NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 19, 2022

Factual Report

METEOROLOGY

DCA19FA089

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A. ACCIDENT

Location: Presque Isle, Maine
Date: March 4, 2019
Time: 1129 eastern standard time
1629 Universal Coordinated Time (UTC)
Airplane: CommutAir flight 4933 Embraer EMB-145XR; Registration: N14171

B. METEOROLOGIST

Don Eick
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On March 4, 2019, at 1129 eastern standard time, CommutAir flight 4933, an Embraer EMB-145XR, N14171, d.b.a. United Express, landed between runway 1 and taxiway A in moderate snow at Northern Maine Regional Airport at Presque Isle (PQI), Presque Isle, Maine. This was the second approach to runway 1 after having conducted a missed approach during the first approach. Radar track data show that the airplane was aligned right of runway 1 during both approaches. Of the 31 passengers and crew onboard, two passengers and 1crewmember received minor injuries. The airplane was substantially damaged. The flight was operating under the provisions of Title 14 *Code of Federal Regulations* Part 121 as a regularly scheduled domestic passenger from Newark International Airport (EWR), Newark, New Jersey, to PQI.

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 eastern standard time (EST) based upon the 24-hour clock, local time is -5 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 estimated at latitude 46.690º N and longitude 68.045º at an elevation of approximately 534 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) 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 1.

1.1 Surface Analysis Chart

The northeast section of the NWS Surface Analysis Chart for 1000 EST on March 4, 2019 with the approximate accident site marked by a red star is included as figure 1. The chart depicted a low-pressure system at 998-hectopascals (hPa)[1] off the Maine coast associated with a frontal wave with a warm front extending eastward and a cold front southward from the low off the East Coast. Another low-pressure area at 1006-hPa was located to the west of the accident site near Quebec, Canada, with a cold front extending south-southwestward into Vermont and New York. The accident site was located between the two low's in an area of relative weak pressure gradient.

The station models over Maine in the vicinity of the accident site indicated winds from the east to northeast at 5 knots, light to moderate snow, with overcast cloud cover, temperatures in the mid to upper 20's degrees Fahrenheit (ºF), with dew point temperatures near 25º F.

[1] Hectopascal (hPa) is the new standard term 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 a temperature of 59º F or 15º Celsius (C).

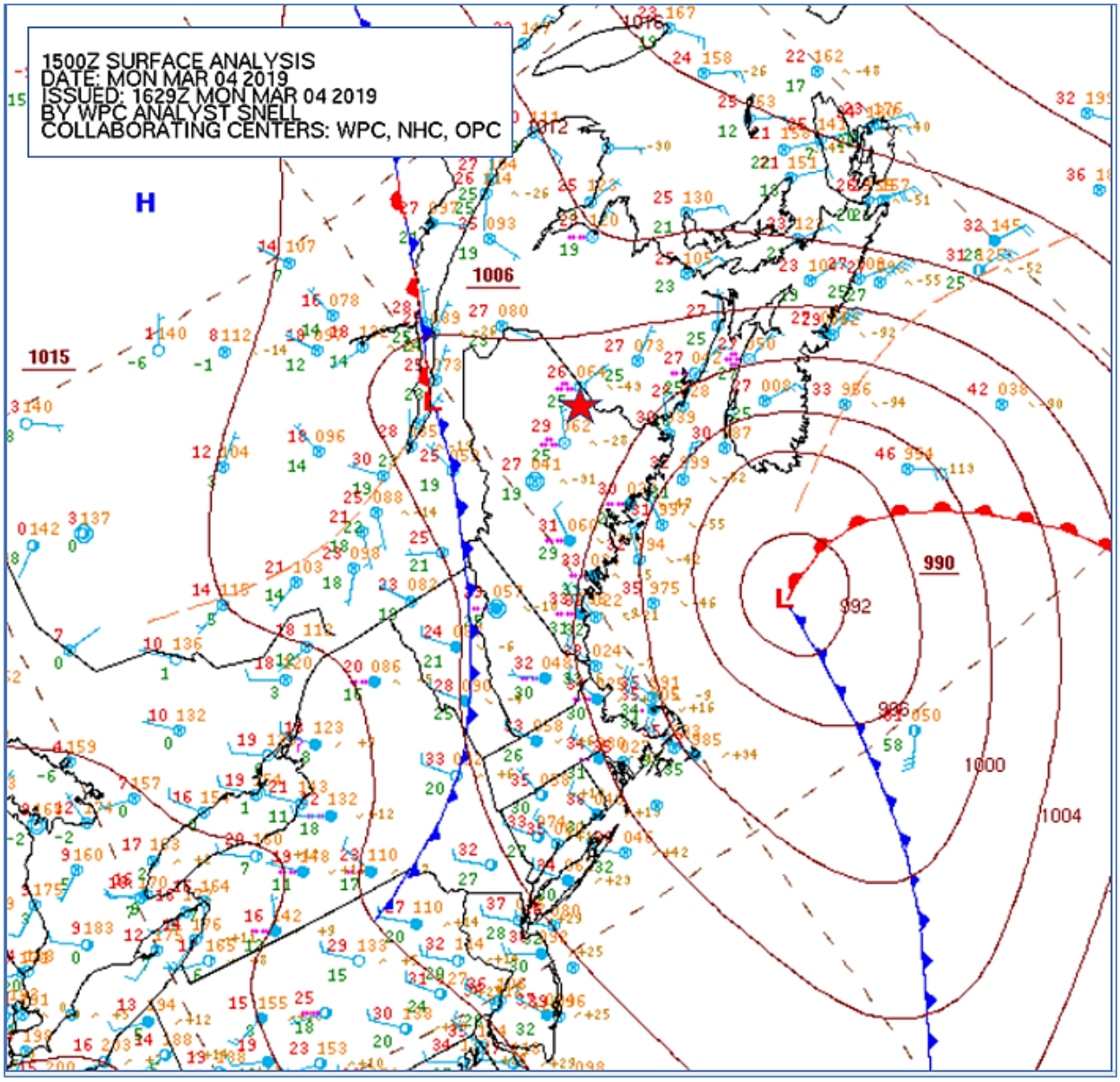

Figure 1 - Northeast section of the NWS Surface Analysis Chart for 1000 EST

1.2 National Composite Radar Mosaic

The northeast section of the NWS National Composite Radar Mosaic for 1145 EST with the accident site marked is included in figure 2. The National radar map depicted a large circular area of precipitation over the area with very light intensity echoes over the accident site, with a band of heavier precipitation extending from approximately 10 miles south to 30 miles east-southeast of the accident site.

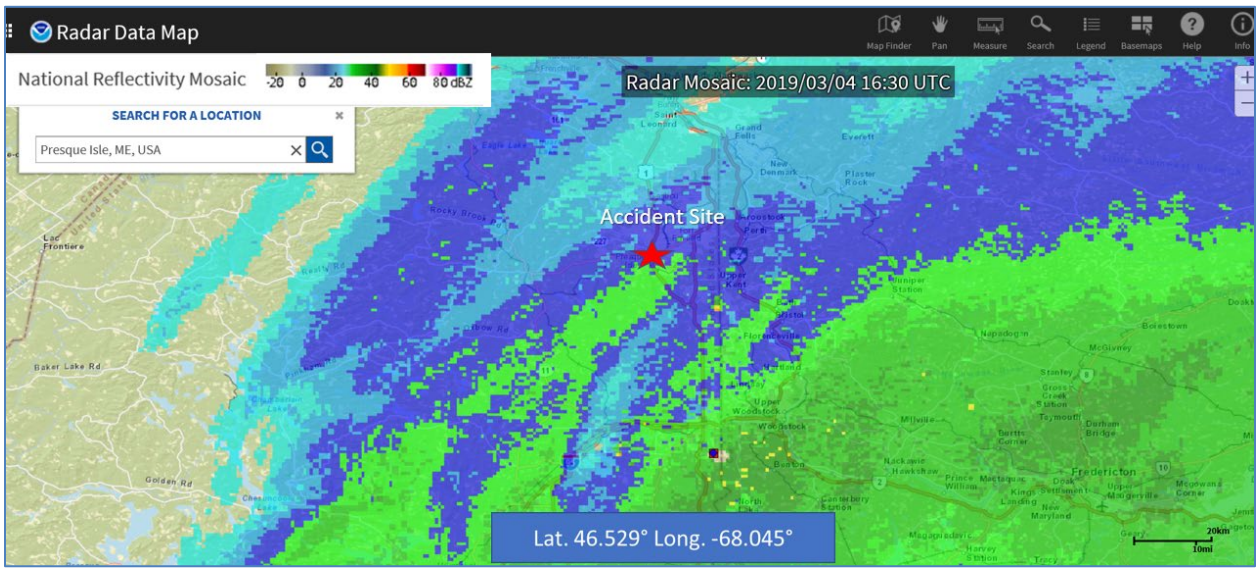

Figure 2 - National Composite Radar Mosaic for 1130 EST

1.3 12-hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart valid for 1900 EST is included as figure 3. The chart depicted the low having moved northeastward to near Quebec and was expected to be located at the northern Maine and Canadian border with the cold front extending southward across the state and into the Atlantic off the New England coast. An area of scattered snow showers was depicted over Maine associated with the low and cold front. The chart did not include the forecast of precipitation in Canada, so the full extent of the precipitation was not depicted.

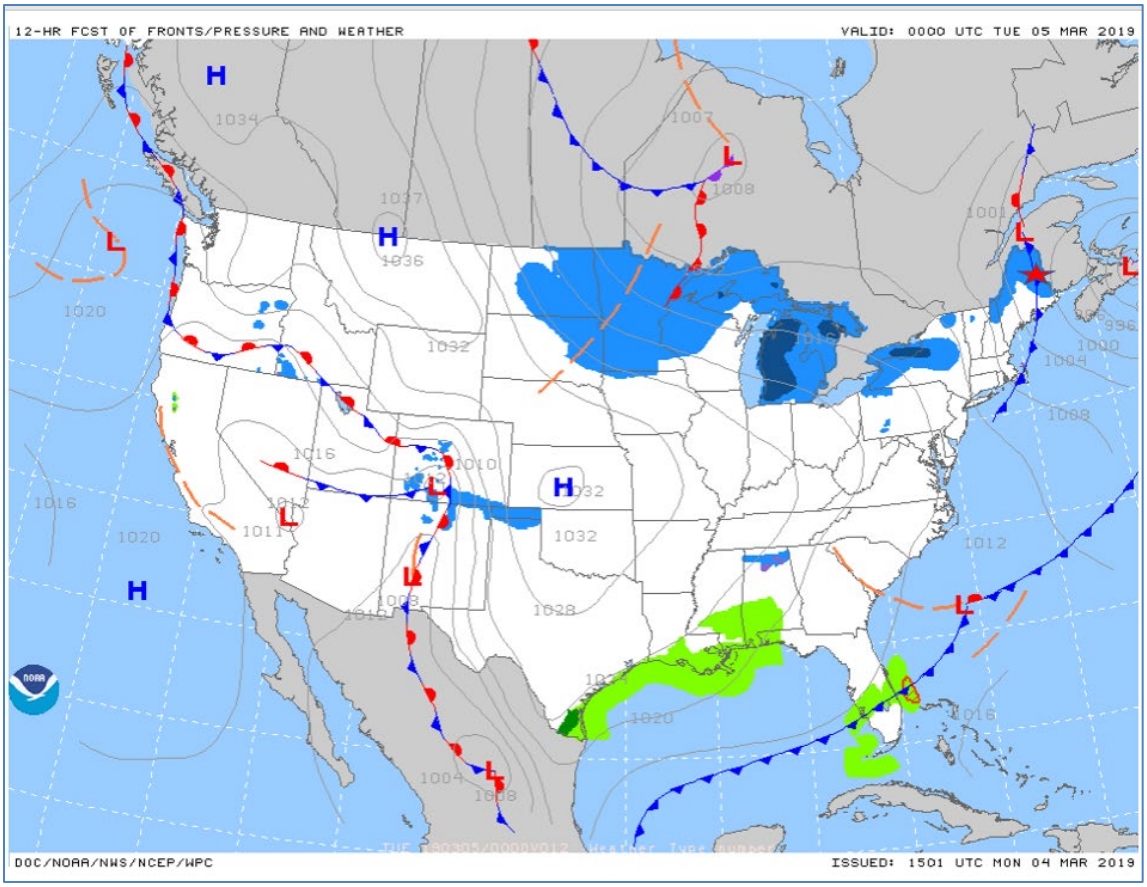

Figure 3 - 12-hour Surface Prognostic Chart valid for 0100 EST on March 5, 2019

2.0 Observations

The official observations issued for the destination and the closest surrounding airport was also 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 17º W based on the latest sectional chart for the area.

2.1 Presque Isle, Maine

The accident occurred at Northern Maine Regional Airport at Presque Isle, Presque Isle, Maine, which lists an elevation of 534 ft[2]. The airport had an Automated Weather Observation System (AWOS) and was not augmented by any human observers. The AWOS reported the following conditions surrounding the period of the accident:

> *KPQI weather observation at 1056 EST, automated, wind from 080° at 6 knots, visibility 1/2 mile in moderate snow and freezing fog, ceiling overcast at 1,300 ft agl, temperature -2° C, dew point temperature -4° C, altimeter 29.70 inches of mercury (Hg). Remarks: automated station, sea-level pressure 1010.3-hPa, hourly precipitation 0.01 inch,*

[2] Runway 1 was the only listed precision approach with an instrument landing system (ILS) approach.

temperature -2.2 C, dew point -4.4 C, freezing rain senor inoperative, and runway visual range (RVR) inoperative.

KPQI special weather observation at 1118 EST, automated, wind from 060° at 4 knots, visibility 1/2 mile in moderate snow and freezing fog, sky condition missing, temperature -3° C, dew point -4° C, altimeter 29.68 inches of Hg. Remarks: automated observation system with a precipitation discriminator, hourly precipitation less than 0.01 inches or a trace, freezing rain sensor and RVR inoperative.

Accident 1129 EST

KPQI special weather observation at 1143 EST, automated, wind from 070° at 5 knots, visibility 3/4 mile in light snow, scattered clouds at 800 ft agl, ceiling overcast at 1,300 ft, temperature -1° C, dew point -4° C, altimeter 29.67 inches of Hg. Remarks: automated observation system with a precipitation discriminator, hourly precipitation since 1056 EST 0.01 inches, freezing rain sensor and RVR inoperative.

KPQI weather observation at 1156 EST, automated, wind from 070° at 6 knots, visibility 1 mile in light snow, a few clouds at 800 ft agl, ceiling overcast at 1,300 ft, overcast clouds at 1,900 ft, temperature -1° C, dew point -4° C, altimeter 29.65 inches of Hg. Remarks: automated observation system with a precipitation discriminator, sea-level pressure 1008.5-hPa, hourly precipitation since 1056 EST 0.01 inches, temperature -1.1° C, dew point -3.9° C, freezing rain sensor and RVR inoperative.

Between 1118 EST through 1156 EST the crosswind component for Runway 1 varied between 4 to 6 knots, with a 1 knot headwind component. The raw METAR and SPECI reports issued surrounding the period with the general flight categories[3] were as follows between approximately 0830 through 1300 EST:

LIFR *METAR KPQI 041356Z AUTO 00000KT 3/4SM -SN BR OVC016 M03/M04 A2978 RMK AO2 SLP128 P0001 T10281044 FZRANO RVRNO=*

LIFR *SPECI KPQI 041422Z AUTO 09004KT 3/4SM -SN BR FEW007 OVC016 M03/M04 A2976 RMK AO2 P0001 FZRANO RVRNO=*

LIFR *SPECI KPQI 041429Z AUTO 08004KT 3/4SM -SN BR FEW007 OVC014 M02/M04 A2975 RMK AO2 P0001 FZRANO RVRNO=*

[3] As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

LIFR *SPECI KPQI 041436Z AUTO 09004KT 1/2SM SN FZFG FEW007 OVC014 M02/M04 A2975 RMK AO2 P0002 FZRANO RVRNO=*

LIFR *SPECI KPQI 041447Z AUTO 08006KT 3/4SM -SN BR SCT007 OVC016 M02/M04 A2974 RMK AO2 P0002 FZRANO RVRNO=*

LIFR *METAR KPQI 041456Z AUTO 07005KT 3/4SM -SN BR BKN009 OVC016 M02/M04 A2973 RMK AO2 CIG 006V011 SLP113 P0002 60003 T10221044 58024 FZRANO RVRNO=*

LIFR *SPECI KPQI 041531Z AUTO 09005KT 1/2SM -SN FZFG BKN011 OVC018 M02/M04 A2971 RMK AO2 P0000 FZRANO RVRNO=*

LIFR ***METAR KPQI 041556Z AUTO 08006KT 1/2SM SN FZFG OVC013 M02/M04 A2970 RMK AO2 SLP103 P0001 T10221044 FZRANO RVRNO=***

LIFR ***SPECI KPQI 041618Z AUTO 06004KT 1/2SM SN FZFG M03/M04 A2968 RMK AO2 P0000 FZRANO RVRNO=***

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LIFR ***SPECI KPQI 041643Z AUTO 07005KT 3/4SM -SN SCT008 OVC013 M01/M04 A2967 RMK AO2 P0001 FZRANO RVRNO=***

IFR ***METAR KPQI 041656Z AUTO 07006KT 1SM -SN FEW008 BKN013 OVC019 M01/M04 A2965 RMK AO2 SLP085 P0001 T10111039 FZRANO RVRNO=***

IFR *SPECI KPQI 041710Z AUTO 06003KT 1 1/4SM -SN SCT011 OVC017 M01/M04 A2964 RMK AO2 P0000 FZRANO=*

IFR *SPECI KPQI 041724Z AUTO 04006KT 2SM -SN SCT009 BKN013 OVC021 M01/M04 A2963 RMK AO2 P0000 FZRANO=*

IFR *SPECI KPQI 041749Z AUTO 06004KT 1 1/4SM -SN FEW009 SCT014 OVC020 M01/M04 A2961 RMK AO2 VIS 3/4V2 1/2 P0000 FZRANO=*

IFR *METAR KPQI 041756Z AUTO 02005KT 1 1/2SM -SN OVC018 M01/M04 A2961 RMK AO2 VIS 3/4V2 ½ SLP071 P0000 60005 T10061039 11006 21044 58041 FZRANO=*

IFR *SPECI KPQI 041803Z AUTO 03007KT 2SM -SN M01/M04 A2961 RMK AO2 VIS 1 1/4V5 P0000 FZRANO $=*

2.2 Caribou, Maine

Caribou Municipal Airport (KCAR), Caribou, Maine was located approximately 10 miles north of KPQI at an elevation of 620 ft. The airport had an Automated Surface Observation System (ASOS). The following conditions were reported at the approximate time of the accident:

> *KCAR weather observation at 1154 EST, automated, wind from 080° at 4 knots, visibility 1/2 mile in light snow and freezing fog, scattered clouds at 700 ft agl, ceiling overcast at 1,300 ft, temperature -2° C, dew point -4° C, altimeter 29.64 inches of Hg. Remarks: automated observation system with a precipitation discriminator, sea-level*

pressure 1005.0-hPa, hourly precipitation 0.03 inches, temperature -2.2° C, dew point -4.4° C.

The raw METAR and SPECI observation surrounding the period with the general flight categories were as follows:

LIFR METAR KCAR 041454Z AUTO 08005KT 1/2SM -SN FZFG FEW007 BKN016 OVC028 M03/M06 A2972 RMK AO2 SLP076 P0002 60002 T10331056 58037

LIFR SPECI KCAR 041532Z AUTO 07005KT 1/4SM -SN FZFG FEW007 OVC014 M03/M05 A2970 RMK AO2 P0002 T10281050

LIFR METAR KCAR 041554Z AUTO 07004KT 1/2SM -SN FZFG VV013 M03/M05 A2969 RMK AO2 SLP066 P0003 T10281050

LIFR SPECI KCAR 041603Z AUTO 07006KT 1/2SM -SN FZFG FEW008 OVC013 M03/M05 A2969 RMK AO2 P0000 T10281050

Accident 1629Z

LIFR METAR KCAR 041654Z AUTO 08004KT 1/2SM -SN FZFG SCT007 OVC013 M02/M04 A2964 RMK AO2 SLP050 P0003 T10221044

LIFR SPECI KCAR 041704Z AUTO 06005KT 3/4SM -SN BKN009 OVC015 M02/M05 A2964 RMK AO2 P0000 T10221050

IFR SPECI KCAR 041711Z AUTO 06006KT 1 1/4SM -SN BKN009 BKN012 OVC017 M02/M05 A2963 RMK AO2 P0000 T10171050

IFR SPECI KCAR 041717Z AUTO 07007KT 1 1/2SM -SN SCT009 OVC012 M02/M05 A2962 RMK AO2

IFR SPECI KCAR 041727Z AUTO 04006KT 2 1/2SM -SN BKN010 OVC014 M02/M05 A2962 RMK AO2 P0000 T10171050

MVFR SPECI KCAR 041735Z AUTO 05006KT 3SM -SN OVC012 M02/M05 A2961 RMK AO2 P0000 T10171050
IFR SPECI KCAR 041750Z AUTO 05006KT 2SM -SN OVC012 M02/M06 A2960 RMK AO2 P0000

IFR METAR KCAR 041754Z AUTO 05006KT 2SM -SN OVC013 M02/M05 A2960 RMK AO2 SLP034 P0000 60008 T10171050 11017 21050 56031

2.3 METAR Display

A display of the METAR observations was obtained from the NWS Aviation Weather Centers (AWC) website[4] immediately after the accident and is included as figure 4. The METARs are plotted in station format form based on the legion in the lower left, with temperature and dew point temperatures provided in °F, and the center of the station color coded by flight category (pink – LIFR, red – IFR, blue – MVFR, and no shading – VFR). The image depicts the conditions recorded at 1145 EST with all the surrounding stations reporting LIFR conditions due to visibilities less

[4] https://aviationweather.gov/metar

than a mile in continuous light intensity snow with low ceilings, with temperatures ranging from 26° to 30° F over the area, with easterly winds of 5 knots.

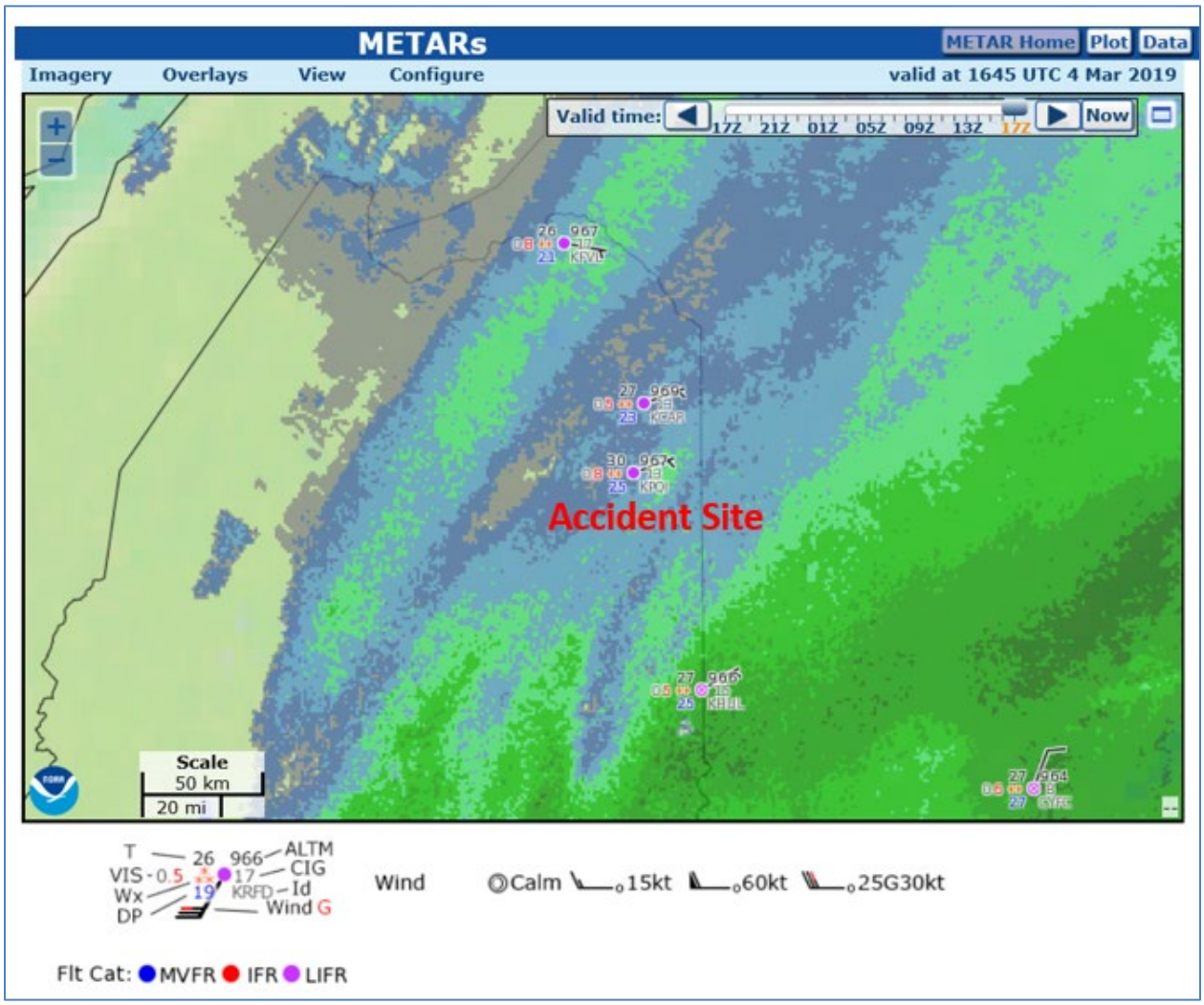

Figure 4 - NWS AWC METAR display at 1145 EST with the radar overlaid

3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site a High-Resolution Rapid Refresh (HRRR)[5] numerical model data was retrieved from the NOAA Air Resources Laboratory and plotted on a standard Skew T log P diagram[6] using the complete

[5] 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.

[6] 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.

Rawinsonde Observation RAOB program software[7]. Figure 5 is the HRRR model sounding for 1200 EST, based on the initial conditions at 0700 EST from the surface to 450-hPa or approximately 20,000 ft.

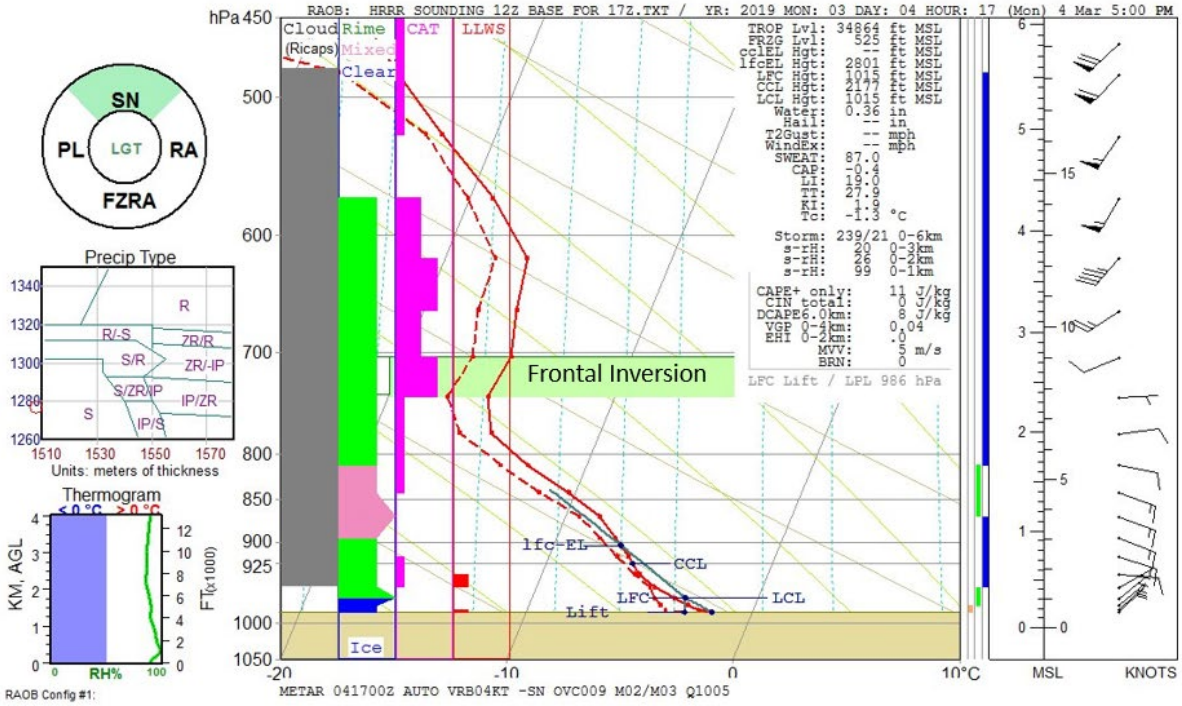

Figure 5 - HRRR numerical model sounding over KPQI at 1200 EST

HRRR model sounding for 1200 EST indicated an elevation of 525 ft, with an expected surface temperature of -1.8º C (28.8º F), a dew point of -3.0º C (26.6º F), a relative humidity of 91%, and with an estimated density altitude of -1,061 ft. The lifted condensation level (LCL) and level of free convection (LFC) were at 490 ft agl (1,015 ft msl), with the convective condensation level (CCL) at 1,652 ft agl (2,177 ft msl). A frontal temperature inversion was identified at approximately 8,500 ft, with the entire depth of the sounding below freezing. The sounding depicted a saturated layer between 900 ft agl and 18,000 ft where the relative humidity exceeded 90% and RAOB supported nimbostratus type clouds capable of producing light snow. The precipitable water content was 0.36 inches.

The HRRR wind profile indicated a surface wind from 040º at 4 knots with wind veering to the east above the surface through 8,000 ft below the temperature inversion. Above the temperature inversion the wind shifted abruptly to the southwest with wind speeds increasing with height. A potential of moderate or greater turbulence existed immediately above the inversion to approximately 12,500 ft. The mean 0 to 6 kilometer (km) wind was from 210º at 28 knots, with the level of maximum wind at 34,700 ft from 220º at 104 knots and was located immediately below the tropopause. The low-level wind component at 1,500 ft agl was from approximately 105° at 10 knots, with wind speeds decreasing to 5 knots or less below 500 ft agl. No significant low-level wind shear (LLWS) or turbulence other than light was identified.

[7] RAOB software – The complete RAwinsonde OBservation program is an interactive sounding analysis program developed by Environmental Research Services, Matamopras, Pennsylvania, for plotting and analyzing upper air data.

Figure 6 is a table of the HRRR model heights, pressure, temperature (T), dew point temperature (Td), relative humidity (RH%), and wind direction and speed, clear air turbulence (CAT), low-level wind shear (LLWS), and icing potential from the surface to 18,000 ft.

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
525	986	-1.8	-3.0	91	40 / 4		LIGHT	LGT Clear
605	983	-2.4	-3.9	89	41 / 5			LGT Clear
764	977	-3.0	-4.2	91	43 / 5			LGT Clear
1004	968	-3.7	-4.6	93	45 / 6			MDT Clear
1381	954	-4.8	-5.0	98	55 / 6	LGT	LIGHT	LGT Rime
1817	938	-5.7	-5.9	98	97 / 8	LGT		LGT Rime
2427	916	-6.5	-7.0	96	113 / 13			LGT Rime
3050	894	-7.4	-8.1	95	116 / 15			LGT Rime
3774	869	-8.5	-9.4	93	116 / 15			MDT Mixed
4575	842	-10.3	-11.6	90	114 / 14	LGT		LGT Mixed
5488	812	-12.6	-13.8	91	103 / 10	LGT		LGT Mixed
6555	778	-14.8	-16.2	89	80 / 9	LGT		LGT Rime
7730	742	-15.6	-17.4	86	86 / 3	SVR		LGT Rime
9033	704	-15.3	-17.0	87	242 / 11	MDT		LGT Rime
10557	662	-15.9	-17.6	87	230 / 23	SVR		LGT Rime
12257	618	-16.4	-17.8	89	216 / 45	MDT		LGT Rime
14200	571	-19.0	-20.1	91	205 / 55			LGT Rime
16239	525	-22.4	-23.1	94	208 / 56	LGT		
18187	484	-25.5	-28.0	80	218 / 60	LGT		

Figure 6 - HRRR model sounding parameters for 1200 EST through 18,000 ft

The HRRR sounding indicated a potential for light icing conditions in the clouds and snow from the surface to approximately 14,000 ft. The icing types ranged from clear ice in the wet snow area, with mixed icing near 3,000 ft.

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) data was 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 images at a resolution of 0.5 km.

Figure 7 is the GOES-16 infrared image at 1127 EST at 4X magnification with a standard GMB temperature enhancement applied. The accident site is obscured by a thick low layer of clouds with a radiative cloud top temperature of 253º Kelvin over KPQI or -20.16º C, which corresponded to cloud tops near 14,500 ft based on the HRRR model sounding. Figure 8 is the GOES-16 visible

image for the same period at normal magnification. The image depicted a thick area of nimbostratus type clouds associated with snow over the accident site.

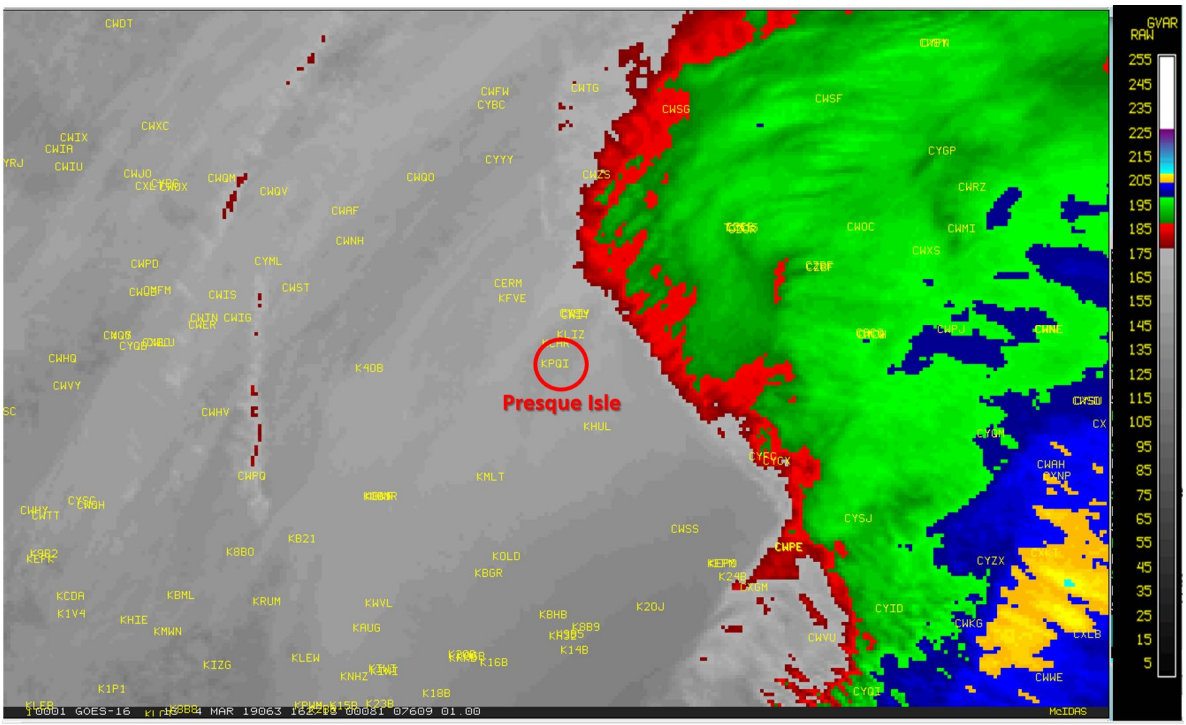

Figure 7 - GOES-16 infrared image at 4X magnification for 1127 EST with standard GMB temperature enhancement scale applied

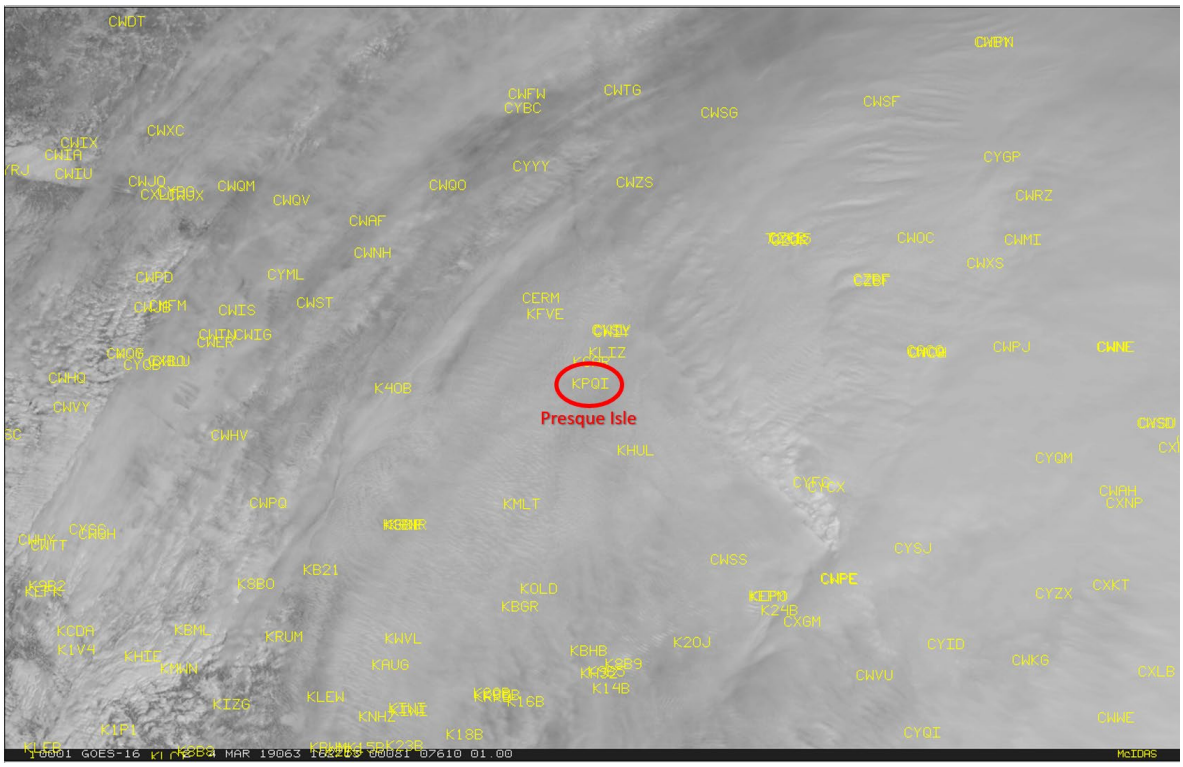

Figure 8 - GOES-16 visible image at 1127 EST at normal magnification

5.0 Pilot Reports

The following pilot reports or PIREPs were recorded over Maine surrounding the period. Cloud bases and tops are reported in msl heights in the following section.

BGR UA /OV BGR 30SW/TM 1444/FL100/TP A319/SK T-016/TA M11/IC LGT RIME

Bangor International Airport (BGR) routine pilot report (UA); Over – 30 miles southwest of BGM VORTAC; Time – 0944 EST; Altitude – 10,000 ft; Type aircraft – Airbus A319 air carrier jet; Sky cover – tops at 1,600 ft; Temperature – minus 11° C; Icing – light rime type icing.

BGR UA /OV BGR 20S/TM 1552/FL060/TP E145/TA M06/IC MOD RIME 110-060

BGR routine pilot report (UA); Over – 20 miles south of BGM VORTAC; Time – 1100 EST; Altitude – 11,000 ft; Type aircraft – Embraer EMB-145 regional air carrier jet; Temperature – minus 6° C; Icing – moderate rime type icing between 11,000 and 6,000 ft.

PWM UA /OV 20 E PSM/TM1600/FL110/TP CRJ7/TA -10/IC LGT/RM DURD

Portland International Jetport (PWM) routine pilot report (UA); Over – 20 miles east of Portsmouth, NH (PSM) VORTAC; Type aircraft – Canadair Regional Jet CRJ-700; Temperature – minus 10° C; Icing – light; Remarks – during descent.

BGR UA /OV BGR/TM 1620/FL070/TP E145/IC MOD RIME ICING/RM DURD

BGR routine pilot report (UA); Over – BGM VORTAC; Time – 1120 EST; Altitude – 7,000 ft; Type aircraft – Embraer EMB-145 regional air carrier jet; Icing – moderate rime type icing; Remarks – during descent.

BGR UA /OV BGR/TM 1630/FL070/TP E145/SK 017/TA M11/IC MOD RIME/RM IC DURD AOB070

BGR routine pilot report (UA); Over – BGM VORTAC; Time – 1130 EST; Altitude – 7,000 ft; Type aircraft – Embraer EMB-145 regional air carrier jet; Sky cover – 1,700 ft; Temperature – minus 11° C; Icing – moderate rime type icing; Remarks – during descent at or below 7,000 ft..

BGR UA /OV 15S BGR/TM1638/FL070/TP GLF4/WX +PRECIP/IC MOD RIME/RM IC DURD AOB 070

BGR routine pilot report (UA); Over – 15 miles south of BGM VORTAC; Time – 1138 EST; Altitude – 7,000 ft; Type aircraft – Gulfstream GIV executive jet; Weather – heavy precipitation; Icing – moderate rime type icing; Remarks – icing encountered during descent at or below 7,000 ft.

BGR UA /OV BGR/TM 1645/FL025/TP GLF4/SK 011/IC LGT RIME/RM IC AOB 025

BGR routine pilot report (UA); Over – BGM VORTAC; Time – 1145 EST; Altitude – 2,500 ft; Type aircraft – Gulfstream GIV executive jet; Sky cover – 1,100 ft; Icing – light rime type icing; Remarks – icing at or below 2,500 ft.

BGR UA /OV BGR 25W/TM 1724/FL095/TP E145/TA M12/IC LGR RIME

BGR routine pilot report (UA); Over – 25 miles west of BGM VORTAC; Time – 1224 EST; Altitude – 9,500 ft; Type aircraft – Embraer EMB-145 regional air carrier jet; Temperature – minus 12° C; Icing – light rime type icing.

BGR UA /OV BGR215025/TM 1725/FLUNKN/TP E145/TA M12/IC LGT RIME 090-135/RMK DURC

BGR routine pilot report (UA); Over – 215° azimuth at 25 miles from BGM VORTAC; Time – 1225 EST; Altitude – unknown; Type aircraft – Embraer EMB-145 regional air carrier jet; Temperature – minus 12° C; Icing – light rime type icing between 9,000 and 13,500 ft; Remarks – during descent.

6.0 Graphic Aviation Forecast

The Graphic Forecast for Aviation (GFA) replaced the Area Forecast for providing enroute weather conditions and cloud cover with bases and tops. The GFA static forecast for "Aviation Surface Forecast" issued by the AWC during the period for wind, visibility, and weather phenomena, with the Graphic-AIRMET[8] (G-AIRMET) Sierra for IFR conditions and G-AIRMET Tango for strong gusty surface winds valid for 1000 EST is included as figure 9 with the accident site located within the red circle. The GFA depicted winds from the southeast at 5 knots, visibility less than 1 mile in light snow over the accident site, with most of Maine expecting IFR to LIFR conditions in light to moderate snow during the period.

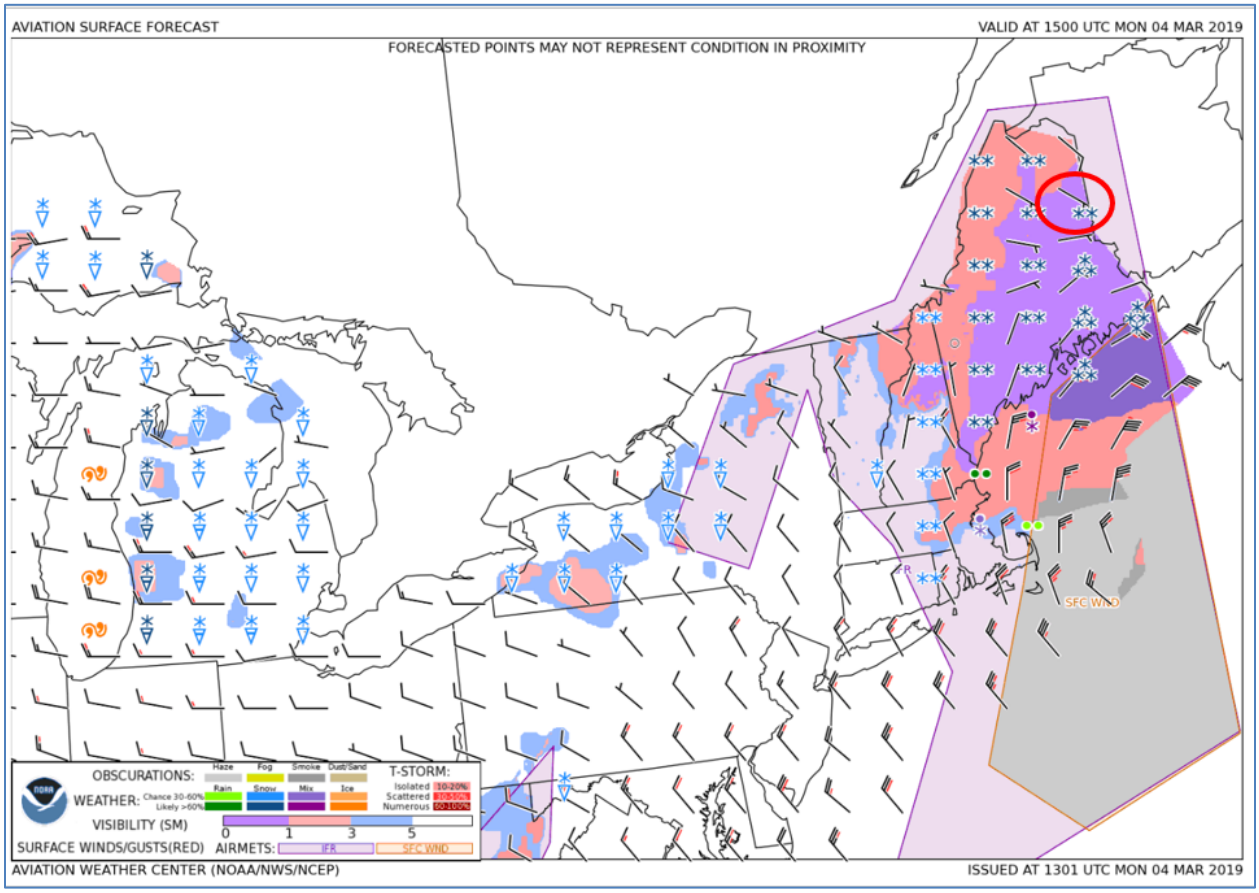

Figure 9 - GFA Surface Forecast valid for 1000 EST with G-AIRMET Sierra for IFR conditions

[8] Airmen's Meteorological Information (AIRMET) is a concise description of weather phenomena that are occurring or may occur (forecast) over an area of at least 3,000 square miles that may affect aircraft safety. AIRMETs are issued for moderate turbulence or icing, sustained surface winds of 30 knots or more, Low-Level Wind Shear (LLWS), widespread restricted visibility below 3 statute miles and/or ceilings less than 1,000 ft agl or IFR conditions and mountain obscuration conditions.

The GFA "Aviation Cloud Forecast" provided cloud coverage, bases, layers, and tops with the G-AIRMET Sierra for mountain obscuration and G-AIRMET Zulu for icing conditions. Figure 10 is the GFA cloud forecast valid for 1000 EST with the accident site located within the red circle. The GFA cloud forecast expected an overcast layer of clouds with bases at 800 ft with tops to 33,000 ft. G-AIRMET Zulu for moderate icing was also current over the area, and G-AIRMET Sierra for mountain obscuration immediately west over the higher terrain of Maine.

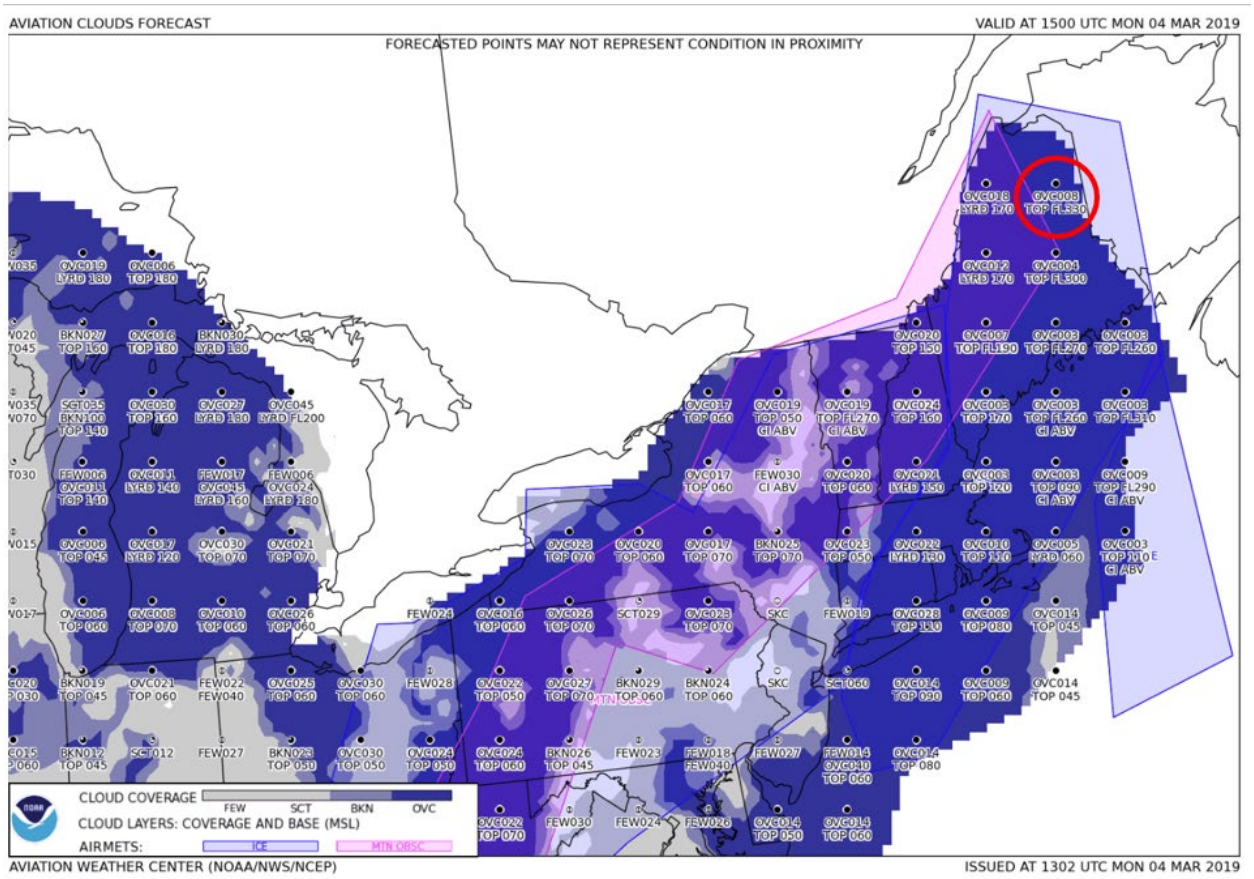

Figure 10 - GFA Sky cover forecast valid for 1000 EST with G-AIRMET Sierra and Zulu for icing conditions

7.0 Terminal Aerodrome Forecast

The NWS Caribou, Maine, Weather Forecast Office (WFO) was responsible for the issuance of the KPQI Terminal Aerodrome Forecast (TAF). The forecast that was current during the period was issued at 0632 EST and valid for a 24-hour period. The forecast was as follows:

TAF KPQI 041132Z 0412/0512 11005KT 2SM -SN OVC030
FM041400 10007KT 3/4SM -SN OVC015
FM041800 06007KT 2SM -SN OVC015
FM042300 03003KT 3SM -SHSN OVC020
FM050400 29005KT P6SM VCSH BKN020
FM050700 28010KT P6SM SCT070

The forecast for the accident flight's estimated time of arrival expected LIFR conditions to prevail with wind from 100º at 7 knots, visibility 3/4 of a mile in light snow, ceiling overcast at 1,500 ft agl. After 1300 EST, the wind was expected from 060 at 7 knots, with visibility 2 miles in light snow, ceiling overcast at 1,500 ft. MVFR conditions and light snow showers in the vicinity were expected until 0200 EST on March 5, 2019.

8.0 Area Forecast Discussion

The NWS Caribou Area Forecast Discussion (AFD) issued to provide additional details to the forecast during the period is included below. The long term forecast and marine weather segments were not relevant and have not been included. The discussion was as follows:

FXUS61 KCAR 041317
AFDCAR
Area Forecast Discussion
National Weather Service Caribou ME
0817 AM EST Mon Mar 4, 2019

.SYNOPSIS...
Low pressure will continue south of the Gulf of Maine this morning and south of Nova Scotia this afternoon. High pressure will follow with colder weather through mid-week.

.NEAR TERM /THROUGH TONIGHT/...
815 am update...
Banded snow falling across Downeast thus bv boosted storm totals upward of 8-12 inches and may need to bump up even more as 1-2+ in/hr presently falling along the coast.

previous discussion
Winter Storm Warnings remain in effect through this afternoon for all of downeast Maine, including the greater Bangor region. Winter Weather Advisories continue in effect for the remainder of northern Maine, with the exception of northwest Aroostook and northern Somerset counties.

Models have come in to good agreement with regard to tracking the low from east of Cape Cod early this morning and to the western tip of Nova Scotia by early this afternoon, then east across Nova Scotia. The heaviest snow amounts still look to be across Downeast Maine, where 6 to 10 inches of snow is expected by late this afternoon. Snow amounts are expected to range from 3 to 6 inches across the central highlands and eastern Aroostook counties. Across the north Maine Woods, generally expecting to 2 to 4 inches by late afternoon.

The steady snow will begin to quickly wind down this afternoon across downeast areas and then taper to snow showers across the north by early this evening, as the low tacks quickly east across Nova Scotia.

Expect partly cloudy skies to develop across central and downeast areas overnight with mostly cloudy skies and a few lingering snow showers across the north. Much colder air will follow in the wake of the low tonight, with low temperatures by morning ranging from 5 to 10 above across the north and 10 to 15 above central and downeast.

.SHORT TERM /TUESDAY THROUGH WEDNESDAY NIGHT/...
Tue will begin fair, brisk, and cold with winds decreasing durg the aftn. Another clipper s/wv advcg from the great lakes will bring increasing cldnss to the Rgn late in the day with sct sn shwrs to the area Tue ngt into

Wed as the s/wv crosses the FA with lclzd sn amts of arnd an inch possible and lesser amts elsewhere. Otherwise, brisk and cold conditions cont by Wed aftn and contg into Thu with sct flurries and isold sn shwrs.

***.AVIATION** /13Z MONDAY THROUGH FRIDAY/...*
NEAR TERM: Widespread IFR conditions are expected at all the terminals in snow through this afternoon. Improvement to MVFR is possible at KBGR/KBHB by late afternoon as snow begins to taper to snow showers. Expect lingering snow showers across the north this evening with IFR/MVFR with conditions then becoming VFR after midnight. At KBGR/KBHB expect VFR conditions this evening through tonight.

SHORT TO LONG TERM: VFR all TAF sites with intermittent MVFR clgs/vsbys in sn shwrs xpctd Tue thru Wed eve.

.CAR WATCHES/WARNINGS/ADVISORIES...
ME...Winter Weather Advisory until 4 PM EST this afternoon for MEZ002-004>006-010-011-031.
Winter Storm Warning until 4 PM EST this afternoon for MEZ015>017-029-030-032.
MARINE...Small Craft Advisory until 4 PM EST this afternoon for ANZ052.
Gale Warning until 4 PM EST this afternoon for ANZ050-051.

Near Term...Duda/Farrar
Short Term...VJN
Long Term...VJN
Aviation...Duda/Farrar/VJN
Marine...Duda/Farrar/VJN

The synoptic situation identified the low pressure system south of the Gulf of Maine was expected to track to south of Nova Scotia, Canada, by the afternoon. High pressure was expected to build in with colder air expected to continue through mid-week.

The short term forecast indicated that Winter Storm Warnings were in effect for the southeast Maine coastal areas or "downeast Maine", which included the greater Bangor region. Winter Weather Advisories continue in effect for the remainder of northern Maine

The aviation section indicated that the forecaster expected widespread IFR conditions with snow expected to continue across Maine's airports with some improvement to MVFR conditions possible at Bangor (KBGR) and Bar Harbor (KBHB) airports in the afternoon. No specific comments were made regarding the conditions at KPQI.

9.0 Winds and Temperature Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current for the route and valid for 1300 EST and for use between 0900 and 1600 EST was as follows:

WINDS ALOFT FORECASTS
DATA BASED ON 041200Z
VALID 041800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	*3000*	*6000*	*9000*	*12000*	*18000*	*24000*	*30000*	*34000*	*39000*
JFK	*3120*	*2927-08*	*2738-11*	*2565-12*	*2483-22*	*2490-35*	*249449*	*248454*	*248451*
BDL	*3220*	*2922-09*	*2633-12*	*2559-15*	*2486-23*	*2488-36*	*239948*	*248553*	*248651*
ALB	*3019*	*3018-15*	*2632-15*	*2549-19*	*2488-25*	*2489-37*	*740048*	*248651*	*238150*

BOS 3323 3022-08 2729-10 2657-13 2478-22 2389-32 238749 238255 238651
PWM 3522 3220-10 2620-12 2536-15 2475-22 2387-33 229248 228754 238952
BML 3117 3109-14 2522-15 2331-19 2374-25 2379-37 228947 228753 238852
BGR 0321 3614-10 1911-11 2425-14 2366-21 2282-33 229548 229755 229454
CAR 1114 0605-13 2407-15 2141-16 2155-24 2176-35 219548 710355 229655

10.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of 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 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 and/or the flight dispatcher in a Part 121 operation to evaluate on the basis of experience and the operational limits of the aircraft. The following advisories were current during the period.

During the period the NWS had no SIGMETs, Convective SIGMETs, or CWA's current for any severe turbulence, thunderstorm, or icing over the route. The NWS AWC did have a full series of AIRMETs current over the area, which are included below.

WAUS41 KKCI 041445
WA1S
-BOSS WA 041445
AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 042100
.
AIRMET IFR...NY LO PA OH WV MD VA
FROM 30N SYR TO 20NNW HNK TO 50NW CSN TO 50SE HMV TO 20SSW HMV
TO HNN TO 40S JHW TO 30SW BUF TO 40ENE BUF TO 30N SYR
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG 15-18Z.
.
AIRMET IFR...ME NH VT MA RI CT NY OH LE MD DE VA NC AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 200SE ACK TO 160SE SIE TO 190ESE
ECG TO 150ESE ILM TO 90SSE ECG TO 30E HTO TO 20NE BDL TO 30SE
ALB TO 60ENE MSS TO YSC TO 70NW PQI
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET MTN OBSCN...ME NH VT MA NY PA WV MD VA NC GA
FROM 70NW PQI TO MLT TO CON TO 20NNE ETX TO 30E SLT TO 20SE PSK
TO 20NW ODF TO ATL TO GQO TO HMV TO HNN TO JHW TO SYR TO MSS TO
YSC TO 70NW PQI
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
....

WAUS41 KKCI 041445
WA1T
-BOST WA 041445
AIRMET TANGO UPDT 2 FOR TURB STG WNDS AND LLWS VALID UNTIL 042100

.
AIRMET TURB...ME NH VT MA RI CT NY NJ MD DE VA AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 200SE ACK TO 160SE SIE TO 20SSE BDL TO YSC TO 70NW PQI
MOD TURB BTN FL220 AND FL370. CONDS ENDG 18-21Z.
.
AIRMET STG SFC WNDS...ME NH MA RI NY AND CSTL WTRS
FROM 70SW YSJ TO 200SE ACK TO 190S ACK TO 90SSW ACK TO 60SSW BGR TO 70SW YSJ
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 21Z
ENDG 21-00Z.
.
LLWS POTENTIAL...ME NH MA CSTL WTRS
BOUNDED BY 100SSW YSJ-200SE ACK-150SSE ACK-100ESE ENE-100SSW YSJ
LLWS EXP. CONDS ENDG 15-18Z.
.

WAUS41 KKCI 041445
WA1Z
-BOSZ WA 041445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 042100
.
AIRMET ICE...ME NH VT MA RI CT NY AND CSTL WTRS
FROM 60N PQI TO 40NE PQI TO 40E HUL TO 140E ACK TO 60S ACK TO 80SE HTO TO 40SW PVD TO 30SW BDL TO 40NNE ALB TO 40NNW MPV TO YSC TO 70NW PQI TO 60N PQI
MOD ICE BLW FL180. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET ICE...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS
FROM 30SSE YOW TO 40NNW MPV TO 50SW MPV TO 30SW BDL TO 20NNE HTO TO 20ESE JFK TO HMV TO HNN TO 30ESE CVG TO 20WSW APE TO 20NNW CLE TO 20ESE YYZ TO 30SSE YOW
MOD ICE BLW 100. CONDS CONTG BYD 21Z ENDG 00-03Z.
.
OTLK VALID 2100-0300Z...ICE ME NH VT MA RI CT NY LO NJ PA OH LE WV MD VA AND CSTL WTRS
BOUNDED BY 20E YSC-30SSE ENE-150ENE ACK-130SE ACK-20N HTO-20N CYN-20SW HAR-50WNW CSN-HMV-HNN-20WSW APE-30SE ECK-60SW MSS-MPV-20E YSC
MOD ICE BLW 100. CONDS ENDG 00-03Z.
.
FRZLVL...RANGING FROM SFC-090 ACRS AREA
MULT FRZLVL 010-090 BOUNDED BY 60WSW YSJ-200SE ACK-180SE SIE-150ESE SIE-30WSW ORF-90SSE HTO-70E ENE-60WSW YSJ
SFC ALG 40SSW PSK-ETX-20NE CON-40NE ENE-80SW YSJ
040 ALG 150SE SIE-180SSE HTO-140ESE ACK
....

11.0 Astronomical Conditions

The United States Naval Observatory's website[9] was used to document the astronomical conditions over Presque Isle, Aroostook County, Maine on March 4, 2019. The time of the accident has been added and is in italic bold print.

[9] https://aa.usno.navy.mil/data/docs/RS_OneDay.php

SUN	
Beginning civil twilight	0536 EST
Sunset	0606 EST
Accident	***1129 EST***
Sun transit	1144 EST
Sunset	1722 EST
End of civil twilight	1752 EST

At the time of the accident the Sun was 36.8° above the horizon and at an azimuth of 175°.

12.0 Flight Release and Weather Document

Attachment 1 is a copy of the dispatch release and weather document issued to the flight at 0834 EST (1334Z), which consisted of 40 pages of information. The weather document included the departure (EWR), destination (PQI), and alternate airport (BTV) observations, forecast, and notice to airmen (NOTAMs), the enroute weather conditions which consisted of AIRMETs (Sierra, Tango, and Zulu) and Convective SIGMETs (none) that were current, winds aloft forecast, and pilot reports over the last 3 hours along the route of flight.

Regarding the destination weather for KPQI the METARs from 0619 through 0756 EST were included along with the TAF issued at 0632 EST. The NOTAMs included one that the PQI automated weather broadcast system temperature was unreliable, and several field conditions (FICON) reports indicating that work was in progress for snow removal with runway 10/28 closed, and runway 1 observed to have ¼" of dry snow covering 100% of runway with runway condition code "3" on touchdown, midpoint, and rollout.

13.0 Dispatch Statement

The Flight Dispatch responsible for the preflight planning, release, and flight following provided a statement regarding his planning and weather assessment for the flight. His statement is included as Attachment 2.

F. LIST OF ATTACHMENTS

Attachment 1 – Dispatch Release and Weather Document
Attachment 2 – Dispatch Statement

Submitted by:

_____
Don Eick
Senior Meteorologist