figure 7 - GOES-16 visible image at 1501 CST at 2X magnification**

## 5.0 Pilot Reports

The following pilot reports (PIREPs) were reported within 100 miles of KSPI and below 18,000 ft between 0900 and 1800 CST. The reports are provided in standard code and abbreviations with time referenced in UTC.

*DEC UA /OV DEC18005/TM 1516/FL11/TP C402/SK TOPS 32 BASES 11/TA 00/IC LGT MXD/RM ON DCNT TO KDEC*

*BMI UUA /OV BMI/TM 1543/FL044/TP E135/SK OVC013-TOP044/TA M05/IC MOD RIME*

*DEC UA /OV 3NM SE OF KDEC/TM 1545/FL10/TP C402/SK OVC005/WX 4SM/TA M05/IC MOD MIXED/RM TOPS 3300 BASES 1000*

*PIA UA /OV KPIA/TM 1606/FL016/TP CRJ2/SK OVC016-TOP033 CLR ABOVE/TA M03/IC LGT RIME/RM DURC RWY31*

*CMI UA /OV DEC/TM 1622/FL040/TP C402/SK OVC012-TOP033/TA M01/IC LGT MIXED IN CLOUDS*

*BMI UA /OV KBMI/TM 1700/FL013/TP LJ31/SK OVC013-TOP031/TA 00/IC MOD RIME*

*PIA UA /OV KPIA/TM 1707/FL034/TP CRJ7/SK OVC017-TOP034/TA M06/IC LGT RIME/RM DURD RWY31*

*DEC UA /OV 3NM N OF KDEC/TM 1750/FL035/TP C402/SK OVC006/WX 4SM/TA M03/WV CALM/IC LIGHT MIXED/RM BASES 1200 TOPS 3300*

PIA UUA /OV PIA/TM 1854/FLUNKN/TP E145/SK OVC019-TOP037/TA M09/IC LGT-MOD RIME/RM DURD  
RWY 31

PIA UA /OV PIA100008/TM 1945/FL024/TP C130/TA -6/IC LGT RIME

PIA UA /OV PIA/TM 2016/FL016/TP CRJ9/SK OVC016-TOP036/TA M06/IC LGT RIME/RM DURD

DEC UA /OV FINAL APCH RY24 DEC/TM 2018/FL006/TP C402/SK BASES OVC 006 TOPS 038/TA -3/IC LGT  
MXD ICG IN CLDS/RM DURD LANDED DEC

DEC UA /OV FINAL APCH RY24 DEC/TM 2036/FLDURD/TP C402/SK TOPS 034 BASES 014/TA -3/IC LGT-  
MOD RIME ICG IN CLDS/RM LANDED DEC

PIA UA /OV BMI/TM 2100/FL070/TP E55P/SK OVC018-TOP038/IC TRACE RIME

**Accident 2103Z**

DEC UA /OV FINAL APCH RY24 DEC/TM 2106/FL018/TP C402/SK BASES OVC 018 TOPS 030/TA -1/IC LGT  
MXD ICG IN CLDS/RM DURD LANDED DEC

CMI UA /OV DEC/TM 2120/FL030/TP C402/SK OVC-TOP030/TA M01/IC TRACE RIME/RM DURC

DEC UA /OV 12NM SW DEC/TM 2123/FL030/TP C402/SK BASES 013 TOPS 030/TA -1/IC TRACE RIME/RM  
DURC DEPARTED DEC

**SPI UA /OV SPI/TM 2128/FLDURGD/TP E55P/SK BKN011/TA M07/IC LGT MX 011-030**

**SPI UA /OV SPI/TM 2145/FLDURGD/TP F900/SK TOP030/IC NEG ICE**

PIA UA /OV KPIA/TM 2202/FL015/TP C680/SK OVC015-TOP034/TA M05/IC TRACE RIME/RM DURC RWY 31

BMI UA /OV KBMI/TM 2221/FL017/TP C560/SK OVC017-TOP040/TA M06/IC LGT-MOD RIME

DEC UA /OV FINAL APCH RY24/TM 2249/FL017 /TP CL35/SK BASES OVC 011 AGL TOPS 28 MSL/IC LGT  
RIME IN CLDS/RM DURD LANDED DEC

DEC UA /OV FINAL APCH RY36/TM 2343/FL010/TP C402/SK BASES 010 AGL TOPS 034 MSL/TA -1/IC MOD  
RIME IN CLDS/RM DURD LANDED DEC

Of the 23 pilot reports recorded between 0900 and 1800 CST, 22 reported encountering icing conditions below 4,400 ft ranging from a trace (4), light (11), light-to-moderate (3), and moderate (4) intensity. There were no severe reports noted over the area during the period, although two PIREPs were coded erroneously as urgent but did not meet the urgent criteria.

Prior to the accident no PIREPs were recorded for KSPI. However, immediately after the accident, two PIREPs were recorded into KSPI. At 1528 CST an Embraer Phenom 300 business jet (E55P) landed at KSPI and reported light mixed icing conditions between 1,100 through 3,000 ft, with a temperature of -7° C. While a Dassault Falcon 900 business jet (F900) that landed at 1545 CST reported cloud tops at 3,000 ft with no icing encountered on descent.

For reference the following icing intensity is taken from the Aeronautical Information Manual (AIM), Safety of Flight, section 7-1-21 PIREPs Relating to Airframe Icing.

**1. Trace.** Ice becomes noticeable. The rate of accumulation is slightly greater than the rate of sublimation. A representative accretion rate for reference purposes is less than ¼ inch (6 mm) per hour on the outer wing. The pilot should consider exiting the icing conditions before they become worse.

**2. Light.** The rate of ice accumulation requires occasional cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is ¼ inch to 1 inch (0.6 to 2.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition.

**3. Moderate.** The rate of ice accumulation requires frequent cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is 1 to 3 inches (2.5 to 7.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition as soon as possible.

**4. Severe.** The rate of ice accumulation is such that ice protection systems fail to remove the accumulation of ice and ice accumulates in locations not normally prone to icing, such as areas aft of protected surfaces and any other areas identified by the manufacturer. A representative accretion rate for reference purposes is more than 3 inches (7.5 cm) per hour on the unprotected part of the outer wing. By regulation, immediate exit is required.

**NOTE-** Severe icing is aircraft dependent, as are the other categories of icing intensity. Severe icing may occur at any ice accumulation rate when the icing rate or ice accumulations exceed the tolerance of the aircraft.

## 6.0 Current Icing Products

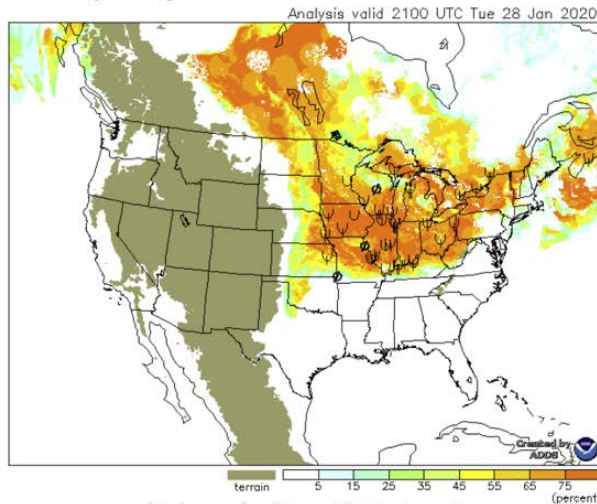
The NWS AWC Current and Forecast Icing Products (CIP/FIP) probability of icing and icing severity for 3000 ft, 5000 ft issued during the period were documented. The CIP and FIP graphics are computer-generated three-dimensional analyses of information related to the likelihood of encountering icing conditions. Information on the graphics is determined from observational data including WSR-88D radar, satellite, pilot weather reports, surface weather reports, lightning and computer model output. This information is available for the 48 contiguous United States, much of Canada and Mexico, and their respective coastal waters.

Figure 8 is the Current Icing Product (CIP) of icing probability for 3,000 ft and 5,000 ft obtained from the NWS AWC website for 1500 CST on January 28, 2020. The chart depicted a greater than 75% probability of encountering icing at 3,000 ft over the area, which decreased to near 65% at 5,000 ft. Multiple PIREPs of icing encounters were noted over the area during the period.

Figure 9 is the CIP maximum icing severity or intensity for 3,000 ft and 5,000 ft and indicated a threat of light to moderate icing, with some supercooled large droplets (SLD) possible over the region at 1500 CST. The severity estimations are roughly based on the accretion rate of ice on an airplane, and the levels are determined by the time it would take for an airfoil to accrete 1/4 in on ice: trace, 1 hour; light, 15 min-1 hour; moderate, 5-15 min; and severe < 5 min. The rates are, in

turn, estimated from the amount of supercooled liquid water expected with a nominal drop diameter of 15 microns, and are further tuned by nearby pilot reports of encountered severity. These are relative values and the use of which should take into account the airframe and the level of icing protection provided by the aircraft. The ultimate safety factor is the vigilance demonstrated by the pilot in potential icing situations.

Probability of icing at 3000 ft. MSL



Probability of icing at 5000 ft. MSL

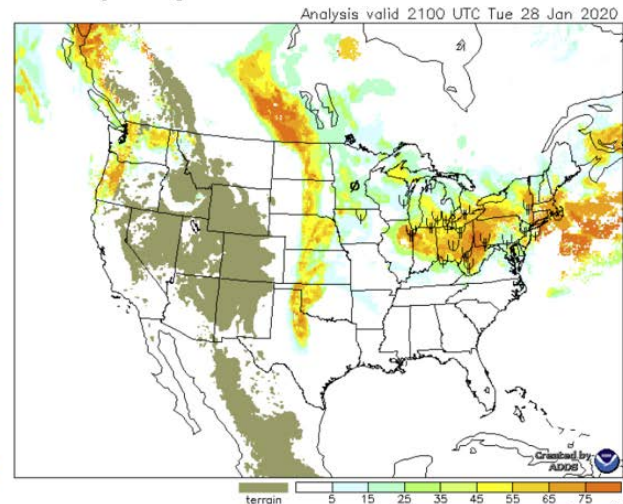
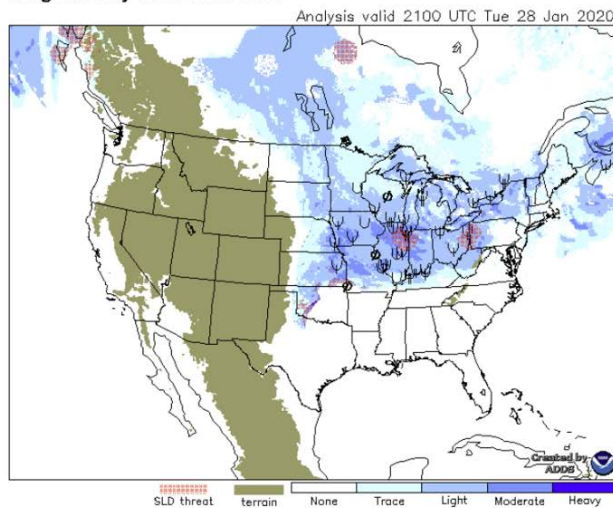


Figure 8 - CIP Probability of Icing at 3,000 ft and 5,000 ft at 1500 CST

Icing severity at 3000 ft. MSL



Icing severity at 5000 ft. MSL

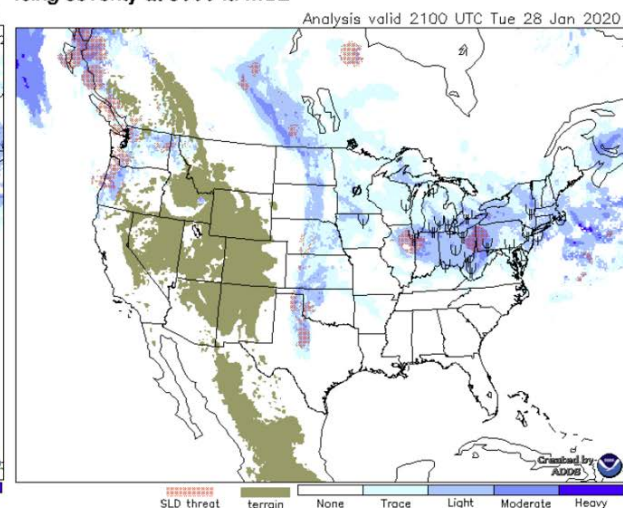


Figure 9 - CIP Icing Severity for 1500 CST

## 7.0 NWS Forecasts

### 7.1 Terminal Aerodrome Forecasts

The NWS Lincoln (KILX), Illinois, Weather Forecast Office (WFO) was responsible for the issuance of the Terminal Aerodrome Forecast (TAF) for KSPI. A TAF is a concise statement of the expected meteorological conditions at an airport during a specified period (usually 24 hours). TAFs are valid for a 5 mile radius around an airport's center point. The forecast issued surrounding the period relevant to the preflight planning and the time of the accident was as follows.

*AMD TAF KSPI 281932Z 2820/2918 28005KT 5SM BR OVC006  
FM282200 VRB03KT P6SM OVC015  
FM291600 08005KT P6SM -SN OVC008=*

The amended TAF issued at 1332 CST expected wind from 280° at 5 knots, visibility 5 miles in mist, with a ceiling overcast at 600 ft agl. The forecast after 1600 CST expected a variable wind at 3 knots, visibility of 6 miles or more, and the ceiling overcast at 1,500 ft agl to continue through the evening.

### 7.2 Area Forecast Discussion

The NWS Area Forecast Discussions (AFD) are issued by each WFO to describe the short term weather conditions within their region with an aviation section that includes the general conditions as they relate to the creation of the TAF. These are useful for additional aviation-related issues that cannot be encoded into the TAF. The discussion also gives some reasoning behind the forecast. These are generated roughly every 6 hours and corresponds to the release of the latest TAFs for that office. The long term and marine sections have been excluded. The forecast discussion issued at 1148 CST was as follows.

*FXUS63 KILX 281748  
AFDILX  
Area Forecast Discussion  
National Weather Service Lincoln IL  
1148 AM CST Tue Jan 28 2020*

*.SYNOPSIS...  
Issued at 259 AM CST Tue Jan 28 2020*

*Cloudy and cool weather will continue across central and southeast Illinois today. A weak weather system tracking across the area on Wednesday, will bring a chance of light snow.*

*.UPDATE...  
Issued at 847 AM CST Tue Jan 28 2020*

*A short-wave trough dropping southeastward across Michigan is providing just enough weak lift to squeeze out a few very light snow flurries or patchy freezing drizzle across central Illinois this morning. As the wave tracks into Ohio and lift wanes, the very light precip will taper off and come to an end by midday. Despite subsidence in the wake of this feature, ample boundary layer moisture trapped beneath an inversion noted on the 12z KILX upper air sounding at around 825mb will ensure an overcast day. High temperatures will only climb a couple of degrees from current readings...topping out in the lower to middle 30s.*

*.SHORT TERM...(Today through Wednesday)  
ISSUED AT 259 AM CST Tue Jan 28 2020*

*08z surface map indicated 1024 mb high over eastern ND with a ridge axis extending southeast into southern IL. 00z ILX sounding showed a sharp subsidence inversion at 900 mb and a saturated low level airmass below. This has allowed the widespread low stratus deck to remain locked in place. Visibilities have generally been 4-7 miles overnight. A light mist has been observed all night outside the office and this is probably occurring over much of the area. However it appears to be so light that it's not accumulating or freezing on surfaces. Will mention patchy freezing drizzle in the grids early this morning with light fog dissipating through mid to late morning. Otherwise there will be very little change in the pattern from what was observed yesterday. This means plenty of low stratus, light winds, and persistence highs in the low to mid 30s.*

*Late tonight and Wednesday, a mid level trof now over the western Plains with a stronger shortwave in the base of the trof over the TX panhandle, will shift east into the Midwest. While the bulk of the precipitation will remain well to the south with the southern stream wave, it now appears enough moisture will advect north for the shortwave trof to squeeze out some light snow. This should primarily occur during the daytime hours Wed, with chance pops southwest of a Galesburg to Robinson line. QPF of a few hundredths of an inch could result in up to a half inch of snow in the southwest CWA.*

*.AVIATION...(For the 18Z TAFS through 18Z Wednesday afternoon)  
Issued at 1147 AM CST Tue Jan 28 2020*

*IFR ceilings prevail at all central Illinois terminals except KPIA late this morning. Based on satellite trends and forecast soundings, it appears ceilings will gradually rise to low MVFR at the remaining sites this afternoon. As an upper disturbance approaches from the west, IFR ceilings and light snow will spread into west-central Illinois Wednesday morning. Have dropped ceilings back to IFR and introduced -SN at KPIA/KSPI after 16z accordingly...but have maintained dry conditions further east. Winds will initially be NW at around 5kt this afternoon, then will back to E/NE by Wednesday morning.*

*.ILX WATCHES/WARNINGS/ADVISORIES...NONE.*

### **7.3 Graphic Forecast for Aviation**

The NWS Graphic Forecast for Aviation (GFA) product replaced the Area Forecast and provides a graphical depiction of surface wind, weather, with color coded general flight categories, and cloud cover, with the graphic AIRMET Sierra for IFR conditions, mountain obscuration, and icing conditions overlaid. The GFA is available at the NWS AWC website and through other weather briefing services.

Figure 10 is the northcentral section of the GFA Surface Weather issued at 1301 CST and valid for 1500 CST with the approximate accident site marked by the red star. The image depicted expected surface winds from the northwest at about 5 knots over the accident site, with no precipitation expected, with visibility unrestricted. A Graphic (G)-AIRMET Sierra for IFR conditions in pink extended over the region and enclosed the accident site.

Figure 11 is the northcentral section of the GFA Cloud Cover product issued at 1302 CSST and valid for 1500 CST with the approximate accident site marked by a red star. The cloud heights are provided with reference to msl heights. The image depicted an extensive area of overcast clouds over Illinois with bases near 1,500 ft (about 900 ft agl) with tops near 5,000 ft. A G-AIRMET Zulu for icing also extended over the accident site.

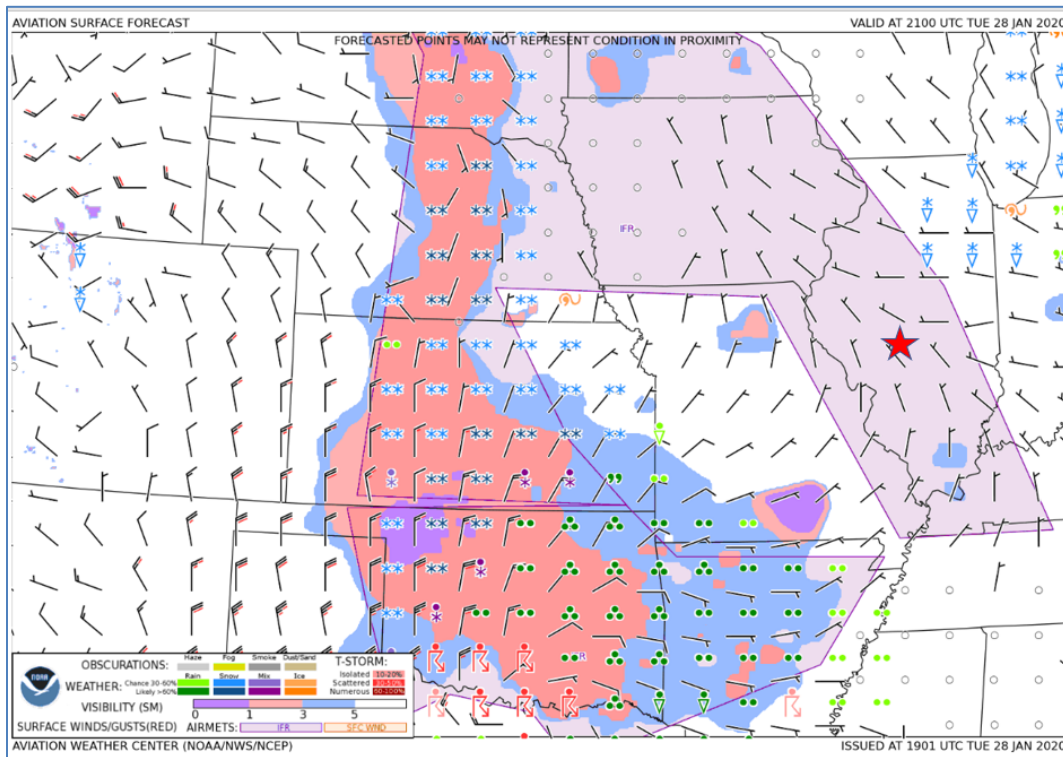


Figure 10 – Northcentral Graphic Forecast for Aviation Surface Weather valid for 1500 CST

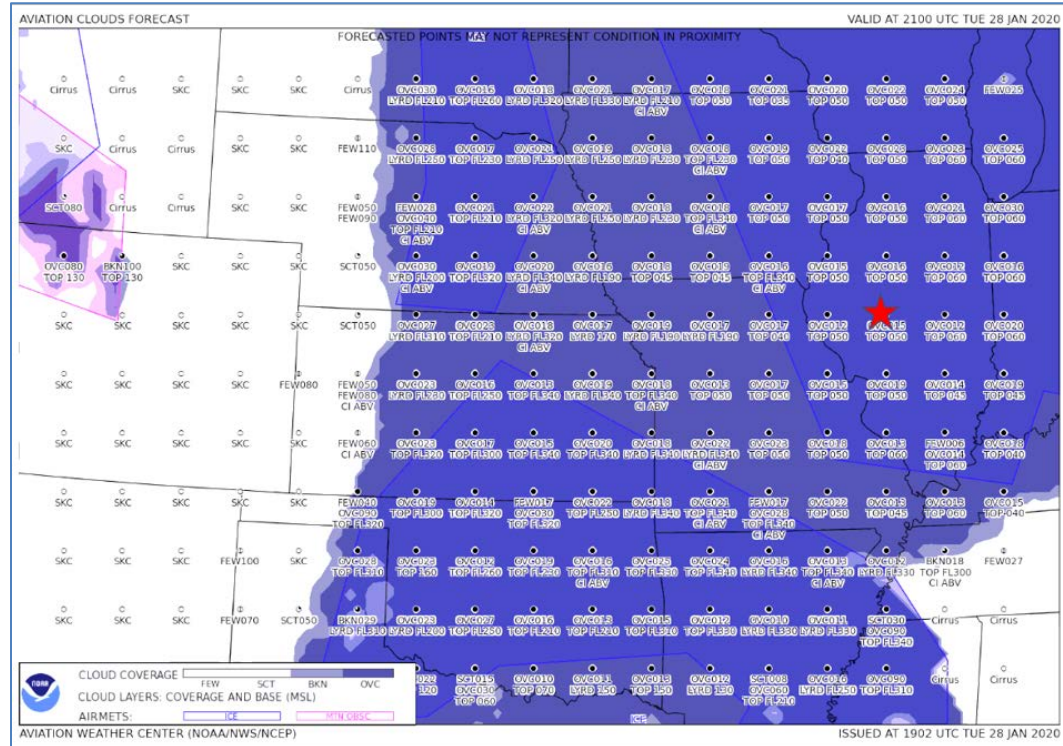


Figure 11 - Northcentral Graphic Forecast for Aviation Cloud Cover valid for 1500 CST

## 7.4 Winds and Temperature Aloft Forecast

The NWS Winds and Temperature Aloft Forecast<sup>14</sup> for the route of flight and valid for 1800 CST and for use between 1400 and 2100 CST were as follows.

### *WINDS ALOFT FORECASTS*

*DATA BASED ON 281800Z*

*VALID 290000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000*

|            |                    |                       |                       |                |                |                |               |               |               |
|------------|--------------------|-----------------------|-----------------------|----------------|----------------|----------------|---------------|---------------|---------------|
| <i>FT</i>  | <i>3000</i>        | <i>6000</i>           | <i>9000</i>           | <i>12000</i>   | <i>18000</i>   | <i>24000</i>   | <i>30000</i>  | <i>34000</i>  | <i>39000</i>  |
| <i>HSV</i> | <i>9900</i>        | <i>3115+00</i>        | <i>3013-02</i>        | <i>2821-07</i> | <i>2531-19</i> | <i>2642-31</i> | <i>265647</i> | <i>269546</i> | <i>269143</i> |
| <i>BHM</i> | <i>9900</i>        | <i>3411+01</i>        | <i>3013-01</i>        | <i>2724-06</i> | <i>2637-18</i> | <i>2544-30</i> | <i>267245</i> | <i>269945</i> | <i>269743</i> |
| <i>BNA</i> | <i>9900</i>        | <i>2722-01</i>        | <i>3020-04</i>        | <i>2923-08</i> | <i>2729-19</i> | <i>2734-31</i> | <i>265449</i> | <i>268148</i> | <i>267845</i> |
| <i>EVV</i> | <i>3308</i>        | <i>2819-01</i>        | <i>2922-04</i>        | <i>2927-09</i> | <i>2722-20</i> | <i>2827-33</i> | <i>276049</i> | <i>275754</i> | <i>266845</i> |
| <i>CGI</i> | <i>9900</i>        | <i>2618+00</i>        | <i>2819-05</i>        | <i>2817-10</i> | <i>2519-20</i> | <i>2621-32</i> | <i>244150</i> | <i>256151</i> | <i>256547</i> |
| <i>STL</i> | <i>0605</i>        | <i>2914-01</i>        | <i>2824-05</i>        | <i>2824-09</i> | <i>2518-21</i> | <i>2618-33</i> | <i>264850</i> | <i>264655</i> | <i>255847</i> |
| <i>SPI</i> | <b><i>9900</i></b> | <b><i>3208-03</i></b> | <b><i>2918-05</i></b> | <i>2818-10</i> | <i>2719-20</i> | <i>2721-34</i> | <i>284950</i> | <i>274456</i> | <i>255347</i> |
| <i>BRL</i> | <i>0108</i>        | <i>3308-03</i>        | <i>3013-06</i>        | <i>2915-10</i> | <i>2717-21</i> | <i>2722-34</i> | <i>273551</i> | <i>274356</i> | <i>254347</i> |

The forecast for KSPI for 3,000 ft expected a wind light and variable at less than 5 knots, at 6,000 ft from 320° at 8 knots with a temperature of -3° C, at 9,000 ft from 290° at 18 knots with a temperature of -5° C.

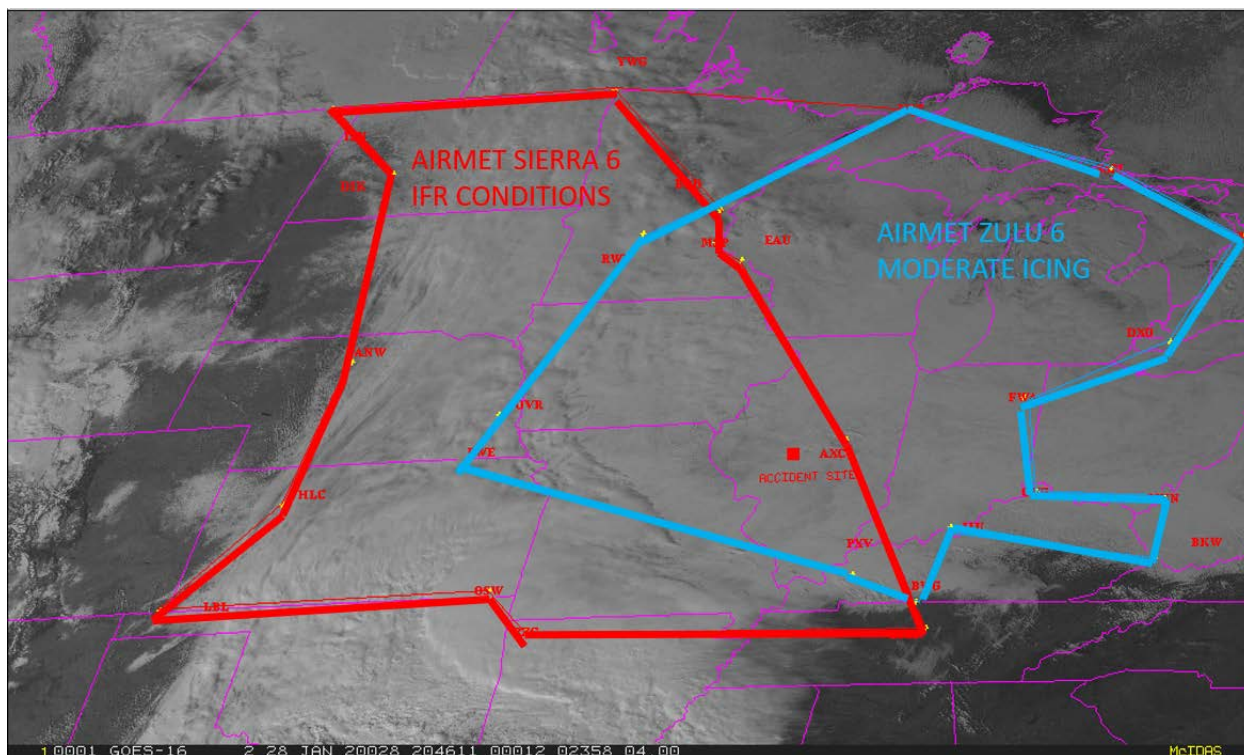
## 8.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of the development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA ARTCCs. There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the Airman's Meteorological Information (AIRMET), and the Center Weather Advisory (CWA). Inflight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft. During the period the NWS AWC issued a series of AIRMETs for IFR conditions, turbulence, and icing conditions over portions of Illinois. No SIGMETs, Convective SIGMETs, or CWAs were issued for the area during the period.

The NWS AWC AIRMET Sierra for IFR conditions and AIRMET Zulu for moderate icing conditions issued at 1445 CST and valid at the time of the accident plotted over the GOES-16 visible satellite image for the same period is included as figure 12 followed by the text advisories.

---

<sup>14</sup> NWS bulletin FBUS31 KWNO



**Figure 12 - GOES-16 visible image with AIRMETs active over the accident site at 1445 CST**

WAUS43 KPCI 282045

WA3S

-CHIS WA 282045

AIRMET SIERRA UPDT 6 FOR IFR AND MTN OBSCN VALID UNTIL 290300

AIRMET IFR...ND SD NE KS MN IA MO WI IL IN KY

FROM 50S YWG TO 60SE BRD TO MSP TO 40SW EAU TO 20NNE AXC TO

20ENE BNA TO RZC TO OSW TO 60W LBL TO 30WSW HLC TO 20SW ANW TO

40ENE DIK TO 70NW ISN TO 50S YWG

CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS CONTG BYD 03Z THRU 09Z.

WAUS43 KPCI 282045

WA3Z

CHIZ WA 282045

AIRMET ZULU UPDT 6 FOR ICE AND FRZLVL VALID UNTIL 290300

AIRMET ICE...KS MO IL KY

FROM 20SW PWE TO 40S PXV TO 20SW BWG TO RZC TO OSW TO 20ENE LBL

TO 50WNW SLN TO 20SW PWE

MOD ICE BTN FRZLVL AND FL200. FRZLVL SFC-100. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET ICE...NE KS MN IA MO WI LM LS MI LH IL IN KY

FROM YQT TO SSM TO YVV TO 30ESE DXO TO FWA TO CVG TO HNN TO 50WSW

BKW TO 20W IJU TO 20SSW BWG TO 40S PXV TO 20SW PWE TO 30WSW OVR

TO 40NNE RWF TO YQT

MOD ICE BTN FRZLVL AND 080. FRZLVL SFC-060. CONDS CONTG BYD 03Z THRU 09Z.

OTLK VALID 0300-0900Z...ICE NE KS MO IL IN KY OK TX AR TN LA MS AL AND CSTL WTRS

BOUNDED BY 30ENE PWE-30WNW IRK-30NW COU-30ENE PXV-30SSE LOZ-40E  
VXV-GQO-LGC-50E CEW-40W CEW-130SE LEV-60SSW LEV-60S LSU-20NW  
LSU-40SSE GGG-30S ADM-40SSE CDS-40E AMA-50WNW SLN-30ENE PWE  
MOD ICE BTN FRZLVL AND FL190. FRZLVL SFC-110. CONDS CONTG THRU 09Z.

.  
FRZLVL...RANGING FROM SFC-080 ACRS AREA  
MULT FRZLVL BLW 080 BOUNDED BY 30WSW IRK-30NNW COU-30ESE STL-  
30W IIU-50ESE BWG-30SW BWG-20E OKC-50ENE ACT-40S CWK-20S  
SJT-60SW SPS-50WNW END-20S SLN-40S PWE-30WSW IRK  
SFC ALG 60NE MMB-50WSW BUM-30NNW PXV-CVG  
040 ALG 40E BFF-20W LBF-30WSW MCK-40S GLD  
....

## 9.0 Preflight Weather Briefing

A search of the FAA Automated Flight Service Station (AFSS) contract provider Leidos indicated that they had no contact with the pilot of N6071R for any weather briefing on January 28, 2020, and no third-party vendors utilized their system for weather data or to file an instrument flight plan.

A further search of third-party vendor ForeFlight indicated that the accident pilot had an account with that company and a search of their records indicated that the pilot had filed IFR flight plans<sup>15</sup> on the day of the accident at 0734 CST from KSRQ to KHSV and from KHSV to KSPI, with no alternate airports specified in either flight leg. The planned or filed altitude was 10,000 ft. A weather briefing was automatically generated for both of those routes; however, it is unknown if the pilot of N6071R viewed those briefings. The weather briefing that was automatically generated for the route between KHSV and KSPI issued at 0724 CST is included as Attachment 1. ForeFlight noted that the pilot did not access any static weather imagery such as the AIRMETs or other graphic products in the ForeFlight mobile app during the period. Again, while an automated route briefing was generated it is unknown if the pilot accessed that data in his familiarization prior to departure. What is known is that the accident pilot did specifically access the KHSV and KSPI METARs and TAFs at 1245 CST. That data current at that time was as follows.

METAR KHSV 281753Z 00000KT 10SM FEW150 12/03 A3006 RMK AO2 SLP179 I6000 T01220033 10122  
21006 58011=

METAR KHSV 281653Z 15003KT 10SM FEW250 09/04 A3009 RMK AO2 SLP189 T00940039=  
METAR KHSV 281553Z 12004KT 10SM CLR 08/03 A3009 RMK AO2 SLP190 T00780033=

KHSV 281751Z 2818/2918 VRB03KT P6SM FEW050 SCT250  
FM290200 07005KT P6SM SCT070 BKN100 OVC200  
FM290800 07005KT P6SM BKN050 OVC080  
PROB30 2910/2916 6SM -RA BR BKN025  
FM291600 09005KT P6SM SCT025 BKN080 BKN200=

METAR KSPI 281752Z 22004KT 5SM BR OVC005 M02/M03 A3014 RMK AO2 SLP213 I6000 T10221033  
11017 21022 57001=  
METAR KSPI 281652Z 32003KT 4SM BR OVC005 M02/M03 A3014 RMK AO2 SLP212 T10171033=

---

<sup>15</sup> ForeFlight system files flight plans directly through the AFTN network and does not interact with the Leidos system.

*METAR KSPI 281552Z 33005KT 4SM BR OVC005 M02/M03 A3015 RMK AO2 SLP216 T10171033=*

*TAF KSPI 281742Z 2818/2918 VRB03KT 4SM BR OVC005  
FM282000 VRB03KT P6SM OVC015  
FM291600 08005KT P6SM -SN OVC008=*

## 10.0 Astronomical Conditions

The astronomical data for Springfield, Illinois on January 28, 2020 obtained from the United States Naval Observatory software<sup>16</sup> provided the following information. The time of the accident has been added in italic bold print for reference.

|                         |                        |
|-------------------------|------------------------|
| <u>Sun</u>              |                        |
| Begin of civil twilight | 0642 CST               |
| Sunrise                 | 0711 CST               |
| Transition              | 1212 CST               |
| <b><i>Accident</i></b>  | <b><i>1502 CST</i></b> |
| Sunset                  | 1713 CST               |
| End civil twilight      | 1742 CST               |

At the approximate time of the accident the Sun was 19.6° above the horizon at an azimuth of 223°.

## F. LIST OF ATTACHMENTS

Attachment 1 – ForeFlight weather briefing for KHSV to KSPI issued at 0724 CST

Submitted by:

---

Donald Eick  
Senior Meteorologist

---

<sup>16</sup> United States Naval Observatory software program: Multiyear Interactive Computer Almanac (MICA).