



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 25, 2017

Weather Study

METEOROLOGY

ANC17FA021

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A. ACCIDENT

Location: Near Chignik Lake, Alaska
Date: May 1, 2017
Time: 1350 Alaska daylight time
2150 Coordinated Universal Time (UTC)
Airplane: Cessna 208B, N803TH

B. METEOROLOGIST

Paul Suffern
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Centers for Environmental Information (NCEI). All times are Alaska daylight time (AKDT) on May 1, 2017, and are based upon the 24-hour clock, where local time is -8 hours from UTC, and UTC=Z (unless otherwise noted). Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site was located at latitude 56.1403° N, longitude 158.8050° W, at an approximate elevation of 3,000 feet (ft).

D. WEATHER INFORMATION

1.0 Synoptic Situation

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

1.1 Surface Analysis Chart

The NWS NCEP/Ocean Prediction Center (OPC) Surface Analysis Chart for 1600 AKDT is provided as figure 1 with the approximate location of the accident site marked within the red circle. The chart depicted a surface low pressure center in the immediate vicinity of the accident site with a pressure of 997-hectopascals (hPa). A dissipating occluded front stretched from Bristol Bay, Alaska, eastward to Anchorage, then southeastward into the northern Gulf of Alaska. A surface trough¹ was located south of the surface low pressure center above the accident site, with the surface trough stretching southwestward into the northern Pacific Ocean. Clouds and precipitation in mountainous terrain would be expected with a surface low pressure center and a surface trough acting as lifting mechanisms at the accident site around the accident time.

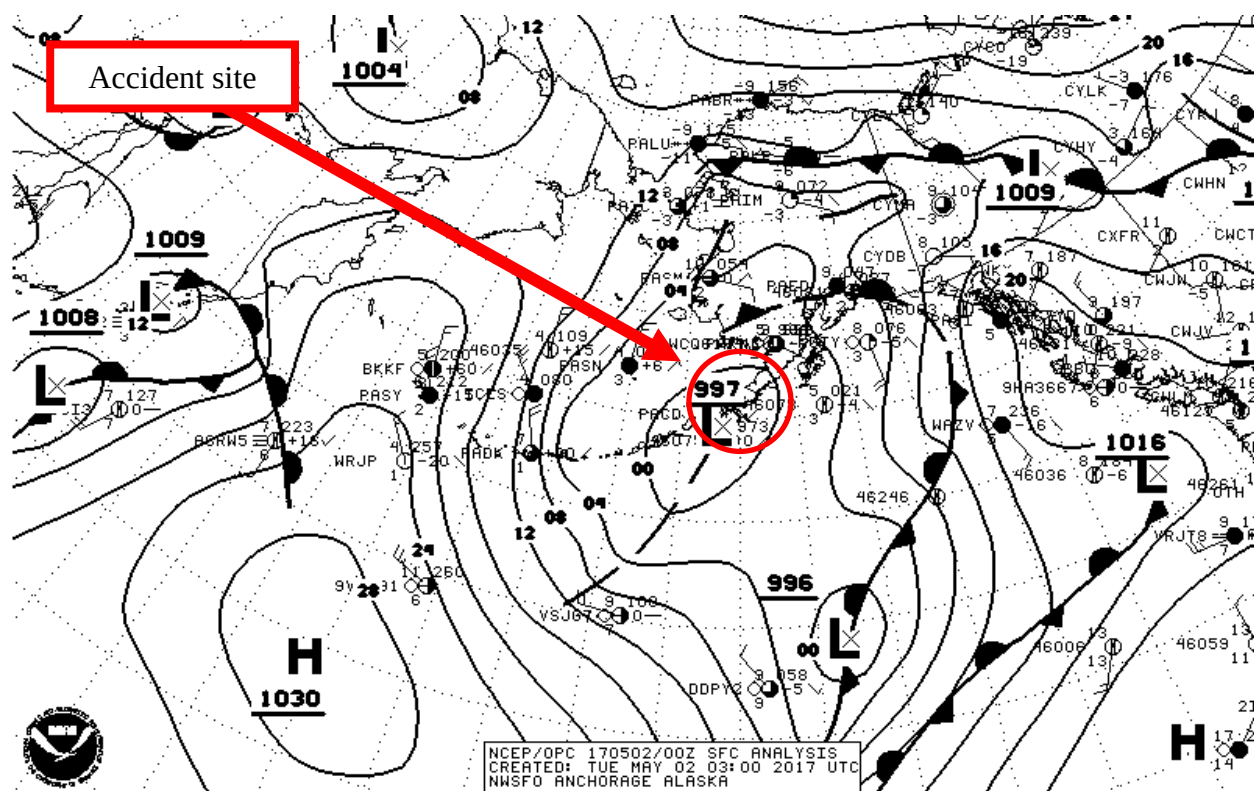


Figure 1 – NCEP/OPC Surface Analysis Chart for 1600 AKDT

1.2 Upper Air Charts

The NCEP/OPC Constant Pressure Charts for 1600 AKDT at 500-hPa is presented in figure 2. A mid-level low pressure center was located just southwest of the accident site at 1600 AKDT with a mid-level trough stretching southwestward from the mid-level low pressure center into the northern Pacific Ocean. This trough and mid-level low pressure center would have acted as lifting mechanisms to help produce clouds and precipitation, especially in mountainous terrain.

¹ Trough – An elongated area of relatively low atmospheric pressure or heights.

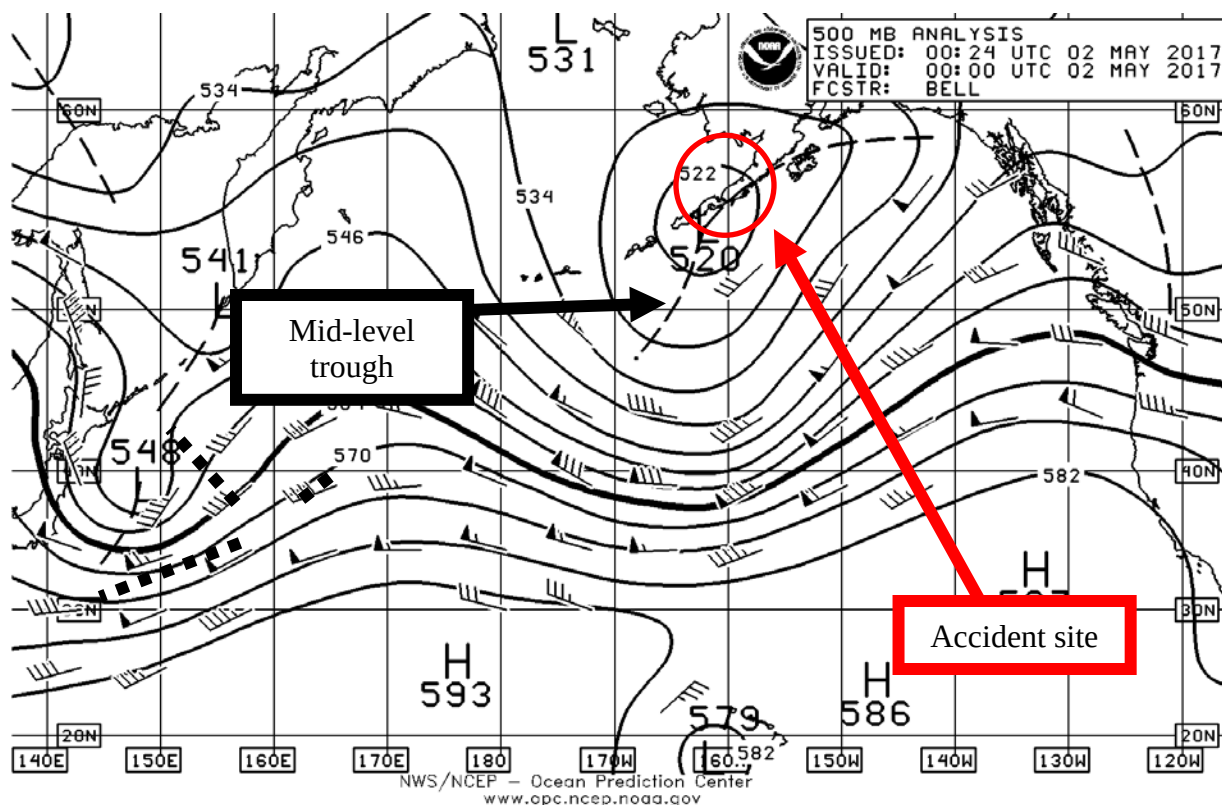


Figure 2 – NWS 500-hPa Constant Pressure Chart for 1600 AKDT

2.0 Surface Observations

The area surrounding the accident site was documented utilizing official Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). Figure 3 is a sectional chart with the accident site and the closest weather reporting locations marked. Included in figure 3 are the departure airport of Port Heiden (PAPH) and the intended destination airport of Perryville (PAPE). PAPE did not have weather instrumentation, but did have a FAA Aviation Weather Camera.

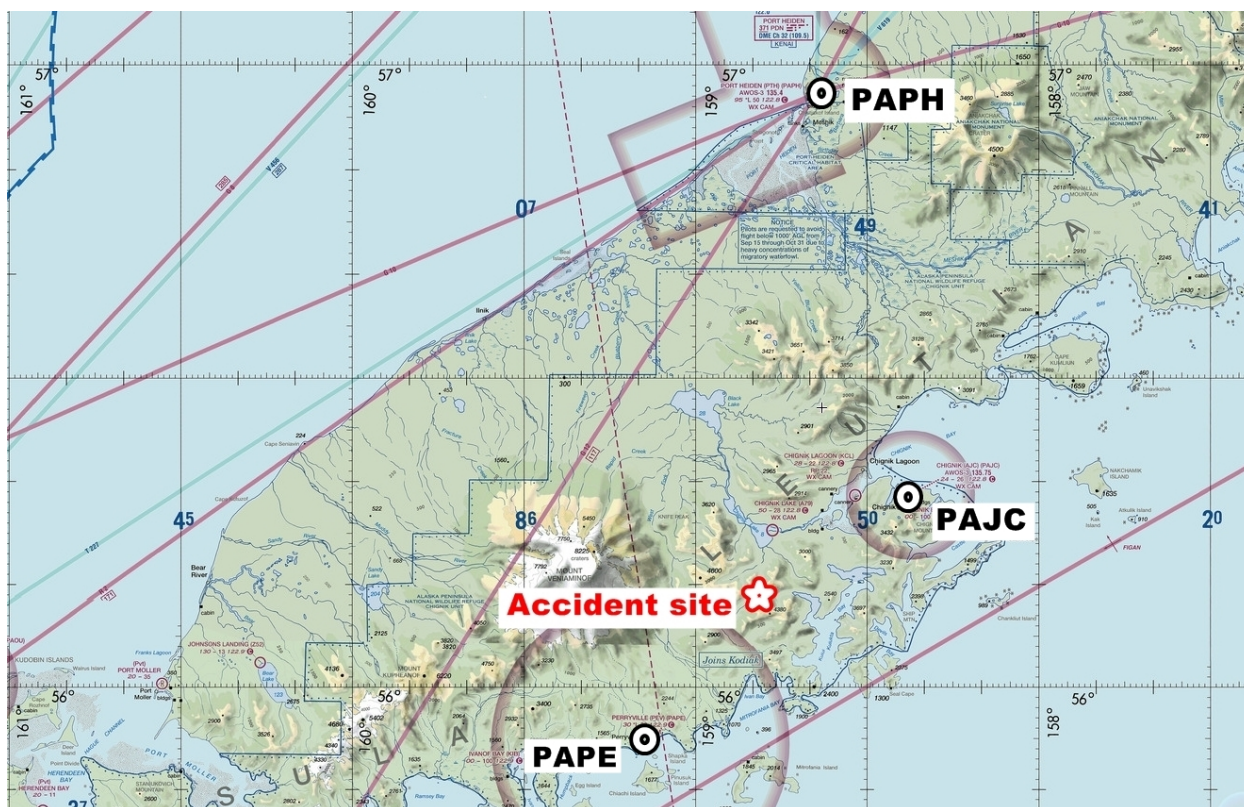


Figure 3 – Sectional chart of accident area with the location of the accident site and surface observation sites

Chignik Airport (PAJC) was the closest official weather station to the accident site, located 2 miles northeast of Chignik, Alaska. PAJC had Automated Weather Observing System (AWOS²) whose reports were not supplemented. PAJC was located 18 miles northeast of the accident site, at an elevation of 24 ft, and had a 16° easterly magnetic variation³ (figure 3). The following observations were taken and disseminated during the times surrounding the accident:⁴

[0956 AKDT] METAR PAJC 011756Z AUTO VRB04KT 10SM FEW032 BKN050 BKN080
03/02 A2950 RMK AO2 SLP988 60003 T00330017 10033 20017 51005=

[1056 AKDT] METAR PAJC 011856Z AUTO 00000KT 10SM SCT014 BKN036 BKN050
04/02 A2950 RMK AO2 SLP989 T00440022=

[1112 AKDT] SPECI PAJC 011912Z AUTO 02007KT 10SM BKN015 BKN022 BKN055
04/02 A2950 RMK AO2=

² AWOS – Automated Weather Observing System is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to twelve thousand ft, and altimeter setting.

³ Magnetic variation – The angle (at a particular location) between magnetic north and true north. 2005, latest measurement taken from <http://www.airnav.com/airport/PAJC>

⁴ Bolded sections in this report highlight information that directly reference the weather conditions that affected the accident location around the accident time.

[1138 AKDT] SPECI PAJC 011938Z AUTO 11006KT 10SM -RA SCT014 OVC026 04/02
A2950 RMK AO2 RAB16 P0000=

**[1156 AKDT] METAR PAJC 011956Z AUTO VRB04KT 10SM FEW012 BKN023 OVC028
05/03 A2951 RMK AO2 RAB16E41 SLP992 P0000 T00500028=**

**[1239 AKDT] SPECI PAJC 012039Z AUTO VRB04KT 10SM -RA OVC017 04/02 A2951
RMK AO2 RAB07 P0001=**

ACCIDENT TIME 1350 AKDT

**[1456 AKDT] METAR PAJC 012256Z AUTO 11010G15KT 10SM FEW020 SCT075 BKN090
06/01 A2951 RMK AO2 RAE03 SLP993 P0000 T00560011=**

**[1526 AKDT] SPECI PAJC 012326Z AUTO 13010G15KT 080V150 10SM BKN024 06/01
A2951 RMK AO2=**

[1546 AKDT] SPECI PAJC 012346Z AUTO 14011G16KT 10SM SCT024 06/02 A2951
RMK AO2=

[1556 AKDT] METAR PAJC 012356Z AUTO 13011G15KT 10SM FEW024 06/01 A2951
RMK AO2 SLP993 60003 T00610011 10061 20033 56002=

PAJC weather at 1156 AKDT, automated, wind variable at 4 knots, 10 miles visibility, few clouds at 1,200 ft above ground level (agl), broken ceiling at 2,300 ft agl, overcast skies at 2,800 ft agl, temperature of 5° Celsius (C), dew point temperature of 3° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, rain began at 1116 AKDT, rain ended at 1141 AKDT, sea-level pressure 999.2 hPa, one-hourly precipitation of a trace, temperature 5.0° C, dew point temperature 2.8° C.

PAJC weather at 1239 AKDT, automated, wind variable at 4 knots, 10 miles visibility, light rain, overcast ceiling at 1,700 ft agl, temperature of 4° C, dew point temperature of 2° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, rain began at 1207 AKDT, one-hourly precipitation of 0.01 inches.

PAJC weather at 1456 AKDT, automated, wind from 110° at 10 knots with gusts to 15 knots, 10 miles visibility, few clouds at 2,000 ft agl, scattered clouds at 7,500 ft agl, broken ceiling at 9,000 ft agl, temperature of 6° C, dew point temperature of 1° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, rain ended at 1403 AKDT, sea-level pressure 999.3 hPa, one-hourly precipitation of a trace, temperature 5.6° C, dew point temperature 1.1° C.

PAJC weather at 1526 AKDT, automated, wind from 130° at 10 knots with gusts to 15 knots, wind varying between 080° and 150°, 10 miles visibility, broken ceiling at 2,400 ft agl, temperature of 6° C, dew point temperature of 1° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator.

PAPH was the departure airport located 6 miles northeast of Port Heiden, Alaska. PAPH had AWOS whose reports were not supplemented. PAPH was located 49 miles north-northeast of the accident site, at an elevation of 95 ft, and had a 16° easterly magnetic variation⁵ (figure 3). The accident airplane departed around 1325 AKDT from PAPH. The following observations were taken and disseminated during the times surrounding the accident:

[0856 AKDT] METAR PAPH 011656Z AUTO 14008KT 10SM BKN037 BKN047 04/01
A2949 RMK AO2 RAE14 SLP988 P0000 T00440006=

[0956 AKDT] METAR PAPH 011756Z AUTO 17005KT 10SM -RA OVC038 04/01 A2949
RMK AO2 RAB51 SLP990 P0000 60000 T00440006 10044 20017 53004=

[1056 AKDT] METAR PAPH 011856Z AUTO 11006KT 10SM OVC034 06/M01 A2949
RMK AO2 RAE09 SLP991 P0000 T00561006=

[1108 AKDT] SPECI PAPH 011908Z AUTO 11006KT 10SM -RA BKN029 OVC035 06/00
A2949 RMK AO2 RAB1859 P0000=

**[1156 AKDT] METAR PAPH 011956Z AUTO 09007KT 10SM -RA BKN027 OVC032 04/01
A2951 RMK AO2 RAB1859 SLP995 P0000 T00440006=**

**[1256 AKDT] METAR PAPH 012056Z AUTO 06007KT 10SM -RA OVC026 04/01 A2951
RMK AO2 SLP998 P0000 60000 T00440011 53007=**

ACCIDENT TIME 1350 AKDT

**[1356 AKDT] METAR PAPH 012156Z AUTO 06007KT 10SM FEW015 BKN031 OVC070
05/02 A2951 RMK AO2 RAE54 SLP996 P0000 T00500017=**

**[1420 AKDT] SPECI PAPH 012220Z AUTO 12010KT 10SM -RA BKN021 BKN033 BKN075
06/02 A2951 RMK AO2 RAB12 P0000=**

[1456 AKDT] METAR PAPH 012256Z AUTO 09008KT 10SM -RA SCT023 BKN029 OVC050
06/02 A2951 RMK AO2 RAB12 SLP995 P0000 T00560022=

[1540 AKDT] SPECI PAPH 012340Z AUTO 13012G17KT 10SM SCT025 BKN031 BKN041
07/00 A2949 RMK AO2 RAE04 P0000=

⁵ Magnetic variation – The angle (at a particular location) between magnetic north and true north. 2005, latest measurement taken from <http://www.airnav.com/airport/PAPH>

PAPH weather at 1156 AKDT, automated, wind from 090° at 7 knots, 10 miles visibility, light rain, broken ceiling at 2,700 ft agl, overcast skies at 3,200 ft agl, temperature of 4° C, dew point temperature of 1° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, rain began at 1059 AKDT, sea-level pressure 999.5 hPa, one-hourly precipitation of a trace, temperature 4.4° C, dew point temperature 0.6° C.

PAPH weather at 1256 AKDT, automated, wind from 060° at 7 knots, 10 miles visibility, light rain, overcast ceiling at 2,600 ft agl, temperature of 4° C, dew point temperature of 1° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, sea-level pressure 999.8 hPa, one-hourly precipitation of a trace, 6-hourly precipitation of a trace, temperature 4.4° C, dew point temperature 1.1° C, 3-hourly pressure increase of 0.7 hPa.

PAPH weather at 1356 AKDT, automated, wind from 060° at 7 knots, 10 miles visibility, few clouds at 1,500 ft agl, broken ceiling at 3,100 ft agl, overcast skies at 7,000 ft agl, temperature of 5° C, dew point temperature of 2° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, rain ended at 1354 AKDT, sea-level pressure 999.6 hPa, one-hourly precipitation of a trace, temperature 5.0° C, dew point temperature 1.7° C.

PAPH weather at 1420 AKDT, automated, wind from 120° at 10 knots, 10 miles visibility, light rain, broken ceiling at 2,100 ft agl, broken skies at 3,300 ft agl, broken skies at 7,500 ft agl, temperature of 6° C, dew point temperature of 2° C, and an altimeter setting of 29.51 inches of mercury. Remarks; station with a precipitation discriminator, rain began at 1412 AKDT, one-hourly precipitation of a trace.

The observations from PAJC and PAPH surrounding the accident time indicated MVFR⁶ conditions with light rain during the period with the lowest cloud cover of 1,700 ft msl.

⁶ Marginal Visual Flight Rules – Refers to the general weather conditions pilots can expect at the surface. MVFR criteria means a ceiling between 1,000 and 3,000 ft agl and/or 3 to 5 miles visibility.

3.0 Upper Air Data

A Global Data Assimilation System (GDAS) computer model upper air sounding for the accident site was generated for 1300 AKDT. The 1300 AKDT sounding was plotted on a standard Skew-T log P diagram⁷ with the derived stability parameters included in figure 4 (with data from the surface to 600-hPa, or 13,000 ft msl.) This sounding data was analyzed utilizing the RAOB⁸ software package. The sounding depicted the lifted condensation level (LCL)⁹ at 3,637 ft msl, a convective condensation level (CCL)¹⁰ of 4,351 ft, and a level of free convection (LFC)¹¹ at 4,839 ft. The freezing level was located at 2,423 ft. The precipitable water value was 0.30 inches.

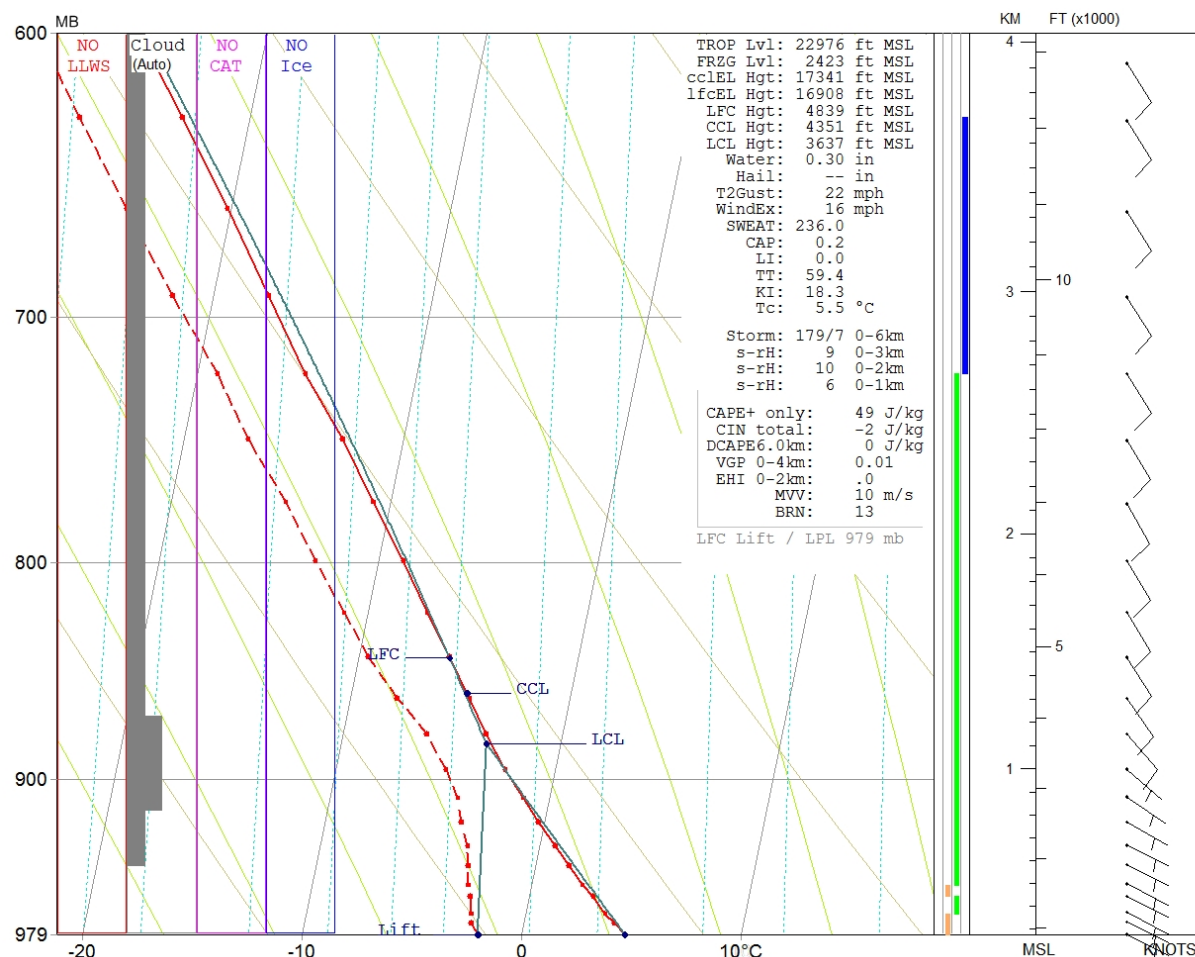


Figure 4 – 1300 AKDT GDAS sounding

⁷ Skew T log P diagram – is a standard meteorological plot 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.

⁸ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

⁹ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁰ Convective Condensation Level (CCL) – The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.

¹¹ Level of Free Convection (LFC) – The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

The 1300 AKDT GDAS sounding indicated a conditionally unstable layer between the surface and 8,500 ft. With a conditionally unstable low-level environment, lifting mechanisms in the area of the accident site at the accident time (sections 1.1 and 1.2) and mountainous terrain, then clouds, rain showers, and precipitation would have been likely above 1,800 ft msl. RAOB indicated that clouds were likely from 1,800 ft through 13,000 ft. No icing conditions were indicated by RAOB through 13,000 ft. However, given the clouds and precipitation seen in the FAA's Aviation Weather Cameras imagery (section 15.0) some icing conditions would have been likely in the clouds above 2,400 ft.

The 1300 AKDT GDAS sounding wind profile indicated a surface wind from 118° at 4 knots with the wind remaining southeasterly through 13,000 ft between 5 and 10 knots. RAOB did not indicate the possibility of low-level wind shear or clear-air turbulence outside of rain shower activity.

4.0 Satellite Data

Visible and infrared data from the Geostationary Operational Environmental Satellite number 15 (GOES-15) 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 software. Visible and infrared imagery (GOES-15 bands 1 and 4) at wavelengths of 0.65 microns (μm) and 10.7 μm , respectively, were retrieved for the period. Satellite imagery surrounding the time of the accident, from 1100 AKDT through 1600 AKDT at approximately 15-minute intervals were reviewed, and the closest images to the time of the accident are documented here.

Figures 5 and 6 present the GOES-15 visible imagery from 1345 and 1400 AKDT at 2X magnification with the accident site highlighted with a red square. Inspection of the visible imagery indicated overcast cloud cover over the accident site at the accident time with mountain obscuration conditions likely (section 2.0). After 1400 AKDT the visible imagery indicated there was a break in the cloud cover near the mountainous terrain at the accident site with the more convective cloud cover bands moving north and northwestward away from the accident site (attachment 1). Figures 7 and 8 present the GOES-15 infrared imagery from 1345 and 1400 AKDT at 6X magnification with the accident site highlighted with a red square. Inspection of the infrared imagery indicated cloud cover over the accident site at the accident time. The lower brightness temperatures (green color, higher cloud tops) were located north of the accident site at the accident time. The brightness temperature above the accident site at the accident time was -16°C and with the vertical temperature profile provided by the 1300 AKDT GDAS sounding, the approximate cloud-top heights over the accident site would have been 9,000 ft. It should be noted these figures have not been corrected for any parallax error.

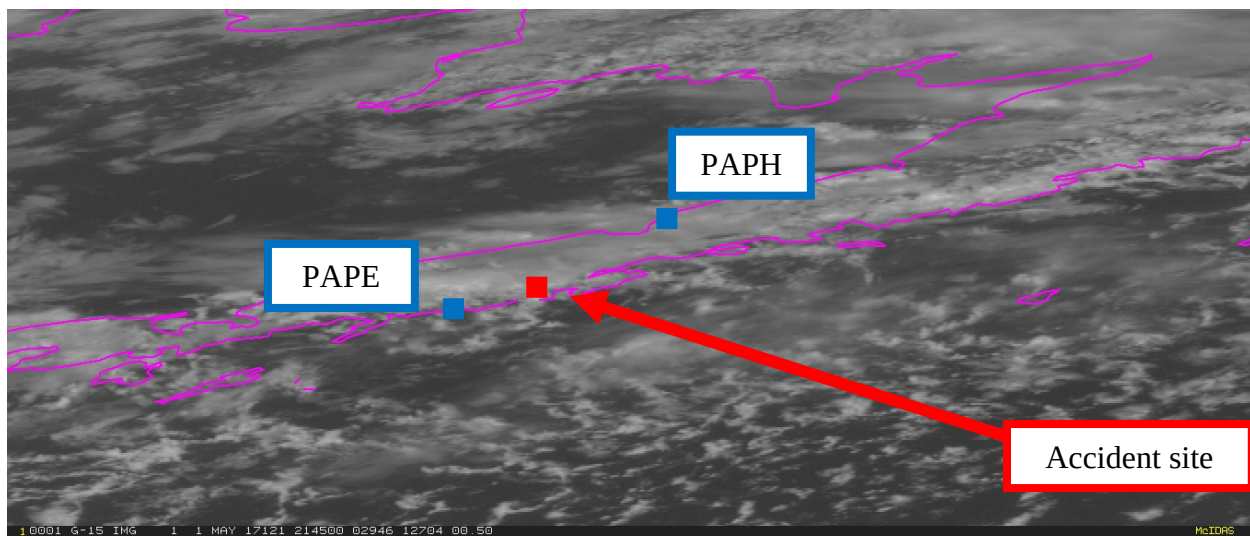


Figure 5 – GOES-15 visible image at 1345 AKDT

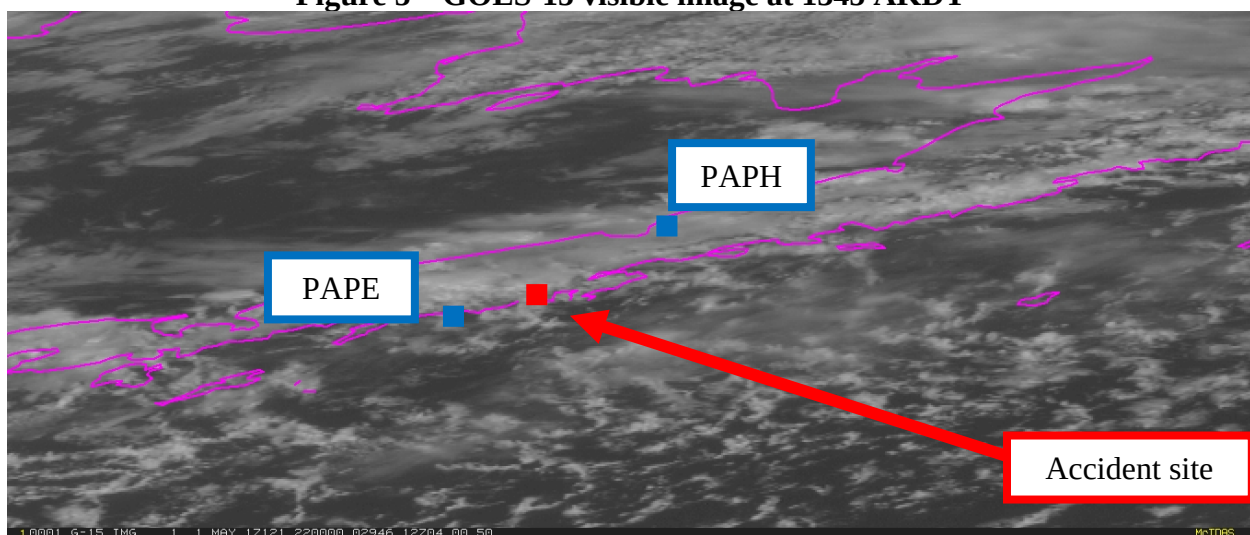


Figure 6 – GOES-15 visible image at 1400 AKDT

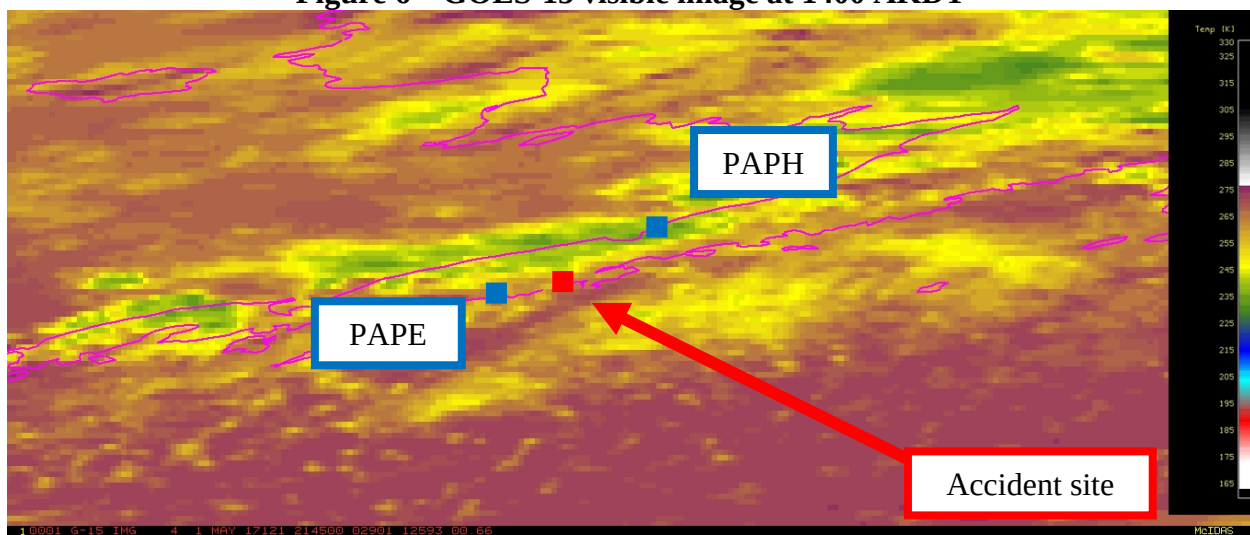


Figure 7 – GOES-15 infrared image at 1345 AKDT

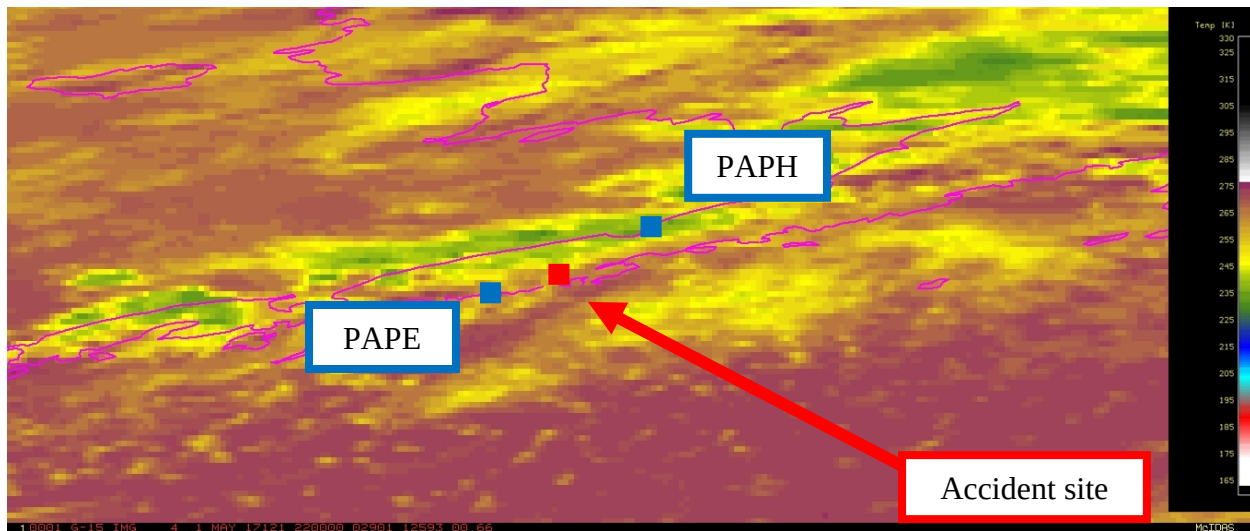


Figure 8 – GOES-15 infrared image at 1400 AKDT

5.0 Radar Imagery Information

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹² to the accident site was the King Salmon, Alaska, radar (PAKC), which was located 168 miles northeast of the accident site at an elevation of 262 ft. Level II and III archive radar data were obtained from the NCEI utilizing the NEXRAD Data Inventory Search and displayed using the NOAA's Weather and Climate Toolkit software. No reflectivity targets were located above the accident site at the accident time.

6.0 Pilot Reports¹³

All pilot reports (PIREPs) for the state of Alaska from about three hours prior to the accident time to about three hours after the accident time were reviewed. Only the PIREP for below FL180¹⁴ within 300 miles of the accident site is provided below:

DUT UA /OV DUT-CDB /TM 2052 /FLUNKN /TP PA31 /WX -SHRA=

Routine pilot report (UA); Between Dutch Harbor and Cold Bay, Alaska; Time – 1252 AKDT (2052Z); Altitude – Unknown; Type aircraft – Piper PA-31 Navajo; Weather – Light rain shower.

¹² The WSR-88D is an S-band 10-centimeter wavelength radar with a power output of 750,000 watts, and with a 28-foot parabolic antenna that concentrates the energy between a 0.87° and 0.96° beam width. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

¹³ Only pilot reports with the WMO header UBAK** identifier were considered.

¹⁴ Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of ft. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

7.0 SIGMET and CWSU Advisories

No SIGMETs valid for the accident site at the accident time.

No Center Weather Service Unit (CWSU) Center Weather Advisories (CWA)s were valid for the accident site at the accident time. No CWSU Meteorological Impact Statements (MIS)s were valid for the accident site at the accident time.

8.0 AIRMETs

The Alaska Aviation Weather Unit (AAWU) issued AIRMET Sierra for mountain obscuration at 1214 AKDT which forecast mountains occasionally obscured by clouds and isolated precipitation:

WAAK48 PAWU 012014

WA80

ANCS WA 012015

AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 020415

.

COOK INLET AND SUSITNA VLY AB

AK RANGE AND CHUGACH MTS OCNL OBSC IN CLDS/PCPN. NC.

.

COPPER RIVER BASIN AC

MTS OCNL OBSC IN CLDS/PCPN. NC.

.

CNTRL GLF CST AD

MTS OBSC IN CLDS/PCPN. NC.

.

KODIAK IS AE

TIL 01Z ALEUTIAN RANGE OCNL OBSC IN CLDS/PCPN. IMPR.

.

BRISTOL BAY AH

PAIL-PADL LN NW MTS OCNL OBSC CLDS/PCPN.

NC.

.

AK PEN AI

MTS OCNL OBSC IN CLDS/ISOL PCPN. NC.

.

UNIMAK PASS TO ADAK AJ

MTS OCNL OBSC IN CLDS/PCPN. NC.

.

PRIBILOF ISLANDS AND SOUTHEAST BERING SEA AL

OCNL CIGS BLW 010/VIS BLW 3SM -SHRA BR/BR. NC.

.

=ANCT WA 012015

AIRMET TANGO FOR TURB/STG SFC WINDS VALID UNTIL 020415

.

COOK INLET AND SUSITNA VLY AB

TIL 23Z SE PAEN OCNL MOD TURB FL270-FL340. WKN.

.

COOK INLET AND SUSITNA VLY AB

TIL 23Z PANC S ALG ERN MTS MOD TURB 020-170. WKN.

.

COOK INLET AND SUSITNA VLY AB

TIL 23Z MAT VLY OCNL MOD TURB BLW 040. WKN.
 .
 CNTRL GLF CST AD
 TIL 00Z ALG CST PAWD E SUSTAINED
 SFC WND 30KT OR GTR. WKN.
 .
 CNTRL GLF CST AD
 TIL 02Z PAWD SW OCNL MOD TURB FL270-FL340. WKN.
 .
 CNTRL GLF CST AD
 TIL 23Z OCNL MOD TURB BLW 040. WKN.
 .
 KODIAK IS AE
 TIL 02Z SE PADQ-PAKH LN OCNL MOD TURB FL270-FL340. WKN.
 .
 ADAK TO ATTU AK
 AFT 02Z ATTU W OCNL MOD TURB FL290-FL360. INTSF.
 .
 =ANCZ WA 012015
 AIRMET ZULU FOR ICING VALID UNTIL 020415
 .
 NONE
 .

9.0 AAWU Graphics

The AAWU convective outlook, icing forecast, flying weather, low-level turbulence, and surface chart forecast graphics valid around the accident time are provided in figures 9 through 14. The AAWU graphics depicted that towering cumulus clouds were likely at the accident site between 1200 and 1500 AKDT with the towering cumulus clouds between 3,000 ft and FL200 (figure 9). No icing or area of low-level turbulence were forecast (figures 10 and 12). MVFR conditions were forecast for the accident site area for between 1000 and 1600 AKDT (figure 11). The AAWU surface charts valid at 1000 and 1600 AKDT (figures 13 and 14) forecast rain showers across the Alaska Peninsula, the accident site, and the mountainous terrain.

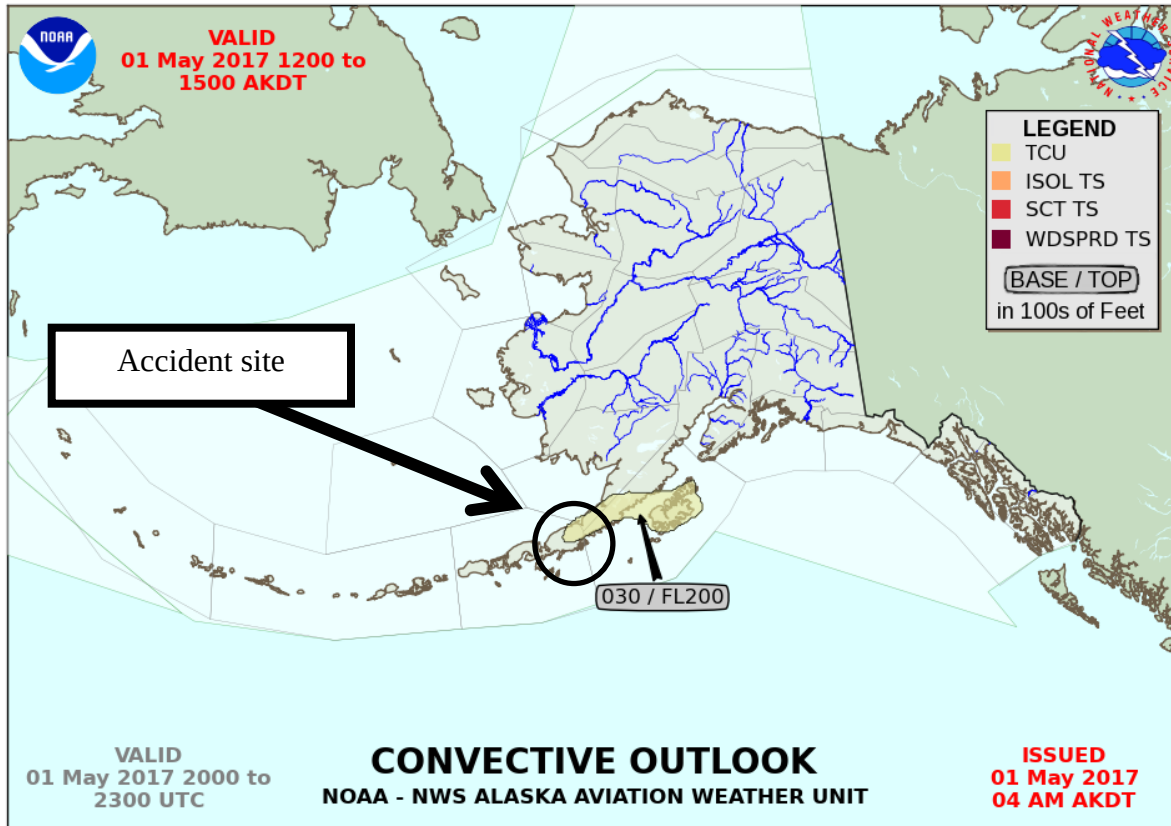


Figure 9 – Convective Outlook graphic from the AAWU valid between 1200 and 1500 AKDT and graphic was issued at 0400 AKDT

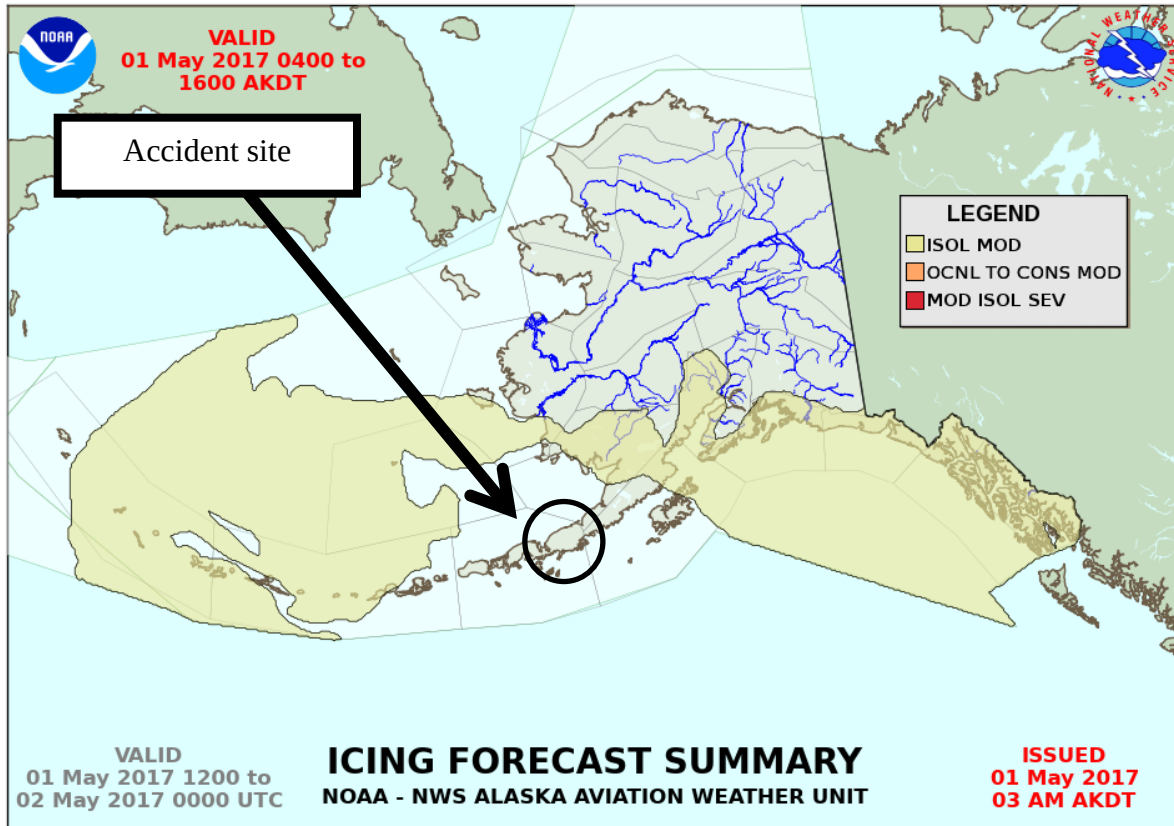


Figure 10 – Icing Forecast Summary graphic from the AAWU valid between 1200 AKDT on May 1st and 0000 AKDT on May 2nd and graphic was issued at 0300 AKDT

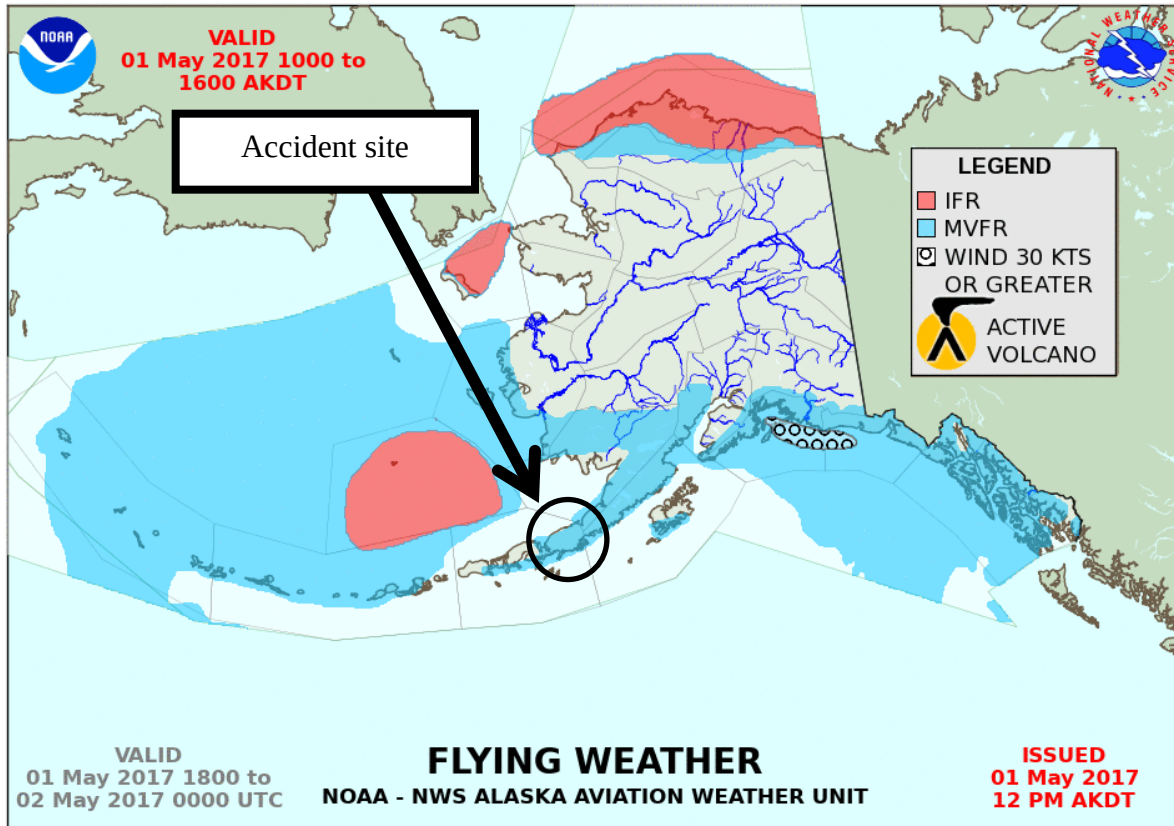


Figure 11 – Flying Weather graphic from the AAWU valid between 1000 and 1600 AKDT and graphic was issued at 1200 AKDT

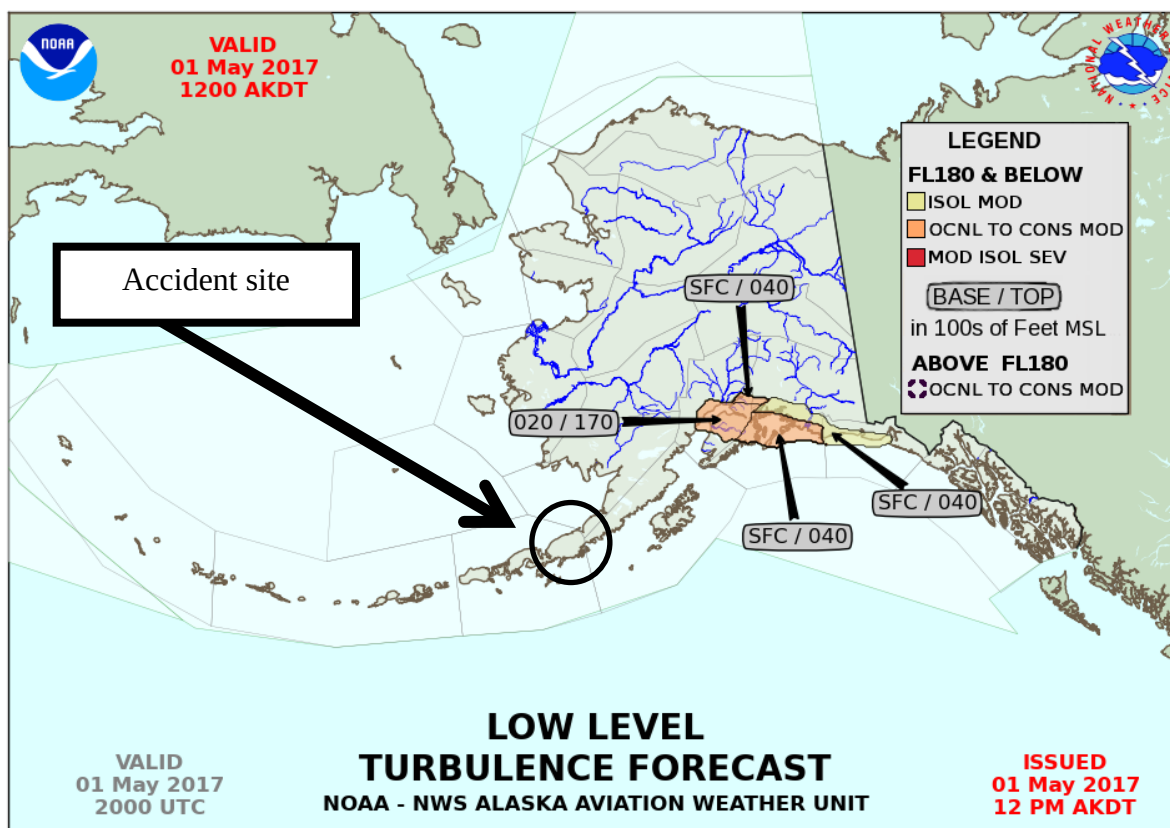
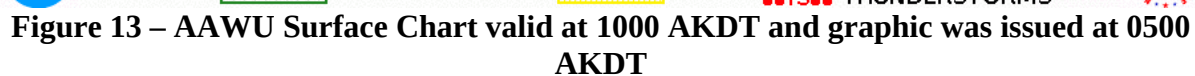


Figure 12 – Low-Level Turbulence Forecast graphic from the AAWU valid at 1200 AKDT and graphic was issued at 1200 AKDT



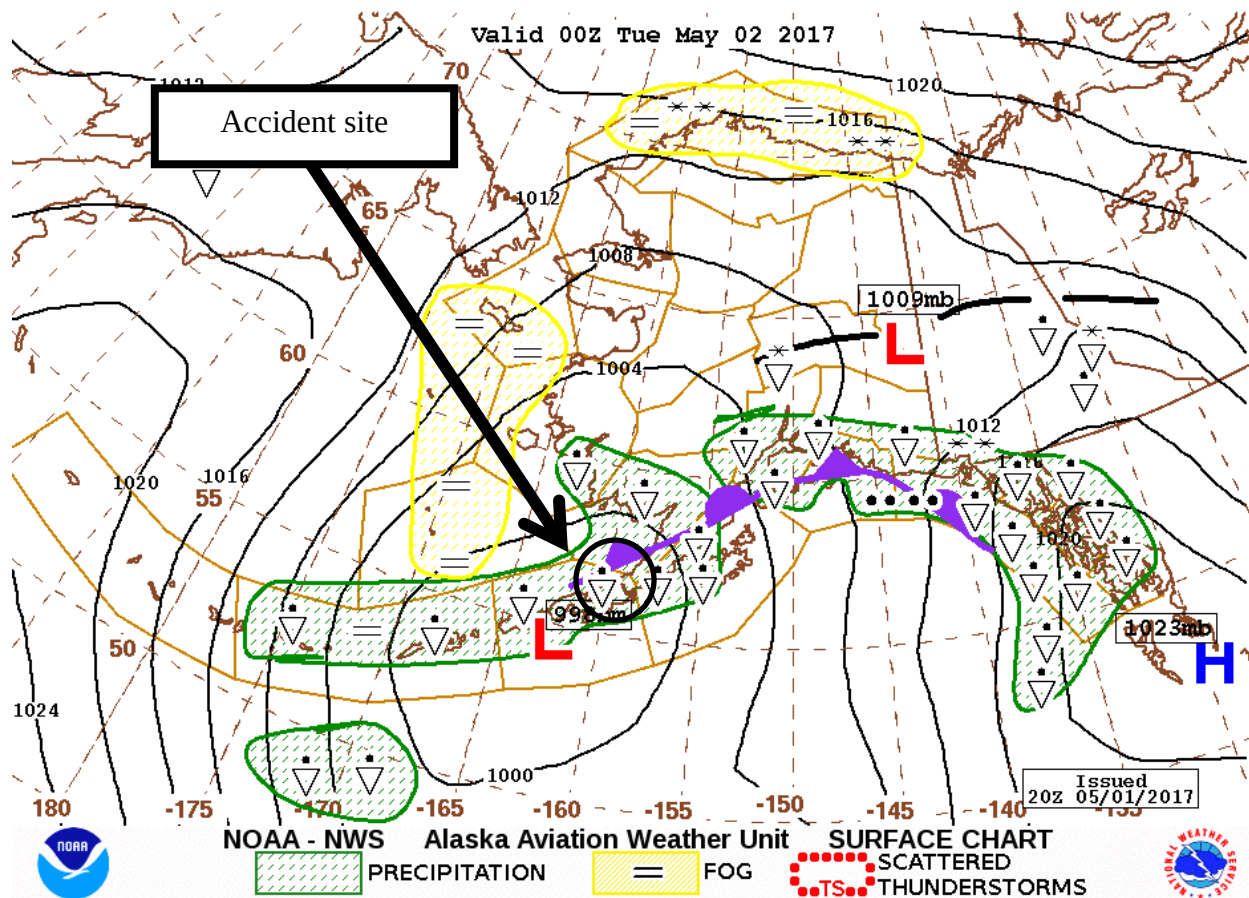


Figure 14 – AAWU Surface Chart valid at 1600 AKDT and graphic was issued at 1200 AKDT

10.0 Area Forecast

The Area Forecast issued at 1214 AKDT, valid at the accident time, forecasted an AIRMET (section 8.0), scattered clouds at 2,000 ft, a broken ceiling at 5,000 ft, cloud tops at 10,000 ft, with an occasional broken ceiling at 2,000 ft and isolated rain showers. No significant turbulence or icing conditions were forecast except in the vicinity of towering cumulus clouds with the freezing level forecast at 1,500 ft:

FAAK58 PAWU 012014

FA8W

ANCC FA 012015

AK SRN HLF EXCP SE AK...

AIRMETS VALID UNTIL 020415

CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.

KUSKOKWIM VLY AF...VALID UNTIL 020800

...CLOUDS/WX...

VCY AK RANGE SCT025 SCT-BKN060 BKN100 TOP FL200. OCNL BKN025.

ISOL -SHRA. ELSW SCT060 SCT-BKN100 TOP 150.

TIL 03Z VCY GAPS AK RANGE SFC WND E-SE G25KT.
OTLK VALID 020800-021400...VFR.
...TURB...
NIL SIG.
...ICE AND FZLVL...
NIL SIG. EXC VCY TCU. FZLVL 030.

.
YKN-KUSKOKWIM DELTA AG...VALID UNTIL 020800
...CLOUDS/WX...
SCT035 SCT-BKN060 SCT-BKN100 TOP 150 LYRS ABV.
PARS-PAHP LN S SCT -SHRA BKN035.
OTLK VALID 020800-021400...VFR. ISOL SHRA.
...TURB...
NIL SIG.
...ICE AND FZLVL...
TIL 23Z KUSKOKWIM BAY ISOL MOD ICEIC 050-140. FZLVL 025.

.
BRISTOL BAY AH...VALID UNTIL 020800
...CLOUDS/WX...
AIRMET MT OBSCPAIL-PADL LN NW MTS OCNL OBSC CLDS/PCPN.
NC...
PAIL-PADL LN NW FEW008 BKN015 OVC060 TOP FL180. ISOL BKN008.
SCT -SHRA. ELSW SCT035 BKN060 OVC100 TOP FL180. ISOL -SHRA.
OTLK VALID 020800-021400...PAIL-PADL LN N MVFR CIG SHRA.
ELSW VFR ISOL SHRA.
...TURB...
NIL SIG.
...ICE AND FZLVL...
TIL 02Z NW PAJZ ISOL MOD ICEIC 050-140. FZLVL 020.

.
AK PEN AI...VALID UNTIL 020800
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/ISOL PCPN. NC...
SCT020 BKN050 TOP 100. OCNL BKN020 ISOL -SHRA.
OFSHR PACIFIC SIDE SCT025 SCT-BKN060 TOP 100. ISOL BKN025 -SHRA.
AFT 23Z PACD E SCT BKN030TCU TOP FL200 -SHRA.
OTLK VALID 020800-021400...MVFR CIG SHRA.
...TURB...
NIL SIG. EXC VCY TCU.
...ICE AND FZLVL...
NIL SIG. EXC VCY TCU. FZLVL 015.

.
UNIMAK PASS TO ADAK AJ...VALID UNTIL 020800
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
BERING SIDE SCT020 BKN050 TOP 100. OCNL BKN020 OVC040 VIS 3-5SM -SHRA BR.
CONDS SPRDG TO ALL SXNS AFT 02Z.
ELSW SCT025 BKN060 TOP 100. ISOL -SHRA.
W PAKO SFC WND N G30KT.
OTLK VALID 020800-021400...MVFR CIG SHRA.
...TURB...
NIL SIG.
...ICE AND FZLVL...
W PAKO ISOL MOD ICEIC 040-100. FZLVL 015.

11.0 Terminal Aerodrome Forecast

Sand Point Airport (PASD), located 76 miles southwest of the accident was the closest site to the accident site with a NWS Terminal Aerodrome Forecast (TAF). The TAF valid at the time of the accident was issued at 0933 AKDT and was valid for a 24-hour period beginning at 1000 AKDT. The TAF for PASD was as follows:

TAF PASD 011733Z 0118/0218 **VRB04KT P6SM -SHRA BKN015 OVC025**
TEMPO 0118/0122 SCT015 BKN025
FM012200 12006KT P6SM -SHRA BKN035
FM020700 04006KT P6SM SCT035=

The forecast expected a variable wind at 4 knots, greater than 6 miles visibility, light rain showers, a broken ceiling at 1,500 ft agl, and overcast skies at 2,500 ft agl. Temporary conditions for PASD were forecast between 1000 and 1400 AKDT with scattered clouds at 1,500 ft agl and a broken ceiling at 2,500 ft agl.

12.0 NWS Area Forecast Discussion

The NWS Office in Anchorage, Alaska, issued the following Area Forecast Discussion (AFD) at 0446 AKDT (closest AFD to the accident time). The AFD discussed the showery regime across Southwest Alaska and Aleutian Peninsula continuing during the day:

237
FXAK68 PAFC 011246
AFDAFC

Southcentral and Southwest Alaska Forecast Discussion
National Weather Service Anchorage AK
446 AM AKDT Mon May 1 2017

.ANALYSIS AND UPPER LEVELS...

The broad low pressure system over the Eastern Aleutians continues to gradually move southward into the North Pacific ocean. This is resulting in northerly winds from the northern Bering extending southward through the Central/Western Aleutians. Therefore, the majority of the Bering and the Aleutians will remain under a showery regime. Meanwhile, the Gulf has an upper level trough swinging through the northern Gulf producing showers across the northern coastal communities. This synoptic feature is reflected by the radar imagery with showers moving through the Prince William Sound, and along the Eastern Kenai Peninsula. Some of the showers are spreading over the Aleutian Range into the Bristol Bay interior. Meanwhile, the Anchorage Bowl, and portions of the Western Kenai Peninsula remains with downsloped drier conditions.

&&

.MODEL DISCUSSION...

The models remain in good agreement heading into the midweek. There is a North Pacific low tracking into the lower Gulf by Tuesday afternoon. The NAM is faster with the progression of this system, and the GFS/ECMWF are slower with this feature. The

GFS/ECMWF storm track coincides with the jet stream transitioning to a southerly meridional flow heading into Tuesday. Therefore, the GFS/ECMWF were the preferred models of choice resulting in above average forecast confidence through the midweek time-frame.

&&

.AVIATION...

PANC...VFR conditions with light northwesterly wind this morning, but will shift around to southeasterly flow by this afternoon.

&&

.SHORT TERM FORECAST SOUTHCENTRAL ALASKA (Days 1 and 2)...

A new upper level wave pushing through Kodiak Island this morning will support precipitation across Southcentral today, and tonight as it pushes northward. The morning sounding at Kodiak indicates a slightly more moist airmass, and steep lapse rates. With little CAPE to work with, thunderstorms are not likely, but a strike or two cannot be ruled out due to easterly flow and orographic enhancement. Persistent onshore flow will continue to support shower development throughout the day even as the wave pushes northward.

While Currently the wave is fairly weak, it is expected to intensify as it pushes northward toward the northern Gulf of Alaska coast throughout the day. Showers are expected to form across the west Kenai Peninsula and Susitna Valley generally south of Talkeetna by this evening. Models indicate weak CAPE mainly over mountainous areas in the Susitna Region. The Anchorage sounding this morning indicates more available moisture at mid-levels than it has over the past several days and steep lapse rates. As a result, a lightning strike or two cannot be ruled out for the Susitna Valley or Kenai Peninsula, but is not likely.

A pattern change is expected by late Tuesday as an unseasonably strong low pressure system moves from the eastern Gulf into the central Gulf. The concern with this system is gusty winds nearing storm force strength, with seas greater than 20 ft. The current track of the storm does not favor a stronger coastal jet, but a more northern track could support sustained storm winds.

&&

.SHORT TERM FORECAST SOUTHWEST ALASKA (Days 1 and 2)...

The large upper level low has slid east to be centered over the Alaska Peninsula with its associated cold air aloft extending into Southwest Alaska, and keeping the area under an unstable and showery regime. A trough rotating around this low will swing across Southwest Alaska this afternoon, and evening bringing an increase in showers and the potential for a few isolated thunderstorms. The diurnal shower activity will taper off on Tuesday as the upper low drops south in response to a very strong low tracking into the Gulf. While precipitation will remain predominantly to the east of the Alaska, and Aleutian Ranges northerly winds will increase rapidly Tuesday night and Wednesday

in response to the presence of the deep Gulf low.

&&

.SHORT TERM FORECAST BERING SEA/ALEUTIANS (Days 1 and 2)...

As the upper low over the Alaska Peninsula drops south tonight and a rather deep surface low tracks north into the Gulf Tuesday and Wednesday, northerly winds will increase across the eastern Bering, Bristol Bay and the Alaska Peninsula. Sustained winds will increase into the 30 to 35 knot range with stronger gusts out of the gaps, and passes in the Alaska Peninsula Tuesday night and Wednesday.

Further west, a ridge building into the Western Aleutians today and tonight will shift east to the Central Aleutians and Bering Tuesday and Tuesday night. The next incoming low pressure system will reach the Western Aleutians Tuesday afternoon then proceed slowly east following behind the ridge. By Wednesday Night, the ridge will reach the Eastern Aleutians, and then continue to amplify over the Alaska Peninsula on Thursday as a frontal system from the south lifts north into the Central Aleutians.

&&

.LONG TERM FORECAST (Days 3 through 7)...

There is fair agreement amongst the models of a deep low moving into the Gulf around Tuesday evening. However, they are struggling with the intensity of the low which could be the difference between a gale force low and a storm force low. For now there is higher confidence in the low remaining gale force. Regardless, this system looks to bring rain to areas around Southcentral Alaska into Thursday, with the heaviest for the north Gulf coast. Meanwhile ridging will have moved in over the Bering with another system trying to approach the Aleutians from the west, but being largely held at bay by the ridge.

&&

.AFC WATCHES/WARNINGS/ADVISORIES...

PUBLIC...NONE.

MARINE...gale...119 120 125 131 351 352.

FIRE WEATHER...NONE.

&&

\$\$

SYNOPSIS AND MODEL DISCUSSION...PD

SOUTHCENTRAL ALASKA...EN

SOUTHWEST ALASKA/BERING SEA/ALEUTIANS...JR

LONG TERM...DK

13.0 Winds and Temperature Aloft Forecast

The NWS 1200 AKDT Winds and Temperature Aloft forecast valid for the closest points to the accident site are included below:

```
822
FBAK31 KWN0 012000
FD1AK1
- DATA BASED ON 011800Z
VALID 020000Z   FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT  3000    6000    9000   12000   18000   24000   30000   34000   39000

ADQ 1613 1713-09 1712-15 1613-23 1713-36 2020-46 191947 192245 212446

AKN 1006 1008-09 1210-16 1312-23 1222-36 1035-47 112347 151346 191446

CDB 9900 9900-10 9900-16 9900-24 0709-37 9900-47 240945 240944 230845
```

The accident site was closest to the ADQ (Kodiak), AKN (King Salmon), and CDB (Cold Bay) forecast points. The 1200 AKDT ADQ forecast indicated a wind from 160° at 13 knots at 3,000 ft and a wind from 170° at 13 knots at 6,000 ft with a temperature of -9° C. The 1200 AKDT AKN forecast indicated a wind from 100° at 6 knots at 3,000 ft and a wind at 6,000 ft from 100° at 8 knots with a temperature of -9° C. The 1200 AKDT CDB forecast indicated a calm wind at 3,000 ft and a calm wind at 6,000 ft with a temperature of -10° C.

14.0 Pilot Weather Briefing and Dispatch Agent Information

The accident pilot did not receive an official weather briefing from sources, such as the FAA Flight Service Station (FSS) or any Direct User Access Terminal Service. According to the accident pilot's log book he departed PAPH at 1325 AKDT. The accident pilot did fill out a risk assessment form before the accident flight, but it is unknown what weather information the accident pilot reviewed before the flight or before filling out the risk assessment. It is also unknown if the accident pilot reviewed any weather information that was mentioned in the General Operations Manual (GOM) for the accident company (attachment 2).

The dispatch agent that was working the accident flight, located in AKN, mentioned that they get their weather mainly from an "FAA website", the aviation web camera site¹⁵, and the village agents. The dispatch agent usually updated their weather about every hour throughout their shift. The dispatch agent stated in an interview that the accident pilot discussed the weather the morning of the accident for areas "down south" and both the dispatch agent and accident pilot agreed that the weather was good. The dispatch agent stated that they did not note any changes to the weather patterns during the accident day for the locations that the accident pilot was travelling. The dispatch agent did not talk to the accident pilot after the accident pilot landed at PAPH, but the dispatch agent did talk to the accident company village agent, and the village agent confirmed that the flight had landed at PAPH and was headed for PAPE.¹⁶

¹⁵ <http://avcams.faa.gov/>

¹⁶ For more information see Witness Statements and Interview Summaries contained in the docket for this accident.

The passenger on the flight leg (from AKN to PAPH) previous to the accident flight leg stated that the weather on the accident day was “chilly and a bit rainy” but it was not raining at PAPH when they arrived around 1313 AKDT. The passenger could not recall what altitude the flight from AKN to PAPH was at, but “seemed lower than usual.” The passenger stated that the flight from AKN to PAPH went through clouds a couple of times, but that the visibility below the clouds was very good.¹⁷

It is unknown if the accident pilot checked or received anymore weather information before or during the accident flight.

15.0 Web Camera Images

Images from the FAA’s Aviation Weather Cameras are shown in figures 15 through 24 along with attachment 3 providing images of the weather conditions surrounding the accident site at the accident time. Figure 25 indicates the web camera locations included in attachment 3. The weather cameras (figures 15 through 20) from Chignik Lake, located 7 miles north-northeast of the accident site at an elevation of 45 ft (figure 16), showed the weather conditions surrounding the accident time with the south facing camera images provided in figures 17 through 20 with times from 1337 AKDT through 1407 AKDT. On the south facing camera images depicted ceilings below 2,700 ft msl, but above 900 ft msl with forward visibilities towards the accident site between 1.5 and 5 miles from the web camera location. The images further suggest complete mountain obscuration conditions prevailed with likely rain showers activity (figures 17 through 20).

The northwest facing weather camera from Chignik Lake (figures 21 through 24) indicated a similar mountain obscuration condition as the southward facing camera with visibilities between 7 and 2.5 miles underneath the clouds, and precipitation and cloud ceilings between 3,550 and 650 ft msl between 1346 and 1406 AKDT (figures 22 through 24).

The weather camera observations, surface observations (section 2.0), and upper air observations (section 3.0), indicated a high probability the accident airplane encountered an area of reduced visibility in mountain obscuration conditions with rain showers that likely led to instrument meteorological conditions at the accident time.

¹⁷ For more information see Witness Statements and Interview Summaries contained in the docket for this accident.

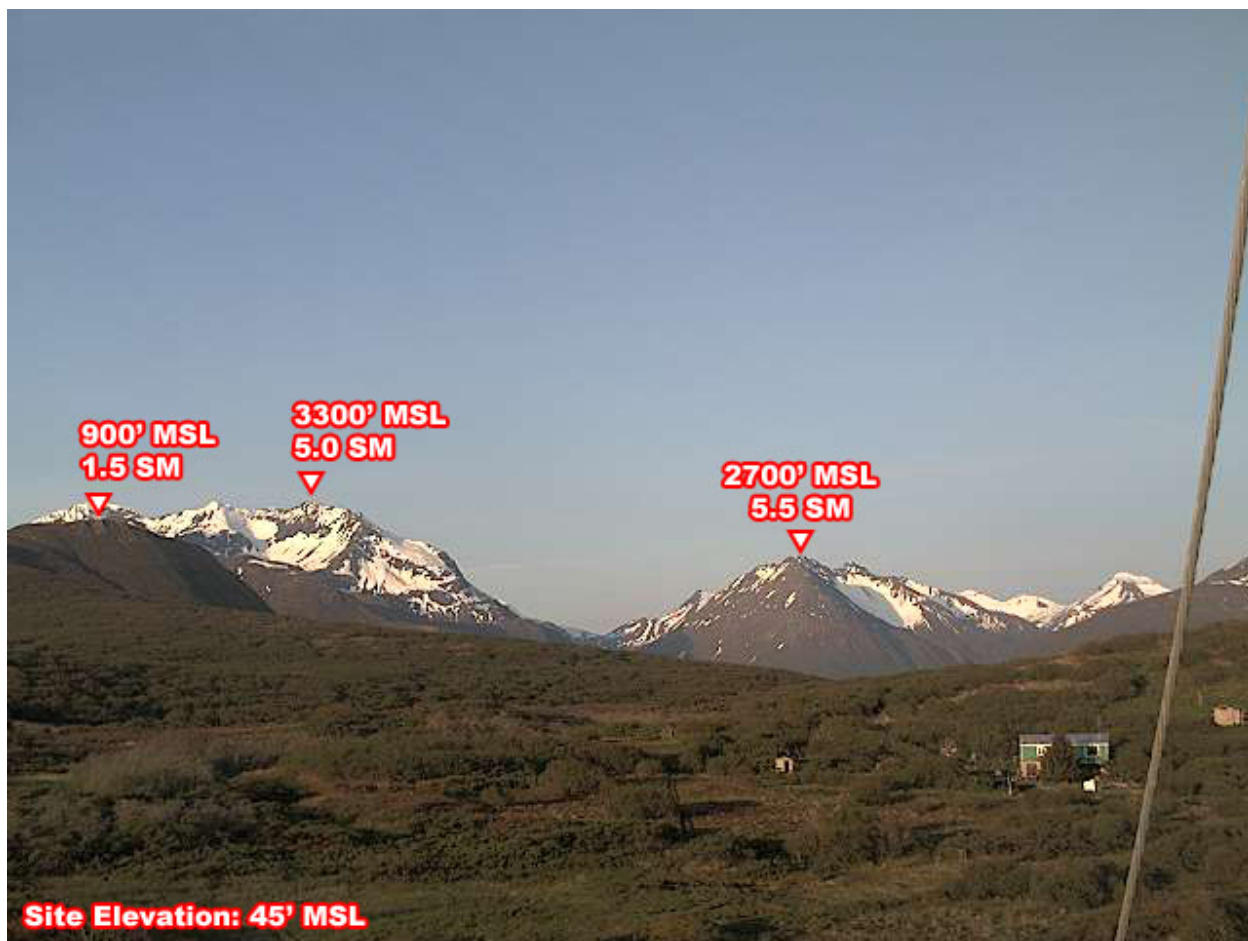


Figure 15 – FAA weather camera from Chignik Lake south view from a standard clear sky weather day

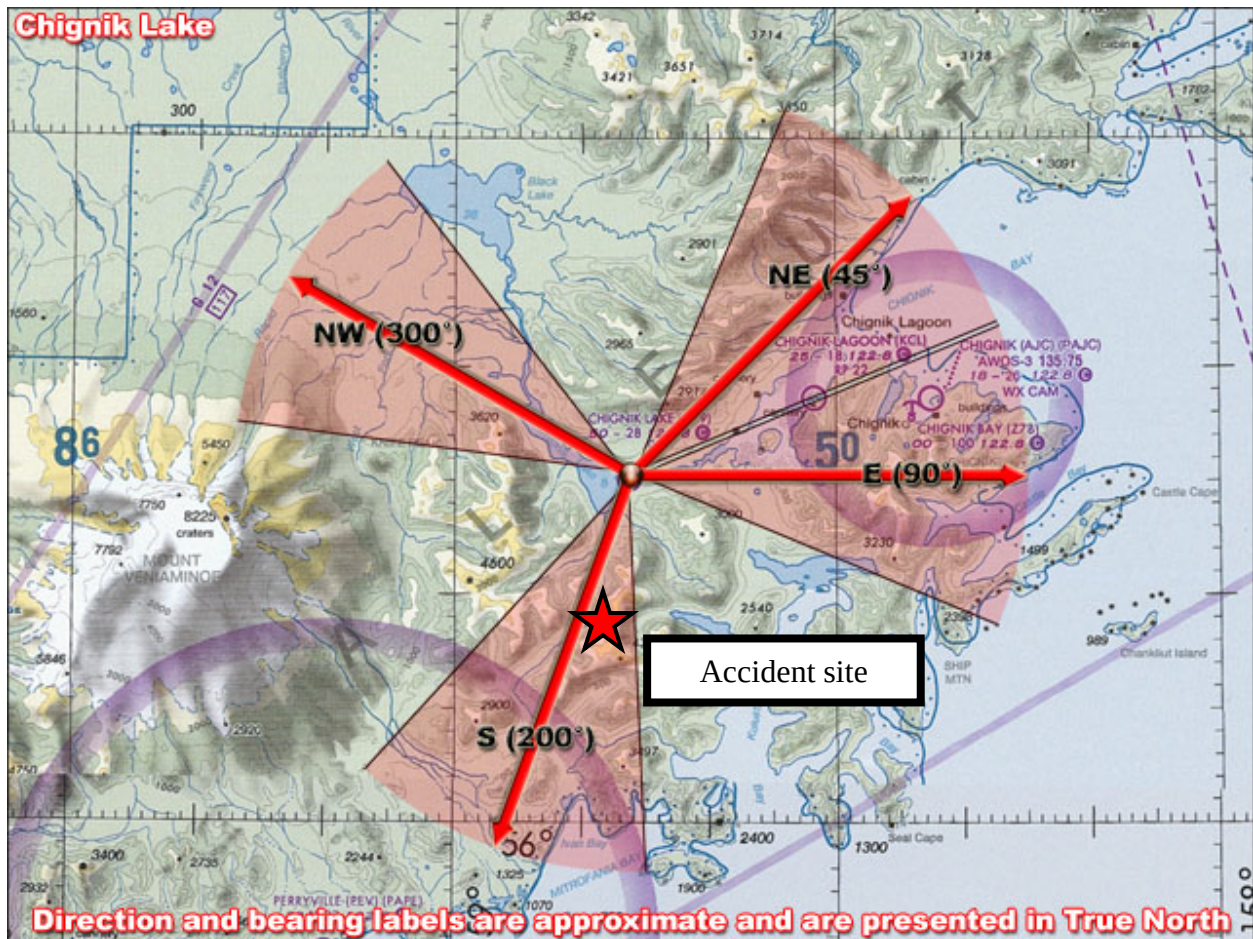


Figure 16 – FAA weather camera Chignik Lake location on sectional chart with the direction the different camera angles face with the accident site marked

Mon 01 May 2017 21:36:56 UTC
Mon 01 May 2017 13:36:56 AKDT

Chignik Lake - South
See <http://avcams.faa.gov> for more information



Figure 17 – FAA weather camera from Chignik Lake south view from 1337 AKDT

Mon 01 May 2017 21:46:58 UTC
Mon 01 May 2017 13:46:58 AKDT

Chignik Lake - South
See <http://avcams.faa.gov> for more information



Figure 18 – FAA weather camera from Chignik Lake south view from 1347 AKDT

Mon 01 May 2017 21:56:53 UTC
Mon 01 May 2017 13:56:53 AKDT

Chignik Lake - South
See <http://avcams.faa.gov> for more information



FAA advisory weather product

Figure 19 – FAA weather camera from Chignik Lake south view from 1357 AKDT

Mon 01 May 2017 22:06:52 UTC
Mon 01 May 2017 14:06:52 AKDT

Chignik Lake - South
See <http://avcams.faa.gov> for more information



Figure 20 – FAA weather camera from Chignik Lake south view from 1407 AKDT



Figure 21 – FAA weather camera from Chignik Lake northwest view from a standard clear sky weather day

Mon 01 May 2017 21:45:51 UTC
Mon 01 May 2017 13:45:51 AKDT

Chignik Lake - NorthWest
See <http://avcams.faa.gov> for more information



Figure 22 – FAA weather camera from Chignik Lake northwest view from 1346 AKDT

Mon 01 May 2017 21:55:51 UTC
Mon 01 May 2017 13:55:51 AKDT

Chignik Lake - NorthWest
See <http://avcams.faa.gov> for more information



Figure 23 – FAA weather camera from Chignik Lake northwest view from 1356 AKDT

Mon 01 May 2017 22:05:52 UTC
Mon 01 May 2017 14:05:52 AKDT

Chignik Lake - NorthWest
See <http://avcams.faa.gov> for more information



Figure 24 – FAA weather camera from Chignik Lake northwest view from 1406 AKDT

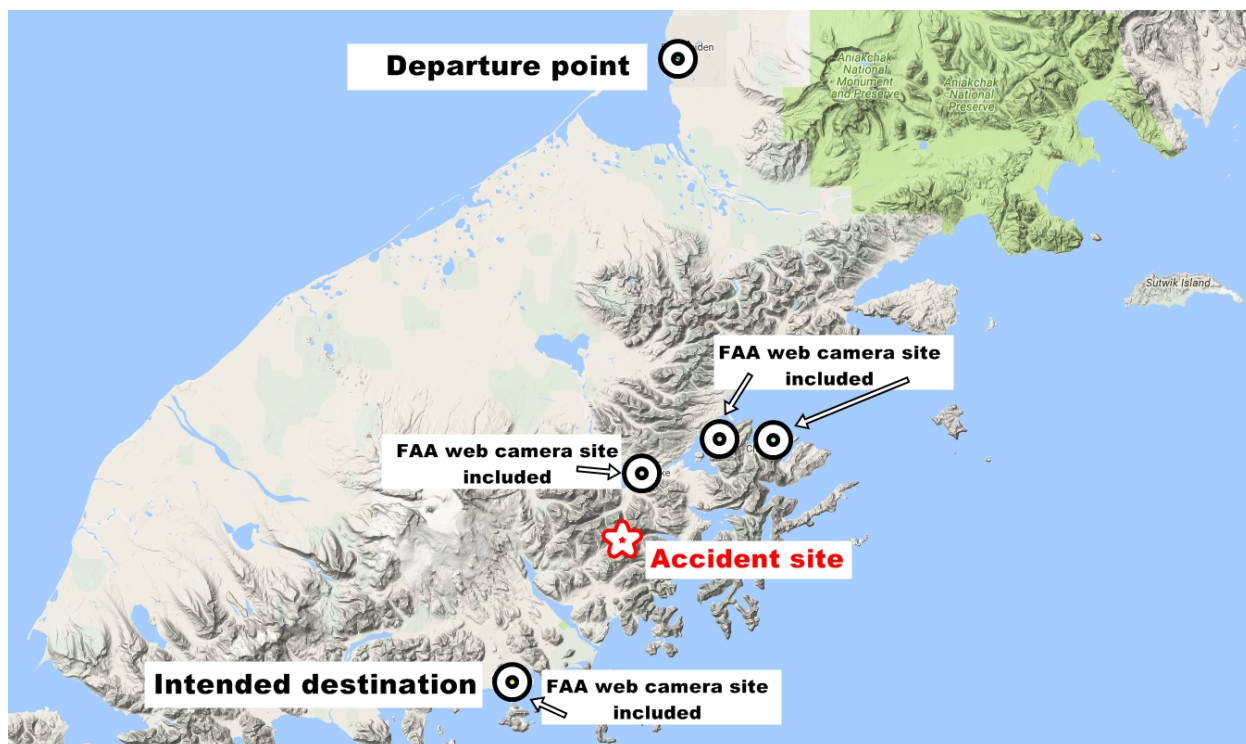


Figure 25 – FAA weather camera sites included in attachment 3

16.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on May 1, 2017, indicated the following:

SUN

Begin civil twilight	0605 AKDT
Sunrise	0650 AKDT
Accident	1350 AKDT
Sun transit	1432 AKDT
Sunset	2216 AKDT
End civil twilight	2302 AKDT

E. LIST OF ATTACHMENTS

Attachment 1 – GOES-15 visible imagery from 1300 to 1500 AKDT with the accident site marked

Attachment 2 – Accident flight company's GOM weather section

Attachment 3 – FAA's Aviation Web Camera images from web cameras (locations seen in figure 25) surrounding the accident site

Submitted by:

Paul Suffern
Senior Meteorologist

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