



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 14, 2017

Weather Study

METEOROLOGY

CEN17LA076

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A. ACCIDENT

Location: Green Bay, Wisconsin
Date: January 11, 2017
Time: about 0913 central standard time (1513 UTC)¹
Airplane: Cessna 182T; C-GTBI

B. METEOROLOGIST

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C. SUMMARY

On January 11, 2017, about 0913 central standard time (CST), a Cessna 182T bearing Canadian registration C-GTBI, was substantially damaged during landing following an in-flight structural icing encounter. The pilot, who was the sole occupant, was not injured. The airplane incurred structural damage to the forward fuselage and firewall. The aircraft was registered to Falconair Ltd., and operated by the pilot under the provisions of 14 *Code of Federal Regulations* Part 91 as a business flight. The flight was not on a flight plan, and originated from Sawyer International Airport, Marquette, Michigan about 0505 CST.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in CST for January 11, 2017 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Location for the accident is Green Bay-Austin Straubel International Airport (GRB) in Green Bay, Wisconsin. Nominal coordinates for GRB are: 44.4846389° north latitude, 88.1297222° west longitude, at an elevation of about 695 feet.

Coordinates (approximation) used for initial icing encounter at about 0700 CST (according to pilot statements²): 46.15° north latitude, 89.42° west longitude, at altitudes of 2,500-2,700 feet. Actual

¹ UTC – abbreviation for Coordinated Universal Time

² In email correspondence with the NTSB, the accident pilot stated: “I cannot state with precision where the icing occurred but I can estimate that it was in the area between Land O Lakes, Wisconsin (KLNL) (N46.15 degrees/W89.21 degrees) and Boulder Junction, Wisconsin (KBDJ) (N46.14 degrees/W89.65 degrees) as I travelled west - I travelled a short distance abeam both those airports as I travelled west...I would estimate icing developing between 1255 UTC and 1305 UTC. My altitude was in the range of my filed flight plan proposal, 2500 - 2700 feet.”

location of onset of aircraft icing is not known but per the accident pilot's email correspondence with the NTSB, is believed to have occurred within about 10 miles of this point.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 0600 CST is presented in figure 1. The surface analysis chart showed the majority of regional station models reporting sub-freezing air temperatures and overcast skies. Wind magnitudes were generally light and directions varied throughout the region. A WSR-88D regional radar composite reflectivity mosaic obtained from the National Centers for Environmental Information (NCEI) for 0700 CST (figure 2) identified light values of reflectivity to the west, north and east of the approximate location for the accident aircraft's initial icing encounter. Section 2.0 discusses weather radar coverage in the area.

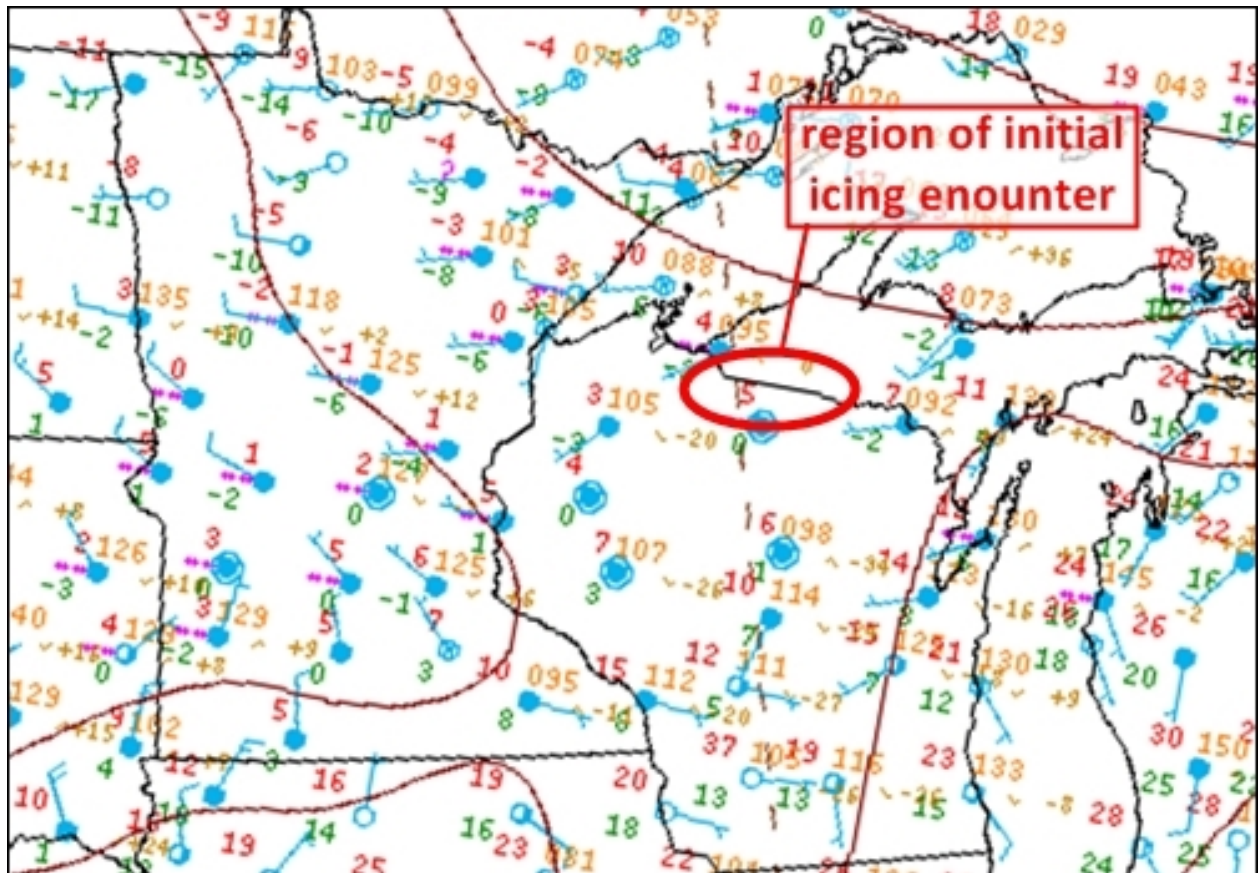


Figure 1 - NWS Surface Analysis Chart for 0600 CST.

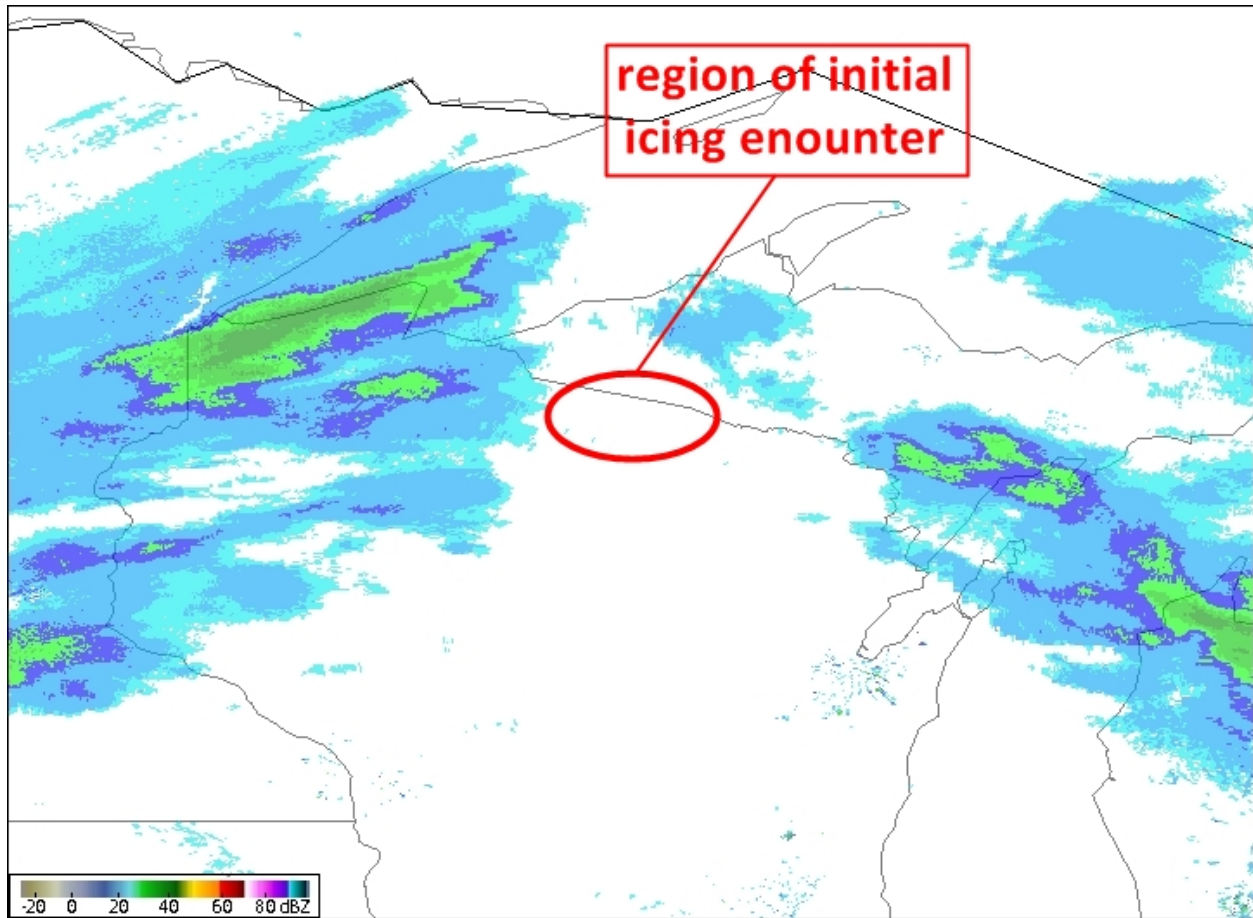


Figure 2 – NCEI WSR-88D mosaic from 0700 CST.

2.0 Weather Radar

WSR-88D³ Level-II weather radar imagery from Marquette, Michigan (KMQT), is presented in figure 3. KMQT was located approximately 81 miles east-northeast of the initial icing encounter at an elevation of about 1,411 feet. Assuming standard refraction and considering the 0.95° beam width⁴ for the WSR-88D radar beam, the KMQT 0.48° tilt would have “seen” altitudes above the approximate location of the initial icing encounter of between about 5,800 and 14,000 feet above msl. Light values of reflectivity were identified to the south, north and east of this location.

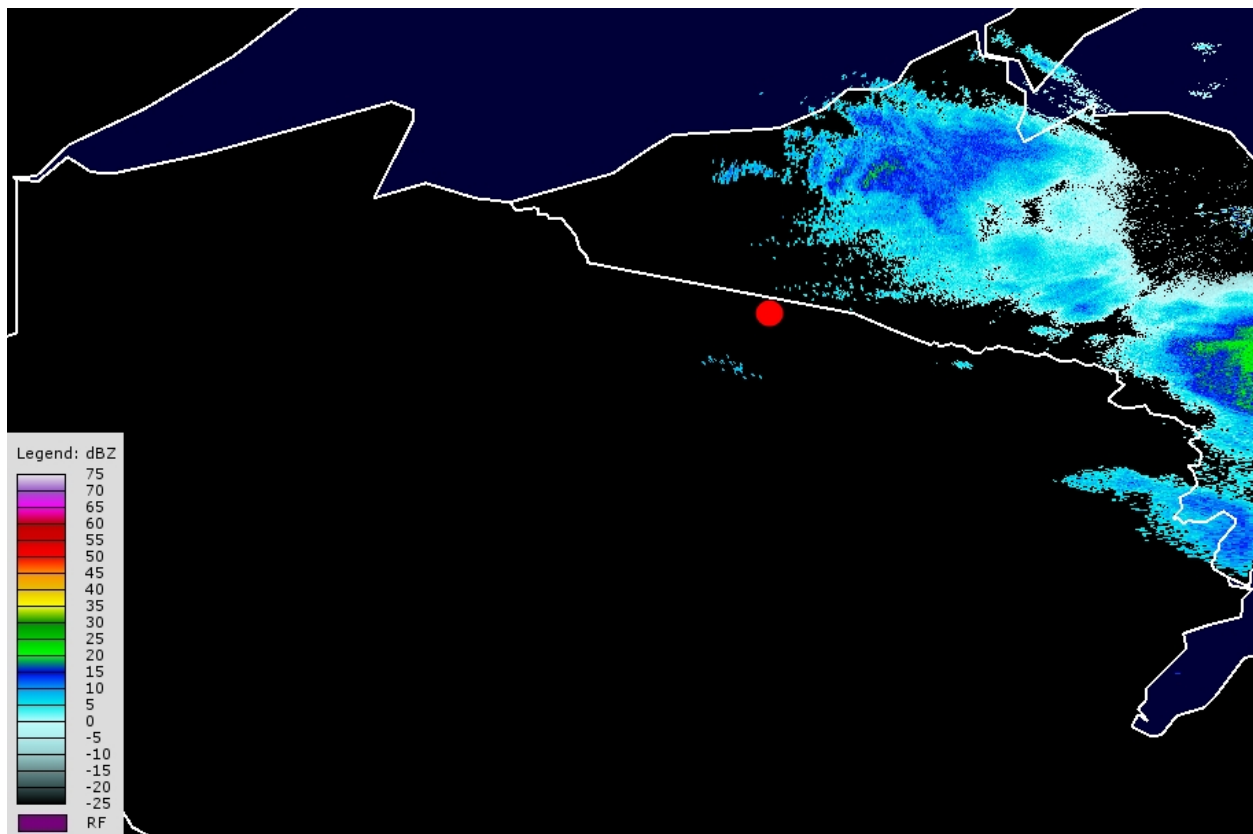


Figure 3 – KMQT 0.48° Level-II reflectivity product from a sweep initiated at 0701:12 CST. Red dot denotes approximate location for accident aircraft’s initial icing encounter at 2,500-2,700 feet at about 0900 CST.

³ Weather Surveillance Radar 88 Doppler (WSR-88D)

⁴ Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward.

WSR-88D Level-II weather radar imagery from Green Bay, Wisconsin (KGRB), is presented in figure 4. KGRB was located approximately 113 miles south-southeast of the initial icing encounter at an elevation of about 682 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KGRB 0.53° tilt would have “seen” altitudes above the approximate location of the initial icing encounter of between about 9,800 and 21,200 feet above msl. Light values of reflectivity were identified to the south of this location.

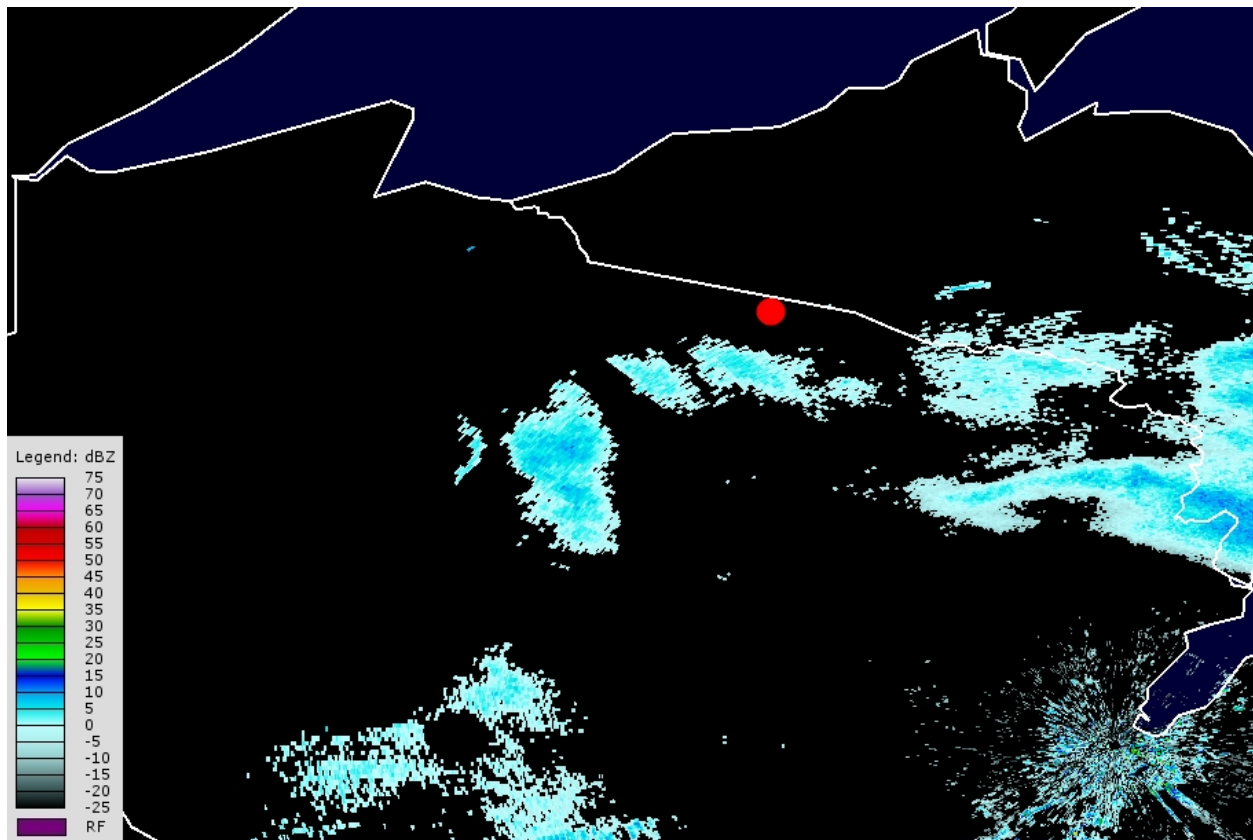


Figure 4 – KGRB 0.53° Level-II reflectivity product from a sweep initiated at 0702:42 CST. Red dot denotes approximate location for accident aircraft’s initial icing encounter at 2,500-2,700 feet at about 0900 CST.

WSR-88D Level-II weather radar imagery from Duluth, Minnesota (KDLH), is presented in figure 5. KDLH was located approximately 122 miles west-northwest of the initial icing encounter at an elevation of about 1,428 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KDLH 0.46° tilt would have “seen” altitudes above the approximate location of the initial icing encounter of between about 11,100 and 23,400 feet above msl. Light values of reflectivity were identified to the south and west of this location.

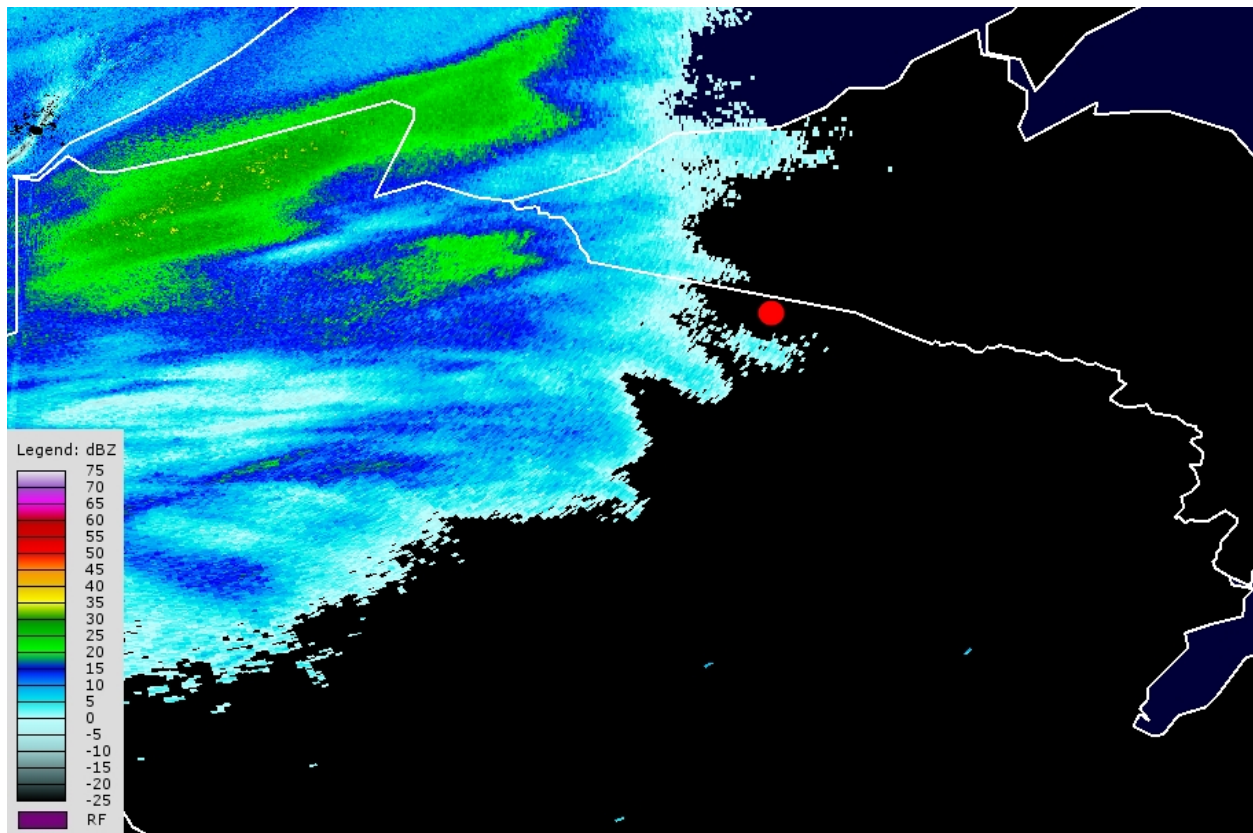


Figure 5 – KDLH 0.46° Level-II reflectivity product from a sweep initiated at 0705:25 CST. Red dot denotes approximate location for accident aircraft’s initial icing encounter at 2,500-2,700 feet at about 0900 CST.

Figure 6 presents a cropped NWS WSR-88D coverage map for below 10,000 feet above ground level (agl).⁵ It indicates that the approximate location of the accident aircraft's initial icing encounter was in an area where the lowest altitude of coverage from WSR-88D detection was between 6,000 and 10,000 agl.⁶ According to information presented in this section, KMQT "saw" slightly below 6,000 feet above msl, and this KMQT minimum coverage altitude would have increased moving west from the approximate location of the accident aircraft's initial icing encounter. Hydrometeors located below the minimum coverage altitudes for the WSR-88Ds would largely have gone undetected by these radars. A review of the hydrometeor classification level 3 product from these WSR-88D radar revealed mainly "dry snow" and "ice crystals" for the scenes depicted in Figures 3-5. "Graupel"⁷ was not identified.

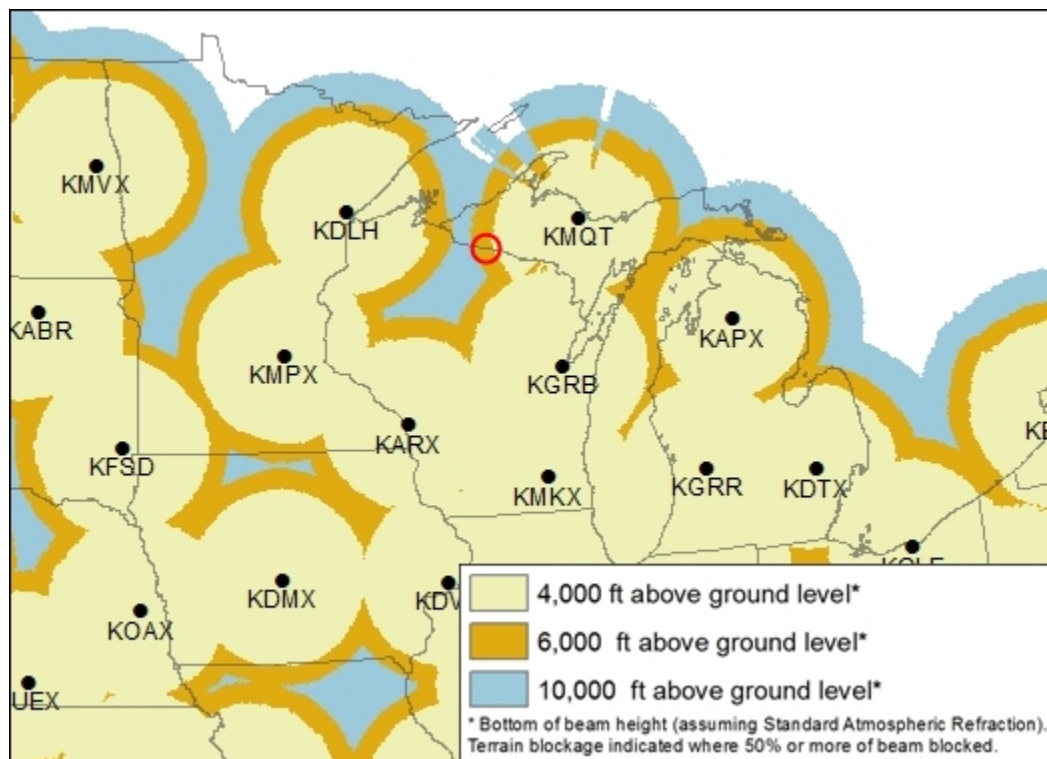


Figure 6 – WSR-88D coverage map for below 10,000 feet agl.

⁵ This map is for Volume Coverage Pattern 12.

⁶ Surface elevation at the approximate location of the accident aircraft's initial icing encounter was about 1,740 feet.

⁷ Graupel - small pellets of ice created when super-cooled water droplets coat, or rime, a snowflake.

3.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at Kings Land O' Lakes Airport (LNL)⁸ in Land O' Lakes, Wisconsin, and was located about 9 miles east of the approximate location of the accident aircraft's initial icing encounter at an elevation of 1,705 feet. Automated reports from LNL during the times surrounding the accident aircraft's initial icing encounter are presented here:

[0555 CST] METAR KLNL 111155Z AUTO 22003KT 5SM -SN SCT013 SCT021
OVC030 M16/M18 A2970 RMK AO2 T11561183 11145 21166=
[0615 CST] METAR KLNL 111215Z AUTO 22003KT 4SM -SN SCT022 BKN055
OVC070 M15/M18 A2969 RMK AO2 T11551181=
[0635 CST] METAR KLNL 111235Z AUTO 24003KT 10SM -SN BKN039 OVC050
M15/M18 A2969 RMK AO2 T11551182=
[0655 CST] METAR KLNL 111255Z AUTO 24003KT 10SM BKN034 OVC040
M15/M18 A2969 RMK AO2 T11531181=
**[0715 CST] METAR KLNL 111315Z AUTO 26003KT 7SM -SN OVC029 M15/M18
A2971 RMK AO2 T11511178=**
[0735 CST] METAR KLNL 111335Z AUTO 25003KT 2SM -SN SCT015 OVC024
M15/M17 A2972 RMK AO2 T11501170=
[0755 CST] METAR KLNL 111355Z AUTO 26004KT 1 1/4SM -SN OVC013 M15/M17
A2972 RMK AO2 T11501170=

At 0715 CST, LNL reported a wind at from 260° at 3 knots, visibility of seven statute miles, light snow, ceiling overcast at 2,900 feet agl, temperature of -15° Celsius (C) and a dew point temperature of -18°C, altimeter setting of 29.71 inches of mercury; remarks included: station with a precipitation discriminator.

An AWOS was located at Eagle River Union Airport (EGV) in Eagle River, Wisconsin, and was located about 14 miles south-southeast of the approximate location of the accident aircraft's initial icing encounter at an elevation of 1,642 feet. Automated reports from EGV during the times surrounding the accident aircraft's initial icing encounter are presented here:

[0555 CST] METAR KEGV 111155Z AUTO 25004KT 4SM -SN SCT012 BKN023
OVC031 M16/M19 A2968 RMK AO2 T11601190 11147 21170=
[0615 CST] METAR KEGV 111215Z AUTO 25006KT 10SM -SN SCT022 SCT028
OVC060 M16/M19 A2969 RMK AO2 T11571188=

⁸ The National Weather Service (NWS) uses the 4-digit International Civil Aviation Organization (ICAO) format for station identifiers (as seen in the body of some formatted weather observations). This report uses the 3-digit International Air Transport Association format for station identification, which does not use the geographic designating digit ("K" for stations in the continental U.S. and "P" for U.S. stations in Alaska and the Pacific region) as found in the ICAO format.

[0635 CST] METAR KEGV 111235Z AUTO 25003KT 10SM -SN BKN047 OVC060 M16/M19 A2967 RMK AO2 T11571188=

[0655 CST] METAR KEGV 111255Z AUTO 25005KT 10SM SCT027 BKN032 OVC047 M15/M19 A2968 RMK AO2 T11551186=

[0715 CST] METAR KEGV 111315Z AUTO 25006KT 10SM OVC025 M15/M18 A2970 RMK AO2 T11551185=

[0735 CST] METAR KEGV 111335Z AUTO 25006KT 3SM -SN OVC023 M15/M18 A2971 RMK AO2 T11531179=

[0755 CST] METAR KEGV 111355Z AUTO 25006KT 1 1/4SM -SN SCT013 OVC023 M15/M18 A2972 RMK AO2 T11531178=

At 0715 CST, EGV reported a wind at from 250° at 6 knots, visibility of ten statute miles or greater, ceiling overcast at 2,500 feet agl, temperature of -15°C and a dew point temperature of -18°C, altimeter setting of 29.70 inches of mercury; remarks included: station with a precipitation discriminator.

An AWOS was located at Lakeland Airport/Noble F. Lee Memorial Field (ARV) in Minocqua-Woodruff, Wisconsin, and was located about 18 miles southwest of the approximate location of the accident aircraft's initial icing encounter at an elevation of about 1,630 feet. Automated reports from ARV during the times surrounding the accident aircraft's initial icing encounter are presented here:

[0555 CST] METAR KARV 111155Z AUTO 00000KT 5SM -SN SCT028 BKN060 OVC070 M15/M18 A2968 RMK AO2 7//// T11521177 11147 21163=

[0615 CST] METAR KARV 111215Z AUTO 00000KT 10SM -SN SCT035 SCT046 OVC050 M15/M18 A2968 RMK AO2 T11521179=

[0635 CST] METAR KARV 111235Z AUTO 00000KT 10SM BKN029 BKN035 OVC050 M15/M18 A2969 RMK AO2 T11501177=

[0655 CST] METAR KARV 111255Z AUTO 27003KT 7SM -SN OVC027 M15/M17 A2970 RMK AO2 T11501175=

[0715 CST] METAR KARV 111315Z AUTO 27003KT 3SM -SN OVC023 M15/M17 A2973 RMK AO2 T11491170=

[0735 CST] METAR KARV 111335Z AUTO 28003KT 2SM -SN SCT009 SCT015 OVC023 M15/M16 A2972 RMK AO2 T11471165=

[0755 CST] METAR KARV 111355Z AUTO 26003KT 1/2SM SN OVC007 M15/M17 A2973 RMK AO2 T11471168=

At 0715 CST, ARV reported a wind at from 270° at 3 knots, visibility of three statute miles, light snow, ceiling overcast at 2,300 feet agl, temperature of -15°C and a dew point temperature of -17°C, altimeter setting of 29.73 inches of mercury; remarks included: station with a precipitation discriminator.

4.0 Pilot Reports

Publicly disseminated pilot reports⁹ made between 0400 and 0900 CST within about 100 miles of the approximate location of the accident aircraft's initial icing encounter below 10,000 feet are presented here:

CMX UA /OV CMX/TM 1105/FL020/TP C208/SK OVC020-TOP040/TA M13/IC
MOD RIME 020-040=

RHI UA /OV IWD-RHI/TM 1110/FL050/TP C208/SK SCT050-TOP110/TA M14/IC
LGT RIME 050-110/RM FZRA, THIN LAYER=

CWA UA /OV KCWA/TM 1300/FL039/TP BE99/SK OVC034-TOP039/SKC/IC
NEG/RM DURD=

CWA UA /OV KCWA/TM 1343/FL040/TP BE99/SK OVC030-TOP040/SKC/IC
TRACE RIME 030-040/RM DURD=

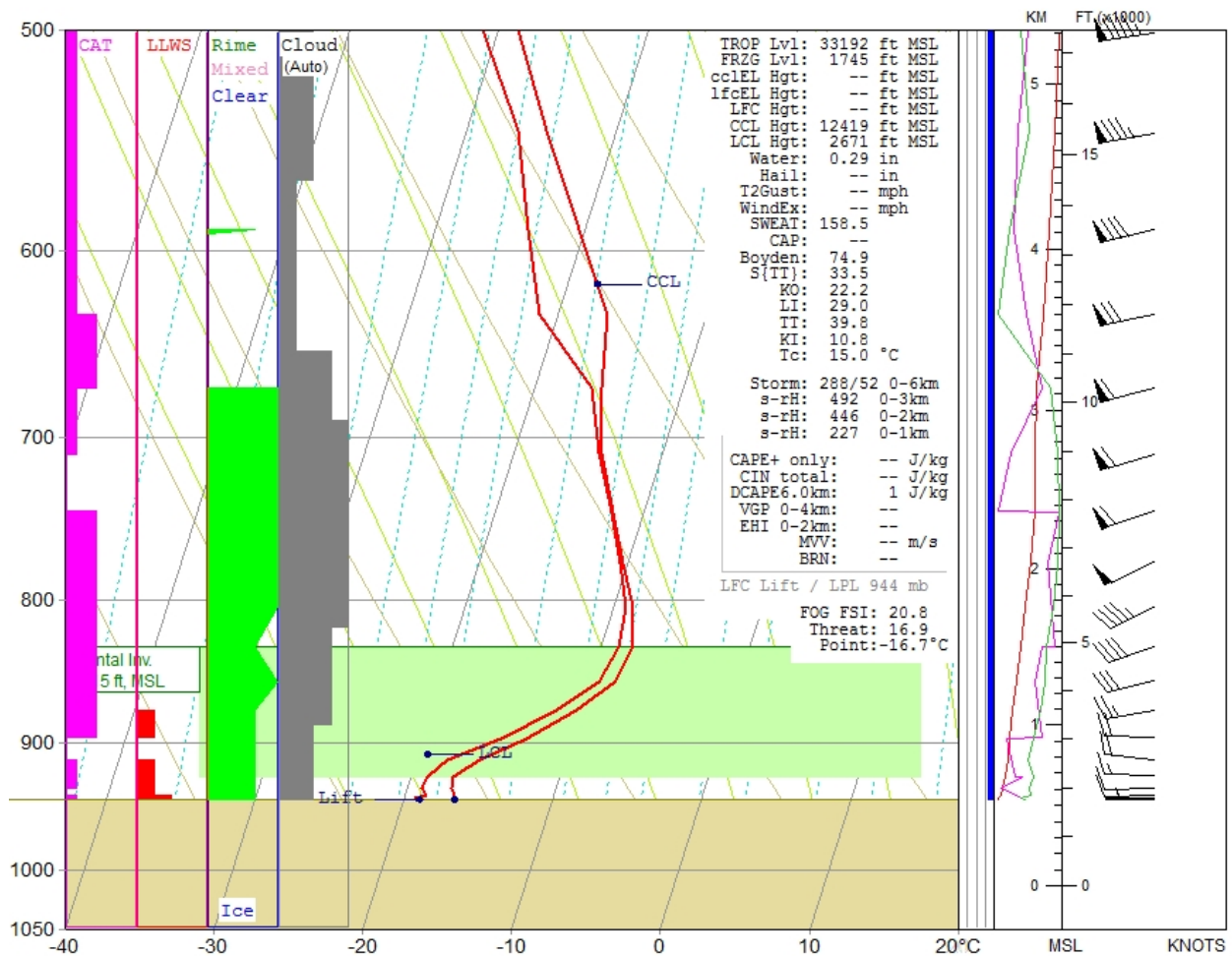
5.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR) model¹⁰ sounding (figure 7) for the approximate location of the accident aircraft's initial icing encounter at 0700 CST was retrieved from the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory. Near the surface, the wind was from the west at 5 knots but backed slightly to the west-southwest with an increase in magnitude to about 40 knots at 5,000 feet. Between about 2,000 and 5,000 feet the temperature increased with height, and relative humidity was between 83 and 93 percent. Calculations made by the Rawinsonde Observation Program (RAOB) did not yield any significant areas of turbulence for this atmosphere. The freezing level was below the surface.

RAOB identified several layers below 4,000 feet with light low-level wind shear (LLWS) with a shallow layer of moderate LLWS near the surface. Further, RAOB identified light and moderate rime icing threats for the entire atmosphere below 10,000 feet. The atmosphere below about 3,500 feet was characterized by a light rime icing threat.

⁹ Only pilot reports with the WMO headers UBMN**, UBWI** and UBMI** were considered.

¹⁰ The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.



6.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-13 infrared ($10.7\mu\text{m}$) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 0700 CST is presented in figure 8. The GOES-13 infrared cloud-top temperatures varied in the area around the approximate location of the accident aircraft's initial icing encounter, however a fair approximation for that location is -22°C . Considering the HRRR model sounding, -22°C corresponded to a cloud top height of about 14,200 feet. It should be noted that figure 8 has not been corrected for any parallax error.

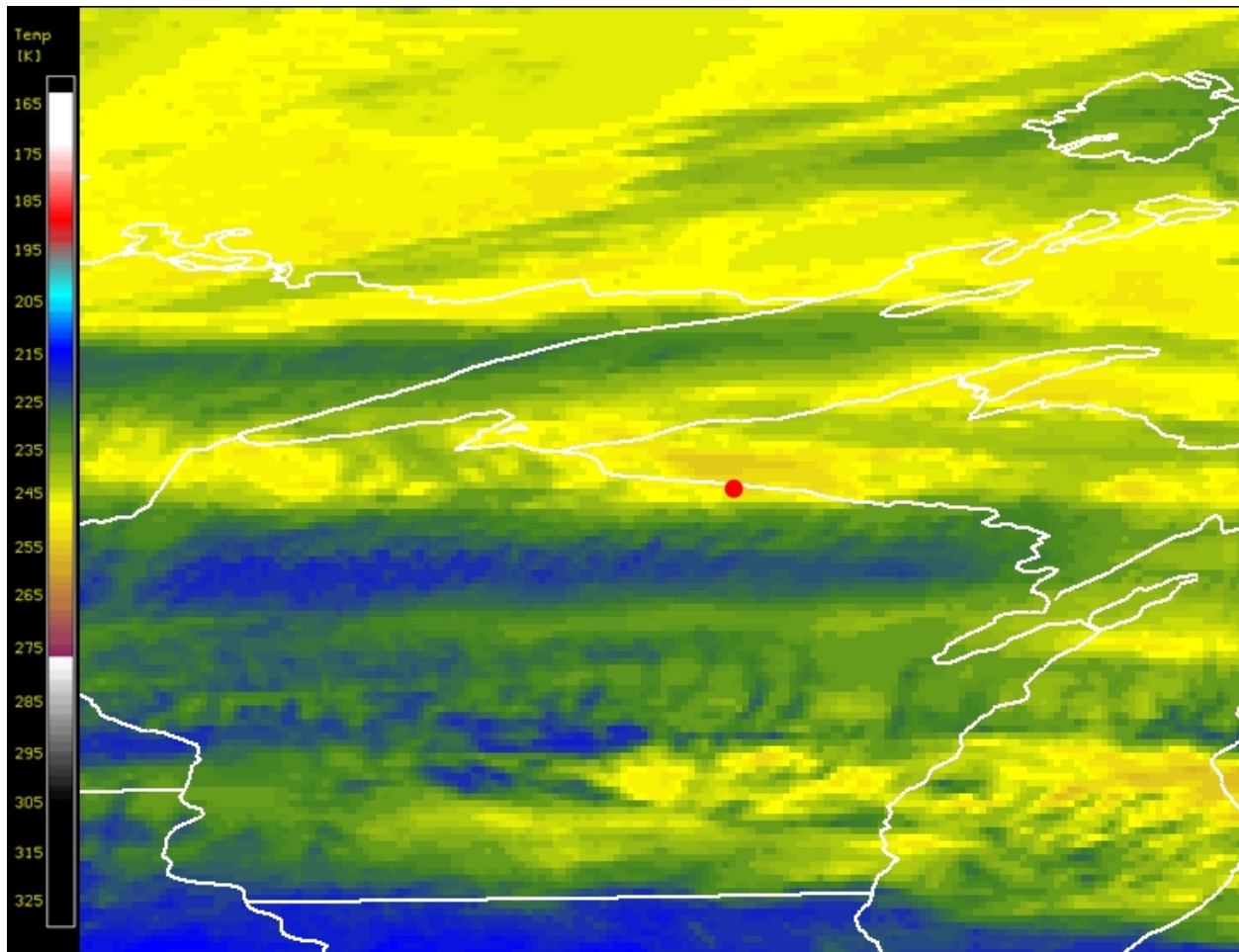


Figure 8 – GOES-13 infrared imagery from 0700 CST. Approximate location of the accident aircraft's initial icing encounter denoted by red dot.

7.0 Area Forecast

An Area Forecast that included the state of Wisconsin, Lake Superior and Upper Peninsula of Michigan was issued at 0445 CST by the Aviation Weather Center (AWC) in Kansas City, Missouri. Cloud heights are above msl. With regard to the approximate location of the accident aircraft's initial icing encounter: the portion of the Area Forecast directed toward the northwestern portion of Wisconsin forecasted overcast clouds at 3,000 feet with cloud tops to FL250¹¹, visibility of three statute miles, light snow; the portion of the Area Forecast directed toward the northeastern portion of Wisconsin forecasted overcast clouds at 6,000 feet with cloud tops to FL270, broken clouds at 2,500 feet beginning at 0700 CST; the portion of the Area Forecast directed toward the western portion of Lake Superior and Upper Peninsula of Michigan forecasted overcast clouds at 2,000 feet with cloud tops to FL250, visibility of three statute miles, scattered light snow showers.

FAUS43 KKCI 111045

FA3W

_CHIC FA 111045

SYNOPSIS AND VFR CLDS/WX

SYNOPSIS VALID UNTIL 120500

CLDS/WX VALID UNTIL 112300...OTLK VALID 112300-120500

ND SD NE KS MN IA MO WI LM LS MI LH IL IN KY

.

SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.

TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.

NON MSL HGTS DENOTED BY AGL OR CIG.

.

SYNOPSIS...10Z LO PRESS NERN NEB. WRMFNT NERN NEB-NWRN IL. CDFNT

NERN NEB-SCNTRL-SWRN NEB. WRMFNT SRN MO-NERN KY. 05Z CDFNT

SERN

LWR MI-CNTRL IL-SWRN MO.

.

WI

NW..OVC030 TOP FL250. VIS 3SM -SN. 17Z WDLY SCT -SHSN. 21Z SCT030
BKN060 TOP 080. OTLK...VFR.

NERN..SCT025 OVC060 TOP FL270. 13Z BKN025. AFT 15Z VIS 3-5SM -SN. 17Z
OVC025. VIS 3SM -SN. OTLK...MVFR CIG SN 04Z VFR SHSN.

SW..BKN040 TOP FL260. 17Z OVC020. VIS 5SM BR. 20Z OVC035. OTLK...VFR.

SE..BKN100 TOP FL260. 21Z OVC030. VIS 5SM -FZDZ. OTLK...MVFR CIG
FZRA.

.

LS UPR MI

W HLF..OVC020 TOP FL250. VIS 3SM SCT -SHSN. 20Z TOP 050. ISOL -SHSN.
OTLK...MVFR CIG TIL 00Z SHSN.

¹¹ Flight Level - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 in Hg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

E HLF..BKN030 TOP 060. 15Z TOP FL260. ISOL -SHSN. 18Z OVC020. VIS 3SM
SCT -SHSN. OTLK...MVFR CIG SHSN.

8.0 AIRMETs

Airmen's Meteorological Information (AIRMET) advisories that were issued prior to 0700 CST and active for the approximate location of the accident aircraft's initial icing encounter for altitudes below 10,000 feet are presented here.

At 0245 CST, an AIRMET TANGO for moderate turbulence was issued:

WAUS43 KKCI 110845
WA3T
_CHIT WA 110845
AIRMET TANGO UPDT 3 FOR TURB STG WNDS AND LLWS VALID UNTIL
111500
.
AIRMET TURB...ND SD NE KS MN IA MO WI LM LS MI LH
FROM 70SW YWG TO 30N INL TO YQT TO SSM TO YVV TO 20ESE ECK TO
40SW DXO TO 40WSW FNT TO 30NE ORD TO 40WNW ODI TO 40E DSM TO 40E
SLN TO GLD TO 70SW RAP TO 100SE MLS TO 70SW YWG
MOD TURB BTN 050 AND 150. CONDS CONTG BYD 15Z THRU 21Z.

At 0245 CST, an AIRMET ZULU for moderate icing was issued:

WAUS43 KKCI 110845
WA3Z
_CHIZ WA 110845
AIRMET ZULU UPDT 1 FOR ICE AND FRZLVL VALID UNTIL 111500
.
AIRMET ICE...ND SD NE MN IA WI LM LS MI LH IL
FROM 20E YQT TO SSM TO YVV TO 60SSW YVV TO 40S ECK TO 30WSW MBS
TO 20SE PMM TO 20SSW ORD TO 30SE MCW TO 30E MCK TO SNY TO BFF TO
70SW RAP TO 100SE MLS TO 30WSW DLH TO 20E YQT
MOD ICE BTN FRZLVL AND 150. FRZLVL SFC-050. CONDS CONTG BYD 15Z
THRU 21Z.

At 0245 CST, an AIRMET SIERRA for instrument flight rule (IFR)¹² conditions was issued:

WAUS43 KKCI 110845
WA3S
_CHIS WA 110845

¹² IFR conditions - ceilings less than 1,000 feet agl and/or visibility less than three statute miles.

AIRMET SIERRA UPDT 1 FOR IFR AND MTN OBSCN VALID UNTIL 111500

.
AIRMET IFR...ND SD NE MN WI LM LS MI
FROM 50S YWG TO 40S BRD TO YQT TO 20ESE SSM TO 30NE MCW TO 60W
FSD TO 30SSE BFF TO 70SW RAP TO 50SSW ISN TO 20N BIS TO 40WSW GFK
TO 50S YWG
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.

At 0553 CST, an updated AIRMET SIERRA for IFR conditions was issued:

WAUS43 KPCI 111153 AAA
WA3S
_CHIS WA 111153 AMD
AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 111500

.
AIRMET IFR...ND SD NE MN IA WI LM LS MI LH...UPDT
FROM 30NE INL TO YQT TO 20SSE SSM TO 40NNE GRB TO 40E GRB TO 30NE
MCW TO 30NW FSD TO 60W ANW TO 30SSE BFF TO 70SW RAP TO 50SSW ISN
TO 30N BIS TO 30NE INL
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.

At 0621 CST, an updated AIRMET SIERRA for IFR conditions was issued:

WAUS43 KPCI 111221 AAB
WA3S
_CHIS WA 111221 AMD
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 111500

.
AIRMET IFR...ND SD NE MN IA WI LM LS MI LH
FROM 30NE INL TO YQT TO 20SSE SSM TO 40NNE GRB TO 40E GRB TO 30NE
MCW TO 30NW FSD TO 60W ANW TO 30SSE BFF TO 70SW RAP TO 50SSW ISN
TO 30N BIS TO 30NE INL
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.

At 0652 CST, an updated AIRMET ZULU for moderate icing was issued:

WAUS43 KPCI 111252 AAA
WA3Z
_CHIZ WA 111252 AMD
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 111500

.
AIRMET ICE...ND SD NE MN IA WI LM LS MI LH IL
FROM 20E YQT TO SSM TO YVV TO 60SSW YVV TO 40S ECK TO 30WSW MBS
TO 20SE PMM TO 20SSW ORD TO 30SE MCW TO 30E MCK TO SNY TO BFF TO
70SW RAP TO 100SE MLS TO 30WSW DLH TO 20E YQT

MOD ICE BTN FRZLVL AND 150. FRZLVL SFC-050. CONDS CONTG BYD 15Z
THRU 21Z.

9.0 SIGMETs

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

10.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Minneapolis Air Route Traffic Control Center that were active for the accident site at the accident time.

11.0 Current Icing Potential/Forecast Icing Potential

Images presenting output from the Current Icing Potential (CIP) and the Forecast Icing Potential (FIP) products for about 0700 CST for 3,000 and 5,000 feet above msl for the area of the icing encounter were provided by the National Center for Atmospheric Research (NCAR).¹³ These images are presented in Attachment 1.

The CIP indicated that at 0700 CST, icing was not identified at 3,000 feet in the area of the initial icing encounter. However, a 40-50 percent probability of light or moderate icing was identified at 5,000 feet. A supercooled liquid drop (SLD) threat was not identified at either 3,000 or 5,000 feet.

1-hour, 2-hour and 3-hour FIP products valid at 0700 CST for the area of the initial icing encounter anticipated a low probability of trace or light severities of icing at 3,000 feet. The same FIP products for 5,000 feet anticipated a slightly higher probability of light to moderate severities of icing. An SLD threat was not anticipated at either 3,000 or 5,000 feet.

12.0 Accident Location Surface Observations

An Automated Surface Observing System (ASOS) was located at GRB and its observations issued during the times surrounding the accident time (during which time a certified weather observer was logged into the ASOS system) are presented here:

[0753 CST] METAR KGRB 111353Z 20006KT 10SM BKN110 M08/M12 A2984 RMK
AO2 SLP115 T10831122=

¹³ Courtesy of Mr. Daniel Adriaansen, NCAR.

[0853 CST] METAR KGRB 111453Z 00000KT 10SM BKN029 OVC110 M08/M12
A2983 RMK AO2 SLP114 T10781117=

**[0910 CST] SPECI KGRB 111510Z 00000KT 10SM SCT029 SCT120 M07/M12
A2983 RMK AO2 T10721117=**

[0953 CST] METAR KGRB 111553Z 27003KT 10SM CLR M07/M11 A2982 RMK
AO2 SLP110 T10721111=

At 0910 CST, GRB reported a calm wind, visibility of ten statute miles or greater, scattered clouds at 2,900 feet agl, scattered clouds at 12,000 feet agl, temperature of -7°C and a dew point temperature of -12°C, altimeter setting of 29.83 inches of mercury; remarks included: station with a precipitation discriminator.

13.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for 46° 9' north latitude and 89° 25' west longitude, for the approximate location of the initial icing encounter, indicated the following:

SUN

Begin Civil Twilight	0704 CST
Sunrise	0738 CST

MOON

Moonset	0631 CST
Moonrise	1610 CST

F. Attachments

Attachment 1. Images presenting output from the Current Icing Potential and the Forecast Icing Potential products for about 0700 CST for 3,000 and 5,000 feet above msl for the area of the icing encounter.

Submitted by:

Mike Richards
Senior Meteorologist

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