NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 17, 2018

Group Chairman's Factual Report

METEOROLOGY

ANC17FA049

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A. ACCIDENT

Location: Tyonek, Alaska
Date: August 23, 2017
Time: between 2220 and 2245 Alaska daylight time
(between 0620 and 0645 UTC[1] on August 24, 2017)
Airplane: Piper, PA-18AS-125; N1905A

B. METEOROLOGY GROUP

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Federal Aviation Administration

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist travelled to Alaska in support of this accident investigation. Unless otherwise noted, all times are in Alaska daylight time (AKDT) for August 23, 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) unless otherwise noted.

Coordinates used for the accident location: 61.19444444° north latitude, 152.02769722° west longitude, at an elevation of about 440 feet.

[1] UTC – abbreviation for Coordinated Universal Time

D. WEATHER INFORMATION

1.0 Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 2200 AKDT is presented in figure 1. The surface analysis chart identified a 992 hectopascals (hPa) low pressure center near the southwestern Alaska coast in Bristol Bay. Station models south, southeast and east of the accident location depicted light continuous rain with temperatures in the 50's degrees Fahrenheit (°F), dewpoint depressions as low as 1°F and light and variable (or calm) winds.

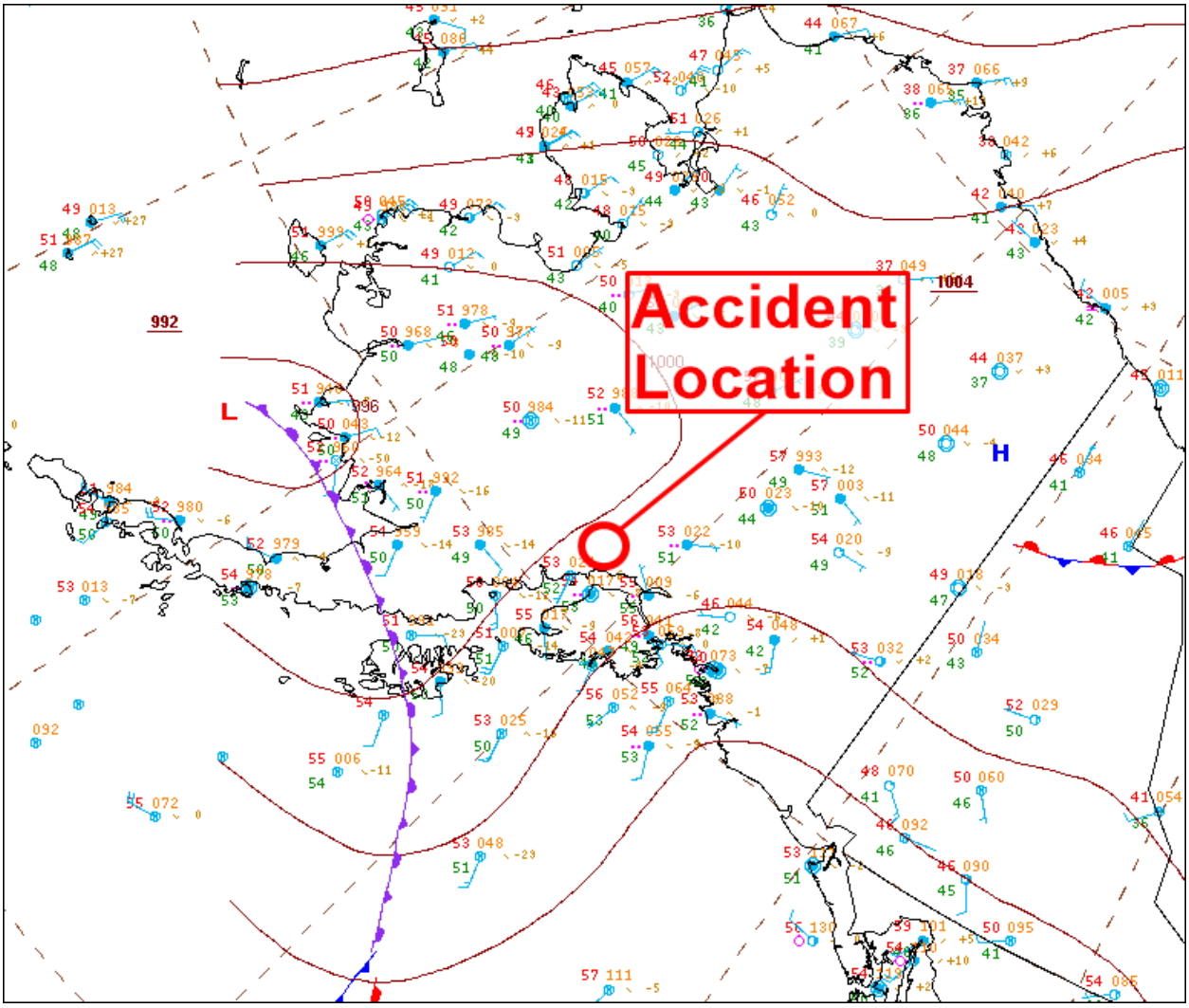

Figure 1 - NWS Surface Analysis Chart for 2200 AKDT.

2.0 Surface Observations

An Automated Weather Observing System was located at Kenai Municipal Airport (PAEN) in Kenia, Alaska, and was located about 44 miles southeast of the accident location at an elevation of about 100 feet. Automated reports from PAEN during the times surrounding the accident time are presented here:

[2053 AKDT] METAR PAEN 240453Z AUTO 00000KT 10SM OVC060 12/12 A2958 RMK AO2 RAE34 SLP017 P0001 T01220122 TSNO=

[2153 AKDT] METAR PAEN 240553Z AUTO 00000KT 10SM -RA FEW050 OVC060 12/12 A2958 RMK AO2 RAB0458 SLP017 P0000 60009 T01220117 10133 20122 56008 TSNO=

[2253 AKDT] METAR PAEN 240653Z AUTO 00000KT 5SM -RA BR SCT050 OVC060 12/12 A2957 RMK AO2 SLP016 P0004 T01170117 TSNO=

[2353 AKDT] METAR PAEN 240753Z AUTO 26003KT 5SM -RA BR SCT049 OVC055 12/12 A2957 RMK AO2 SLP015 P0006 T01170117 TSNO=

At 2253 AKDT, PAEN reported a calm wind, visibility of 5 miles, light rain, mist, scattered clouds at 5,000 feet above ground level (agl), ceiling overcast at 6,000 feet agl, temperature of 12° Celsius (C) and a dew point temperature of 12°C, altimeter setting of 29.57 inches of mercury; remarks included: station with a precipitation discriminator, 0.04 inches of precipitation since 2153 AKDT, no thunderstorm information.

Unofficial meteorological reporting station STNA2 (data courtesy of the Bureau of Land Management and the National Park Service) was located about 54 miles west of the accident site at an altitude of 1,226 feet. Calibration, maintenance and siting standards of this instrument, as well as the overall quality of the data, are not known. Reporting of certain parameters[2] from STNA2 during the times surrounding the accident time are presented here:

Time	Temp	RH	W_Mag	W_Dir	G_Mag
2050	51.0	98	0	---	3.5
2150	49.0	99	0	---	1.7
2250	48.0	99	0	---	2.6
2350	47.0	99	0	---	2.6

[2] Temp=temperature (°F); RH=relative humidity (%); W_Mag=average wind magnitude (knots); W_Dir=average wind direction (true); G_Mag=gust wind magnitude (knots)

3.0 Weather Radar

WSR-88D Level-II weather radar imagery from near Kenai, Alaska (PAHG), are presented in figures 2-7. PAHG was located approximately 34 miles southeast of the accident site at an elevation of about 242 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the PAHG 1.4° tilt would have "seen" altitudes above the accident location of between about 4,300 and 7,800 feet msl.

The PAHG imagery surrounding the accident period identified reflectivity features consistent with light to extreme[3] intensities of precipitation in the region and adjacent to the accident site. A vertical cross-section of a "cell" adjacent to the accident location (figure 7) identified the highest values of reflectivity (in decibels [dBZ]) were located between about 4,000 and 6,000 feet.

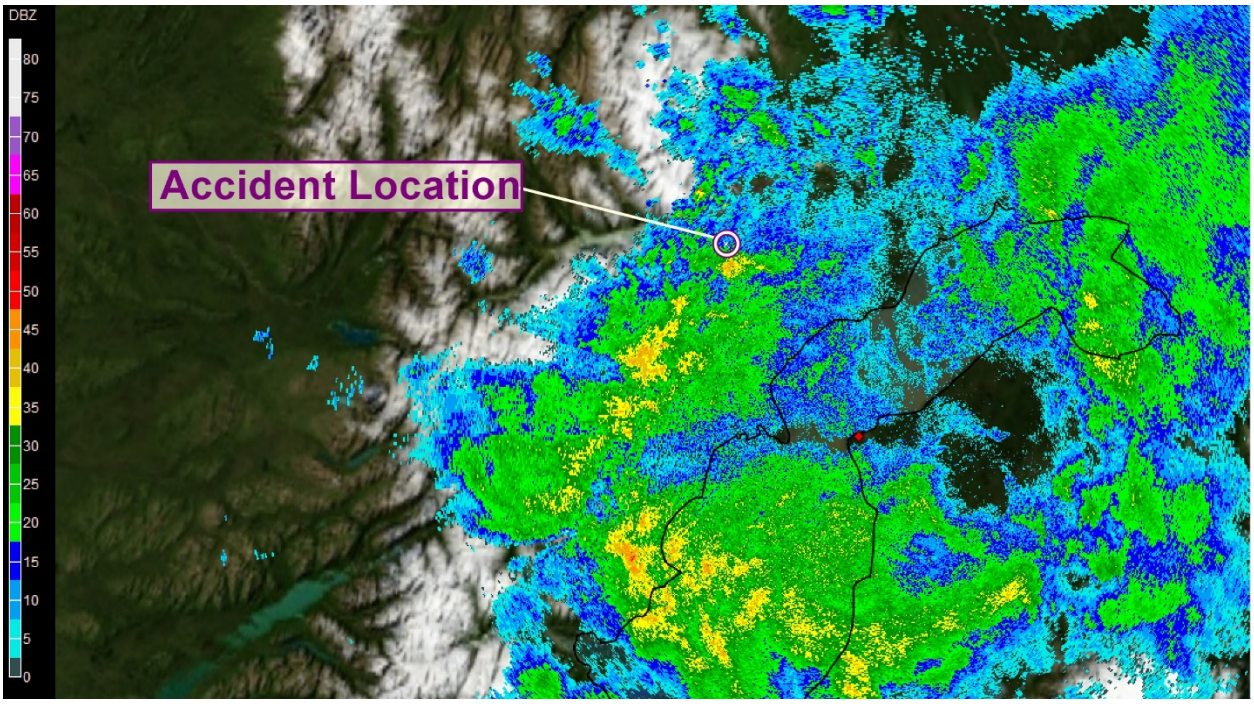

Figure 2 – PAHG 1.4° Level-II reflectivity product from a sweep initiated at 2222:35 AKDT.

[3] The Federal Aviation Administration defines "extreme" precipitation as greater than 50 dBZ with rainfall rates of 2.0-16+ inches/hour.

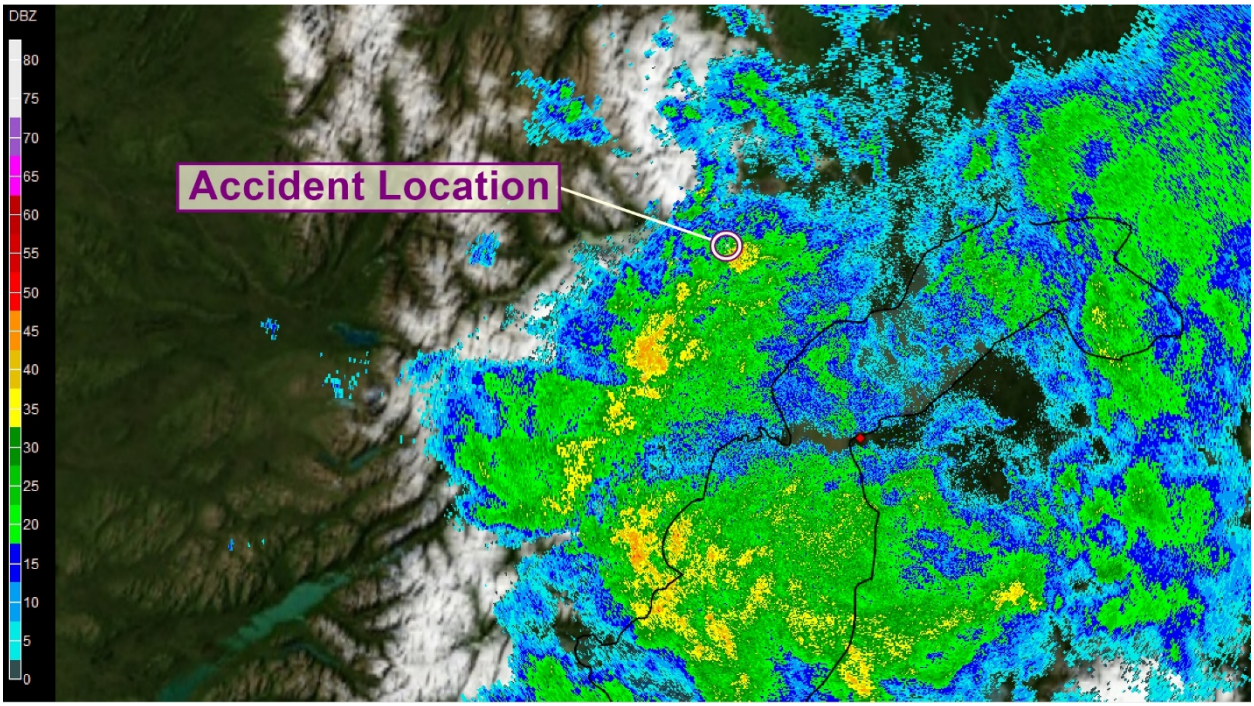

Figure 3 – PAHG 1.4° Level-II reflectivity product from a sweep initiated at 2228:23 AKDT.

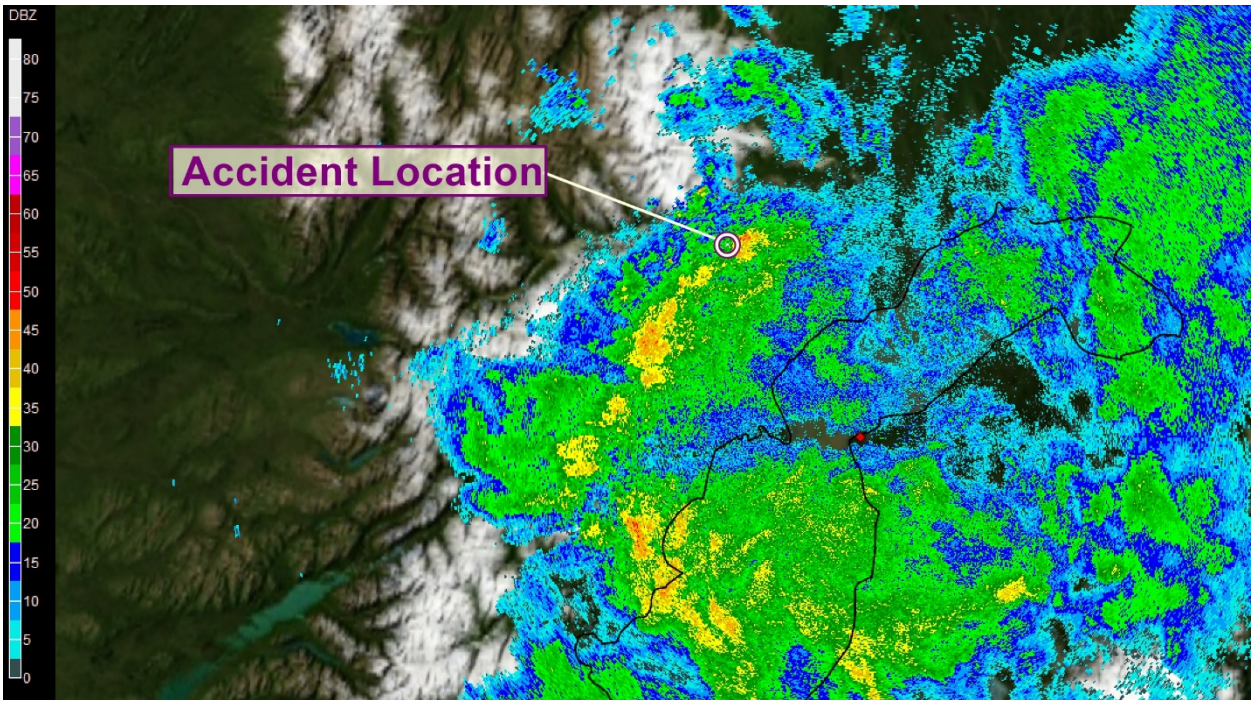

Figure 4 – PAHG 1.4° Level-II reflectivity product from a sweep initiated at 2234:11 AKDT.

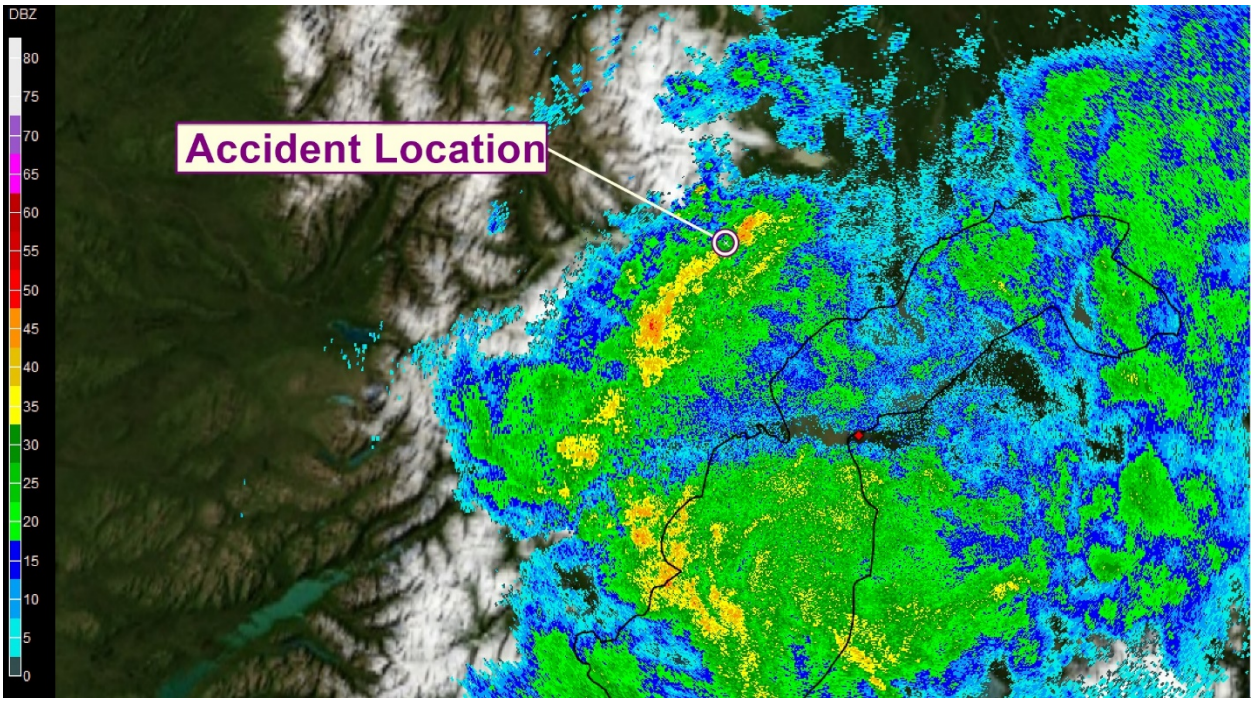

Figure 5 – PAHG 1.4° Level-II reflectivity product from a sweep initiated at 2239:59 AKDT.

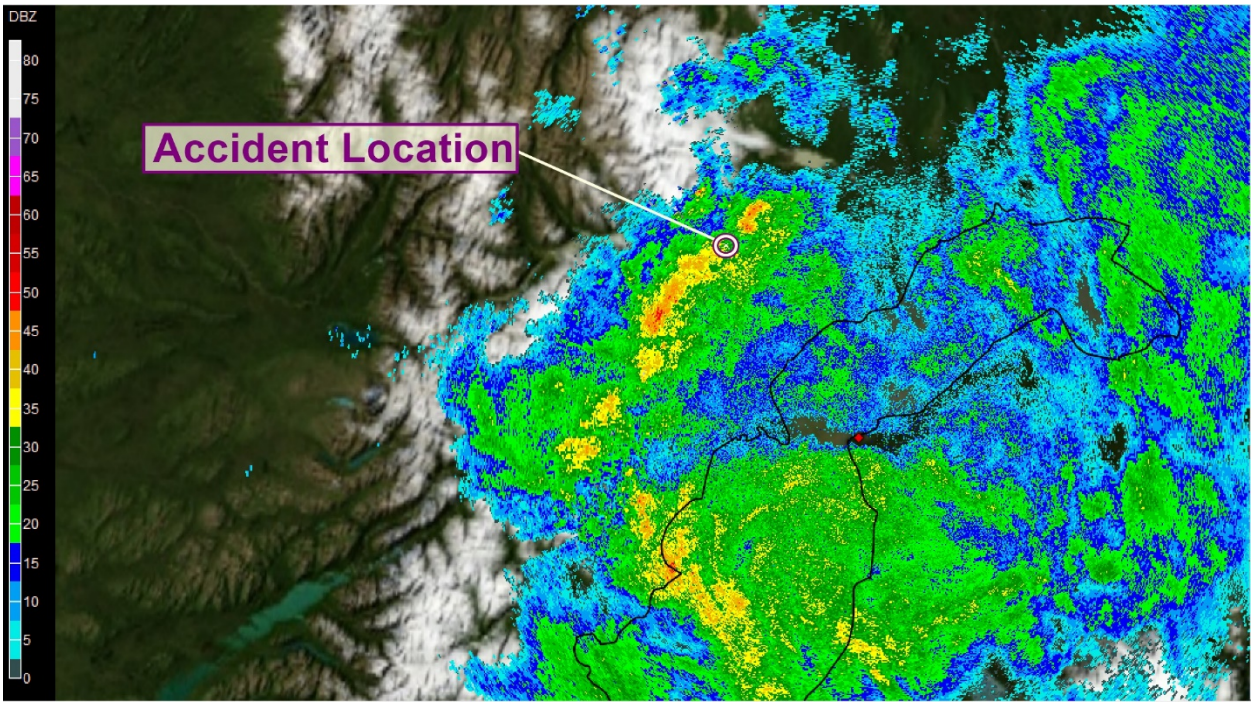

Figure 6 – PAHG 1.4° Level-II reflectivity product from a sweep initiated at 2245:47 AKDT.

Figure 7 – North-south 0-10,000 feet (approximate) vertical cross-section of the Level-II reflectivity product from the volume scan initiated at 2233:08 AKDT through the cell adjacent to and to the east of the accident site. Color table is as presented in figures 2-6.

WSR-88D Level-III composite[4] weather radar imagery from PAHG for the times surrounding the third Kenai Flight Service Station telephone weather briefing (see section 15), are presented in figures 8-11. This composite imagery identified an extensive area of reflectivity surrounding the accident location and extending east through the Anchorage area.

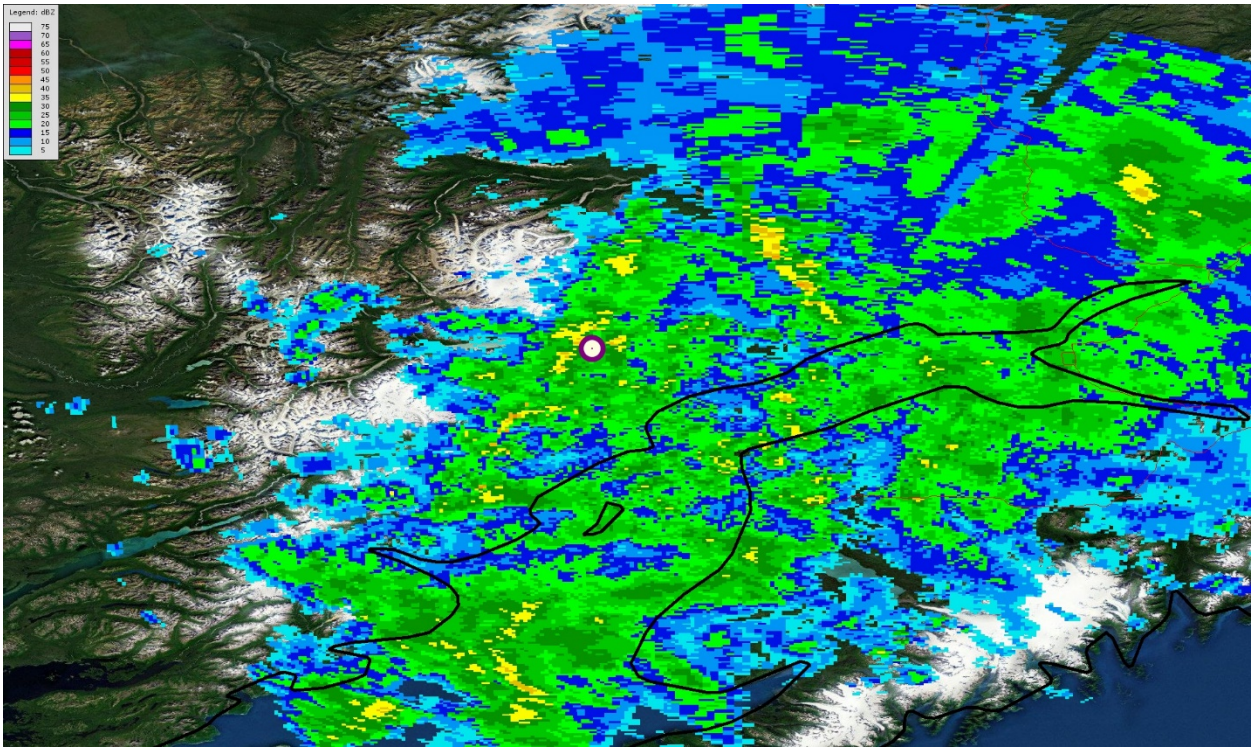

Figure 8 – PAHG Level-III composite reflective image from a volume scan initiated at 2056 AKDT. The white dot denotes the accident location.

[4] The composite reflectivity product combines data from all elevation scans (tilts) in a volume scan to show the highest reflectivity value from the vertical cross section above a particular location.

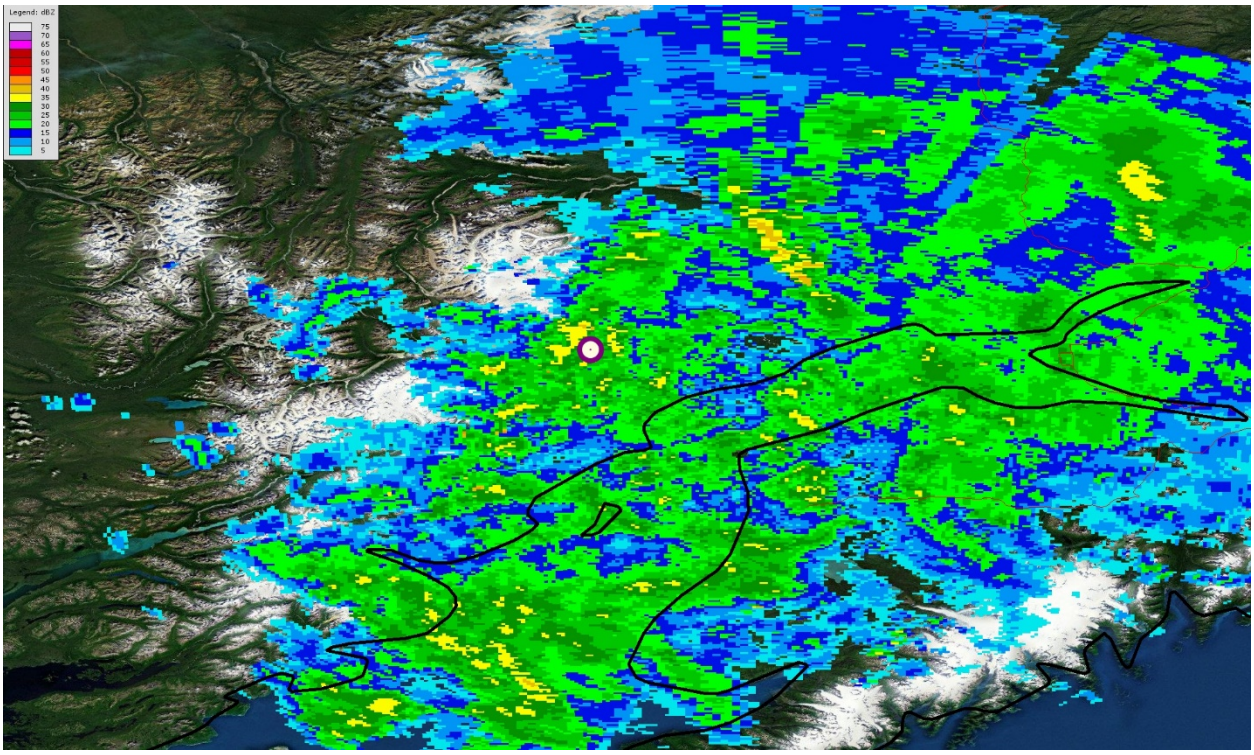

Figure 9 – PAHG Level-III composite reflective image from a volume scan initiated at 2102 AKDT. The white dot denotes the accident location.

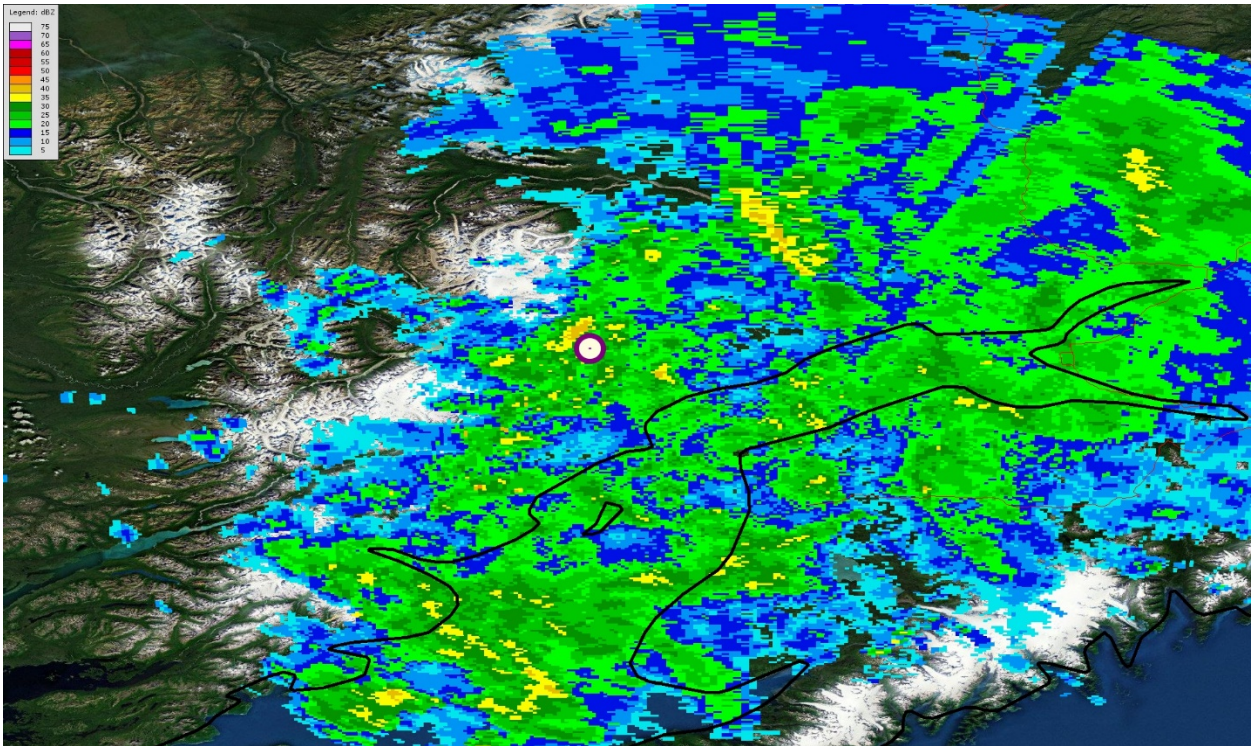

Figure 10 – PAHG Level-III composite reflective image from a volume scan initiated at 2108 AKDT. The white dot denotes the accident location.

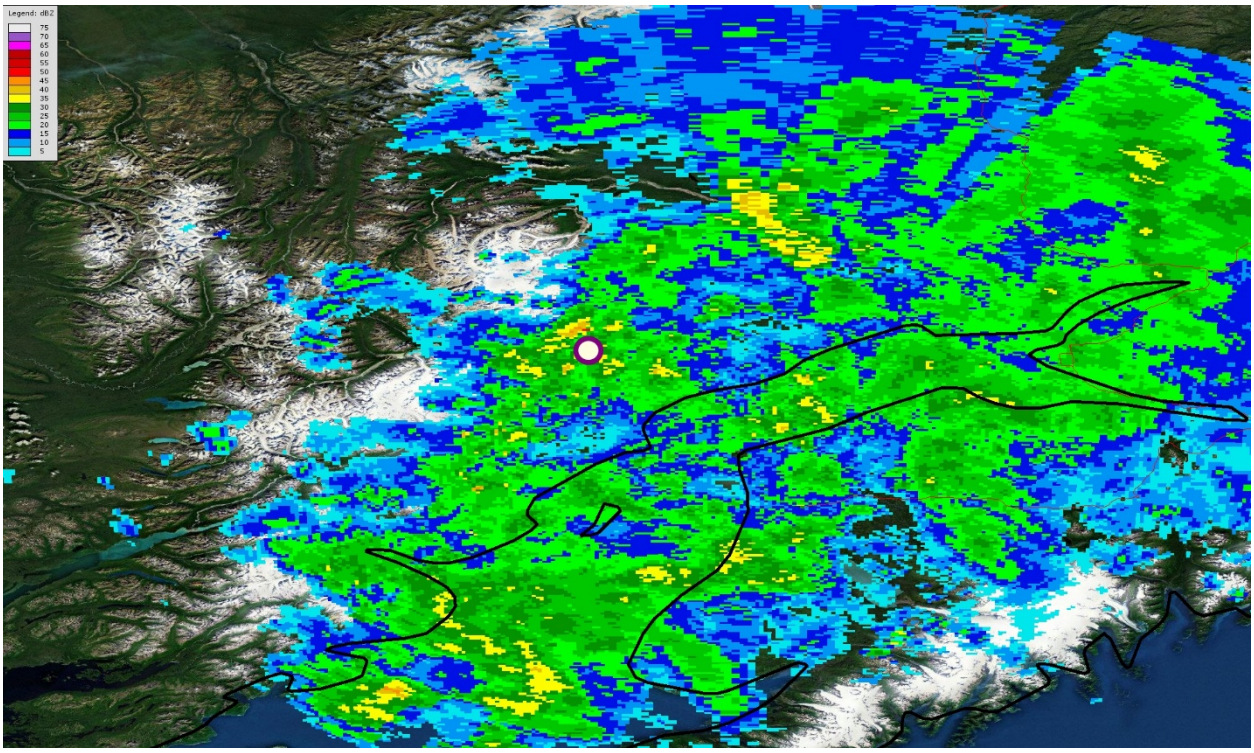

Figure 11 – PAHG Level-III composite reflective image from a volume scan initiated at 2114 AKDT. The white dot denotes the accident location.

4.0 Lightning

There was no lightning detected by the Earth Networks Total Lightning Network near the accident site between 2200 and 2300 AKDT (inclusive).

5.0 Pilot Reports

There were no publicly-disseminated pilot reports (PIREPs)[5] made near the accident time and near the accident site. Most publicly disseminated PIREPs made on the night of the accident were from the Anchorage region. At 2327 AKDT, a Cessna 172 aircraft at 3,500 feet operating between Anchorage and Kenai, Alaska, reported a forward visibility of 10 miles in rain showers, light to moderate turbulence and negative icing.

> ENA UA /OV MRI-ENA /TM 0727 /FL035 /TP C172 /WX FV10SM SHRA /TB LGT-MOD /IC NEG=

[5] Only pilot reports with the WMO header UBAK** were considered.

6.0 Upper Air Data

A Global Data Assimilation System (GDAS) model sounding (figure 12) for the accident location at 2200 AKDT was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory. Below 13,000 feet the wind was generally from the south with magnitudes below 30 knots. The wind magnitude was 9 knots at 2,100 feet but increased to 29 knots at 5,500 feet. Calculations made by the Rawinsonde OBservation Program did not yield any significant areas of non-convective turbulence for this atmosphere but did identify light low-level wind shear in the lowest 1,000 feet agl. It also identified light to moderate severities of icing between about 7,000 to 15,000 feet. The freezing level was at about 6,800 feet. Relative humidity was greater than 90 percent between near the surface and about 14,000 feet.

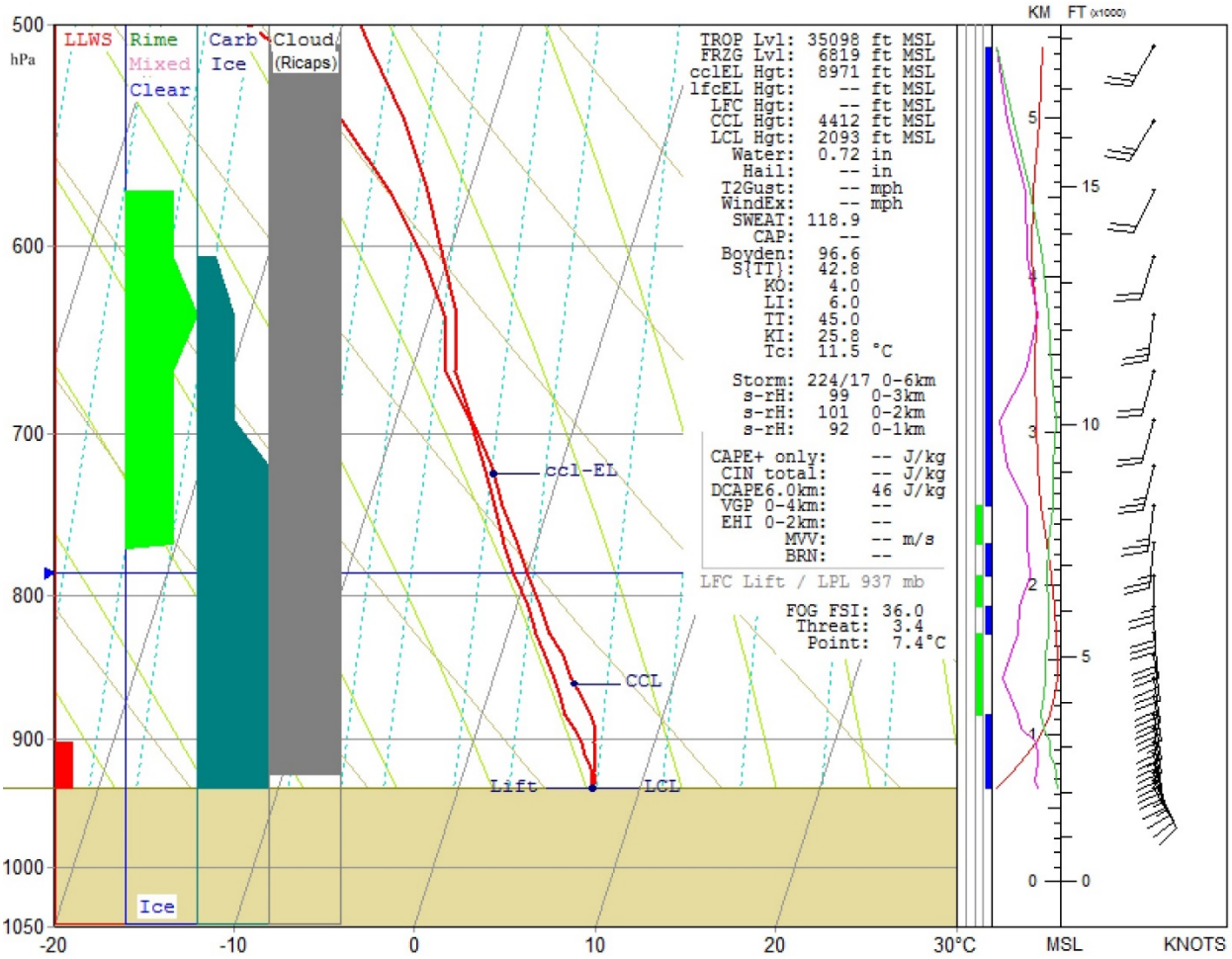

Figure 12 – GDAS model sounding data in SkewT/LogP format for 2200 AKDT at the accident site, surface to 500 hPa.

7.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-15 infrared (10.7µm) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 2230 AKDT is presented in figure 13. The GOES-15 infrared cloud-top temperatures varied in the accident region around the accident time. Considering the GDAS sounding (data not plotted in figure 12), cloud top heights in the accident regional are estimated to be above 20,000 feet. It should be noted that figure 13 has not been corrected for any parallax error.

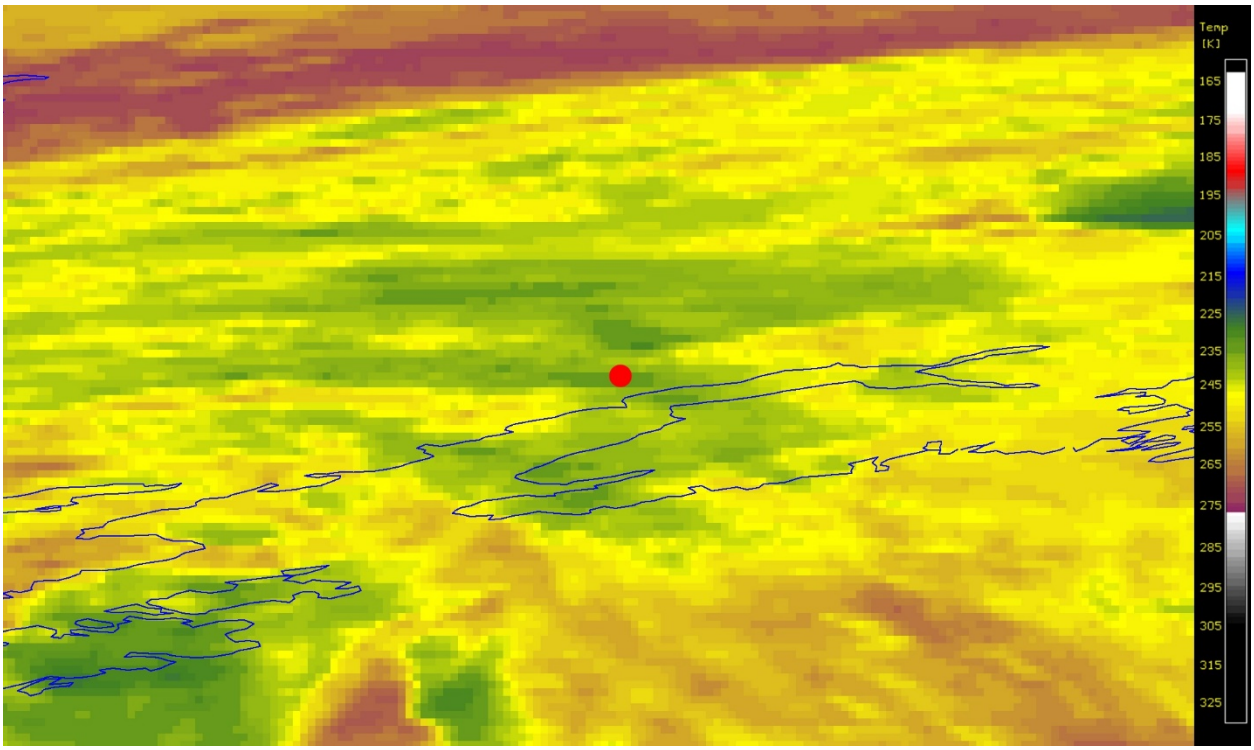

Figure 13 – GOES-15 infrared imagery (brightness temperature in degrees Kelvin) from 2230 AKDT. Accident location denoted by red dot. This image has not been corrected for any parallax error.

8.0 Weather Cameras

Images from the Merrill Pass Low, Beluga and Nikiski Federal Aviation Administration (FAA) weather cameras for the times surrounding the accident period are presented in Attachment 1. These cameras did not have a direct view of the accident location; however, they were able to identify cloudy conditions in the region.

9.0 AIRMETs

An Airmen's Meteorological Information (AIRMET) advisory SIERRA for "mountains occasionally obscured in clouds/precipitation" was issued at 2010 AKDT and was active for the accident site at the accident time.

WAAK48 PAWU 240410
WA8O
ANCS WA 240415
AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 241215
.
COOK INLET AND SUSITNA VLY AB
MTS OCNL OBSC IN CLDS/PCPN. NC.

10.0 SIGMETs

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

11.0 Area Forecast

An Area Forecast that included the forecast for the accident location was issued by the Alaska Aviation Weather Unit (AAWU) at 2010 AKDT. The Area Forecast included the AIRMET information, and for the region (excluding the following Alaska/Aleutian Range region) forecasted few clouds at 1,500 feet, scattered clouds at 2,500 feet, broken to overcast clouds at 4,500 feet, with clouds tops to 15,000 feet and clouds layered about that to FL260, with light rain, occasional broken clouds at 2,500 feet with light rain and mist. Along the Alaska and Aleutian Ranges it forecasted occasional broken clouds at 1,500 feet and visibilities 3-5 statute miles and light rain and mist, and isolated ceilings below 1,000 feet agl with visibilities below 3 statute miles with moderate rain and mist. For Merrill Pass, the Area Forecast forecasted IFR ceilings[6] with moderate rain and mist. For the region the Area Forecast forecasted isolated moderate turbulence below 6,000 feet and isolated moderate icing between 8,000-15,000 feet with the freezing level at 6,000 feet.

FAAK48 PAWU 240410
FA8H
ANCH FA 240415
AK SRN HLF EXCP SE AK...
.
AIRMETS VALID UNTIL 241215
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.

[6] Instrument Flight Rule (IFR) ceilings are ceilings below 1,000 feet agl

NON MSL HEIGHTS NOTED BY AGL OR CIG.
.
SYNOPSIS VALID UNTIL 242200
1008 MB LOW 190 NM S PASI WILL DRIFT S WARD AND DSIPT DUR PD. 994 MB LOW 80 NM E PASN WILL MOV INTO BRISTOL BAY BY END OF PD. ASSOCD OCFNT FROM JUST N OF LOW-PADL-PAKH THENCE S WARD WILL EXTEND FROM SE SIDE KENAI PEN SE WARD INTO GULF AK BY END OF PD. N-S RIDGE WILL BUILD INTO WRN BERING SEA TO LIE ACROSS WRN ALEUTIANS BY END OF PD.
.
COOK INLET AND SUSITNA VLY AB...VALID UNTIL 241600
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
FEW015 SCT025 BKN-OVC045 TOP 150 LYRS ABV TO FL260 -RA. OCNL BKN025 -RA BR.
ALG AK-ALEUTIAN RANGE AND ELSW PATK N OCNL BKN015/VIS 3-5SM -RA BR. ISOL CIG BLW 010/VIS BLW 3SM RA BR.
VCY TURNAGAIN ARM SFC WND SE 20G30KT.
AFT 12Z VCY COOK INLET S PAEN SFC WND N-NE G25KT.
OTLK VALID 241600-242200...NW PATK-PAHO LN MVFR CIG RA BR.
ELSW VFR OCNL RA. TURNAGAIN ARM WND.
PASSES...
LAKE CLARK...MERRILL...RAINY...WINDY...PORTAGE...IFR CIG RA BR TURB.
...TURB...
ISOL MOD TURB BLW 060.
...ICE AND FZLVL...
ISOL MOD ICEIC 080-150. FZLVL 060.

An Area Forecast for the accident region was issued at 2228 AKDT (about the time of the accident):

FAAK48 PAWU 240628 AAA
FA8H
ANCH FA 240621 AMD
AK SRN HLF EXCP SE AK...
.
AIRMETS VALID UNTIL 241215
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.
.
SYNOPSIS VALID UNTIL 242200
1008 MB LOW 190 NM S PASI WILL DRIFT S WARD AND DSIPT DUR PD. 994 MB LOW 80 NM E PASN WILL MOV INTO BRISTOL BAY BY END OF PD.

ASSOCD OCFNT FROM JUST N OF LOW-PADL-PAKH THENCE S WARD WILL EXTEND FROM SE SIDE KENAI PEN SE WARD INTO GULF AK BY END OF PD. N-S RIDGE WILL BUILD INTO WRN BERING SEA TO LIE ACROSS WRN ALEUTIANS BY END OF PD.

.

COOK INLET AND SUSITNA VLY AB...VALID UNTIL 241600 UPDT

...CLOUDS/WX...UPDT

AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...

ALG AK-ALEUTIAN RANGE AND ELSW PATK N SCT015 OVC025 TOP 150 LYRS ABV TO FL260 -RA. OCNL BKN015/VIS 3-5SM -RA BR. ISOL CIG BLW 010/VIS BLW 3SM RA BR.

ELSW FEW025 SCT045 OVC060 TOP 150 LYRS ABV TO FL260 -RA. OCNL BKN045/VIS 5SM -RA BR.

VCY TURNAGAIN ARM SFC WND SE 20G30KT.

AFT 12Z VCY COOK INLET S PAEN SFC WND N-NE G25KT.

OTLK VALID 241600-242200...NW PATK-PAHO LN MVFR CIG RA BR.

ELSW VFR OCNL RA. TURNAGAIN ARM WND.

PASSES...

LAKE CLARK...MERRILL...RAINY...WINDY...PORTAGE...IFR CIG RA BR TURB.

...TURB...

ISOL MOD TURB BLW 060.

...ICE AND FZLVL...

ISOL MOD ICEIC 080-150. FZLVL 060.

12.0 AAWU Graphical Products

Graphical products issued by the AAWU applicable to the accident time are presented in figures 14-18. The graphics identified IFR or MVFR[7] conditions[8], isolated moderate icing between 8,000 and 15000 feet, isolated moderate turbulence below 6,000 feet and light or moderate precipitation at the accident location at or near the accident time.

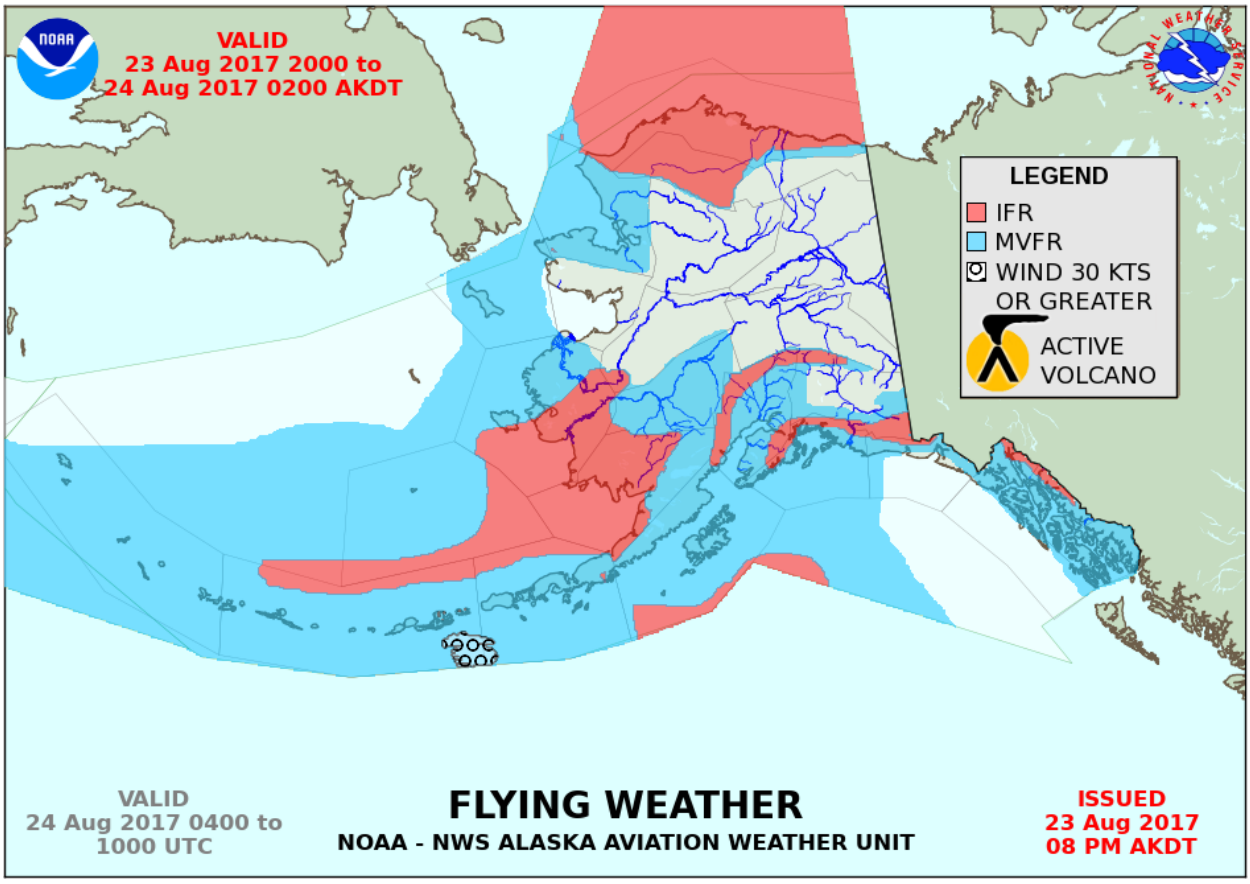

Figure 14 – Flying Weather graphic issued at 2000 AKDT and valid between 2000 AKDT on August 23, 2017, and 0200 AKDT on August 24, 2017.

[7] Marginal Visual Flight Rules (MVFR) – A subcategory of visual flight rules. MVFR means a ceiling between 1,000 and 3,000 feet agl (inclusive) and/or 3 to 5 statute miles visibility.
[8] The accident site was close to the boundary of these two categories.

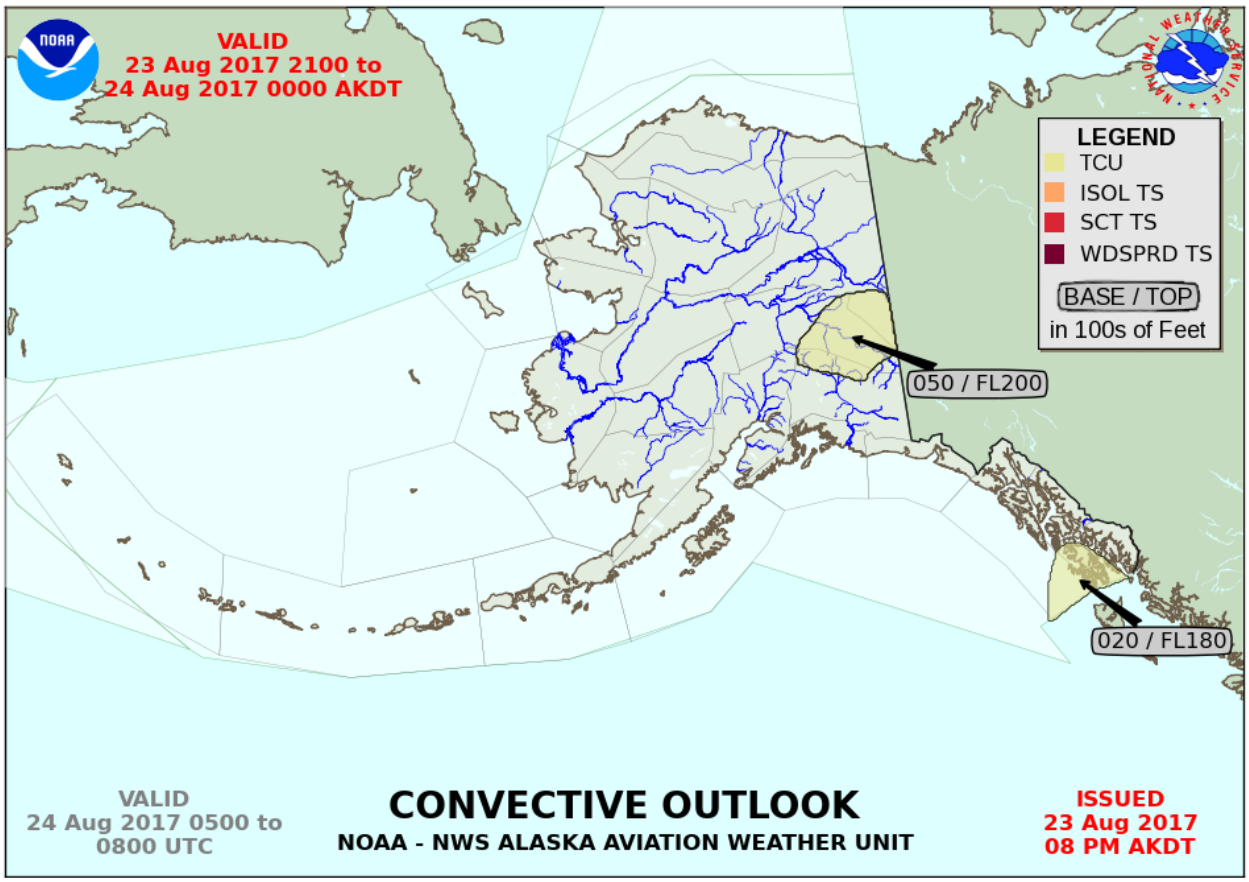

Figure 15 – Convective Outlook graphic issued at 2000 AKDT and valid between 2100 AKDT on August 23, 2017, and 0000 AKDT on August 24, 2017.

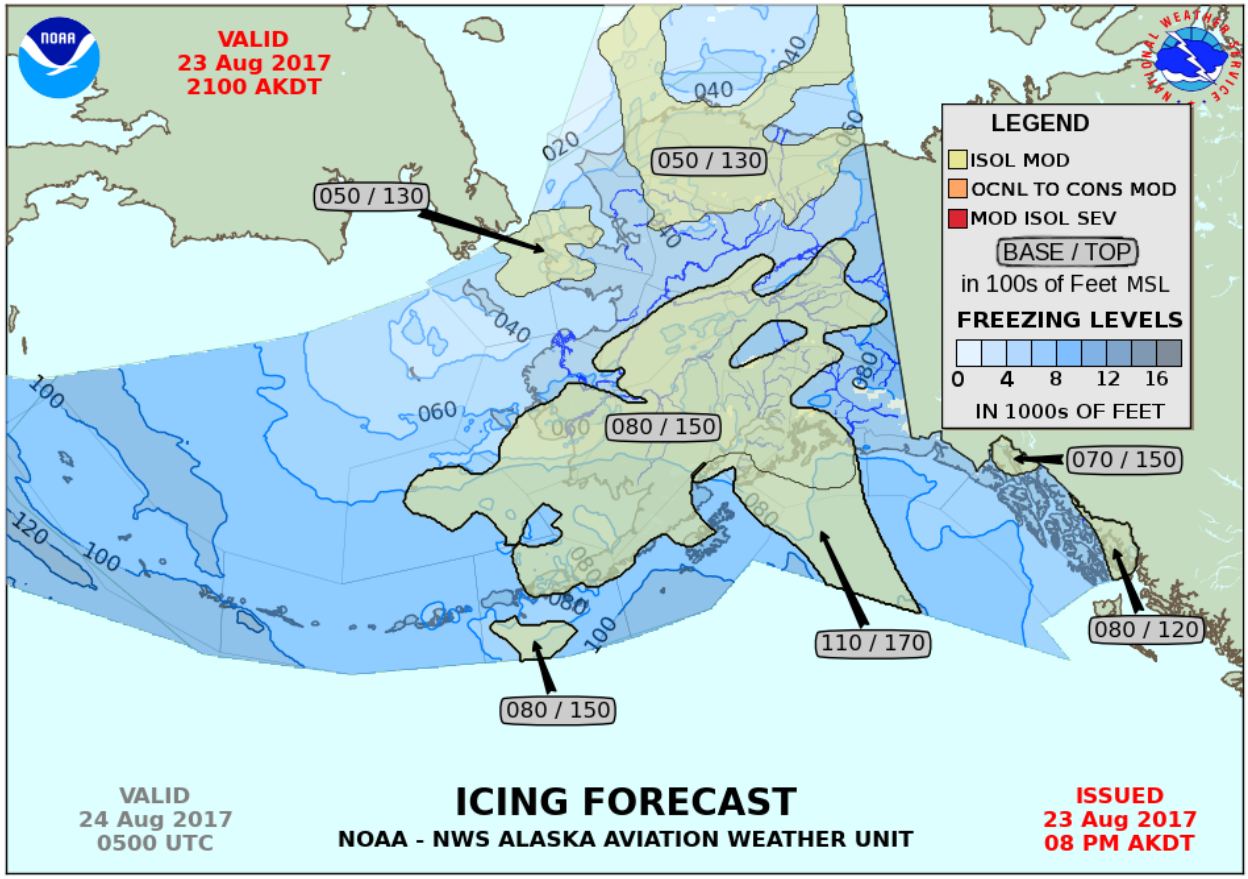

Figure 16 – Icing Forecast graphic issued at 2000 AKDT and valid for 2100 AKDT.

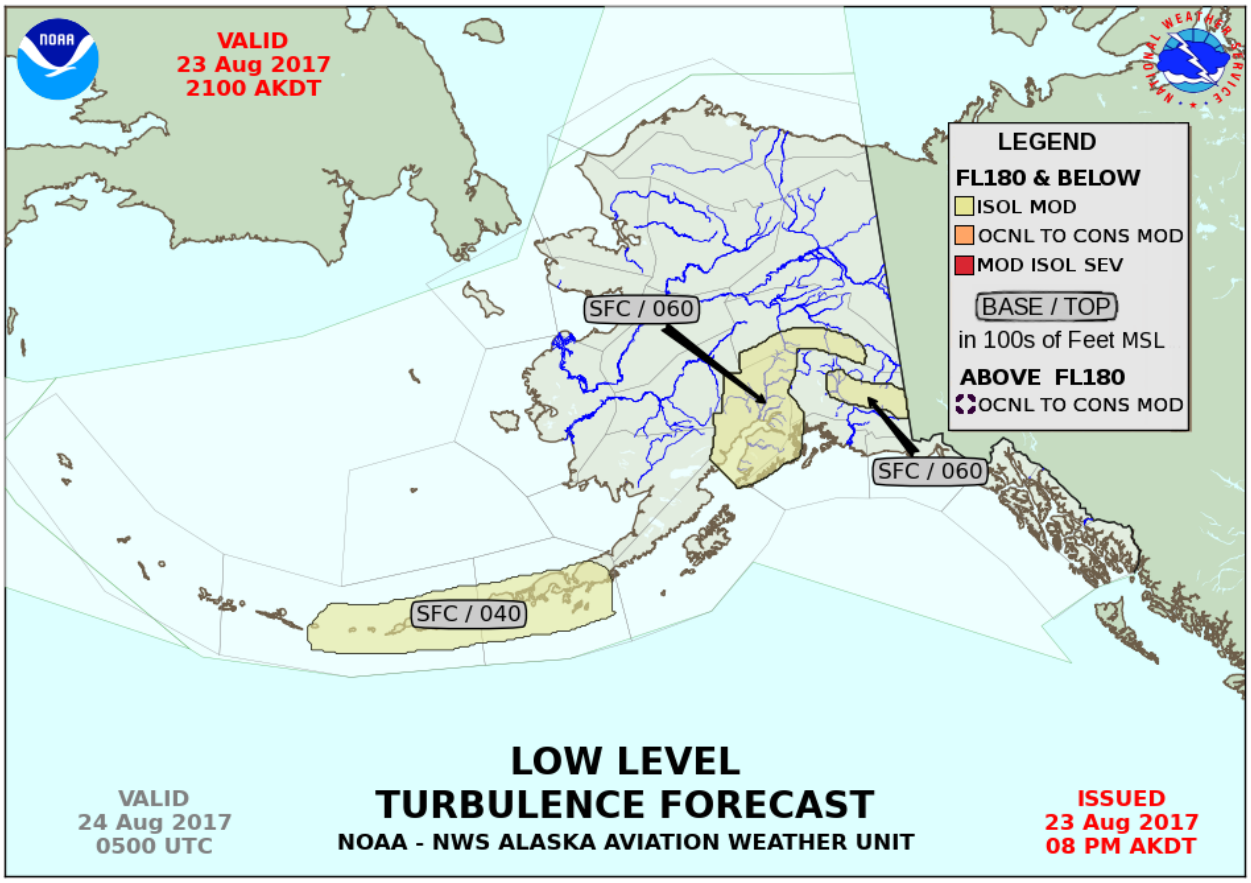

Figure 17 – Low Level Turbulence Forecast graphic issued at 2000 AKDT and valid for 2100 AKDT.

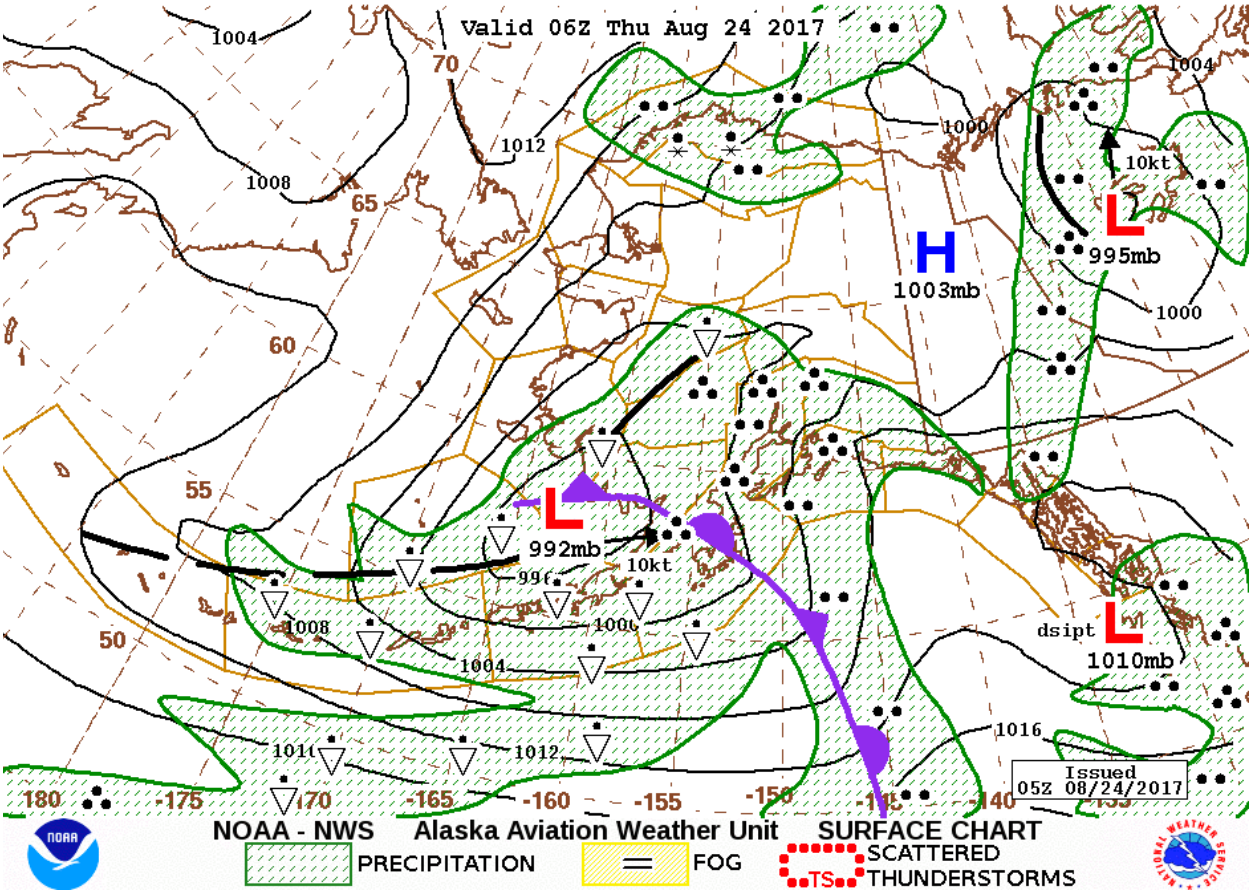

Figure 18 – Surface Chart issued at 2100 AKDT and valid for 2200 AKDT.

13.0 CWSU Products

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

14.0 Astronomical

The astronomical data obtained from the United States Naval Observatory for 61° 12' north latitude and 152° 20' west longitude, for the accident location, indicated the following:

SUN

Sunset	2141 AKDT
End Civil Twilight	2231 AKDT

MOON

Moonrise	0918 AKDT
Moonset	2226 AKDT

PHASE OF THE MOON

Waxing Crescent with 5% of the Moon's visible disk illuminated.

15.0 FAA Weather Briefings

The FAA Kenia Flight Service Station (ENA Flight Service) received three different calls from the accident pilot requesting weather information on the day of the accident. According to the FAA (see Attachment 2):

> *ENA Flight Service received 3 separate phone calls from the pilot over an period of 1 ½ hours. Communication with the pilot was through a satellite phone in which case each call was eventually lost due to interuption* (sic) *of satellite coverage.*
>
> *The first contact was at 7:50 pm lcl and last approximately one minute before the call was lost. the pilot requested an outlook for flight via Merrill Pass to Anchorage tonight and tomorrow. The specilist* (sic) *provided the terminal forecast for Anchorage before the call was lost.*
>
> *Second contact at 7:56pm lcl lasted approximately 3 minutes before the call was lost. The pilot requested a weather breifing* (sic) *asking if vfr flight was possible from Merrill Pass to Anchorage. The specialist provided the Merrill Pass forecast which was for marginal vfr conditions, the Area Forecast and the Anchorage terminal forecast before the call dropped, again.*
>
> *The final contact was at 9:08 pm lcl and lasted approximately 10 minutes before the call was lost. The pilot requested if vfr flight across the Alaska range was recommended?*
>
> *The specialist advised that there was mountain obscuration in clouds and precip across the route. Then provided the area forecast, a pilot report for Lake Clark Pass which stated that vfr flight was not recommended through the pass and weather cameras across the route (Lake Clark, Beluga & Merrill Pass Low.) The specialist provided the national weather service synopsis.*
>
> *The pilot started to file a vfr flight. the call dropped before the flight plan was completed.*

A transcript of the three phone calls between the accident pilot and the Kenai Flight Service Station is presented in Attachment 3.

A summary of an interview performed with the Kenai Flight Service Station specialist who provided preflight weather briefings to the accident pilot on the accident day is presented in Attachment 4.

A copy of weather information from the accident day retrieved from the Operational and Supportability Implementation System (OASIS) at the Kenai Flight Service Station is presented in Attachment 5.

E. LIST OF ATTACHMENTS

Attachment 1 - Images from the Merrill Pass Low, Beluga and Nikiski FAA weather cameras for the times surrounding the accident period.

Attachment 2 - Email from FAA Alaska Flight Service Quality Control/Quality Assurance.

Attachment 3 - Transcript of three phone calls between the accident pilot and the Kenai Flight Service Station.

Attachment 4 - Summary of an interview performed with the Kenai Flight Service Station specialist who provided preflight weather briefings to the accident pilot on the accident day.

Attachment 5 - Weather information from the accident day retrieved from the Operational and Supportability Implementation System at the Kenai Flight Service Station.

Submitted by:

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Mike Richards
Senior Meteorologist

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