

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



CEN24LA168

METEOROLOGY

Specialist's Factual Report

August 28, 2024

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A. ACCIDENT

Location: Clearbrook, Minnesota
Date: April 29, 2024
Time: 0027 central daylight time
0527 universal coordinated time (UTC)
Airplane: Cessna 172; Registration: N12805

B. METEOROLOGY SPECIALIST

Donald Eick
Senior Meteorologist
National Transportation Safety Board
Washington, DC

C. SUMMARY

On April 29, 2024, about 0027 central daylight time, a Cessna 172M airplane, N12805, was substantially damaged when it was involved in an accident near Clearbrook, Minnesota. The pilot sustained serious injuries. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight. The flight was returning from Stanley Municipal Airport (08D), Stanley, North Dakota, back to Bemidji Regional Airport (BJI), Bemidji, Minnesota.

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 remotely, collecting data from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the Weather Prediction Center (WPC), and the National Center for Environmental Information (NCEI). This report documents the general weather products and forecasts over the region during the period and documents the pertinent meteorological parameters to the accident. All times are reported as central daylight time (CDT) based upon the 24-hour clock, local time is -5 hours from UTC, and UTC=Z. Airport and 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. continental 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 is based on the coordinates of latitude 47.69801°N and longitude 95.43174°W at an elevation of approximately 1,344 ft.

E. FACTUAL 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 and other products can be found in the Federal Aviation Administration (FAA) "Aviation Weather Handbook", FAA-H-8083-28¹.

1.1 Surface Analysis Chart

The north-central section of the NWS Surface Analysis Chart for 0100 CDT is included as figure 1 with the approximate accident site marked by a red star and the departure (K08D) and planned destination airport of (KBJI) are indicated. The chart depicted a low-pressure system at 1004-hectopascals (hPa)² over southern Minnesota associated with an occluded front. With the occluded front extending southeastward into Iowa to the triple point, where a cold front extended southward and a warm front turning to a stationary front extended to the east. A trough³ of low pressure also extended from the low to the northwest across southern Minnesota and into South Dakota (the previous chart for 2200 CDT depicted the trough extending northward over North Dakota and Minnesota, and along the flight route). The station models along the route of flight depicted easterly winds, rain and mist, overcast cloud cover with temperatures in the mid to upper 30's degrees Fahrenheit (°F), with temperature dew point spreads of 2°F. Several stations in North Dakota and Minnesota reported unknown precipitation (symbol "?") which is commonly reported during freezing precipitation, ice pellets, or mixed liquid and freezing precipitation.

¹ <https://www.faa.gov/regulationspolicies/handbooksmanuals/aviation/faa-h-8083-28-aviation-weather-handbook>

² Hectopascals (hPa) is the standard unit for reporting sea-level pressure and is interchangeable with the former term millibar (mb) with the same units. The standard atmosphere is based on a sea-level pressure of 1013.2-hPa at 59° Fahrenheit (F) or 15° Celsius (C).

³ Trough or abbreviated "TROF" is an elongated area of low-pressure and is if sufficient moisture and lifting is available supports clouds and precipitation formation.

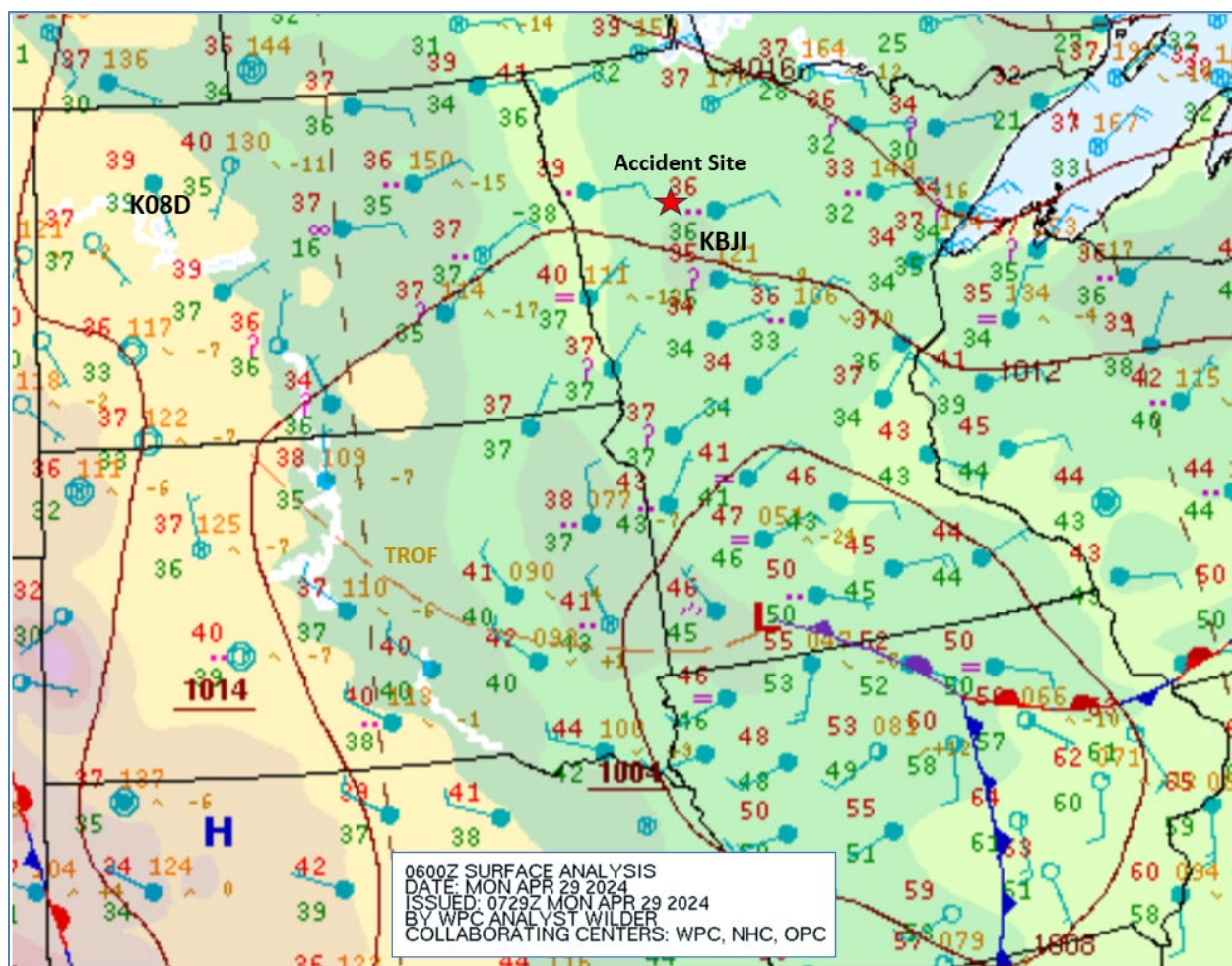


Figure 1 - NWS Surface Analysis Chart for 0100 CDT with the approximate accident site marked by the red star.

1.2 Short Range Forecast

The NWS WPC 12-hour Surface Prognostic Chart valid for 0100 CDT is included as figure 2 with the approximate accident site marked by the red star. The prognostic chart depicted the low-pressure center over southern Minnesota with the frontal wave further south and the trough of low-pressure extending northwestward across the Dakotas. A large area of likely rain (60 to 70% probability) was depicted over the route of flight and the accident site, with a small area of potential ice indicated immediately south of the accident site.

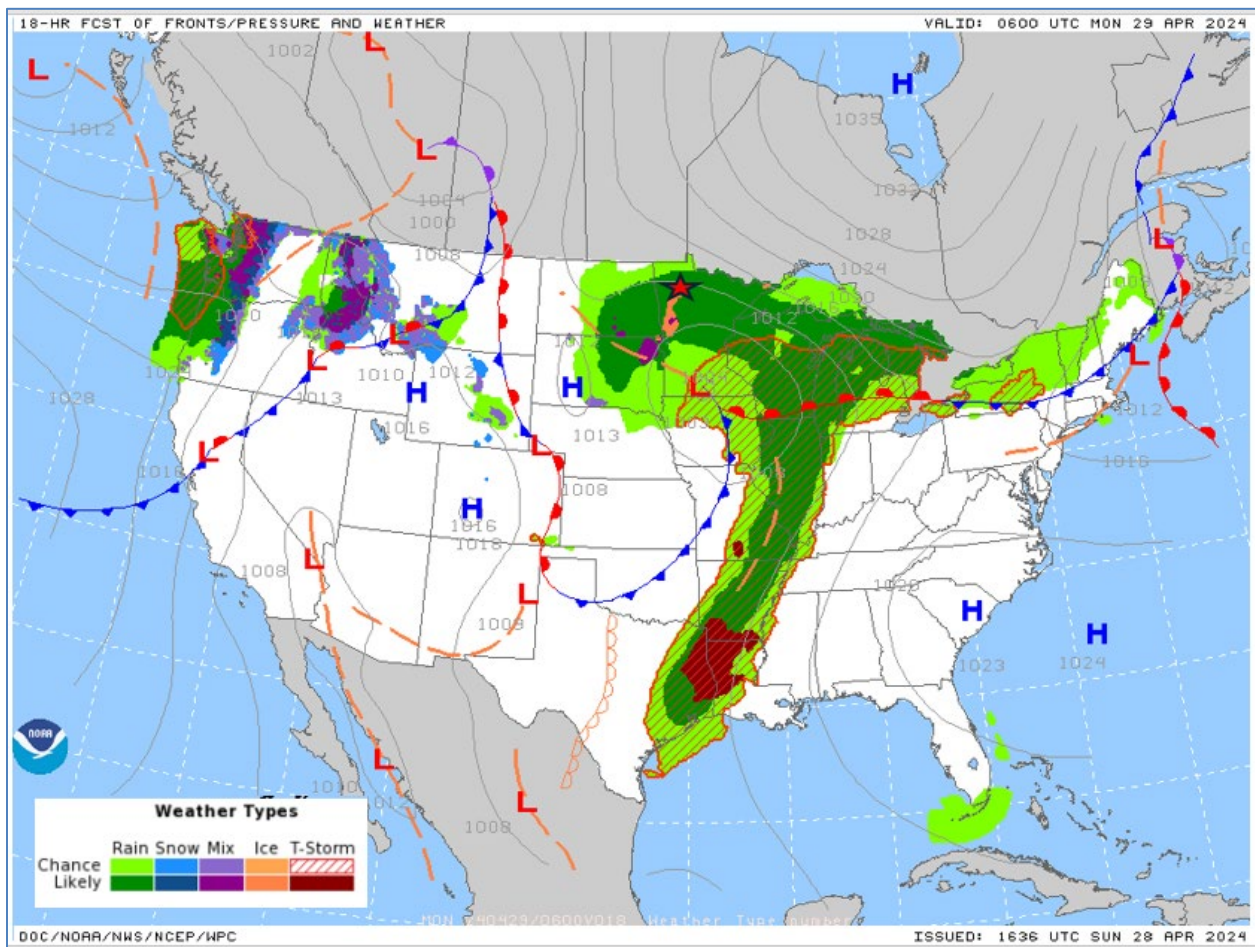


Figure 2 - NWS WPC 12-hour Surface Prognostic Chart valid for 0100 CDT with the approximate accident site marked by the red star.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METAR⁴) and Aviation Selected Special Weather Reports (SPECI). Cloud heights are reported above ground level (agl) in the following section. The magnetic variation over the area was estimated at 2° East based on the latest sectional chart for the area.

2.1 Fosston, Minnesota

The closest weather reporting facility to the accident site was from Fosston Municipal Airport/Anderson Field (KFSE), Fosston, MN, located about 15 miles

⁴ METAR is an abbreviation of Meteorological Aerodrome Report.

southwest of the accident site at an elevation of 1279 ft. The airport had an Automated Weather Observation System (AWOS), which disseminated observations every 20-minutes longline⁵ and broadcasted locally line of sight on 118.35 VHF⁶. The following conditions were reported at the approximate time of the accident.

Weather observation for KFSE at 0015 CDT, automated, wind from 080° at 7 knots, visibility 5 miles in moderate rain, ceiling broken at 1,300 ft agl, overcast at 2,100 ft, temperature 3°C (37°F), dew point temperature 2°C (35°F), and altimeter 29.86 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator.

The general flight categories⁷ and raw observations issued surrounding the period were as follows:

MVFR METAR KFSE 290235Z AUTO 08008KT 7SM RA OVC018 03/02 A2992 RMK AO2=

MVFR METAR KFSE 290255Z AUTO 08008G15KT 7SM -RA BKN020 OVC024 03/02 A2991 RMK AO2=

MVFR METAR KFSE 290315Z AUTO 08007KT 10SM -RA BKN017 OVC024 03/02 A2990 RMK AO2=

MVFR METAR KFSE 290335Z AUTO 09007KT 7SM DZ OVC017 03/02 A2990 RMK AO2=

MVFR METAR KFSE 290355Z AUTO 08008KT 10SM DZ OVC015 03/02 A2989 RMK AO2=

MVFR METAR KFSE 290415Z AUTO 08011KT 7SM DZ OVC015 03/02 A2988 RMK AO2=

MVFR METAR KFSE 290435Z AUTO 08011KT 7SM RA BKN015 OVC021 03/02 A2988 RMK AO2=

MVFR METAR KFSE 290455Z AUTO 08008KT 5SM -RA BKN015 OVC021 03/02 A2987 RMK AO2=

MVFR METAR KFSE 290515Z AUTO 08007KT 5SM RA BKN013 OVC021 03/02 A2986 RMK AO2=

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MVFR METAR KFSE 290535Z AUTO 09011G14KT 7SM -RA BKN016 OVC022 03/02 A2986 RMK AO2=

⁵ Longline refers to transmitting the data to the FAA Weather Message Switching Center Replacement (WMSCR) which makes the observations available to users through various links and the internet.

⁶ Very High Frequency, typical radio band used in aviation for line-of-sight communication and navigation.

⁷ 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 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. ** MVFR is a subset of VFR.

MVFR METAR KFSE 290555Z AUTO 10010G14KT 5SM RA OVC013 03/02 A2986 RMK AO2=

MVFR METAR KFSE 290615Z AUTO 11010G19KT 4SM RA SCT013 OVC019 03/02 A2987 RMK AO2=

MVFR METAR KFSE 290635Z AUTO 10008G17KT 4SM -RA SCT021 BKN025 OVC040 02/01 A2986 RMK AO2 P0001=

2.2 Bemidji, Minnesota

The planned destination of Bemidji Regional Airport (KBJI), Bemidji, MN, was located about 26 miles southeast of the accident site at an elevation of 1,391 ft. The airport also had an AWOS which broadcasted locally on 119.275 VHF and reported the following conditions about the time of the accident.

Weather observation for KBJI at 0035 CDT, automated, wind from 090° at 18 knots gusting to 23 knots, visibility 10 miles in light rain, ceiling overcast at 1,000 ft agl, temperature 2°C (36°F), dew point temperature 2°C (36°F), and altimeter 29.86 inHg. Remarks: automated station with a precipitation discriminator, temperature 2.1°C, dew point 2.1°C.

The general flight categories and raw observations reported surrounding the period were as follows:

MVFR METAR KBJI 290155Z AUTO 08011KT 10SM -RA SCT022 OVC030 04/03 A2992 RMK AO2 P0002 T00350032=

MVFR METAR KBJI 290215Z AUTO 08010G15KT 7SM -RA BKN022 OVC030 04/04 A2993 RMK AO2 T00350035=

MVFR METAR KBJI 290235Z AUTO 08012KT 7SM -RA OVC020 03/03 A2993 RMK AO2 P0001 T00330033=

MVFR METAR KBJI 290255Z AUTO 08013KT 7SM -RA BKN015 OVC021 03/03 A2992 RMK AO2 P0002 60004
T00320032=

MVFR METAR KBJI 290315Z AUTO 07012G15KT 7SM -RA SCT010 OVC014 03/03 A2991 RMK AO2 P0001
T00310031=

MVFR METAR KBJI 290335Z AUTO 08012G16KT 7SM -RA OVC010 03/03 A2990 RMK AO2 P0002 T00300030=

IFR METAR KBJI 290355Z AUTO 09010KT 7SM -RA OVC008 03/03 A2990 RMK AO2 P0003 T00300030=

IFR METAR KBJI 290415Z AUTO 09009KT 7SM -RA OVC008 03/03 A2990 RMK AO2 T00300030=

MVFR METAR KBJI 290435Z AUTO 10016G21KT 10SM -RA SCT008 OVC014 03/03 A2989 RMK AO2 P0001
T00270027=

MVFR METAR KBJI 290455Z AUTO 09013G24KT 10SM -RA OVC012 03/03 A2988 RMK AO2 P0001 T00250025=

MVFR METAR KBJI 290515Z AUTO 09017G23KT 10SM OVC012 02/02 A2987 RMK AO2 T00220022=

Accident 0527Z

MVFR METAR KBJI 290535Z AUTO 09018G23KT 10SM -RA OVC010 02/02 A2986 RMK AO2 T00210021=

MVFR METAR KBJI 290555Z AUTO 08012G18KT 5SM -RA OVC010 02/02 A2985 RMK AO2 P0001 60009
T00200020 10036 20020 400470020=

MVFR METAR KBJI 290615Z AUTO 09010KT 5SM RA OVC010 02/02 A2985 RMK AO2 P0002 T00180018=

MVFR METAR KBJI 290635Z AUTO 11013G18KT 5SM RA BKN010 OVC013 02/02 A2986 RMK AO2 P0005
T00170017=

MVFR METAR KBJI 290655Z AUTO 13006KT 7SM -RA BKN010 OVC014 02/02 A2987 RMK AO2 P0008 T00160016=

MVFR METAR KBJI 290715Z AUTO 13009G16KT 10SM -RA OVC010 02/02 A2987 RMK AO2 T00150015=

MVFR METAR KBJI 290735Z AUTO 12009KT 10SM -RA SCT010 BKN018 OVC030 01/01 A2986 RMK AO2
T00130013=

2.3 Aviation Weather Center METAR Display

The NWS Aviation Weather Center's (AWC) website METAR display at 0045 CDT depicting the conditions immediately after the accident is included as figure 3. The chart depicts the general flight categories by color coded stations, and the latest observation for the period along with the radar reflectivity image for 0045 CDT and surface features. The chart depicted a trough of low pressure extending from northern Minnesota south-southwest through eastern North Dakota and to the west of the accident site. A large band of light to moderate reflectivity echoes along the general route of flight with light intensity echoes over the accident site. The station models depicted general IFR to MVFR conditions over the route of flight due to rain and mist, with ceilings between 500 to 1,000 ft agl.

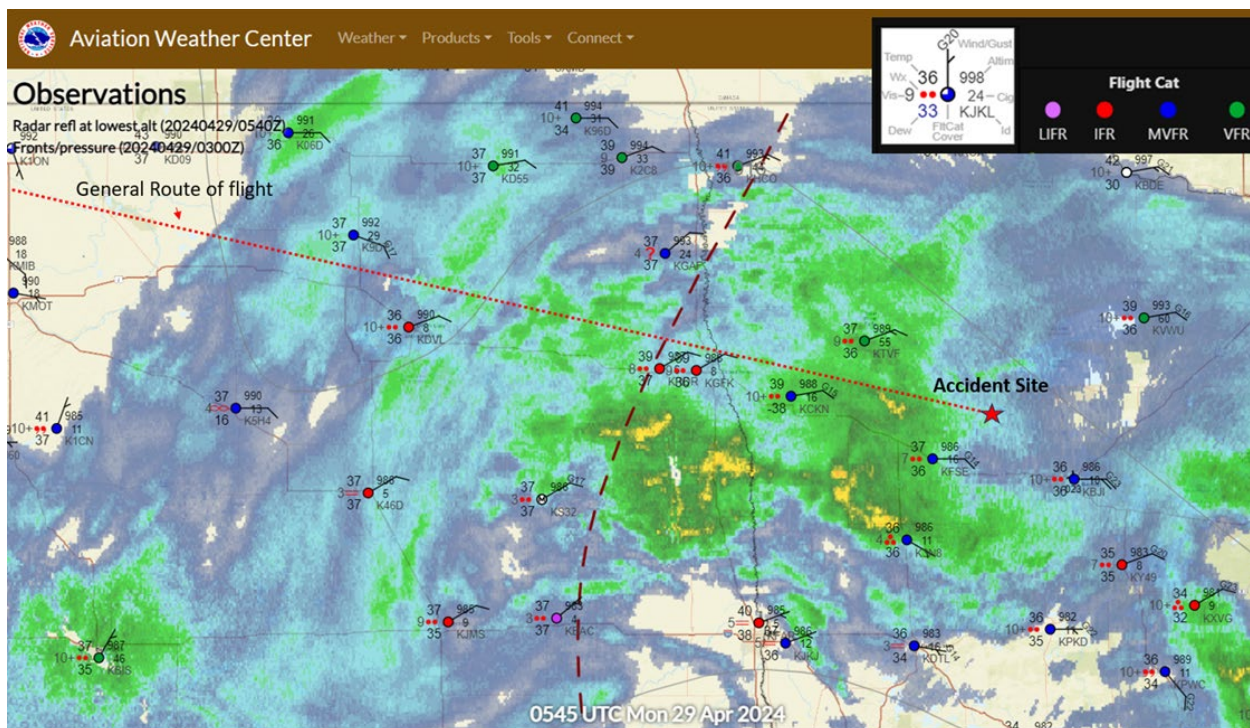


Figure 3 - NWS Aviation Weather Center's METAR for 0045 CDT with the regional radar mosaic overlaid and surface features.

3.0 Sounding

High-Resolution Rapid Refresh (HRRR)⁸ numerical model data were obtained from the NOAA Air Resource Laboratory website for 0000 CDT on April 29, 2024, over the closest grid point⁹ to the accident site coordinates. The data were then plotted on a standard skew T log P diagram¹⁰ using the RAOB Analysis software¹¹ from the surface to 450-hPa or approximately 22,000 ft and is included as figure 4.

⁸ The HRRR is a NOAA real-time 3 kilometer (km) resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by 3 km grids with 3 km radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a 1-hour period.

⁹ Grid point was at latitude 47.70°N and longitude 95.43°W.

¹⁰ 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.

¹¹ RAOB -The Complete RAOBsonde OBservation program is an interactive sounding analysis program developed by Eosonde Research Services (ERS) previously known as Environmental Research Services, The Villages, Florida.

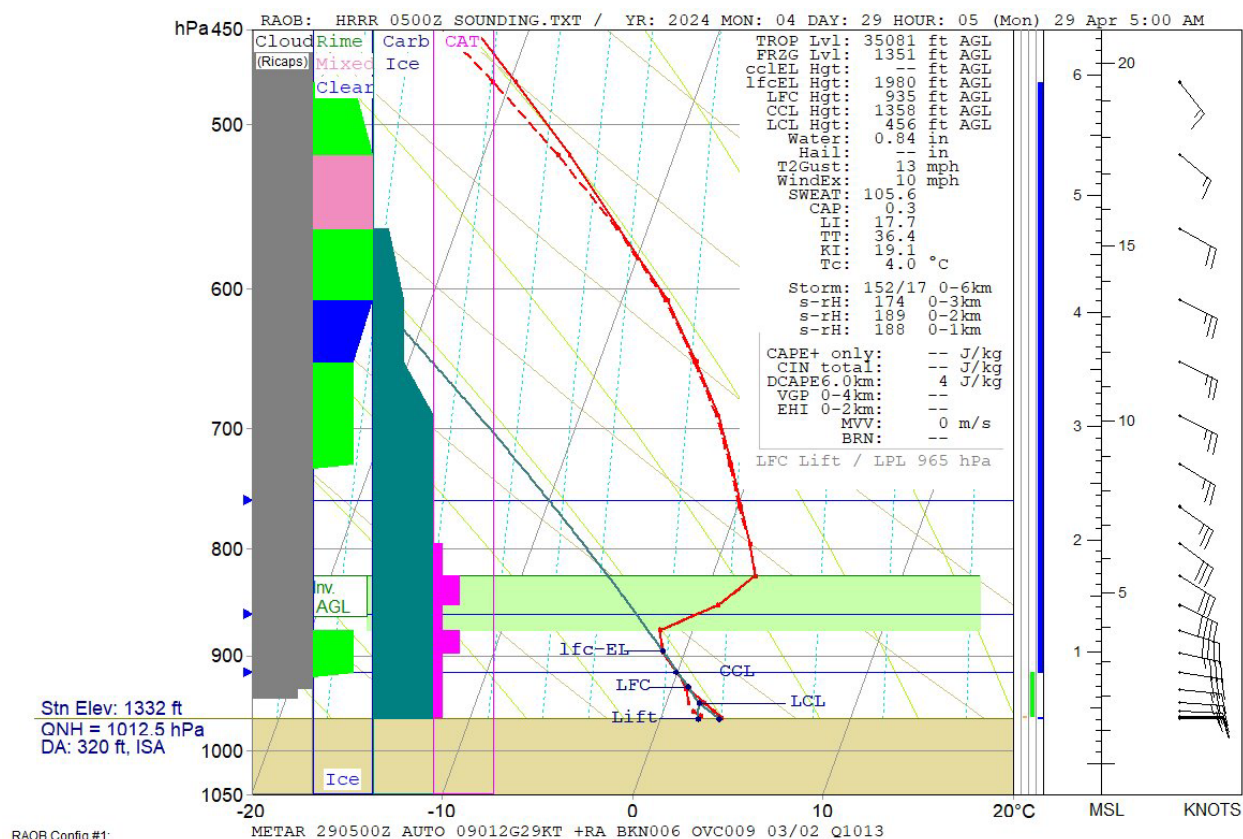


Figure 4 - High-Resolution Rapid Refresh (HRRR) numerical model sounding for 0000 CDT over the approximate accident site.

The sounding depicted an elevation of 1,332 ft over the grid point with a near surface temperature of 3.1°C (37.6°F), a dew point temperature of 2.0°C (35.6°F), with a relative humidity of 92%. The sounding depicted the lifted condensation level (LCL) at 456 ft agl, the level of free convection (LFC) at 935 ft agl, and the convective condensation level (CCL) at 1,358 ft agl. The sounding was saturated from the LCL through 26,000 ft and was characterized as stable with a Lifted Index of 17.7 and no positive convective available potential energy (CAPE). The RAOB analysis indicated the sounding supported nimbostratus type clouds with rain. The precipitable water content was 0.84 inches. A frontal inversion was noted between 2,800 ft and 4,165 ft agl (green shaded area across image), which resulted in multiple freezing levels. The first freezing level was identified near 2,680 ft with temperatures below freezing through 4,600 ft msl. Temperatures continued warming in the inversion through roughly 5,500 ft, above which the temperature cooled with height through the third freezing level at 7,700 ft with temperatures remaining below freezing above this level. Two areas of icing were depicted in the sounding, one at the cloud bases through about 4,600 ft (below the inversion), and the other above the inversion from 7,700 ft through 17,000 ft msl. The RAOB Analysis program supported structural rime type icing in the accident airplane's flight altitudes. The sounding also indicated that there was a high potential for severe carburetor or induction system type icing at cruise or

climb power from the surface through 10,000 ft (dark green on left axis). A plot of the carburetor icing potential is covered in section 7.0.

The sounding wind profile indicated a surface wind from 090° at 12 knots with potential gusts to 23 knots, with winds veering to the southeast. The mean 0 to 6 kilometer (or 18,000 ft) mean wind was from 120° at 23 knots. A low-level wind maximum was identified at about 4,000 ft with winds from 110° at 39 knots. The RAOB Analysis program indicated strong vertical wind shears and the potential for moderate turbulence was indicated between 3,000 ft and 6,000 ft.

A table of the sounding parameters from the surface to 13,000 ft is included below, with the height, pressure (Pres), temperature (T), dew point temperature (Td), relative humidity (RH), wind direction and speed, and derived clear air turbulence (CAT), low-level wind shear (LLWS) and icing type and intensity.

Height (ft-msl)	Pres (hPa)	T (°C)	Td (°C)	RH (%)	Wind (dir/kts)	CAT (FAA)	LLWS (FAA)	Icing-Type (USAF)
1332	965	3.1	2.0	92	090/ 12			
1360	964	3.2	2.0	92	090/ 12	LGT	MODRT	
1415	962	3.0	2.1	94	091/ 17	LGT	LIGHT	
1554	957	2.7	1.6	92	092/ 20	LGT	LIGHT	
1805	948	2.0	1.2	94	094/ 23	LGT	LIGHT	
2199	934	1.0	0.8	99	097/ 27	LGT		
2683	917	0.0	0.0	100	100/ 30	LGT		LGT Rime
3262	897	-1.1	-1.1	100	104/ 33	MDT	LIGHT	LGT Rime
3912	875	-1.7	-1.7	100	110/ 39	LGT		LGT Rime
4643	851	0.9	0.9	100	118/ 39	MDT		
5497	824	2.3	2.3	100	125/ 32	LGT		
6447	795	1.4	1.4	100	130/ 28			
7532	763	0.2	0.1	99	129/ 26			
8766	728	-1.1	-1.2	99	123/ 24			LGT Rime
10167	690	-2.7	-2.8	99	119/ 23			LGT Rime
11717	650	-4.9	-5.0	99	118/ 23			LGT Rime
13476	607	-7.6	-7.7	99	120/ 23			MDT Clear

A review of the accident airplane's flight track indicated that the pilot climbed to a cruising level of 9,000 ft where the sounding indicated a wind from 120° at 23 knots with a temperature of -1°C. The pilot began a slow descent at about 2347 CDT through the time of the accident at 0027 CDT, and during that period re-entered the area of low-level icing area below 4,000 ft.

4.0 Satellite imagery

The GOES-16 infrared satellite data were obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison in Madison, WI, and processed using the Man-computer Interactive Data Access System (McIDAS)

software. The band 13 infrared imagery at a wavelength 10.3 μm provided a spatial resolution of 2 kilometers (km), with radiative cloud top brightness temperatures.

Figure 5 is the GOES-16 infrared image for 0021 CDT at 4X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops. The image depicted an extensive area of enhanced clouds over the area with a radiative cloud top temperature of 235 kelvin or -35°C , over the accident site, which, according to the HRRR sounding represented cloud tops near 26,000 ft.

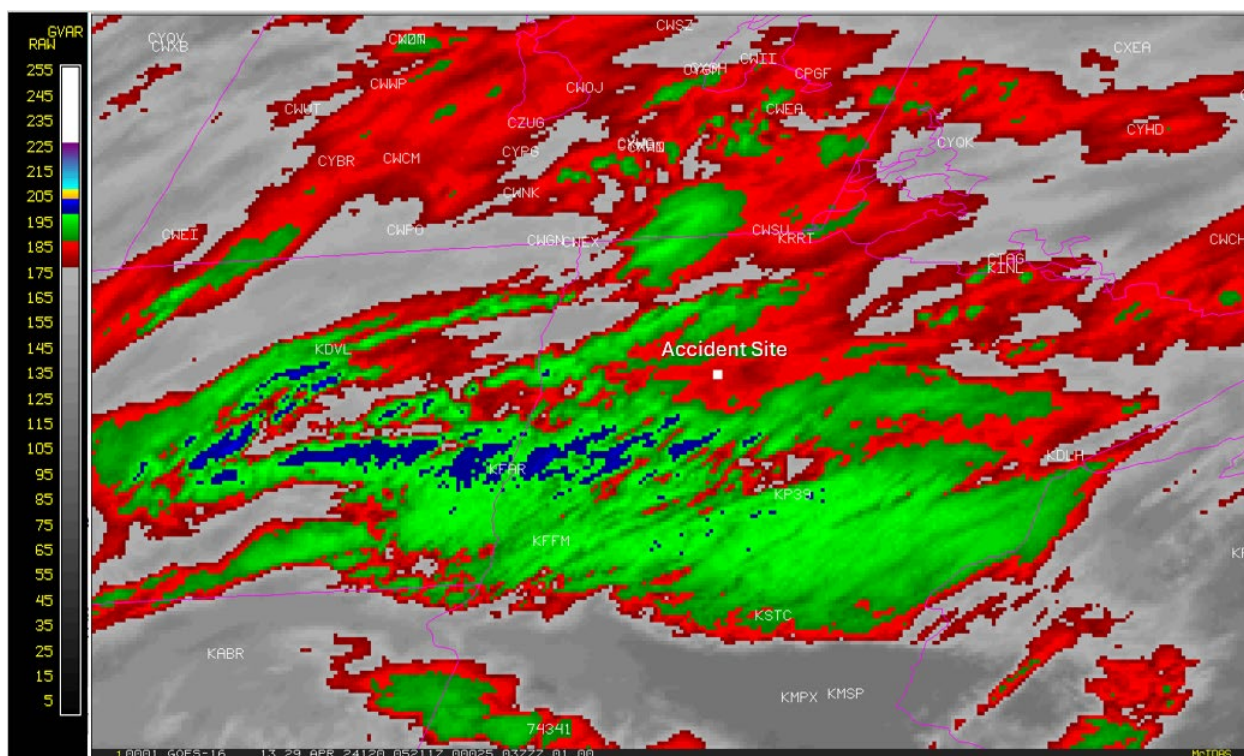


Figure 5 - GOES-16 infrared satellite image for 0021 CDT at 4X magnification with a standard MB enhancement curve applied.

5.0 Weather Radar Imagery

The closest NWS Weather Surveillance radar 1988 Doppler (WSR-88D) was located at Grand Forks (KMXV), ND, located about 76 miles west of the accident site. The lowest elevation scan of 0.53° was scanning the altitudes between 5,110 ft through 12,730 ft assuming standard refraction of the radar beam over the accident site.

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors¹², it is a function of the drop size

¹² Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface. Hydrometeors are classified as; (a) Liquid or

distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in dBZ and is a general measure of echo intensity. The FAA Aviation Weather Handbook defines echoes less than 30 dBZ as “light” in intensity, “moderate” echoes 30-40 dBZ, “heavy” with echoes of >40-50 dBZ, and “extreme” intensity with echoes above >50 dBZ. These are the new standard radio phraseology terms used by air traffic controllers to describe weather conditions to pilots as shown in the table below. Light rain is typically reported at the surface when reflectivities reach 20 dBZ, while air traffic control weather displays, and airborne weather radar typically do not display echoes less than 30 dBZ or light intensity echoes on their weather displays.

Reflectivity (dBZ) Ranges	Weather Radar Echo Intensity Terminology
<30 dBZ	Light
30 - 40 dBZ	Moderate
>40 - 50 dBZ	Heavy
>50 dBZ	Extreme

Figure 6 is a depiction of the KMXV WSR-88D 0.53° base reflectivity image for 0031 CDT with the accident airplane’s flight track overlaid in magenta. The aircraft is observed operating through echoes of 15 to 30 dBZ (light to moderate intensity echoes) during its final descent. Light rain is typically reported at the surface when echoes overhead are 20 dBZ and greater.

solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals.

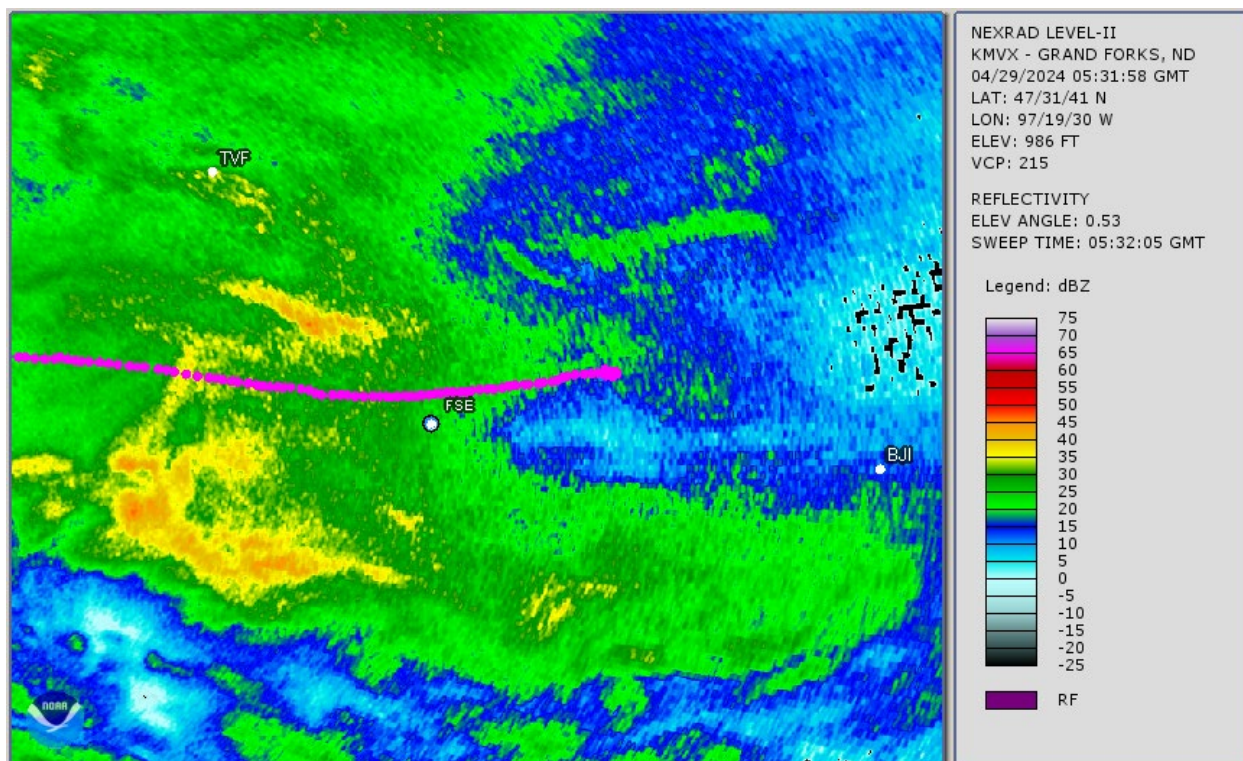


Figure 6 - NWS Grand Forks (KMVX) WSR-88D 0.53° base reflectivity image for 0031 CDT with flight track overlaid in magenta.

6.0 Pilot Reports

The following pilot reports (PIREPs) were disseminated longline¹³ and in the FAA database from 1800 through 0500 CDT within 50 miles of the approximate accident site and below 21,000 ft. The reports are in standard code and abbreviations, with time in UTC and altitude in msl heights.

PKD UA /OV PKD/TM 2335/FL070/TP SF50/TB LGT CHOP/IC NEG/RM IMC

BJI UA /OV BJI/TM 0539/FL023/TP PC12/SK UNKN023-TOPUNKN/RM DURD

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BJI UA /OV BJI/TM 0747/FL210/TP PC12/SK UNKN025-TOP210/TA UNKN/IC NEG

BJI UA /OV BJI/TM 0845/FL021/TP PC12/SK UNKN021-TOPUNKN/TA M01/IC NEG

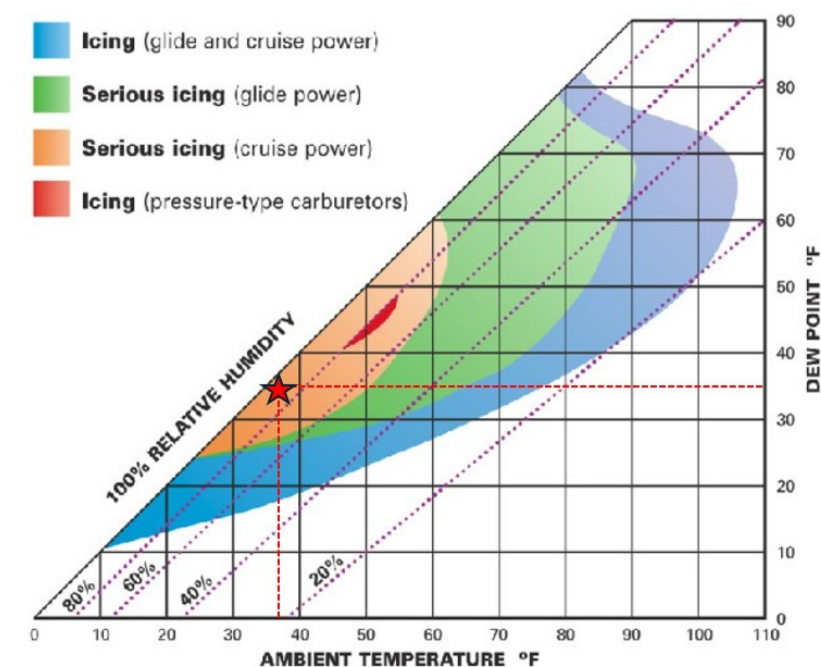
GPZ UA /OV GPZ/TM 0858/FL150/TP C525/SK UNKN-TOP150/TA M03/IC LGT RIME

¹³ Includes only the reports official recorded and disseminated as a PIREP and may not include "ride reports" broadcasted or other conditions solicited by air traffic controllers and not entered in the formal PIREP format coding. These reports are available to users in near real-time.

Of the 5 reports within 50 miles of the accident site one over BJI reported cloud tops near 21,000 ft after the accident. There were no icing reports prior to the accident and only one report of light rime type icing after the accident at 15,000 ft.

7.0 Carburetor Icing Potential

The FAA carburetor icing chart given the weather conditions reported from KFSE at 0015 CDT with a temperature of 37°F, a dew point temperature of 34°F, with a relative humidity of 92% is plotted in figure 7 and indicated a serious icing condition in cruise power.



METAR KFSE 0015 CDT - Temp. 37F, Dew Point 35F, relative humidity 92%

Figure 7 - FAA Carburetor Icing Potential for the area.

8.0 NWS Forecasts

The NWS Grand Forks (KFGF) Weather Forecast Office (WFO) was responsible for issuing the local forecasts and weather warnings for the destination and departure airports, while the NWS AWC was responsible for the primary aviation products and inflight weather advisories.

8.1 Terminal Aerodrome Forecast

The Terminal Aerodrome Forecast (TAF) current for the destination issued by KFGF during the period were as follows. TAFs are issued for a 5 statute mile radius of the airport center point, with specific forecast for winds, visibility, weather, sky conditions, and low-level wind shear conditions as required. TAFs are basically issued every 6 hours with amendments as changing conditions are expected. The forecast period of the expected arrival time is indicated in bold type, and color coded as red for IFR conditions, blue for MVFR conditions, or black for VFR conditions.

TAF KBJI 282323Z 2900/2924 08016G20KT 5SM -RA OVC018

FM290600 06009KT 3SM -SHRA OVC005

FM291000 07008KT 3SM -RASN OVC005

FM291700 05005KT 4SM -RA OVC005=

AMD TAF KBJI 290123Z 2901/2924 07011KT 6SM -RA SCT018 OVC035

FM290600 07010KT 5SM -SHRA OVC010

FM291000 07008KT 3SM -RASN OVC005

FM291700 05005KT 4SM -RA OVC005=

Departed 0232Z

AMD TAF KBJI 290406Z 2904/2924 09010KT 6SM -RA OVC008

FM290600 07010KT 5M -SHRA OVC007

FM291000 07008KT 3SM -RASN OVC005

FM291700 05005KT 4SM -RA OVC005=

*TAF KBJI **290520Z 2906/3006 09010KT 6SM -RA OVC008***

FM291000 07008KT 3SM -RASN OVC005

FM291700 05005KT 4SM -RA OVC005

FM300300 29005KT P6SM BKN004=

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The forecast current at the time of departure was issued at 2023 CDT (second forecast listed) and was an amended forecast and expected general MVFR conditions to prevail, with conditions at 0100 CDT (0600Z) expecting a wind from 070° at 10 knots, visibility 5 miles in light rain showers, with a ceiling overcast at 1,000 ft agl. The forecast was amended after departure at 2306 CDT to IFR conditions (the ceiling was lowered to 700 ft agl). The next scheduled TAF was issued at 0020 CDT and continued to expect IFR conditions with wind from 090° at 10 knots, visibility 6 miles in light rain, with a ceiling overcast at 800 ft agl.

8.2 Graphic Forecast for Aviation

The NWS Graphic Forecast for Aviation (GFA) is a graphical depiction of surface wind, thunderstorms, precipitation, color-coded general flight categories, and cloud

cover bases and tops reported in msl heights, from graphical output from the NWS National Digital Forecast Database (NDFD) with the Graphic-Airmen's Meteorological Information (G-AIRMET) for IFR conditions, mountain obscuration, icing conditions, and strong surface wind overlaid. The GFA provides a forecast for the enroute phase of flight and for locations without a TAF, such as in this case at KHSP. The GFA is available at the NWS AWC website and through other weather briefing services.

The NWS 6-hour GFA Surface and Cloud Forecasts current for the period at 0100 CDT is included as figure 8 and 9. The GFA surface forecast depicted an extensive area of IFR (pink) and MVFR conditions (blue) due to restricted visibility over the Dakotas and Minnesota with rain showers and mixed rain and snow over northern Minnesota in the vicinity of the accident site. The surface winds were expected from the east at 20 to 25 knots. A Graphic-AIRMET for IFR conditions was also depicted over the entire area at 0100 CDT. While the GFA cloud forecast depicted a large area of overcast clouds with bases near 1,700 ft msl with tops to Flight Level (FL)¹⁴ 340. A Graphic-AIRMET for icing conditions, valid for 0100 CDT, was depicted over the area by the blue polygram.

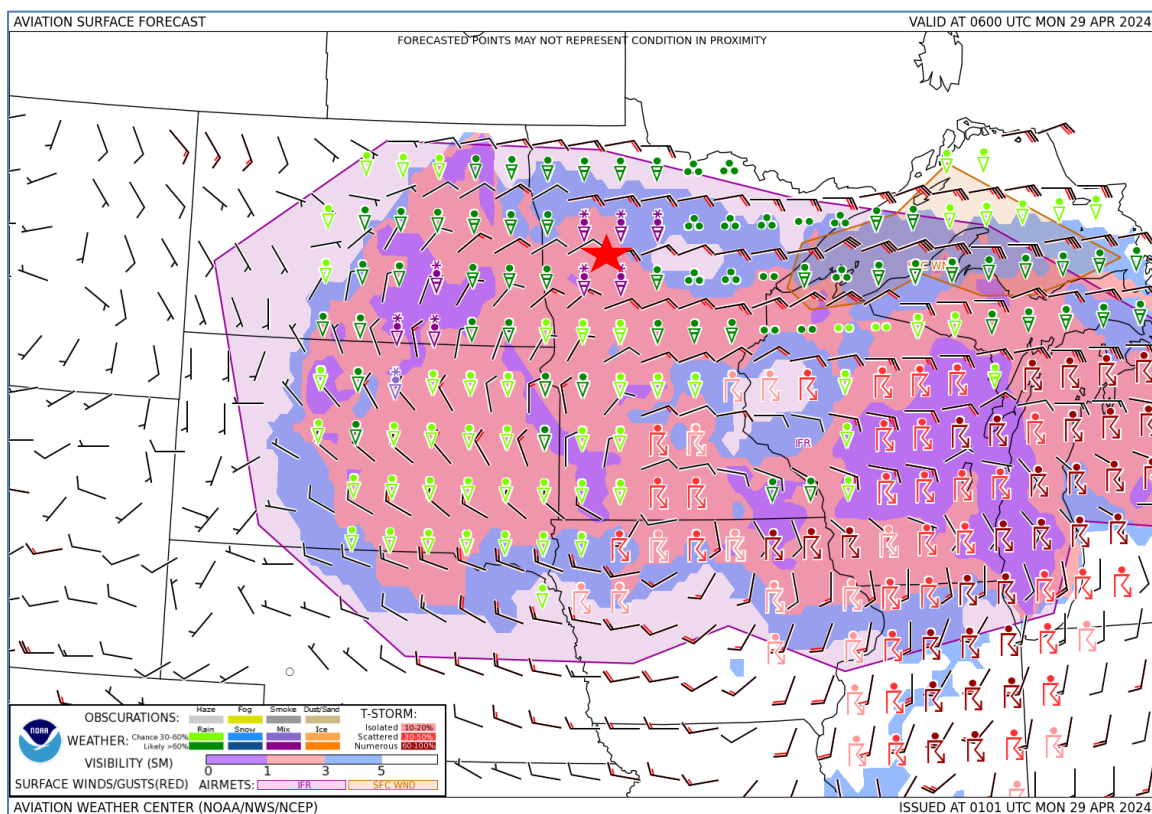


Figure 8 - NWS 6-hour Graphic Forecast for Aviation Surface Forecast valid for 0100 CDT.

¹⁴ Flight Level (FL) is reference to pressure altitude in 100's of feet with the altimeter set to 1013.25-hPa or 29.92 inHg, and is typically used when operating above 18,000 ft. So FL340 is a reference to tops to 34,000 ft.

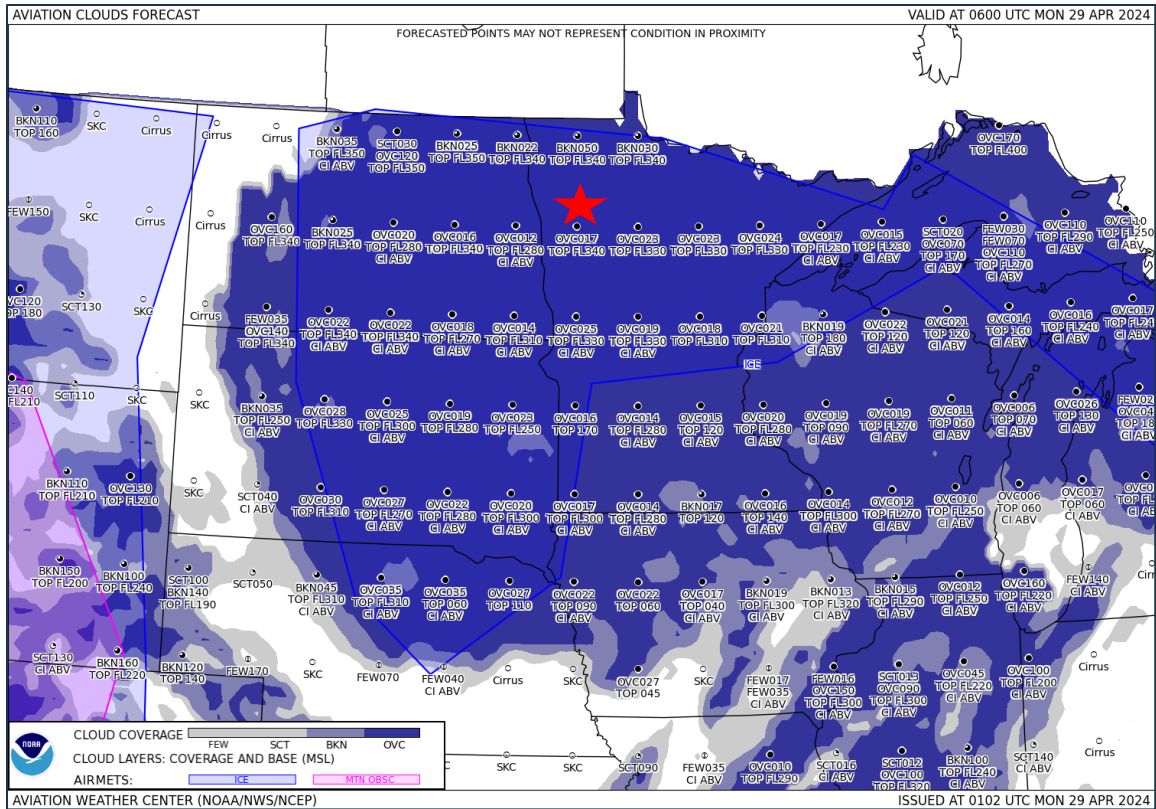


Figure 9 - NWS 6-hour Graphic Forecast for Aviation Cloud Forecast valid for 0100 CDT.

8.3 Area Forecast Discussion

The NWS FGF WFO issued the following Area Forecast Discussion around 1900 CDT for the region that included the accident site.

FXUS63 KFGF 290001
AFDFGF

Area Forecast Discussion
National Weather Service Grand Forks ND
701 PM CDT Sun Apr 28 2024

.KEY MESSAGES...

- 30 percent chance for an inch or greater of snow in north central Minnesota Monday morning bringing the chance for isolated minor impacts to travel.

- Multiple systems will continue to bring periods of rain to the region from Tuesday through the end of the week.

.UPDATE...

Issued at 701 PM CDT Sun Apr 28 2024

The band of precipitation currently sits in between Fargo and Grand Forks. This band is still expected to continue to move northward throughout the night. Total rainfall seen from this band has been up to half an inch. As we lose sunlight, lighter amounts of rain up to a couple tenths is more likely for counties north of Highway 200. Forecast remains on track.

.DISCUSSION...

Issued at 228 PM CDT Sun Apr 28 2024

Upper level low pressure system is centered over the central plains tracking northeast into Minnesota and Iowa. Rain (moderate at times) is situated along and north of the upper level low and is tracking northward. This rain will continue to overspread eastern North Dakota and northwestern Minnesota throughout the remainder of the afternoon and into the evening hours. The low pressure system is associated with the southwesterly flow aloft that will be stuck in place through mid-week before turning zonal/northwesterly end of the week as represented by cluster analysis.

As the precipitation moves northward this evening and overnight snow may mix in at times in eastern North Dakota and northwestern Minnesota as temperatures near the surface cool to the low to mid 30s. Areas near Lake of the Woods and Beltrami (north central Minnesota) reach the low 30s easily overnight bringing the chance (30%) for rain to transition over to snow. Atmospheric soundings differ in residence time, onset of snow, and growth within the DGZ. 30% of guidance has snow lasting longer, becoming moderate at times, and longer time within the DGZ. This leads to accumulations of an 1 or more in north central Minnesota on elevated surfaces. There exists a chance (30%) for isolated impacts to travel where snow starts to accumulate on elevated surface. However, majority (70%) of guidance has the rain/snow mix remaining, as saturation is through the low and mid-levels, temperatures hover above freezing/are isothermal in the low levels, and DGZ growth is limited. This would bring little to no impacts and up to an inch of new snowfall. Likely (70%) QPF of 0.50 to 1.25 inches from this evening through Monday evening. Temperatures quickly rewarm by Monday mid-morning transitioning all rain/snow back over to rain, with the system exiting by the evening hours. Temperatures warm into the mid to upper 40s for Monday afternoon. Dry conditions move in briefly Monday night, with temperatures in the low to mid 30s.

An active pattern will continue beyond Monday, as a trough and associated jet streak over the western US passes several waves through the Northern Plains.

.AVIATION /00Z TAFS THROUGH 00Z TUESDAY/...

Issued at 630 PM CDT Sun Apr 28 2024.

Light rain continues to lift northward, with KFAR likely seeing more showers than steady rain through much of the evening. Light rain is currently being observed at KBJI and will move into KGFK and KTVF by around 03Z. A transition to a mix of rain and snow remains possible heading into Monday morning, with little to no impact expected from accumulating snow. Any snow will transition back to rain by mid-morning. As for ceilings, a best case scenario of MVFR is expected this evening, with the expectation of more widespread IFR CIGs later tonight and into Monday morning. Some guidance suggests LIFR CIGs are possible around sunrise Monday; however, there is low confidence regarding location, and consistency is minimal.

.FGF WATCHES/WARNINGS/ADVISORIES...

ND...None.

MN...None.

8.4 Winds and Temperature Aloft Forecast

The NWS Winds and Temperatures Aloft Forecast valid for the period along the general route of flight is included below based on the FBUS forecast bulletin. The forecast was valid for 0100 CDT and for use between 2200 through 0700 CDT. The stations along the route were: DIK - Dickinson, ND, MOT - Minot, ND, GFK - Grand Forks, ND, AXN - Alexandria, MN, and DLH - Duluth, MN.

FD3US3

DATA BASED ON 281800Z

VALID 290600Z FOR USE 0300-1200Z. 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>DIK</i>		<i>3505+01</i>	<i>3616-02</i>	<i>3521-07</i>	<i>3314-19</i>	<i>9900-30</i>	<i>151548</i>	<i>191057</i>	<i>241453</i>
<i>MOT</i>		<i>0912+00</i>	<i>0620-04</i>	<i>0515-07</i>	<i>0907-19</i>	<i>1414-30</i>	<i>161848</i>	<i>172258</i>	<i>222055</i>
<i>GFK</i>	<i>1027</i>	<i>1316-01</i>	<i>1132-03</i>	<i>1141-07</i>	<i>1325-17</i>	<i>1520-29</i>	<i>152047</i>	<i>171656</i>	<i>192953</i>
<i>AXN</i>	<i>1236</i>	<i>1910+04</i>	<i>2111-02</i>	<i>2112-06</i>	<i>1915-18</i>	<i>1324-30</i>	<i>152747</i>	<i>194150</i>	<i>203850</i>
<i>DLH</i>	<i>0941</i>	<i>1233+01</i>	<i>1129-01</i>	<i>1515-04</i>	<i>1920-16</i>	<i>1623-28</i>	<i>219543</i>	<i>710452</i>	<i>205854</i>

The station closest to the accident site was Grand Forks, ND (GFK) located about 80 miles west-northwest of the accident site. The forecast for GFK at 3,000 ft was for wind from 100° at 27 knots, at 6,000 ft wind from 130° at 16 knots with a temperature of -1°C, and at 9,000 ft wind from 110° at 32 knots with a temperature of -3°C.

8.5 Current icing Product

The NWS AWC Current Icing Product (CIP) display for 9,000 ft at 0045 CDT is included as figure 10 with the approximate accident site marked by the red star. The image depicted light to moderate icing conditions at 9,000 ft with an area of heavy intensity icing immediately west of the accident site and along the general route of flight. The Graphic-AIRMET for occasional moderate icing conditions from the freezing level which ranged from 3,000 ft to 10,000 ft over the area with tops to 20,000 ft, is displayed on the image.

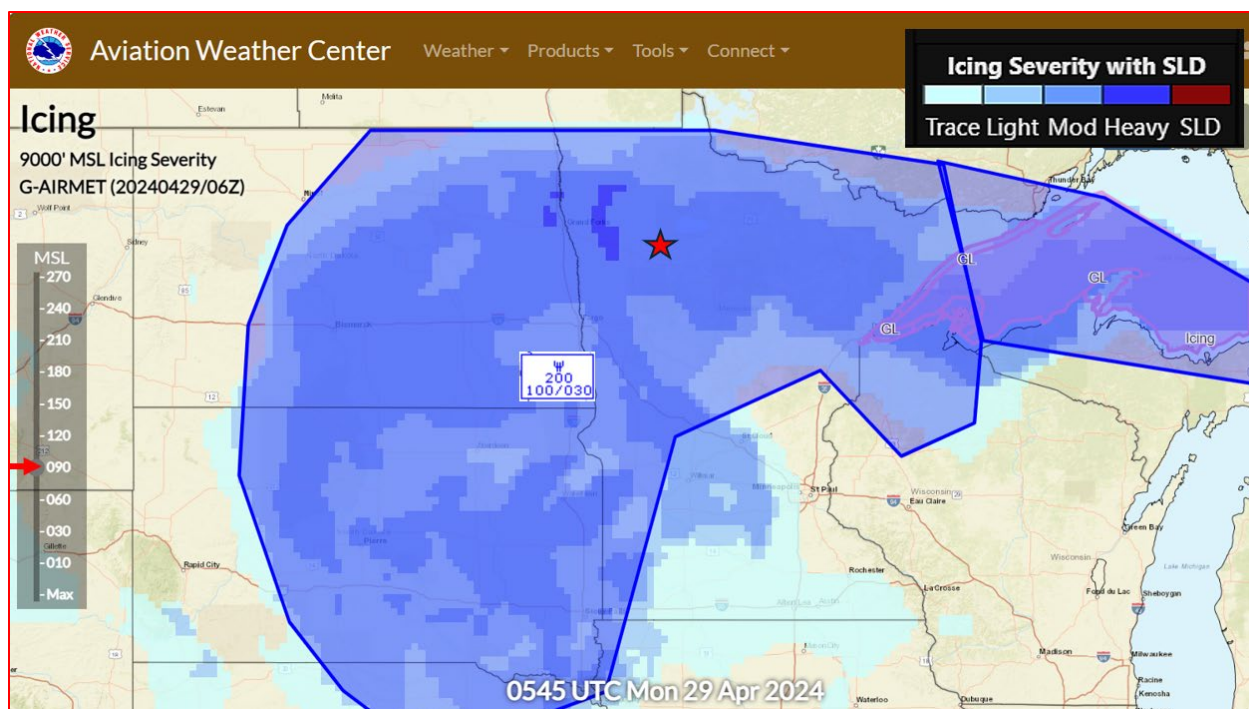


Figure 10 - NWS Current Icing Product and Graphic-AIRMET for Icing for 0045 CDT.

9.0 Inflight Weather Advisories

In-flight Aviation Weather Advisories are forecasts that 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) at the various Air Route Traffic Control Centers (ARTCCs). There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the Graphic-AIRMET, and the Center Weather Advisory (CWA). Inflight advisories serve to notify en-route pilots of the possibility of encountering hazardous flying conditions that 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 based on experience and the operational limits of the aircraft. Once issued they are broadcast by FAA air traffic controllers upon issuance and available on inflight weather broadcasts.

The NWS had G-AIRMETs current for IFR conditions, occasional moderate icing conditions between the freezing level and 23,000 ft. The freezing level was noted extending between 4,000 ft and 12,000 ft over the area. There were no SIGMETs, Convective SIGMETs, or Center Weather Advisories current over the route during the period. The text version of the advisories¹⁵ were as follows:

¹⁵ The legacy text AIRMETs may differ from the graphic version, which shows the growth and decay of

WAUS43 KPCI 290245

WA3S

CHIS WA 290245

AIRMET SIERRA FOR IFR VALID UNTIL 290900

.
AIRMET IFR...ND SD NE MN IA WI LM LS MI LH IL IN
FROM 50NNE MOT TO 70WNW INL TO 60E INL TO 70N SAW TO 50NE ASP TO
40ENE ECK TO 30S ECK TO GIJ TO 20E IOW TO 40ENE OVR TO 50W OBH
TO 50WSW RAP TO 40W DIK TO 50NNE MOT
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 09Z THRU 15Z.

WAUS43 KPCI 290245

WA3Z

CHIZ WA 290245

AIRMET ZULU FOR ICE AND FRZLVL VALID UNTIL 290900

.
AIRMET ICE...MN WI LM LS MI LH
FROM 80WNW YQT TO 40E YQT TO 60NW SSM TO 50NW YVW TO 40NE ECK TO
20SE MBS TO 40SSE TVC TO 20NNW TVC TO 60S SAW TO 50SW SAW TO
30WNW RHI TO 80WNW YQT
MOD ICE BTN FRZLVL AND FL230. FRZLVL 040-120. CONDS ENDG 06-09Z.

.
AIRMET ICE...ND SD NE MN IA WI LS MI
FROM 70N MOT TO 80WNW YQT TO 50SSW RHI TO 40ESE MCW TO 30SW MSP
TO 70SSE FSD TO OBH TO 40NNW LBF TO 80W ANW TO 40W DPR TO 20NE
DIK TO 30WSW MOT TO 70N MOT
MOD ICE BTN FRZLVL AND FL200. FRZLVL 020-110. CONDS CONTG BYD 09Z
THRU 15Z.

.
FRZLVL...RANGING FROM 020-140 ACRS AREA
MULT FRZLVL 070-090 BOUNDED BY 30E RAP-40WSW ANW-50WNW LBF-
30NNE BFF-30SSW RAP-30E RAP
MULT FRZLVL 030-110 BOUNDED BY 70NNW MOT-40E YQT-20N SSM-30SE
SSM-40WNW RWF-40SSW FSD-40ESE PIR-20SSE GFK-60W GFK-40N
DPR-50SSW DIK-20ESE ISN-70NNW MOT
040 ALG 60SSW YWG-60ESE MOT-BIS-50N PIR-50WSW ABR-FAR-70N SAW
080 ALG 50WSW RAP-30ENE LBF-50WNW OVR-20S RWF-50W SAW-60SE SSM
120 ALG 20WNW ARG-30SSE AXC-30SW MBS-30E MBS-40ENE ECK

....

10.0 Astronomical Conditions

The astronomical data were obtained from the United States Naval Observatory's website¹⁶ and provided the following astronomical conditions for the accident site in Clearbrook, MN, on April 28, 2024.

the conditions over the period of the hazardous conditions. The text version are scheduled to be discontinued in the future.

¹⁶ <https://aa.usno.navy.mil/data/index>

Sun	Time (CDT)
Begin civil twilight	0634
Sunrise	0708
Sunset	2131
End civil twilight	2205
Accident	0027 on April 29, 2024

Moon	Time (CDT)
Moonrise	0213
Moonset	0936
Accident	0027 on April 29, 2024
Moonrise	0309

At the time of the accident both the sun and the moon were more than 15° below the horizon and provided no illumination. Dark nighttime conditions existed at the time of the accident.

11.0 Weather Briefing

The FAA contract Automated Flight Service Station (AFSS) provider Leidos and no 3rd party vendors using the Lockheed Flight Service (LFS) computer had any contact with N12805 on April 28 or 29, 2024. A separate search of ForeFlight indicated the pilot did file an IFR flight plan between O8D-KBJI with the company, which was follows. Attachment 1 is the route briefing generated with the flight plan.

Date Created Mon, 29 Apr 2024 02:15:59 GMT
 Status SUCCESSFUL
 ARTICC State Supplementary Info Requested: RQS
 Request Type FILE
 Tail N12805
 Type IFR
 Type/Equip C172/SBDGR
 Speed 115
 From O8D
 To KBJI
 Alternate KTVF
 Route
 Departure Time (old) 02:25
 Departure Time Mon, 29 Apr 2024 02:25:00 GMT
 Scheduled Filing Time
 ETE 02:40
 Cruise 9000

Fuel 05:00
Remarks
Pilot Mark Kindem
Address
Email [\(redacted\)](#)
Phone (redacted)
Base KBJI
Souls 1
Color W
Destination Contact
Destination Phone
"Generated FPL Message (FPL-N12805-IG
-C172/L-SBDGR/LB2
-ZZZZ0225
-N0115A090 DCT
-KBJI0240 KTVF
-PBN/D2 DEP/08D DOF/240429 REG/N12805 CODE/A073E0 OPR/BEMIDJI
AVIATION
-E/0500 P/1 R/E
A/WHITE
C/MARK KINDEM (KBJI)"
Expected Route

12.0 Pilot Statement

The pilot provided a statement of the conditions and indicated that on the day of the accident he was flying home from 08D and was about 25 to 30 miles out when he was cleared for the RNAV 13 approach into KBJI. Shortly after 0030 CDT the engine RPM went down, as if the key was shut off. He then pulled the carburetor heat, and the engine made no sound difference. He then added full rich mixture, power to full, nothing brought the power back up. He also indicated that he was in instrument meteorological conditions (IMC) at the time and concentrated on flying the airplane as it descended. He indicated he broke out of the clouds at about 500 ft and attempted to turn to Clearbrook when the accident occurred.

He believes the temperature and dew point were favorable for carburetor icing, and that the carburetor heat was insufficient to clear it up. He also stated that he usually does not use carburetor heat during cruise flight but does use it when he reduces the throttle on approach to landing.

F. ATTACHMENTS

1 - ForeFlight Route briefing

Submitted by:

Donald Eick
NTSB Senior Meteorologist