

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ANC23LA002

METEOROLOGY

Specialist's Factual Report

December 30, 2022

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A. ACCIDENT

Location: Cordova, Alaska
Date: October 16, 2022
Time: 1427 Alaska Daylight time
2227 coordinated universal time (UTC)
Airplane: Piper PA-32-260; Registration: N3432W

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 60.4644° N, Longitude 145.8221° W, and elevation of 1,700 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 1300 AKDT is provided as figure 1 with the approximate location of the accident site marked by the black circle. The chart depicted a low-pressure system in southwestern Alaska along the Alaska Peninsula and another low-pressure system in southern Yukon, Canada, with pressures of 986- and 1001-hectopascals (hPa), respectively. A trough³ stretched west to east in the northwestern Gulf of Alaska in the vicinity of the accident site. Additional surface frontal boundaries were in the eastern Gulf of Alaska and from eastern Alaska into northwestern Canada. 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 an east wind at 10 knots, an air temperature of 50° Fahrenheit (°F), with a dew point temperature of 49°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.

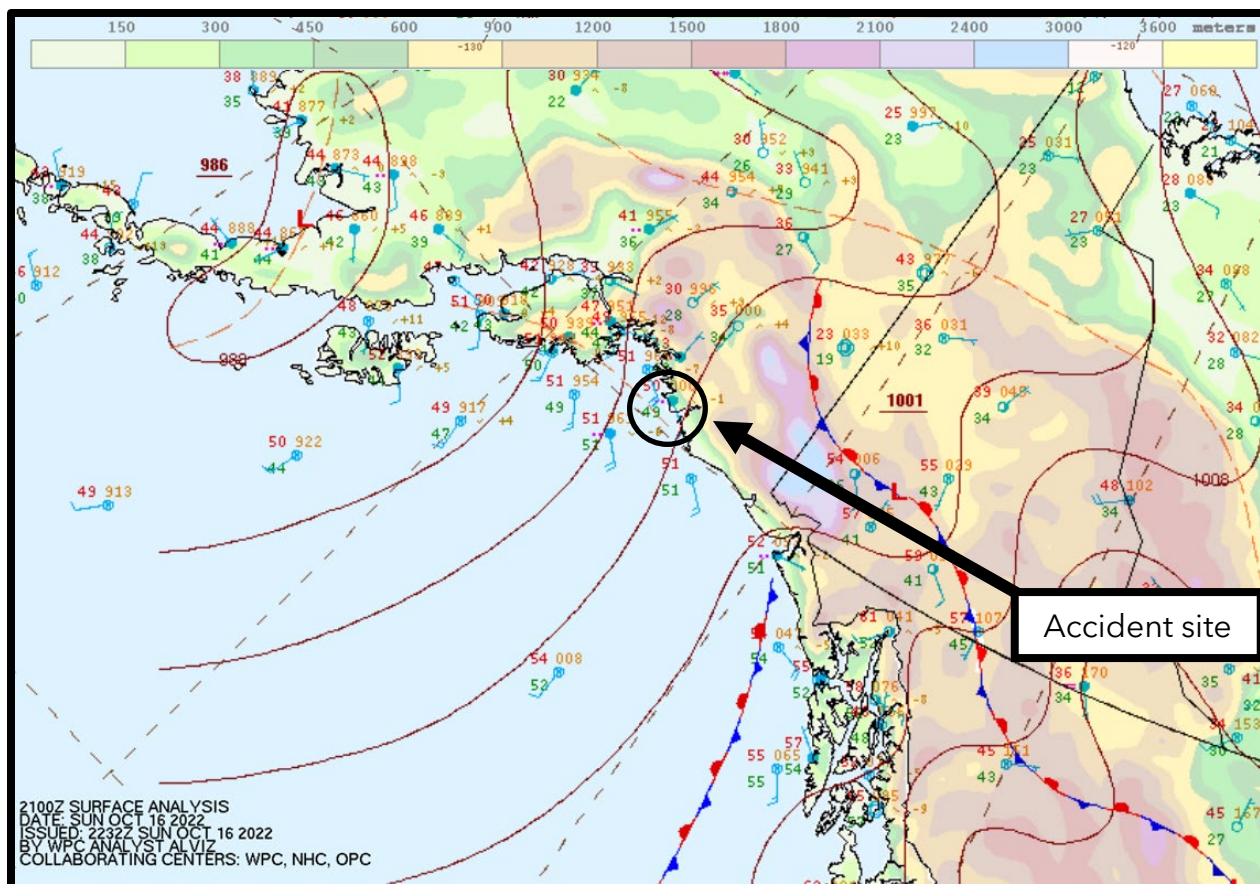


Figure 1. NWS Surface Analysis Chart for 1300 AKDT.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Special 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 a magnetic variation⁴ of 17° east in the area.

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

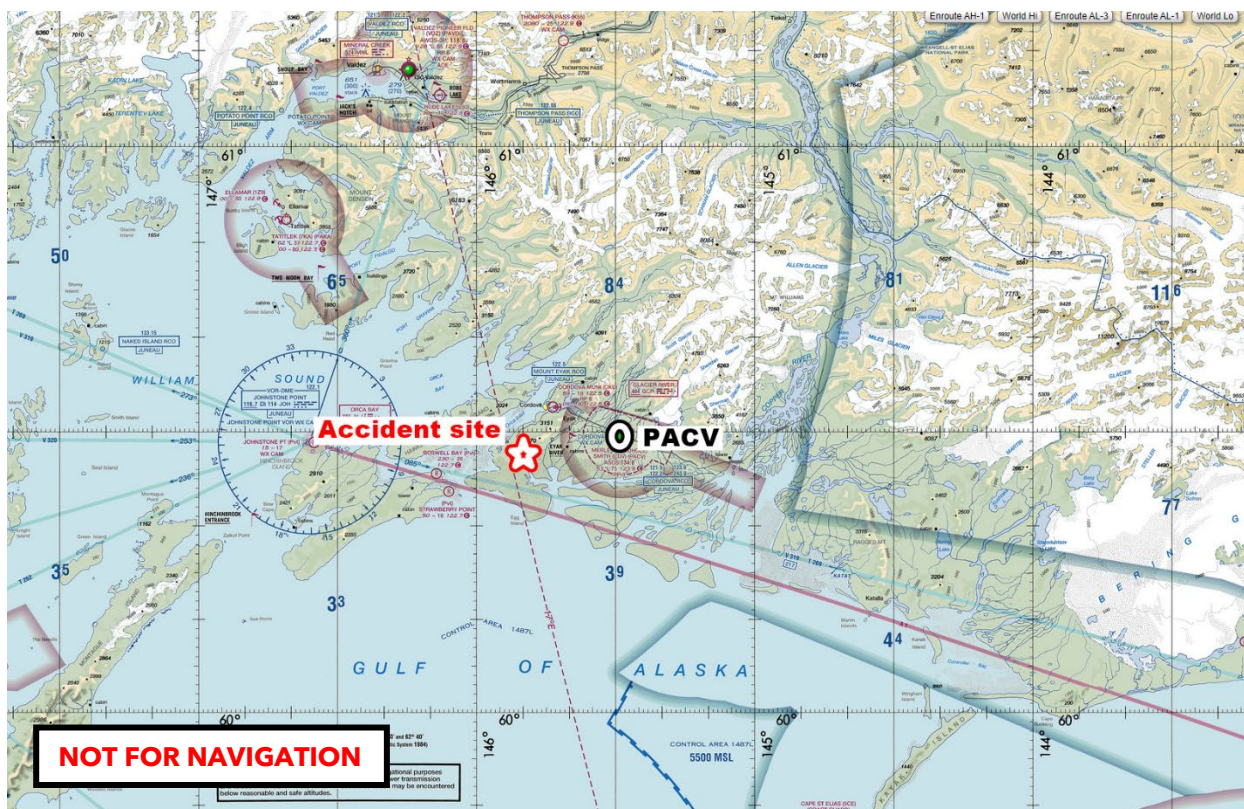


Figure 2. FAA sectional aeronautical chart of the accident area with the location of the accident site and surface observation site.

Merle K (Mudhole) Smith Airport (PACV) had the closest official weather station to the accident site. PACV had an Automated Surface Observing System (ASOS⁵) whose longline⁶ reports were augmented by a Contract Weather Observer (CWO). The PACV ASOS was located 10 miles east-northeast of the accident site, at an elevation of 53 ft, and issued the following observations surrounding the accident time:⁷

⁵ ASOS - Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure. ASOS are maintained by the NWS.

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 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.

[1206 AKDT] SPECI PACV 162006Z 12010G16KT 5SM -RA BR OVC004
10/09 A2954 RMK AO2 P0000 T01000094=

[1234 AKDT] SPECI PACV 162034Z 12010KT 4SM -RA BR BKN005
OVC014 10/09 A2953 RMK AO2 P0003 T01000089=

[1253 AKDT] METAR PACV 162053Z 12012G19KT 4SM -RA BR BKN006
OVC012 10/09 A2953 RMK AO2 SLP000 P0004 60006 T01000094
58001=

[1353 AKDT] METAR PACV 162153Z 11011G19KT 10SM BKN007
OVC025 11/09 A2952 RMK AO2 RAE16 SLP998 P0000 T01060094=

**[1423 AKDT] SPECI PACV 162223Z 11014G24KT 10SM -RA
BKN010 BKN014 OVC024 11/09 A2950 RMK AO2 RAB18 CIG
007V012 P0000 T01060089=**

ACCIDENT TIME 1427 AKDT

**[1453 AKDT] METAR PACV 162253Z 12016G27KT 10SM OVC012
11/09 A2950 RMK AO2 PK WND 13027/2250 RAB18E49 SLP989
P0000 T01060089=**

[1544 AKDT] SPECI PACV 162344Z 13011G21KT 2 1/2SM
R27/6000VP6000FT -RA BR OVC008 11/09 A2950 RMK AO2 RAB2259
CIG 005V013 P0004 T01060094=

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

PACV weather at 1423 AKDT, wind from 110° at 14 knots with gusts to 24 knots, visibility 10 miles or greater, light rain, broken ceiling at 1,000 ft above ground level (agl), broken skies at 1,400 ft agl, overcast skies at 2,400 ft agl, temperature of 11° Celsius (C), dew point temperature 9°C, and an altimeter setting of 29.50 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator, rain began at 1418 AKDT, ceiling varying between 700 and 1,200 ft agl, a trace of precipitation since 1353 AKDT, temperature 10.6°C, dew point temperature 8.9°C.

PACV weather at 1453 AKDT, wind from 120° at 16 knots with gusts to 27 knots, visibility 10 miles or greater, overcast ceiling at 1,200 ft agl, temperature of 11°C, dew point temperature 9°C, and an altimeter setting of 29.50 inHg. Remarks, automated station with a precipitation discriminator, peak wind from 130° at 27 knots at 1450 AKDT, rain began at 1418 AKDT and ended at 1449 AKDT, sea level pressure 998.9-hPa, a trace of precipitation since 1353 AKDT, temperature 10.6°C, dew point temperature 8.9°C.

The observations from PACV surrounding the accident time indicated MVFR to IFR⁸ conditions in light rain and gusting winds.

3.0 Upper Air Sounding

A Global Data Assimilation System (GDAS) model sounding was created for the accident site coordinates for 1300 AKDT with a surface elevation of 1,194 ft.⁹ The GDAS sounding was plotted on a standard Skew-T Log P diagram¹⁰ from the surface to 600-hPa (or approximately 14,000 ft) using the RAOB¹¹ software package, which is included as figure 3. The sounding depicted the lifted condensation level (LCL)¹² at 459 ft agl (1,653 ft msl) and the convective condensation level (CCL)¹³ at 3,569 ft msl. The precipitable water value at 0.64 inches. The freezing level was located at 5,380 ft.

⁸ 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.

⁹ 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.

¹⁰ 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.

¹¹ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Esonde Research Services, The Villages, Florida.

¹² LCL – The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹³ 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.

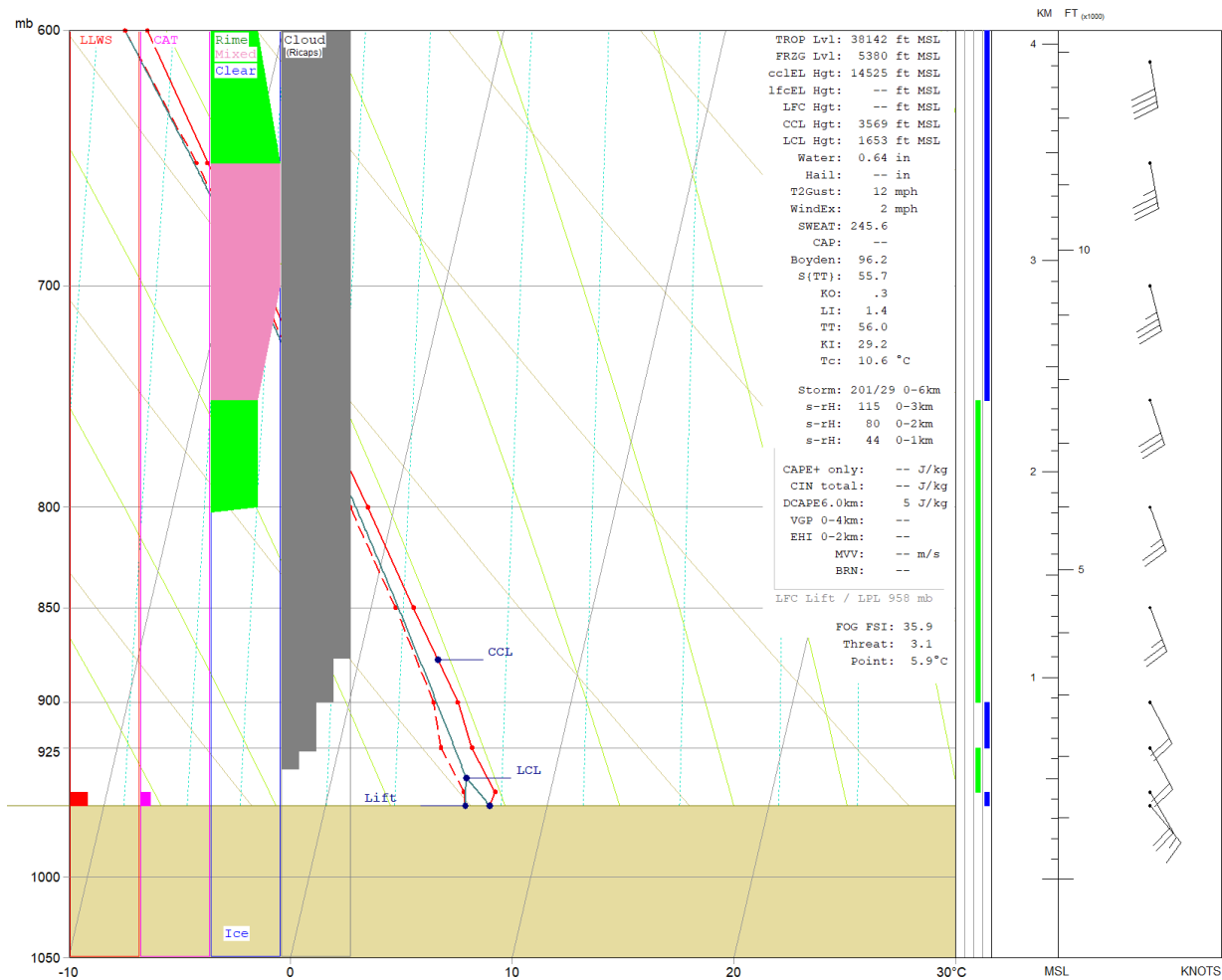


Figure 3. 1300 AKDT GDAS sounding.

The 1300 AKDT GDAS sounding indicated a conditionally unstable to stable environment from the surface through 8,000 ft with a stable environment above 8,000 ft. Clouds were indicated by RAOB above 1,700 ft msl (~500 ft agl) through 14,000 ft. No icing was indicated by RAOB below 6,000 ft.

The 1300 AKDT GDAS sounding wind profile indicated a near surface wind from 141° at 16 knots with the wind remaining southeasterly to southerly through 14,000 ft. The wind speed increased to 25 knots by 6,000 ft and 40 knots by 14,000 ft. RAOB did indicate the possibility of light low-level wind shear (LLWS) and clear-air turbulence (CAT) below 2,000 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 1100 AKDT through 1800 AKDT and reviewed, and the closest images to the time of the accident were documented.

Figure 4 presents the GOES-17 visible imagery from 1427 AKDT at 2X magnification with the accident site highlighted with a red square with cloud cover noted above the accident site. Figure 5 presents the GOES-17 infrared imagery from 1427 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 northeast of the accident site at the accident time. The cloud cover had a radiative cloud top temperature of 243 Kelvin above the accident site and would have been near 20,000 ft based on the vertical temperature profile provided by the 1300 AKDT GDAS sounding (243 Kelvin is not depicted in figure 3). It should be noted these figures have not been corrected for any parallax error.

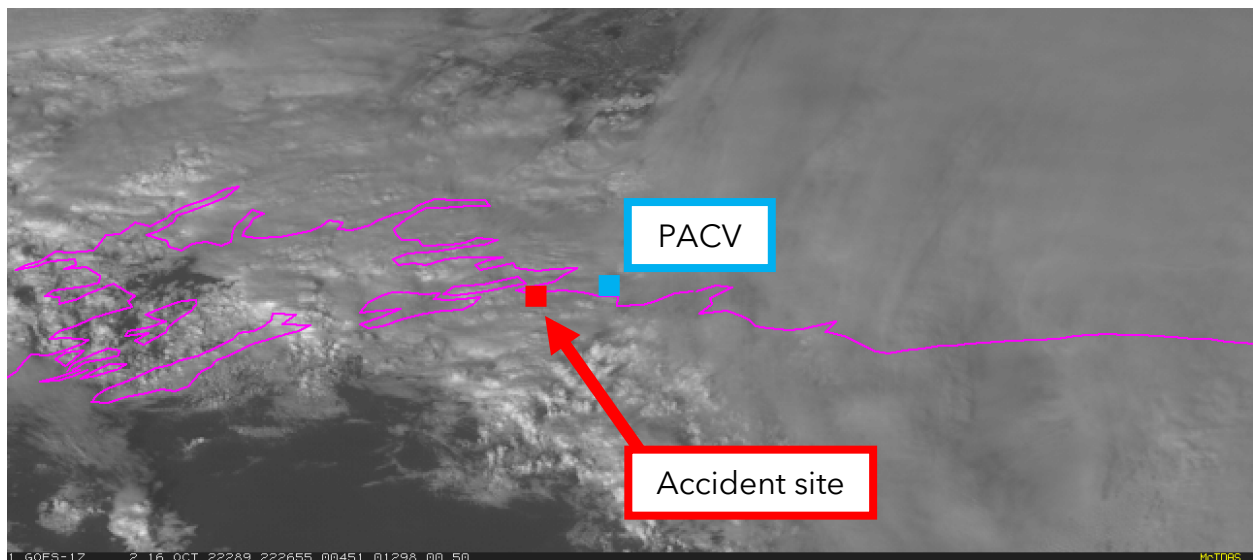


Figure 4. GOES-17 visible image at 1427 AKDT.

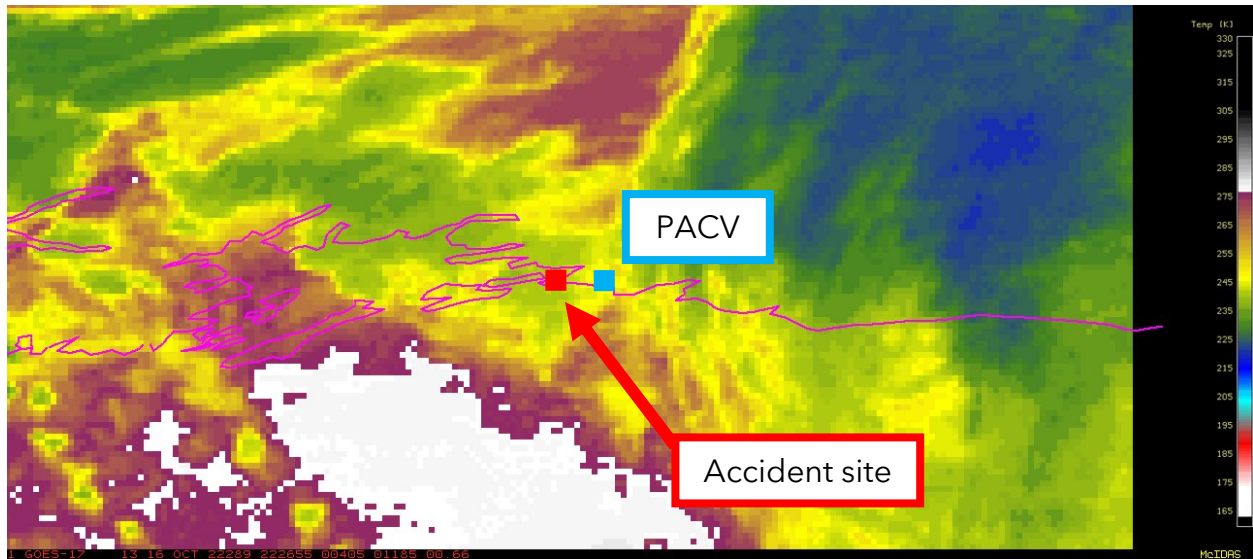


Figure 5. GOES-17 infrared image at 1427 AKDT.

Experimental aviation cross-section imagery using JPSS satellite information¹⁴ was provided by the Cooperative Institute for Research in the Atmosphere (CIRA)¹⁵. The Anchorage (PANC) to Juneau (PAJN) cross-section was obtained for time from 1320 to 1332 AKDT (figure 6) and 1412 to 1423 AKDT (figure 7) and the accident site is identified as location "C" on the imagery.¹⁶

¹⁴ [CIRA Aviation Homepage \(colostate.edu\)](https://cira.colostate.edu/)

¹⁵ Additional information and imagery from Cooperative Institute for Research in the Atmosphere (CIRA) can be found at: [Regional and Mesoscale Meteorology Branch \(colostate.edu\)](https://cira.colostate.edu/Regional-and-Mesoscale-Meteorology-Branch/) and [CIRA Aviation - Create Custom Flight Path \(colostate.edu\)](https://cira.colostate.edu/Create-Custom-Flight-Path/)

¹⁶ [CIRA Aviation Introduction/FAQ \(colostate.edu\)](https://cira.colostate.edu/CIRA-Aviation-Introduction/FAQ/)

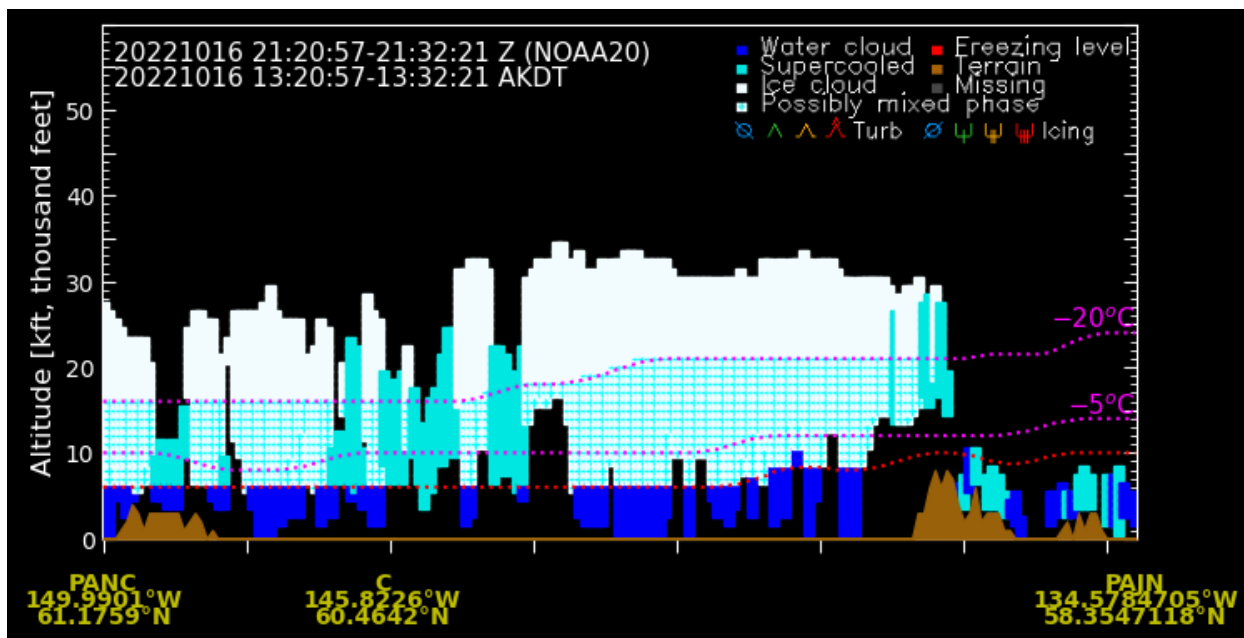


Figure 6. JPSS experimental aviation cross-section imagery from PANC to PAJN between 1320 to 1332 AKDT.

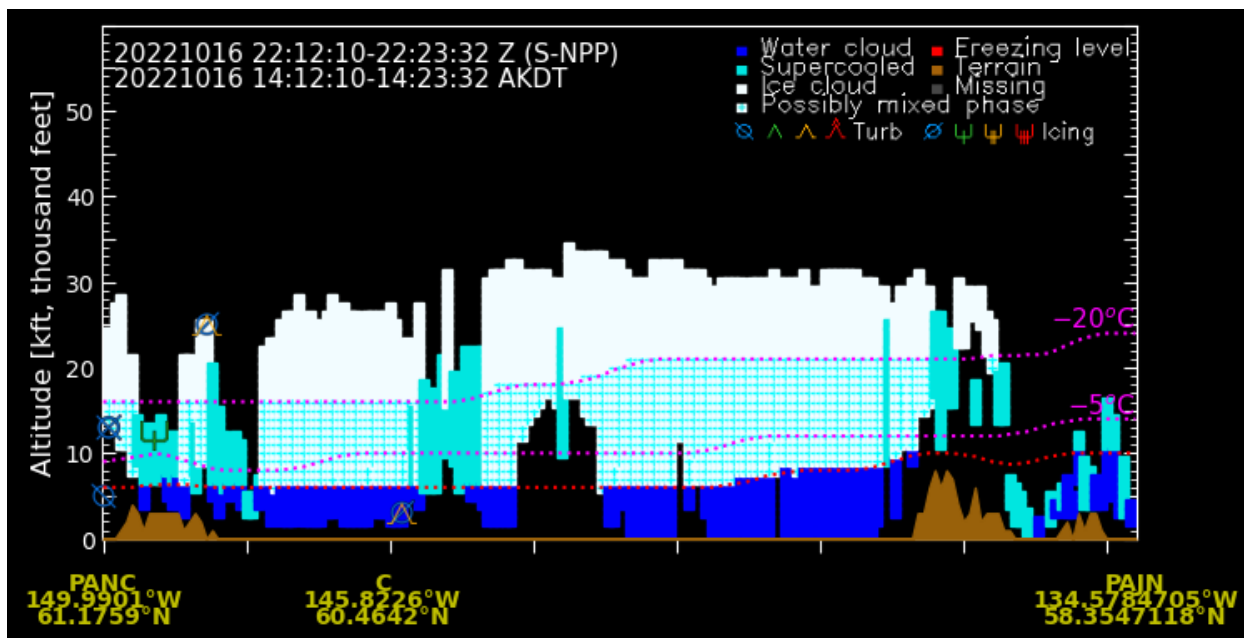


Figure 7. JPSS experimental aviation cross-section imagery from PANC to PAJN between 1412 to 1423 AKDT.

5.0 Weather Surveillance Radar Imagery

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁷ to the accident site was Middleton Island, Alaska, WSR-88D, (PAIH) located 62 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 8). 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.

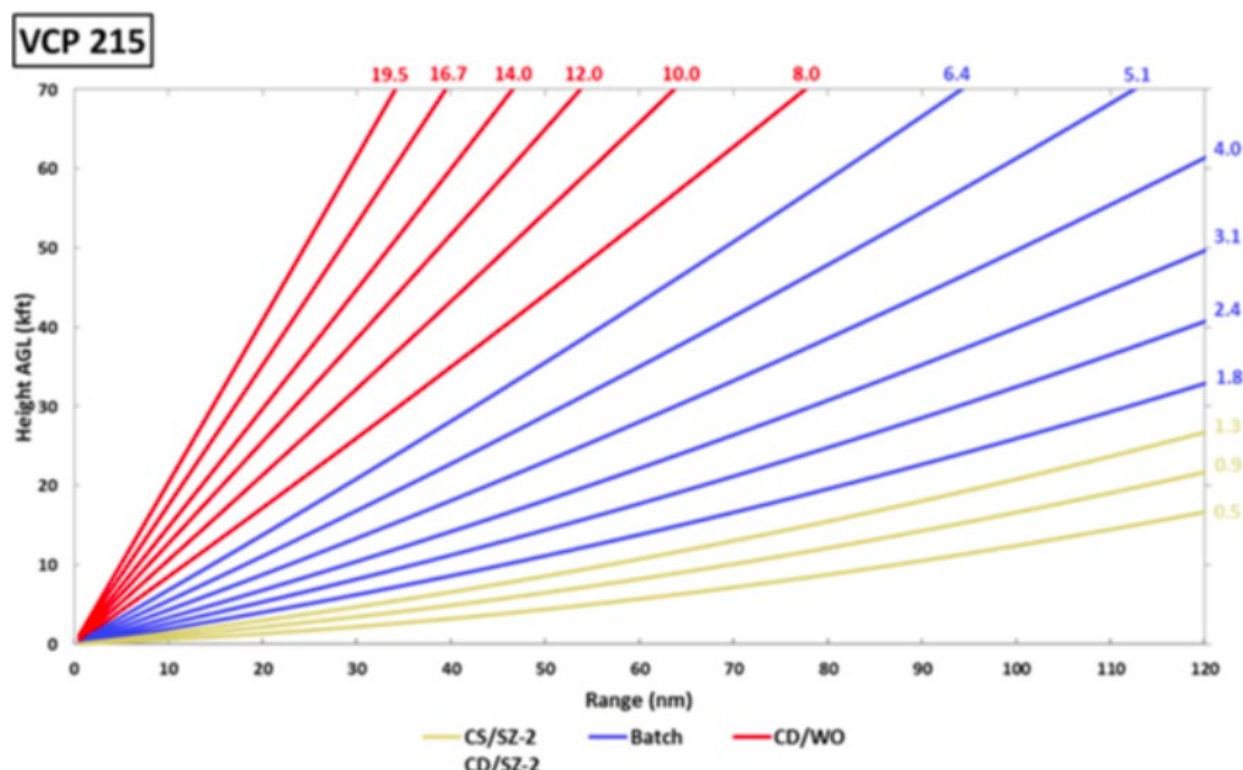


Figure 8. VCP-215 Precipitation Mode Scan Strategy¹⁸.

¹⁷ 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.

¹⁸ 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

5.2 Beam Height Calculation

Assuming standard refraction¹⁹ of the PAIH WSR-88D radar beam with the antenna elevation at 132 ft, and considering a beamwidth²⁰ 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.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP
PAIH 0.5°	6,160 ft	4,360 ft	7,960 ft

Based on the radar height calculations, the elevation scans reviewed from PAIH listed in the above table depicted the conditions between 4,360 ft and 7,960 ft over the accident site and this elevation scan “saw” the closest weather radar information to the ground.

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)

¹⁹ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

²⁰ Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

5.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²¹ 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 dBZ²² and is a general measure of echo intensity. FAA Advisory Circular AC 00-24C²³, "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 to 50 dBZ, inclusive. Finally, any dBZ values above 50 dBZ shall be described as "extreme."

5.4 Base Reflectivity and Lightning Data

Figure 9 presents the PAIH WSR-88D base reflectivity images for the 0.5° elevation scan initiated at 1426:33 AKDT, with a resolution of 0.5° X 250 m. The image depicted reflectivity values between 30 and 45 dBZ above the accident site with the precipitation moving from southeast to northwest (attachment 1).

There were no lightning flashes²⁴ reported within 50 miles of the accident site within 30 minutes prior to or following the accident time.²⁵

²¹ 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.

²² 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.

²³

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

²⁴ 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.

²⁵ A review of Earth Networks Total Lightning network and GOES Geostationary Lightning Mapper was done.

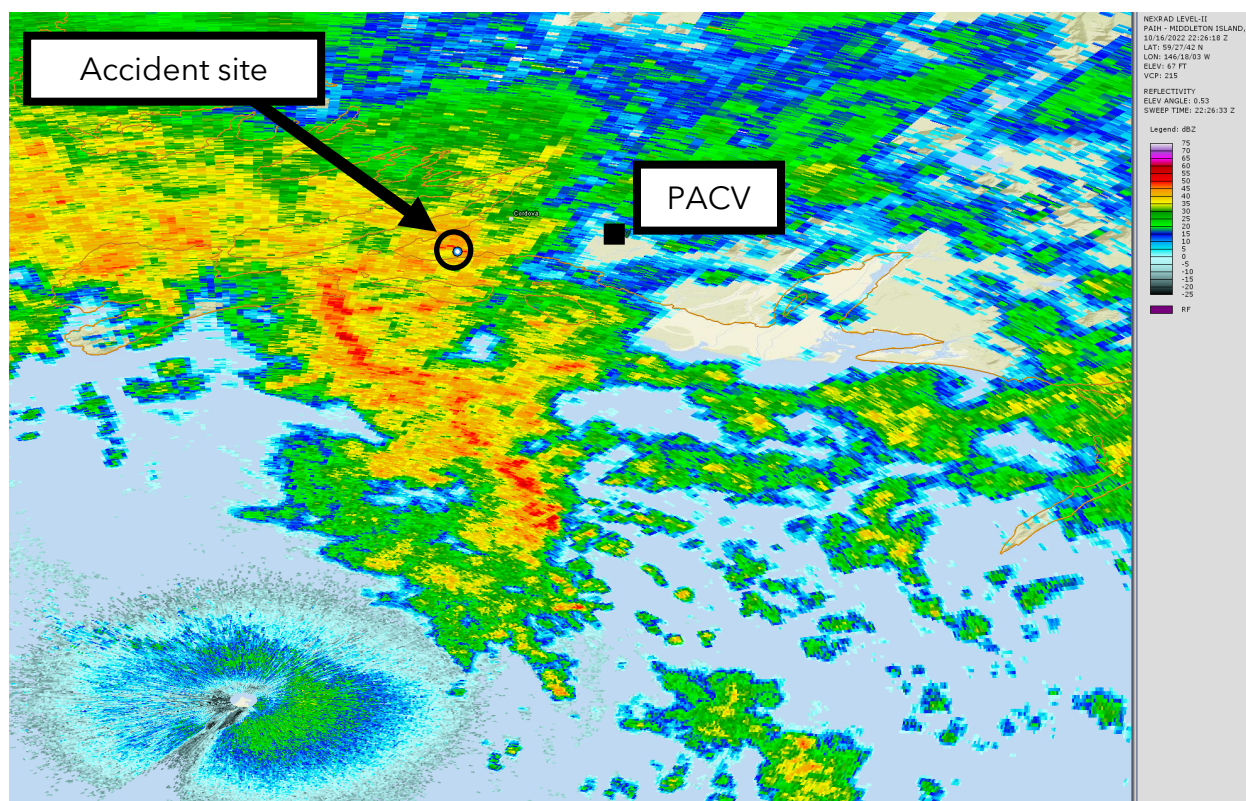


Figure 9. PAIH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1426:33 AKDT with the accident site marked with the black circle.

6.0 Pilot Reports

The longline-disseminated pilot reports²⁶ (PIREPs) distributed into the national airspace system (NAS) were reviewed for about two hours on either side of the accident time. The only PIREP issued into the NAS within 100 miles of the accident site for below 19,000 ft is shown below:

000 UAAK04 KAWN 162200 CDV UA /OV CDV/TM 2203/FL030/TP B737/TB OCNL
030-150/IC NEG/RM DURC

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.

²⁶ Only pilot reports with the World Meteorological Organization headers UBAK** were considered. These do not include pilot reports only broadcast via radio.

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)²⁷ 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 to IFR conditions with rain showers. For more information please see attachment 2.

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. AIRMET Tango and Zulu were valid for above 24,000ft and 6,000 ft, respectively:

WAAK48 PAWU 162006
WA8O
ANCS WA 162015
AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 170415

.
COOK INLET AND SUSITNA VLY AB
MTS OCNL OBSC IN CLDS/PCPN. NC.

.
COPPER RIVER BASIN AC
MTS ONCL OBSC IN CLDS/PCPN. NC.

.
CNTRL GLF CST AD
MTS OBSC IN CLDS/PCPN. NC.

.
KODIAK IS AE
MTS OCNL OBSC IN CLDS/PCPN. NC.

.
KUSKOKWIM VLY AF
MTS OBSC IN CLDS/PCPN. NC.

.
YKN-KUSKOKWIM DELTA AG
OCNL CIGS BLW 010/VIS BLW 3SM -RASN BR. NC.

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

²⁷ [Alaska Aviation Weather Unit](#)

.
BRISTOL BAY AH
MTS OBSC IN CLDS/PCPN. NC.

.
AK PEN AI
MTS OCNL OBSC IN CLDS/PCPN. NC.

.
=ANCT WA 162015
AIRMET TANGO FOR TURB/STG SFC WINDS VALID UNTIL 170415

.
COOK INLET AND SUSITNA VLY AB
OCNL MOD TURB FL240-FL400. NC.

.
COPPER RIVER BASIN AC
OCNL MOD TURB FL240-FL400. NC.

.
CNTRL GLF CST AD
OCNL MOD TURB FL240-FL400. NC.

.
KODIAK IS AE
TIL 23Z OFSHR NE PADQ OCNL MOD TURB FL280-FL380. WKN.

.
KUSKOKWIM VLY AF
TIL 05Z ALG AK RANGE OCNL MOD TURB FL240-FL400. WKN.

.
=ANCZ WA 162015
AIRMET ZULU FOR ICING VALID UNTIL 170415

.
COOK INLET AND SUSITNA VLY AB
PANC S ALG ERN MTS OCNL MOD ICEIC 060-130.
FZLVL 045. NC.

.
COPPER RIVER BASIN AC
VCY PAMX OCNL MOD ICEIC 090-FL200. FZLVL 060. NC.

.
CNTRL GLF CST AD
OCNL MOD ICEIC 060-130. FZLVL 045. NC.

.
YKN-KUSKOKWIM DELTA AG
INLAND OCNL MOD ICEIC 060-130.
FZLVL 010. NC.

.
BRISTOL BAY AH
OCNL MOD ICEIC 060-130. FZLVL 015 SW TO 040 NE. NC.

.
AK PEN AI
AFT 02Z NW PACD OCNL MOD ICEIC 040-100.
FZLVL 020. INTSF.

.
PRIBILOF ISLANDS AND SOUTHEAST BERING SEA AL
OCNL MOD ICEIC 040-100. FZLVL 010. WKN FM N.

.
BL/JAM OCT 2022 AAWU

11.0 Area Forecast

The Area Forecast valid for the accident site at the accident time was issued at 1206 AKDT and forecast few clouds at 800 ft, scattered clouds at 1,500 ft, and overcast clouds 2,500 ft with clouds tops at 13,000 ft and layered clouds above to FL200²⁸ with light rain showers. Occasional MVFR visibility conditions were forecast with isolated IFR ceilings and visibilities:

FAAK48 PAWU 162006
FA8H
ANCH FA 162015
AK SRN HLF EXCP SE AK...

.
AIRMETS VALID UNTIL 170415
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.

.
SYNOPSIS VALID UNTIL 171400
A QSTNRY 987 MB LOW VCY PAHP WL SLOLY WKN TO 989 MB BY 14Z. ASSOC
TROF LOW-PADL-SWD LN WL MOV TO LOW-PASL-PADQ-SWD LN BY END OF FCST
PD. OTRW RDG HI PRES OVR THE WRN BERING SEA WL SLOLY MOV E THRU THE
FCST PD.

.
COOK INLET AND SUSITNA VLY AB...VALID UNTIL 170800
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
FEW015 SCT035 BKN060 TOP 160 LYRS ABV TO FL300. OCNL BKN035 -SHRA.
VCY MTS ISOL CIGS BLW 010/VIS 3-5SM -SHRA BR/-SHRASN.
VCY TURNAGAIN ARM SFC WND E 20G30KT.
OTLK VALID 170800-171400...VCY MTS MVFR CIG SHRASN. ELSW VFR SHRA.
PASSES...LAKE CLARK...MVFR CIG SHRA.
MERRILL...RAINY...MVFR CIG SHRASN.
WINDY...MVFR CIG SHRASN. NRN APCH TURB.
PORTAGE...ERN APCH IFR CIG RA BR. ELSW MVFR CIG SHRA TURB.
...TURB...
AIRMET TURBOCNL MOD TURB FL240-FL400. NC...
PAAQ S ALG ERN MTS ISOL MOD TURB BLW 060.
...ICE AND FZLVL...
AIRMET ICEPANC S ALG ERN MTS OCNL MOD ICEIC 060-130.
FZLVL 045. NC...
OTRW N PAUO ISOL MOD ICEIC 090-FL200.
ELSW ISOL MOD ICEIC 060-130.

.
COPPER RIVER BASIN AC...VALID UNTIL 170800

²⁸ 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.

...CLOUDS/WX...
AIRMET MT OBSCMTS ONCL OBSC IN CLDS/PCPN. NC...
FEW020 SCT050 BKN080 TOP 160 LYRS ABV TO FL300.
MTS OCNL BKN050 VIS 3-5SM -RASN BR/-SN.
ELSW OCNL BKN050 -SHRA.
ALL SXNS ISOL CIGS BLW 010/VIS BLW 3SM -SHRA BR/-SHRASN BR/BR.
OTLK VALID 170800-171400...MTS MVFR CIG SHRASN. ELSW VFR.
PASS...TAHNETA...MVFR CIG -SHSN.
...TURB...
AIRMET TURBOCNL MOD TURB FL240-FL400. NC...
ISOL MOD TURB BLW 060.
...ICE AND FZLVL...
AIRMET ICEVCY PAMX OCNL MOD ICEIC 090-FL200. FZLVL 060. NC...

CNTRL GLF CST AD...VALID UNTIL 170800

...CLOUDS/WX...
AIRMET MT OBSCMTS OBSC IN CLDS/PCPN. NC...
FEW008 SCT015 OVC025 TOP 130 LYRS ABV TO FL200 -SHRA.
OCNL BKN015 VIS 3-5SM -SHRA BR.
ISOL CIGS BLW 010/VIS BLW 3SM -SHRA BR.
ISOL BKN030TCU TOP FL200 -SHRA.
OTLK VALID 170800-171400...MVFR CIG SHRA.
...TURB...
AIRMET TURBOCNL MOD TURB FL240-FL400. NC...
...ICE AND FZLVL...
AIRMET ICEOCNL MOD ICEIC 060-130. FZLVL 045. NC...

•
KODIAK IS AE...VALID UNTIL 170800
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
FEW015 SCT025 BKN040 TOP 120 LYRS ABV TO FL200.
OCNL BKN025 -SHRA. ISOL BKN015 VIS 3-5SM -SHRA BR.
TIL 05Z OFSHR NE PADQ ISOL BKN030TCU TOP FL200 -SHRA.
OFSHR PADQ N SFC WND S-SE G25KT.
OTLK VALID 170800-171400...MVFR CIG SHRA.
...TURB...
AIRMET TURBTIL 23Z OFSHR NE PADQ OCNL MOD TURB FL280-FL380. WKN...
...ICE AND FZLVL...
ISOL MOD ICEIC 060-130. FZLVL 040.
•

12.0 Terminal Aerodrome Forecast

PACV was the closest site with an NWS Terminal Aerodrome Forecast²⁹ (TAF) current at the time of the accident. The PACV TAF was issued at 1302 AKDT and was valid for a 21-hour period beginning at 1300 AKDT. The 1302 AKDT TAF for PACV was as follows:

PACV 162102Z 1621/1718 **12012G20KT 6SM -SHRA SCT006 OVC010**
TEMPO 1621/1624 4SM -SHRA BR BKN006
FM170000 10006KT P6SM -SHRA SCT010 OVC025=

Between 1300 and 1600 AKDT, the forecast expected a wind from 120 at 12 knots with gusts to 20 knots, 6 miles visibility, light rain showers, scattered clouds at 600 ft agl, and an overcast ceiling at 1,000 ft agl. Temporary conditions³⁰ were forecast between 1300 and 1600 AKDT with 4 miles visibility, light rain showers, mist, and a broken ceiling at 600 ft agl.

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 0444 AKDT, the closest AFD to the accident time with an aviation section:

FXAK68 PAFC 161244
AFDAFC

Southcentral and Southwest Alaska Forecast Discussion
National Weather Service Anchorage AK
444 AM AKDT Sun Oct 16 2022

.ANALYSIS AND UPPER LEVELS...

Broad low pressure system sits nearly stationary near the Kuskokwim Delta today and tomorrow before dropping south to merge with a low in the North Pacific. Associated longwave troughing extends into the central Bering and the Gulf of Alaska. Upper level riding over Canada clips into the Copper River Basin today, getting shoved off to the northeast as troughing moves north from the Gulf of Alaska. Another high pressure ridge sets up over the

²⁹ 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

³⁰ The TEMPO group is used for any conditions in wind, visibility, weather, or sky condition which are expected to last for generally less than an hour at a time (occasional), and are expected to occur during less than half the time period.

western Bering and will linger through Monday evening.

Radar shows rain filling in across portions of Southcentral and Southwest Alaska tonight. Other observations show freezing precipitation further inland for places like the Kuskokwim Valley and Kuskokwim Delta near Bethel, as well as in the Copper River Basin.

Two larger systems are developing, one over Russia and one in the North Pacific. Both will have some impact over Southern Alaska towards mid-week.

&&

.MODEL DISCUSSION...

Models are in good overall synoptic agreement through the short term. Which the general consensus at the surface is better, there are still some minute issues, mainly with precipitation and tracking of the shortwaves. Models seem to have a pretty good handle on the two larger systems, one over Russia and one over the North Pacific, as they work their way towards the Bering Sea and Gulf of Alaska respectively.

&&

.AVIATION...

PANC...Light rain will continue. Expect periods of MVFR-IFR conditions throughout much of the day today.

&&

.SHORT TERM FORECAST SOUTHCENTRAL ALASKA (Days 1 through 3; Today through Tuesday night)...

A surface low south of Cordova this morning will move over Prince William Sound then weaken rapidly as it moves inland by Sunday afternoon. A widespread area of precipitation stretching from Prince William Sound and the southern Copper River Basin to the Susitna Valley will lift northeast across the region today as the aforementioned low and associated upper-level shortwave move toward the Copper River Basin. Along the coast and over the Mat-Su Valleys and Anchorage Bowl, the precipitation is falling mainly as rain. For the Copper River Basin, however, the precipitation continues to fall as wintry mix, with snow in the western half of the basin and a mix of snow, sleet, and freezing rain from the Richardson Highway east. The frozen precipitation over this area will wind down by late morning as southerly winds increase and temperatures finally climb above freezing.

A series of shortwaves and surface troughs will continue to move north across the Gulf of Alaska in the wake of this initial system. These features will keep conditions unsettled late Sunday

through Monday. with a steady rain along the coast and periodic waves of showers inland. With the persistent southerly flow aloft, temperatures across much of Southcentral will stay above the freezing mark. This will mean much of the precipitation that falls from Sunday night through Monday is expected to fall as rain, with the exception of locations along the northern Susitna Valley and Copper River Basin as well as higher elevations.

Attention then shifts back to the southern Gulf for Tuesday as a potent storm system lifts north from the Pacific. A front will swing out ahead of the center of circulation, likely bringing strong winds and heavy rain to Kodiak Island by Tuesday afternoon. The front is expected to continue north to the Southcentral coast by Tuesday night. There remains a bit of uncertainty as to how far inland the front advances for Wednesday as the northern extent of precipitation. Right now, this system looks to weaken quickly as it takes a more eastward track toward Yakutat for Wednesday afternoon.

&&.SHORT TERM FORECAST SOUTHWEST ALASKA (Days 1 through 3: Today through Tuesday)...

A broad low pressure system extends across the eastern Aleutians and southern Alaska Peninsula. Upper level shortwaves rotating on the eastern side of the low is moving northward with rain across Bristol Bay. A surge of warm, moist air has slowly changed the precipitation type from wintry mix to all rain in the Kuskokwim Delta. Not much changes are expected with precipitation continuing through Monday afternoon/evening as the broad low remains quasi- stationary. By Monday night, the low will weaken and lift northward in response to a Bering Sea high pressure system shifting eastward. Precipitation will then taper off as the high builds overhead with cool, dry conditions returning on Tuesday.

&&

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

A broad low pressure system extends across the eastern Aleutians and southern Alaska Peninsula. Small craft northerly winds along with scattered rain/snow showers continues across the Bering Sea and Aleutian Chain as cold air streams over the relatively warm sea waters on the back side of the low. Winds are expected to diminish along with precipitation tapering off by Monday night as a ridge of high pressure builds overhead. Meanwhile, a front extending ahead of a strong low in the Sea of Okhotsk will advance eastward. This front has the potential to bring storm force southerly winds into the western Aleutians and Bering Sea between Monday and Tuesday.

&&

.LONG TERM FORECAST (Days 4 through 7: Wednesday through Saturday)...

There is reasonably good consensus with the models most of this forecast period. Confidence continues to increase regarding the low tracking into the Gulf Of Alaska Tuesday-Wednesday. This low contains the remnants of a former tropical system. All the global models have a tight pressure gradient, expect strong (gale to hurricane force) winds and enhanced seas with this low. Heavy precipitation is anticipated along the northern Gulf coast. There is a second system that will sweep across the Bering and Aleutians with the front near Cold Bay Wednesday morning. Expect gale force winds and precipitation. This front will weaken as it approaches the Southwest Alaska coast. Cyclonic flow will impact the Bering through day 6 and by Saturday the models are out of phase. It is also worth mentioning that temperatures will be warmer than normal. A number of locations in Southcentral, including Anchorage and Palmer will see afternoon temperatures in the mid to upper 40s.

&&

.AFC WATCHES/WARNINGS/ADVISORIES...

PUBLIC...Winter Weather Advisory 141

MARINE...NONE.

FIRE WEATHER...NONE.

&&

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14.0 Winds and Temperature Aloft Forecast

The NWS 1158 AKDT Winds and Temperature Aloft forecast valid for the closest points to the accident site are included below:

FBAK31 KWNO 161958
FD1AK1
DATA BASED ON 161800Z
VALID 170000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000
ANC 1520 1636-02 1736-08 1732-15 1726-29 1736-41 187346 187647 186748
MDO 1726 1728-02 1731-08 1735-15 1746-28 1880-35 681544 680748 188349
YAK 1714 1819+01 1923-04 1739-07 1962-18 1995-28 690842 691251 690359

The closest forecast points to the accident site were Anchorage (ANC), Middleton Island (MDO), and Yakutat (YAK). The 1158 AKDT forecast was for use between 1200 AKDT and 1900.

15.0 Weather Camera Imagery

Images from the FAA's Aviation Weather Cameras³¹ were retrieved for the Johnstone Point and Cordova weather camera locations around the accident timeframe and are contained in attachment 3.

³¹ [FAA WeatherCams](#)

16.0 Pilot Weather Briefing

The accident pilot requested and received weather information³² from Alaskan Flight Services³³ (AK FSS). Around 1220 AKDT the accident pilot called AK FSS and was provided weather information from the AK FSS preflight position, and as part of the weather information AK FSS preflight position stated, "VFR flight not recommended." The accident pilot stated that he was having trouble hearing AK FSS and would call them back on frequency. Around 1224 AKDT the accident pilot talked to AK FSS inflight position 1 on frequency before departure from Yakutat. AK FSS inflight position 1 provided an abbreviated briefing per the accident pilot's request, and the abbreviated briefing contained all the standard weather information and did mention "VFR flight not recommended" due to the weather in the Cordova area. The accident pilot stated to AK FSS inflight position 1 that his departure time would be 1300 AKDT. At 1426:12 AKDT, the accident pilot contacted AK FSS inflight position 2 to provide an update on his position and request an update on weather in the Anchorage area. For more information regarding AK FSS contact and discussion please see attachment 4.

A search of archived ForeFlight information indicated that the accident pilot did not have a ForeFlight account. It is unknown what, if any, additional weather information the accident pilot viewed before or during the accident flight.

17.0 Astronomical Data

The astronomical data obtained for the accident site on October 16, 2022, indicated the following:

SUN

Begin civil twilight	0744 AKDT
Sunrise	0827 AKDT
Sun transit	1329 AKDT
Accident time	1427 AKDT³⁴
Sunset	1830 AKDT
End civil twilight	1912 AKDT

At the time of the accident the Sun was located at an altitude of 19.49° and azimuth of 195.26°.

³² https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

³³

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

³⁴ Inserted accident time for reference and context.

E. LIST OF ATTACHMENTS

Attachment 1 - PAIH 0.5° base reflectivity animation from 1400 and 1440 AKDT

Attachment 2 - AAWU graphics valid at the accident time

Attachment 3 - FAA weather camera imagery

Attachment 4 - AK FSS audio data

Submitted by:

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Senior Meteorologist