

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ANC22FA053

METEOROLOGY

Specialist's Factual Report

October 17, 2022

TABLE OF CONTENTS

A. ACCIDENT	3
B. METEOROLOGY SPECIALIST	3
C. DETAILS OF THE INVESTIGATION	3
D. FACTUAL INFORMATION	4
1.0 SYNOPTIC SITUATION	4
1.1 Surface Analysis Chart.....	4
2.0 SURFACE OBSERVATIONS	5
3.0 UPPER AIR SOUNDING	10
4.0 SATELLITE DATA.....	12
5.0 WEATHER SURVEILLANCE RADAR IMAGERY.....	13
5.1 Volume Scan Strategy	13
5.2 Beam Height Calculation	14
5.3 Reflectivity.....	15
5.4 Base Reflectivity and Lightning Data	15
6.0 PILOT REPORTS	16
7.0 SIGNIFICANT METEOROLOGICAL INFORMATION	17
8.0 CENTER WEATHER SERVICE ADVISORIES	17
9.0 ALASKA AVIATION WEATHER UNIT GRAPHICS	17
10.0 AIRMEN'S METEOROLOGICAL INFORMATION.....	17
11.0 AREA FORECAST	19
12.0 TERMINAL AERODROME FORECAST	20
13.0 NATIONAL WEATHER SERVICE AREA FORECAST DISCUSSION	21
14.0 WINDS AND TEMPERATURE ALOFT FORECAST.....	25
15.0 WEATHER CAMERA IMAGERY.....	25
16.0 PILOT WEATHER BRIEFING	25
17.0 ASTRONOMICAL DATA	26
E. LIST OF ATTACHMENTS	26

A. ACCIDENT

Location: Valdez, Alaska
Date: July 11, 2022
Time: 1730 Alaska Daylight time
0130 coordinated universal time (UTC) on July 12, 2022
Airplane: Champion 7EC; Registration: N4340C

B. METEOROLOGY SPECIALIST

Specialist Paul Suffern
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation remotely, collecting data from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). This Specialist's Factual Report contains the meteorological factors pertinent to the weather surrounding the accident time. All times are Alaska daylight time (AKDT) and are based upon the 24-hour clock, where local time is -8 hours from UTC. Directions are referenced to true north and distances are in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports and "P" for OCONUS¹ airports.

The accident site was at an approximate latitude 61.1338° N, Longitude 145.7312° W, and elevation of 2,560 feet (ft).

¹ Outside Continental United States (OCONUS) - Overseas, refers to any country or place beyond CONUS. Alaska, Hawaii, and the U.S. territories are considered overseas.

D. FACTUAL 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 and the WPC, 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.²

1.1 Surface Analysis Chart

The Alaska section of the NWS 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 two low-pressure systems in the Gulf of Alaska with pressures of 1007- and 1005-hectopascals (hPa), respectively. Troughs³ stretched in several directions from each low-pressure systems with the closest trough to the accident site stretching from the 1005-hPa low pressure system in the eastern Gulf of Alaska, northward to Cape Suckling. Troughs and fronts can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present.

The closest station model to the accident site depicted a southwest wind at 5 knots, an air temperature of 57° Fahrenheit (°F), with a dew point temperature of 57°F, light rain, and overcast clouds.

² https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

³ Trough - An elongated area of relatively low atmospheric pressure or heights.

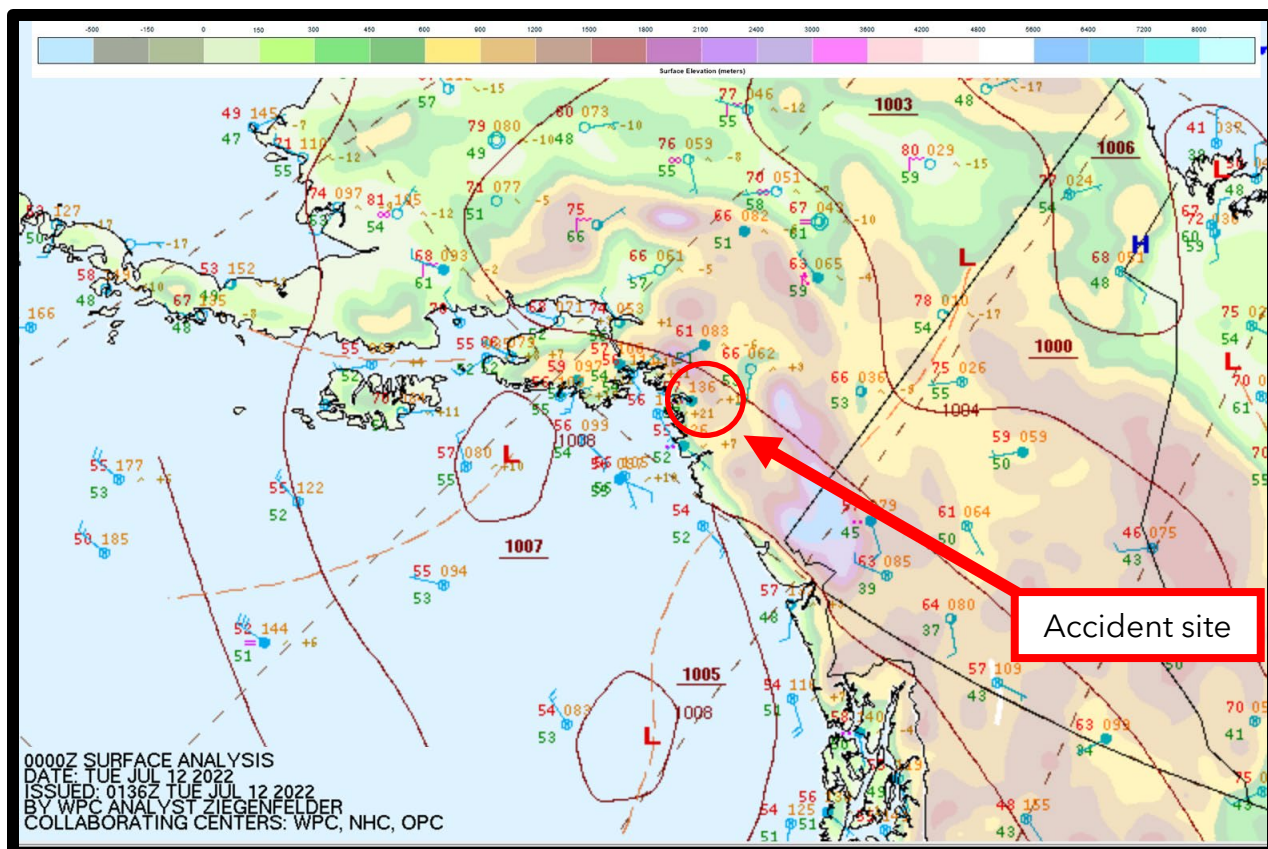


Figure 1. NWS Surface Analysis Chart for 1600 AKDT.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials Reports (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 2 is a local sectional chart with the accident site and the closest weather reporting location marked. The chart depicted the magnetic variation⁴ of 17° east over the area.

⁴ Magnetic variation - The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

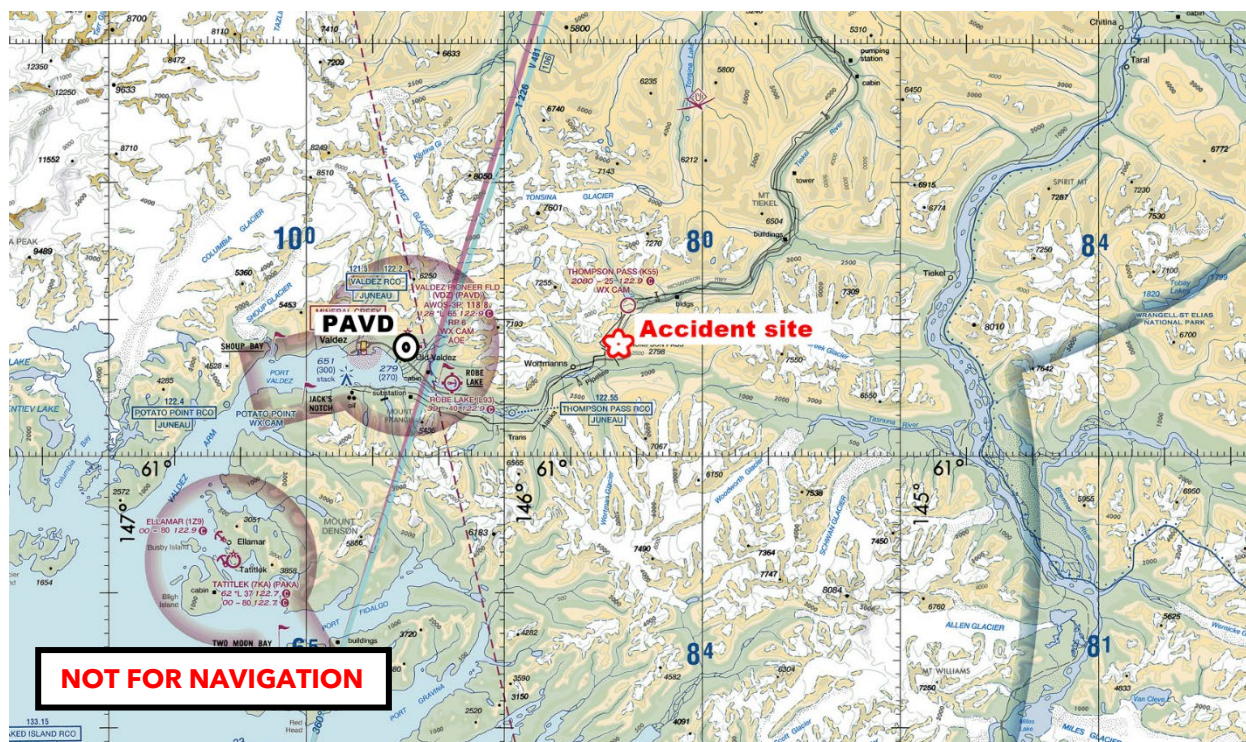


Figure 2. FAA sectional aeronautical chart of the accident area with the location of the accident site and surface observation site.

Valdez Pioneer Field Airport (PAVD) had the closest official weather station to the accident site and was the departure airport. PAVD had an Automated Weather Observing System (AWOS⁵) whose longline⁶ reports were augmented by air traffic control (ATC) when the tower was in operation⁷. The PAVD AWOS was located 15 miles west of the accident site, at an elevation of 128 ft, and issued the following observations surrounding the accident time:⁸

⁵ AWOS - Automated Weather Observing System is equipped with meteorological instruments to typically observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to 12,000 feet, and altimeter setting. AWOS are maintained by the FAA. Certain AWOS may have different reporting or observational equipment.

⁶ "Longline" refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station's Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline dissemination of weather observations is the primary vehicle through which the weather observations are distributed.

⁷ ATC operation hours between 0700 and 1830 local.

⁸ The bold sections in this NWS product and the rest of the products in this report are intended to highlight the text that directly reference the weather conditions that affected the accident location around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times around the accident time.

[1456 AKDT] METAR PAVD 112256Z 23006KT 1SM -RA BR SCT002
OVC009 13/13 A2992 RMK AO2 SLP132 VIS NE 1 1/2 P0009
T01280128 \$=

[1511 AKDT] SPECI PAVD 112311Z 24008KT 1SM -RA BR FEW008
OVC031 13/13 A2993 RMK AO2 VIS NE 1 1/2 P0001 \$=

[1556 AKDT] METAR PAVD 112356Z 24006KT 3SM -RA BR FEW015
OVC031 14/14 A2994 RMK AO2 SLP136 P0005 60026 T01390139
10144 20117 51016 \$=

[1601 AKDT] SPECI PAVD 120001Z 25006KT 3SM -RA BR FEW015
OVC031 14/14 A2994 RMK AO2 P0000 \$=

**[1656 AKDT] METAR PAVD 120056Z 26011KT 3SM -RA BR FEW015
OVC031 14/14 A2993 RMK AO2 SLP135 P0002 T01390139 \$=**

ACCIDENT TIME 1730 AKDT

**[1756 AKDT] METAR PAVD 120156Z 29011KT 7SM -RA FEW015
OVC031 13/13 A2993 RMK AO2 SLP135 P0000 T01330133 \$=**

[1856 AKDT] METAR PAVD 120256Z 28011KT 7SM FEW015 OVC031
14/13 A2994 RMK AO2 RAE51 SLP138 P0001 60003 T01390128 53002
\$=

The bold type observations decoded in plain language were as follows:

PAVD weather at 1656 AKDT, wind from 260° at 11 knots, visibility 3 miles, light rain, mist, few clouds at 1,500 ft above ground level (agl), overcast ceiling at 3,100 ft agl, temperature of 14° Celsius (C), dew point temperature 14°C, and an altimeter setting of 29.93 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator, sea level pressure 1013.5-hPa, 0.02 inches of precipitation since 1556 AKDT, temperature 13.9°C, dew point temperature 13.9°C, maintenance is needed on the system.

PAVD weather at 1756 AKDT, wind from 290° at 11 knots, visibility 7 miles, light rain, few clouds at 1,500 ft agl, overcast ceiling at 3,100 ft agl, temperature of 13°C, dew point temperature 13°C, and an altimeter setting of 29.93 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure 1013.5-hPa, a trace of precipitation since 1656 AKDT, temperature 13.3°C, dew point temperature 13.3°C, maintenance is needed on the system.

The observations from PAVD surrounding the accident time indicated MVFR to VFR⁹ conditions in light rain.

Several unofficial surface observations sites were closer to the accident site than PAVD and their locations are documented in figure 3 using the MesoWest network¹⁰. Thompson Pass FAA Web Cam (K55WC)¹¹, Richardson Highway @MP 18.6 (RHVA2)¹², and Upper Tsaina River (UPPA2)¹³ stations were located within 4 miles from the accident site. The data from K55WC, RHVA2, and UPPA2 can be found in attachments 1, 2 and 3¹⁴.

⁹ 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.

¹⁰ [MesoWest Data \(utah.edu\)](http://mesowest.utah.edu)

¹¹ [MESOWEST STATION INTERFACE \(utah.edu\)](http://mesoweststationinterface.utah.edu)

¹² [MESOWEST STATION INTERFACE \(utah.edu\)](http://mesoweststationinterface.utah.edu)

¹³ [MESOWEST STATION INTERFACE \(utah.edu\)](http://mesoweststationinterface.utah.edu)

¹⁴ Maintenance schedule and reliability for these stations is unknown.

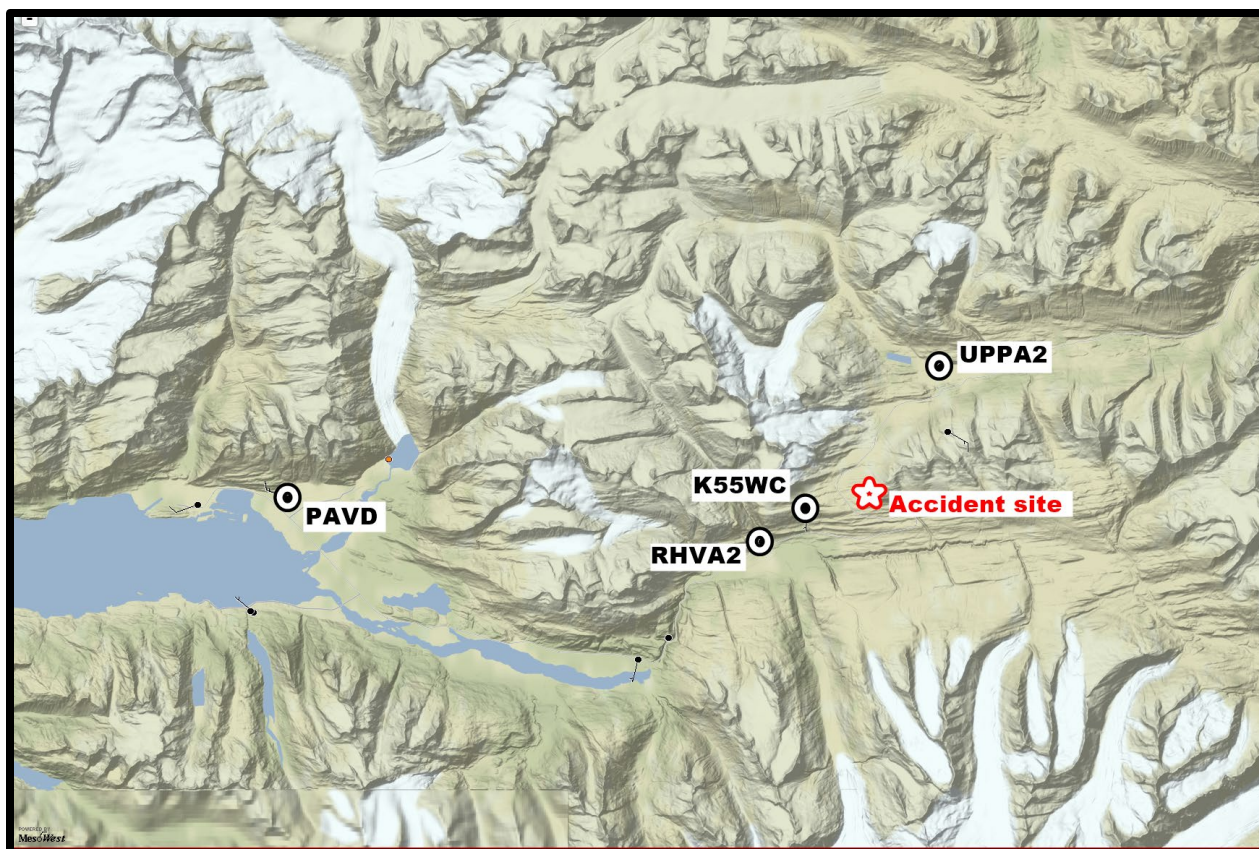


Figure 3. Additional surface observation sources with the location of the accident site marked.

3.0 Upper Air Sounding

A Global Data Assimilation System (GDAS) model sounding was created for the accident site coordinates for 1600 AKDT with a surface elevation of 2,569 ft.¹⁵ The GDAS sounding was plotted on a standard Skew-T Log P diagram¹⁶ from the surface to 600-hPa (or approximately 14,000 ft) using the RAOB¹⁷ software package and is included as figure 4. The sounding depicted the lifted condensation level (LCL)¹⁸ at 335 ft agl (2,904 ft msl), the level of free convection (LFC)¹⁹ at 1,140 ft agl (3,709 ft msl), and the convective condensation level (CCL)²⁰ at 2,069 ft agl (4,638 ft msl). The precipitable water value at 0.88 inches.

¹⁵ GDAS sounding was created using NOAA Air Resource Laboratory:

<https://ready.arl.noaa.gov/READYamet.php>

Closest point available was 19.07° N, 155.75° W.

¹⁶ 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.

¹⁷ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Esonde Research Services, The Villages, Florida.

¹⁸ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁹ 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.

²⁰ 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.

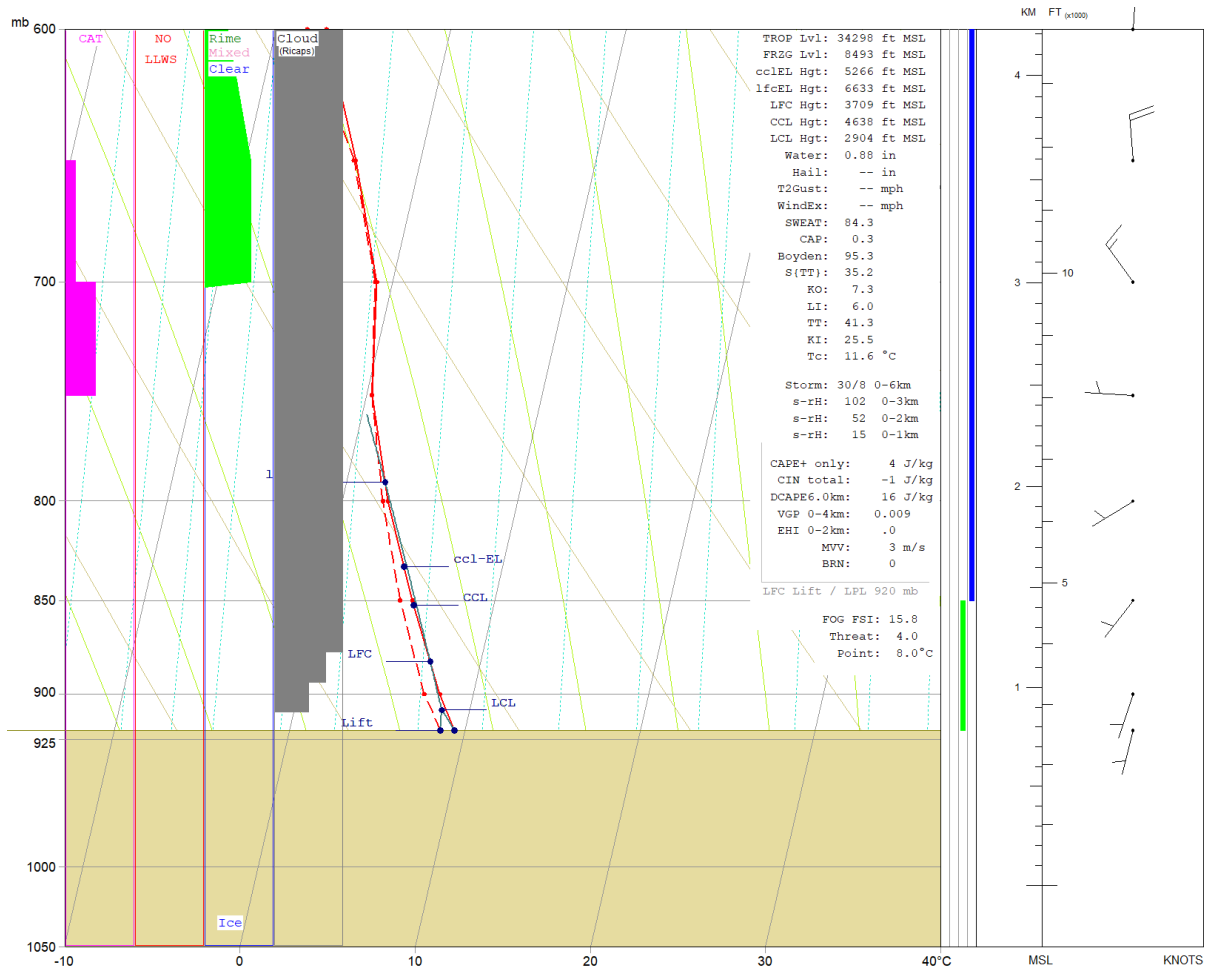


Figure 4. 1600 AKDT GDAS sounding.

The 1600 AKDT GDAS sounding indicated a conditionally unstable environment from the surface through 5,000 ft with a stable environment from 5,000 ft through 14,000 ft. Clouds were indicated by RAOB above 2,800 ft msl (~240 ft agl) through 14,000 ft. No icing was indicated by RAOB below 10,000 ft.

The 1600 AKDT GDAS sounding wind profile indicated a near surface wind from 193° at 5 knots with the wind remaining variable and under 10 knots through 10,000 ft. RAOB did not indicate the possibility of low-level wind shear (LLWS) or clear-air turbulence (CAT) below 8,000 ft.

4.0 Satellite Data

Geostationary Operational Environmental Satellite number 17 (GOES-17) visible and infrared data were 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-17 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 1400 AKDT through 2000 AKDT and reviewed, and the closest images to the time of the accident were documented.

Figure 5 presents the GOES-17 visible imagery from 1730 AKDT at 2X magnification with the accident site highlighted with a red square with cloud cover noted above the accident site. Figure 6 presents the GOES-17 infrared imagery from 1730 AKDT at 6X magnification with the accident site highlighted with a red square. Cloud cover was depicted above the accident site with the lower cloud top temperatures (blue and green colors; higher cloud tops) located north, east, and south of the accident site at the accident time. The cloud cover had a radiative cloud top temperature of 264 Kelvin above the accident site and would have been near 15,000 ft based on the vertical temperature profile provided by the 1600 AKDT GDAS sounding. It should be noted these figures have not been corrected for any parallax error.

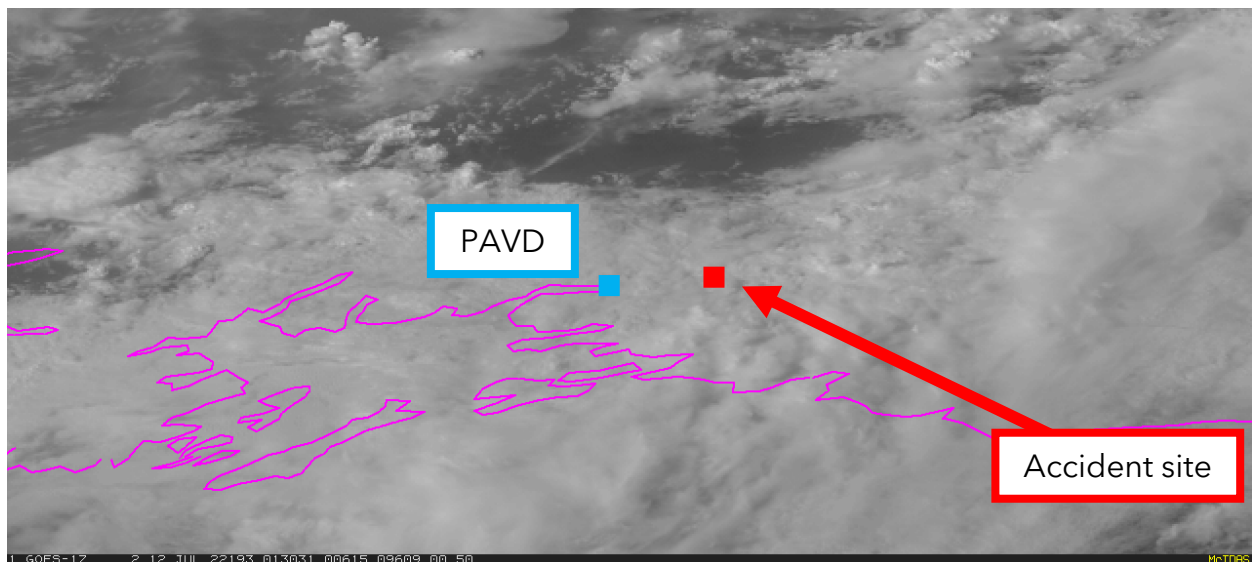


Figure 5. GOES-17 visible image at 1730 AKDT.

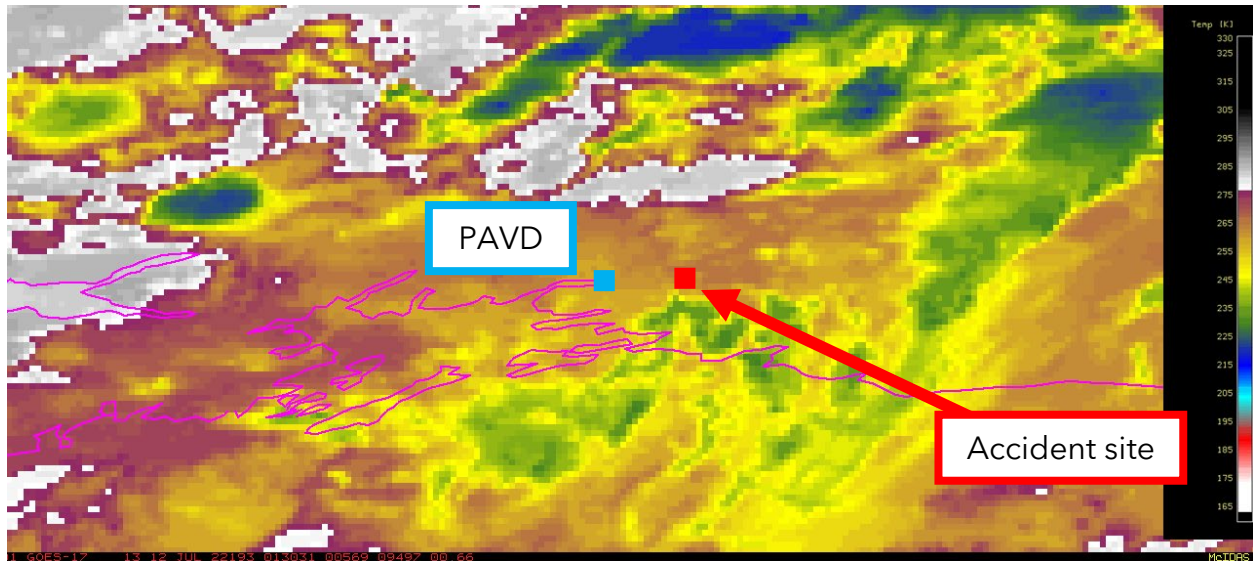


Figure 6. GOES-17 infrared image at 1730 AKDT.

Additional satellite imagery was obtained from the Cooperative Institute for Research in the Atmosphere (CIRA)²¹ and is provided in attachments 4 and 5.

5.0 Weather Surveillance Radar Imagery

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)²² to the accident site was Middleton Island, Alaska, WSR-88D, (PAIH) located 102 miles south-southwest of the accident site. The Level II 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.

5.1 Volume Scan Strategy

During the period surrounding the accident, the PAIH WSR-88D radar was operating in the precipitation mode VCP-215 (figure 7). The following figure provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.

²¹ Additional information and imagery from Cooperative Institute for Research in the Atmosphere (CIRA) can be found at: [Regional and Mesoscale Meteorology Branch \(colostate.edu\)](http://colostate.edu/Regional_and_Mesoscale_Meteorology_Branch) and [CIRA Aviation - Create Custom Flight Path \(colostate.edu\)](http://colostate.edu/CIRA_Aviation_-_Create_Custom_Flight_Path)

²² 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.

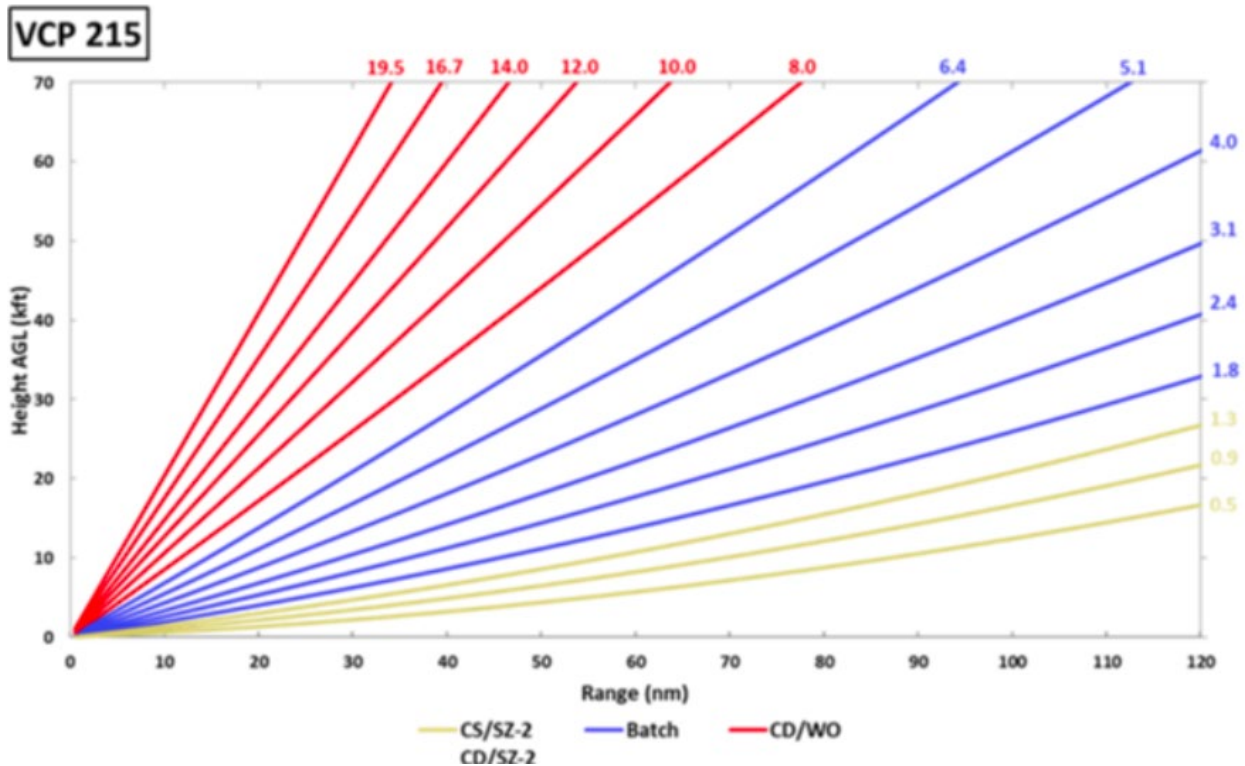


Figure 7. VCP-215 Precipitation Mode Scan Strategy²³.

5.2 Beam Height Calculation

Assuming standard refraction²⁴ of the PAIH WSR-88D radar beam with the antenna elevation at 132 ft, and considering a beamwidth²⁵ of 0.95°, the following table shows the approximate heights for the radar beam center, top and base for antenna elevations over the accident site. These heights have been rounded to the nearest 10 ft.

²³ Contiguous Surveillance (CS)--The low Pulse Repetition Frequency (PRF) scan of the split cut. Gives a high R_{max} value to determine proper target location and intensity, but a low V_{max} value limits the velocities that can be measured. Contiguous Doppler (CD)--The high PRF scan of the split cut. Gives a low R_{max} value causing more range folded (multiple trip) echoes, but a high V_{max} value to get higher, more accurate velocity values. Batch Mode - Uses alternating low and high PRFs on each radial for one full rotation at each elevation angle. The two resulting data sets (low PRF and high PRF) are combined to resolve range ambiguity. Used in the middle elevation angles.

W - With range unfolding (W)

WO - Without range unfolding (WO)

²⁴ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

²⁵ Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP
PAIH 0.5°	13,090 ft	8,060 ft	18,120 ft

Based on the radar height calculations, the elevation scans reviewed from PAIH listed in the above table depicted the conditions between 8,060 ft and 18,120 ft over the accident site and this elevation scan “saw” the closest weather radar information to the ground.

5.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²⁶ it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in dBZ²⁷ and is a general measure of echo intensity. FAA Advisory Circular AC 00-24C²⁸, “Thunderstorms,” dated February 19, 2013, also defines the echo intensity levels and weather radar echo intensity terminology associated with those levels. For dBZ values less than 30 the weather radar echo intensity terminology should be “light.” For dBZ values between 30 and 40, the terminology should be “moderate.” “Heavy” terminology is used for dBZ values greater than 40 dBZ but less than 50 dBZ, inclusive. Finally, any dBZ values above 50 dBZ shall be described as “extreme.”

5.4 Base Reflectivity and Lightning Data

Figure 8 presents the PAIH WSR-88D base reflectivity images for the 0.5° elevation scan initiated at 1731:23 AKDT, with a resolution of 0.5° X 250 m. The image depicted reflectivity values between 5 and 25 dBZ above the accident site with the precipitation moving from north to south (attachment 6).

²⁶ Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth’s surface; also, any water particles blown by the wind from the earth’s surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist, or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth’s surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glazed ice.

²⁷ dBZ – A non-dimensional “unit” of radar reflectivity which represents a logarithmic power ratio (in decibels or dB) with respect to radar reflectivity factor, Z.

²⁸

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1020774

There were no lightning flashes²⁹ reported within 50 miles of the accident site within 30 minutes prior to or following the accident time.³⁰

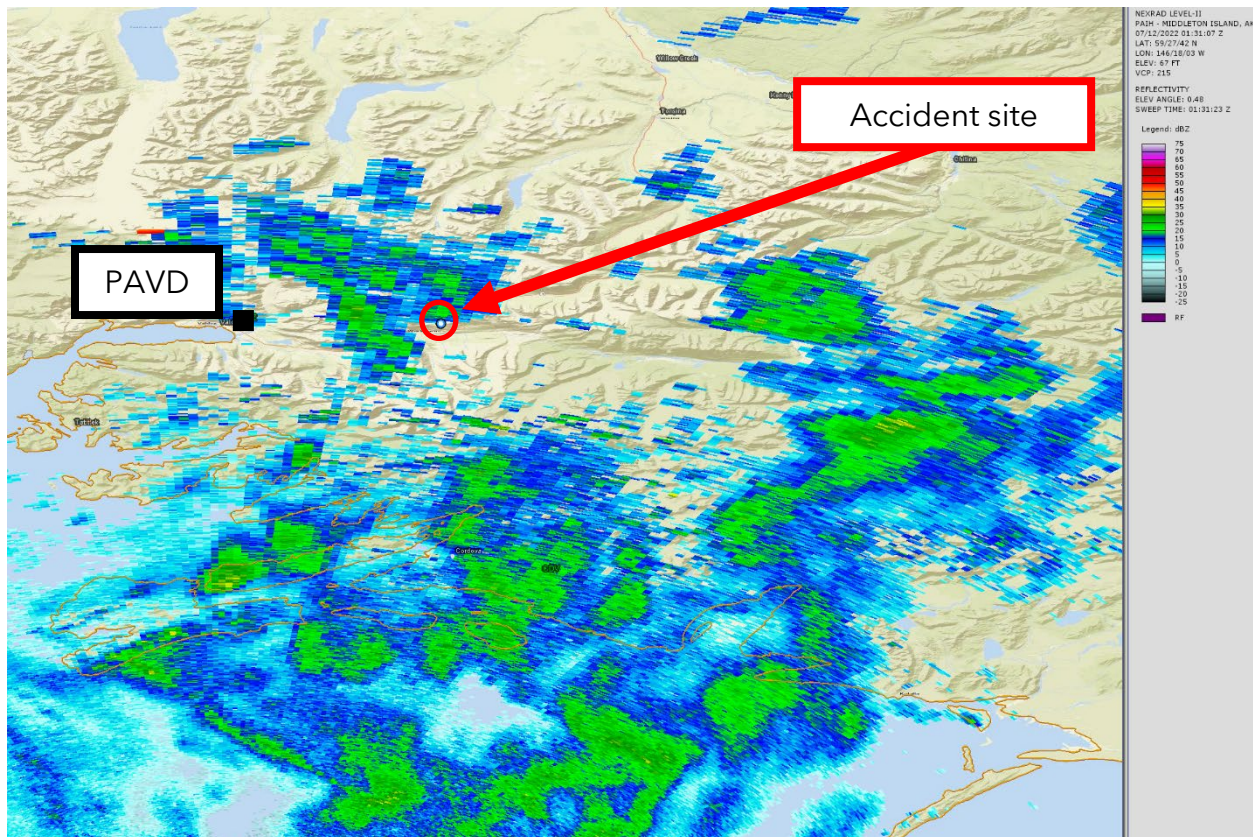


Figure 8. PAIH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1731:23 AKDT with the accident site marked with the red circle.

6.0 Pilot Reports

The longline-disseminated pilot reports³¹ (PIREPs) were reviewed for about two hours on either side of the accident time and there were no PIREPs issued into the national airspace system within 100 miles of the accident site.

²⁹ Lightning Flash – This is one contiguous conducting channel and all the current strokes/pulses that flow through it. There are two types of flashes: ground flashes and cloud flashes.

³⁰ A review of Earth Networks Total Lightning network and GOES-16 Geostationary Lightning Mapper was done.

³¹ Only pilot reports with the World Meteorological Organization headers UBAK** were considered. These do not include pilot reports only broadcast via radio.

7.0 Significant Meteorological Information

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

8.0 Center Weather Service Advisories

The Anchorage (ZAN) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. There was no Center Weather Advisory (CWA) valid from ZAN CWSU at the accident time.

9.0 Alaska Aviation Weather Unit Graphics

The Alaska Aviation Weather Unit (AAWU)³² produced graphic forecast information valid for the proposed route of flight and the accident time. The graphical AAWU forecast valid at the accident time indicated MVFR conditions with light rain. For more information please see attachment 7.

10.0 Airmen's Meteorological Information

There was a text Airmen's Meteorological Information (AIRMET) advisory Sierra issued at 1206 AKDT valid for the accident site at the accident time that forecasted mountain obscuration conditions due to clouds and precipitation:

WAAK48 PAWU 112006
WA8O
ANCS WA 112015
AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 120415
.
COOK INLET AND SUSITNA VLY AB
ERN MTS OCNL OBSC BY CLDS. IMPR.
.
COPPER RIVER BASIN AC
MTS OCNL OBSC BY CLDS/PCPN. DTRT.
.
CNTRL GLF CST AD
PAVD E MTS OCNL OBSC BY CLDS/PCPN. SPRDG W.
DTRT FM E.
.
KODIAK IS AE
ALUTN MTS OCNL OBSC BY CLDS. NC.
.
KUSKOKWIM VLY AF

³² [Alaska Aviation Weather Unit](#)

AK RANGE PAFK NE OBSC BY FU. NC.

.
YKN-KUSKOKWIM DELTA AG
ALG CST/OFSHR AND PABE SE OCNL CIG BLW 010/
ISOL VIS BLW 3SM BR. NC.

.
YKN-KUSKOKWIM DELTA AG
KILBUCK MTS OBSC BY CLDS/PCPN. NC.

.
BRISTOL BAY AH
S PAKN OCNL CIG BLW 010/VIS BLW 3SM BR. NC.

.
BRISTOL BAY AH
ALUTN RANGE PAKN S OBSC BY CLDS. IMPR.

.
AK PEN AI
BERING SIDE OCNL CIG BLW 005/VIS BLW 1SM FG/BR. IMPR.

.
AK PEN AI
MTS OCNL OBSC BY CLDS. NC.

.
UNIMAK PASS TO ADAK AJ
OCNL CIG BLW 010/ISOL VIS BLW 3SM -RA BR/BR. NC.

.
UNIMAK PASS TO ADAK AJ
MTS OCNL OBSC BY CLDS/ISOL PCPN. NC.

.
ADAK TO ATTU AK
CIG BLW 010/OCNL VIS BLW 1SM FG. NC.

.
ADAK TO ATTU AK
MTS OBSC BY CLDS. NC.

.
PRIBILOF ISLANDS AND SOUTHEAST BERING SEA AL
OCNL CIG BLW 010/VIS BLW 3SM -RA BR/BR. NC.

.

11.0 Area Forecast

The Area Forecast valid for the accident site at the accident time was issued at 1204 AKDT and forecast few clouds at 600 ft, with broken clouds at 3,000 ft, overcast clouds at 8,000 ft and cloud tops at FL180³³ with occasional light rain:

FAAK48 PAWU 112004
FA8H
ANCH FA 112015
AK SRN HLF EXCP SE AK...

.
AIRMETS VALID UNTIL 120415
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.

.
SYNOPSIS VALID UNTIL 121400
1005 MB LO 230NM NW PASN WL MOV SE TO BE CNTRD OVR PRIBILOF IS
BY 06Z. ASSOCD OCFNT ARCS ARND LO TO 70NM W ST MATTHEW IS-70NM W
PASN-SEGUAM IS LN AND WL MOV ESE ACRS CNTRL BERING SEA THRU PD.
OCFNT ASSOCD 1001 MB QSTNRY LO 200NM S PAYA EXTDS FM LO-PAMD-CYDB
LN AND WL RMN NRLY STNRY OVR SE MAINLAND AK AND SRN YKN THRU PD.

.
COOK INLET AND SUSITNA VLY AB...VALID UNTIL 120800
...CLOUDS/WX...
AIRMET MT OBSCERN MTS OCNL OBSC BY CLDS. IMPR...
ERN MTS FEW006 BKN015 OVC060 TOP FL180. ISOL CIG BLW 010.
ELSW FEW060 SCT100 SCT200. ISOL SKC.
VCY AK RANGE PAPT S ISOL BKN060CB TOP FL350 -TSRA.
AFT 02Z VCY AK RANGE PAPT S SCT BKN060CB TOP FL350 -TSRA.
OTLK VALID 120800-121400...VFR.
PASSES...LAKE CLARK...MERRILL...RAINY...WINDY...VFR ISOL TS.
PORTAGE...MVFR CIG.
...TURB...
NIL SIG. EXC VCY CB.
...ICE AND FZLVL...
PAEN-PATK LN SE ISOL MOD ICEIC 110-FL180. FZLVL 110.

.
COPPER RIVER BASIN AC...VALID UNTIL 120800
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC BY CLDS/PCPN. DTRT...
SCT040 BKN060 OVC080 TOP FL180. OCNL BKN040 -SHRA.
W PAGK ISOL BKN060CB TOP FL350 -TSRA.
AFT 23Z W PAGK SCT BKN060CB TOP FL350 -TSRA.
OTLK VALID 120800-121400...MVFR CIG SHRA.
PASS...TAHNETA...MVFR CIG SHRA.
...TURB...
NIL SIG. EXC VCY CB.

³³ 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 standard 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.

...ICE AND FZLVL...
 ISOL MOD ICEIC 110-FL180. FZLVL 100.
 .
CNTRL GLF CST AD...VALID UNTIL 120800
...CLOUDS/WX...
*****AIRMET MT OBSC***PAVD E MTS OCNL OBSC BY CLDS/PCPN. SPRDG W.**
DTRT FM E...
PAVD-PAMD LN E FEW006 BKN030 OVC080 TOP FL180. OCNL -RA.
ELSW FEW060 SCT180.
OTLK VALID 120800-121400...MVFR CIG RA.
...TURB...
NIL SIG.
...ICE AND FZLVL...
ISOL MOD ICEIC 110-FL180. FZLVL 100.
 .
 KODIAK IS AE...VALID UNTIL 120800
 ...CLOUDS/WX...
 AIRMET MT OBSCALUTN MTS OCNL OBSC BY CLDS. NC...
 ALG ALUTN MTS FEW003 BKN030 OVC060 TOP 160.
 ELSW GENLY SKC. ISOL FEW040 SCT180.
 OFSHR S KODIAK IS SFC WND W-NW 20G30KT.
 OTLK VALID 120800-121400...VFR.
 ...TURB...
 TIL 02Z PAKH SW ISOL MOD TURB BLW 040.
 ...ICE AND FZLVL...
 NIL SIG. FZLVL 110.
 .

12.0 Terminal Aerodrome Forecast

PAVD was the closest site with an NWS Terminal Aerodrome Forecast³⁴ (TAF) current at the time of the accident. The PAVD TAF was issued 1529 AKDT and was valid for a 24-hour period beginning at 1600 AKDT. The 1529 AKDT TAF for PAVD was as follows:

FTAK31 PAFC 112329
 TAFPAVD
 TAF
 PAVD 112329Z 1200/1224 **VRB03KT 3SM -RA BR FEW008 BKN015**
 FM122100 VRB03KT P6SM -SHRA FEW010 OVC035=

After 1600 AKDT, the forecast expected a variable wind at 3 knots, 3 miles visibility, light rain, mist, few clouds at 800 ft agl, and a broken ceiling at 1,500 ft agl.

³⁴ According to NWS Instruction 10-813: "An NWS TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex."
www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

13.0 National Weather Service Area Forecast Discussion

The NWS weather forecast office in Anchorage, Alaska, (WFO AFC) was responsible for the public forecast in the region of the accident site. WFO AFC issued the following Area Forecast Discussion (AFD) at 0437 AKDT, the closest AFD to the accident time with an aviation section:

FXAK68 PAFC 111237
AFDAFC

Southcentral and Southwest Alaska Forecast Discussion
National Weather Service Anchorage AK
437 AM AKDT Mon Jul 11 2022

.ANALYSIS AND UPPER LEVELS...

There are a few key features to note that will play important roles in the forecast for the coming days. A low spins in the eastern Gulf, whose trough extends up into Southcentral today. Associated shortwaves are producing areas of increased instability to portions of Southcentral, which will result in areas of wet thunderstorms and rain showers. Over Southwest Alaska, upper level ridging is in place and will track eastward over the next couple of days. A separate low is dropping south across the Bering Sea today and tomorrow before crossing over the AKPen and then pushing into the northern Pacific. Its front pushes onshore over the Southwest coast, however, the brunt of any associated precipitation will likely remain over the AKPen and higher elevations, including the Kilbuck Mountains and Western Alaska Range.

&&

.MODEL DISCUSSION...

Models remain in good overall synoptic agreement through the short term. There is better consistency with the shortwave dropping south across Southcentral today, increasing confidence regarding thunderstorms and convective activity across the higher elevations of the Susitna Valley and the Talkeetna Mountains. There is a good handle on the low drifting south across the Bering. The main challenge with this will be regarding its front and associated precipitation across Southwest tomorrow afternoon.

&&

.AVIATION...

PANC...VFR conditions and light winds will persist. A pressure gradient building in later this afternoon will produce some gusty Turnagain Arm winds for the evening and overnight hours. Winds should come down again after midnight.

&&

.FIRE WEATHER...

Upper level riding moves over Southwest today, conditions will begin to dry out and warm up. Northerly winds will also likely pick up ahead of the ridge today, and will gradually diminish through the evening and overnight hours. A shortwave moving across Southcentral promotes increased instability, resulting in the chance for wet thunderstorms across the Mat-Su Valley, Talkeetna Mountains and the Chugach Mountains today.

&&

.SHORT TERM FORECAST SOUTHCENTRAL ALASKA (Days 1 through 3: Today through Wednesday)...

Shortwaves continue to move towards the Alaska Range and Susitna Valley this morning which has produced a few thunderstorms near the Alaskan Range mostly in Fairbanks area. While another shortwave is bringing showers from near McCarthy and south to Cordova this should continue today into Tuesday morning. More showers and thunderstorms are expected to form along these waves mainly over the higher terrain this afternoon especially across the Talkeetnas and northern Susitna Valley as well as the northern Copper River Basin. Some of these storms could move into the populated valley areas especially from Big Lake and Willow and across the MAT Valley. There is the potential that cloud cover could limit thunderstorms if this happens showers are still expected across much of the area, however current thinking is that skies will clear enough by early afternoon and allow thunderstorms to form. Showers should linger into Tuesday morning as the shortwaves move south. Tuesday the ridge will move overhead with lingering clouds clearing a bit in the afternoon also temperatures should remain in the 60s to low 70s in most areas. An isolated shower or thunderstorm is possible across the Wrangell Mountains on Tuesday afternoon otherwise most areas will remain dry Tuesday afternoon. Farther south a low pressure system south of Kodiak Island will bring rain to the Island by Tuesday afternoon tapering off Wednesday as the low move to the east. By Wednesday the ridge will give way to a shortwave trough moving out of western Alaska this will bring rain to the Susitna Valley by Wednesday afternoon with rain chances increasing across the Talkeetnas, the MAT valley and northern Copper River Basin by Wednesday evening. Anchorage may even see a shot of rain by Wednesday night.

&&

.SHORT TERM FORECAST SOUTHWEST ALASKA (Days 1 through 3)...

Remnants of overnight convection is headed south of Bristol Bay this morning. Meanwhile, a ridge is passing through from north to

south as high clouds are filtering into the Kuskokwim Delta. Areas of fog are confined to southern Bristol Bay and the AKPen this morning and should begin to lift later this morning. As the Bering low approaches the Pribilofs today, the pressure gradient along the Southwest coast tightens, especially into Bristol Bay and will lead to windier onshore flow. Isolated thunderstorms are possible today for the interior Bristol Bay and along the Western Alaska Range. Southeasterly flow at 850 could mix warmer air to the surface towards New Stuyahok and Iliamna. Temperatures drop about ten degrees closer to coast where onshore flow is strong and any low stratus in the morning will slow temperatures from warming.

By Tuesday morning, the Bering low will move into the eastern Bering and continue to move towards the AKPen. Rain showers chances increase along the front and south of the Kuskokwim mountains in the wrap around moisture. Isolated thunderstorms inland cannot be ruled out Tuesday as a polar trough follows closely behind the passage of the Bering low. The trough is expected to pass from north to south beginning Tuesday night. Temperatures will be trend cooler through the rest of the week.

&&

.SHORT TERM FORECAST BERING SEA/ALEUTIANS (Days 1 through 3)...

Bering Sea low is continuing southeast. Rainfall is being reported in the Pribilofs this morning and chances will gradually taper off this afternoon through tonight. A ridge is starting to push out of the Eastern Aleutians as an upper jet streak develops along the eastern Aleutians tonight. Chances for precipitation will move along the Aleutians and pass through the AKPen overnight. Chances for rain showers may linger on Tuesday that form on the backside of the low. Flow will become northerly across most of the Bering Sea and gusty winds may move through bays and passes Wednesday morning, especially for the eastern half of the Bering.

A high pressure ridge will bring weaker winds and quieter weather going into midweek. A North Pacific low approaches the Western Aleutians on Tuesday night, but the extent northward and will be slow through Wednesday. Winds and precipitation chances could begin increasing Wednesday night and reach as far east as Adak.

&&

.MARINE (Days 3 through 5: Wednesday through Friday)...

Gulf of Alaska: A front extending from a North Pacific low lingers across the Gulf through Friday. A low forms over Kodiak Island late Thursday. Forecast confidence is unsettled. Generally light winds and seas less than 10 feet.

Aleutians/Bering: High pressure moves across the Bering through Friday. A low approaches the Western Aleutians for Friday.

Forecast confidence is good. Gusty Westerly winds across the Northern Bering, diminish late Thursday. Seas less than 10 feet.

.LONG TERM FORECAST (Days 4 through 7: Thursday through Sunday)...

Looking ahead into the long term forecast, models advertise a similar synoptic pattern for the week. On Thursday, an upper-level low is located over the Gulf of Alaska while another upper low is positioned over the North Pacific near the Western Aleutians. A shortwave ridge builds in between the two lows and extends from the Central Aleutians east to the Alaska Peninsula. The Gulf low gradually tracks east to the Panhandle through Sunday. The North Pacific low moves over the Central Aleutians by Saturday morning and then tracks east along the rest of the Chain and Alaska Peninsula, reaching southwest Alaska late on Sunday. At the same time, the aforementioned ridge builds to the east and spreads across the Gulf by Sunday. For Saturday and Sunday, both deterministic and ensemble models generally illustrate a low breaking off from the main North Pacific low and moving either along or south of the Western Aleutians. The main forecast uncertainty at this time lies with the evolution and progression of the North Pacific low and its secondary low, as well as the development of various shortwaves within the flow. The latest GFS runs show a secondary low developing south of the Aleutians by Saturday night/Sunday morning, and this low remains south of the Aleutians while its parent low tracks over the Alaska Peninsula. The GEFS and Canadian mean hint at a similar type of synoptic development and evolution. However, the GEM develops the secondary low over the Aleutians late on Sunday as its parent low takes a slightly more northern track over the interior part of Southwest. The ECMWF is a bit of a mixed bag since it also brings the parent low over interior Southwest but keeps its secondary low south of the Aleutians. Thus, given the synoptic uncertainty for Saturday and Sunday, forecast confidence decreases going into the weekend.

.AFC WATCHES/WARNINGS/ADVISORIES...

PUBLIC...NONE.

MARINE...NONE.

FIRE WEATHER...NONE.

&&

\$\$

14.0 Winds and Temperature Aloft Forecast

The NWS 1201 AKDT Winds and Temperature Aloft forecast valid for the closest points to the accident site are included below:

FBAK31 KWNO 112001
FD1AK1
DATA BASED ON 111800Z
VALID 120000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
ANC	1607	1605+07	9900+03	3109-03	3612-15	0220-27	032644	023253	012553
GKN	1814	2308+06	3409+01	3412-04	0215-16	0220-28	033245	033654	022050
MDO	1414	1508+03	0211+01	0115-03	0119-16	0122-28	012745	012955	012248

The closest forecast points to the accident site were Anchorage (ANC), Gulkana (GKN), and Middleton Island (MDO). The 1201 AKDT forecast was for use between 1200 AKDT and 1900.

15.0 Weather Camera Imagery

Images from the FAA's Aviation Weather Cameras³⁵ were retrieved for the Valdez Pioneer and Thompson Pass weather camera locations around the accident timeframe and are contained in attachment 8.

16.0 Pilot Weather Briefing

The accident pilot did not request nor receive weather information³⁶ from Alaskan Flight Services³⁷ or ForeFlight. A search of archived ForeFlight information indicated that the accident pilot did have a ForeFlight account that did do several route string combinations prior to the accident flight (attachment 9). It is unknown what, if any, additional weather information the accident pilot viewed before or during the accident flight.

³⁵ [FAA WeatherCams](#)

³⁶ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

³⁷ https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/fs/alaskan/aska/

17.0 Astronomical Data

The astronomical data obtained for the accident site on July 11, 2022, indicated the following:

SUN

Begin civil twilight	0245 AKDT
Sunrise	0427 AKDT
Sun transit	1349 AKDT
Accident time	1730 AKDT³⁸
Sunset	2309 AKDT

At the time of the accident the Sun was located at an altitude of 35.64° and azimuth of 249.80°.

E. LIST OF ATTACHMENTS

Attachment 1 - Weather data from K55WC

Attachment 2 - Weather data from RHVA2

Attachment 3 - Weather data from UPPA2

Attachment 4 - Additional satellite imagery around the accident time provided by CIRA

Attachment 5 - Animation of satellite imagery around the accident time

Attachment 6 - PAIH 0.5° base reflectivity animation from 1702 and 1750 AKDT

Attachment 7 - AAWU graphics valid at the accident time

Attachment 8 - FAA weather camera imagery

Attachment 9 - ForeFlight information

Submitted by:

Paul Suffern
Senior Meteorologist

³⁸ Inserted accident time for reference and context.