

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ANC23FA074

METEOROLOGY

Specialist's Factual Report

November 13, 2023

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 RADAR IMAGERY	13
6.0 PILOT REPORTS	13
7.0 SIGNIFICANT METEOROLOGICAL INFORMATION	14
8.0 CENTER WEATHER SERVICE ADVISORIES	14
9.0 ALASKA AVIATION WEATHER UNIT GRAPHICS	14
10.0 AIRMEN’S METEOROLOGICAL INFORMATION.....	14
11.0 AREA FORECAST	16
12.0 TERMINAL AERODROME FORECAST	19
13.0 NATIONAL WEATHER SERVICE AREA FORECAST DISCUSSION	19
14.0 WINDS AND TEMPERATURE ALOFT FORECAST.....	22
15.0 WEATHER CAMERA IMAGERY.....	22
16.0 PILOT WEATHER INFORMATION	22
17.0 ADDITIONAL INFORMATION.....	23
18.0 ASTRONOMICAL DATA	26
E. LIST OF ATTACHMENTS	27

A. ACCIDENT

Location: St. Mary's, Alaska
Date: September 12, 2023
Time: 2047 Alaska daylight time
0447 coordinated universal time (UTC) on September 13
Airplane: Piper PA-18-150; Registration: N109T

B. METEOROLOGY SPECIALIST

Paul Suffern
Senior Meteorologist
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

The NTSB's Senior Meteorologist did not travel for this investigation but gathered all data remotely. Data for this investigation were collected 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 (ADKT) 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 located at approximate latitude 62.8637° N, longitude 161.7726° W, on a mountain side at an elevation of about 1,200 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 Federal Aviation Administration (FAA) "Aviation Weather Handbook", FAA-H-8083-28.²

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over Alaska for 2200 ADKT is provided as figure 1 with the location of the accident site within the black circle. The chart depicted a low-pressure system at 1000-hectopascals (hPa) located along the Alaskan Peninsula with two low-pressure systems at 1001-hPa located in the northern Bering Strait with a trough³ stretched from the 1000-hPa to the 1001-hPa low pressure systems. The accident site was located west of the surface trough. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present.

The station model closest to the accident site depicted an air temperature of 42°F, a dew point temperature of 40°F, cloudy skies, and a northwest wind at 10 knots.

² [FAA-H-8083-28](#)

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

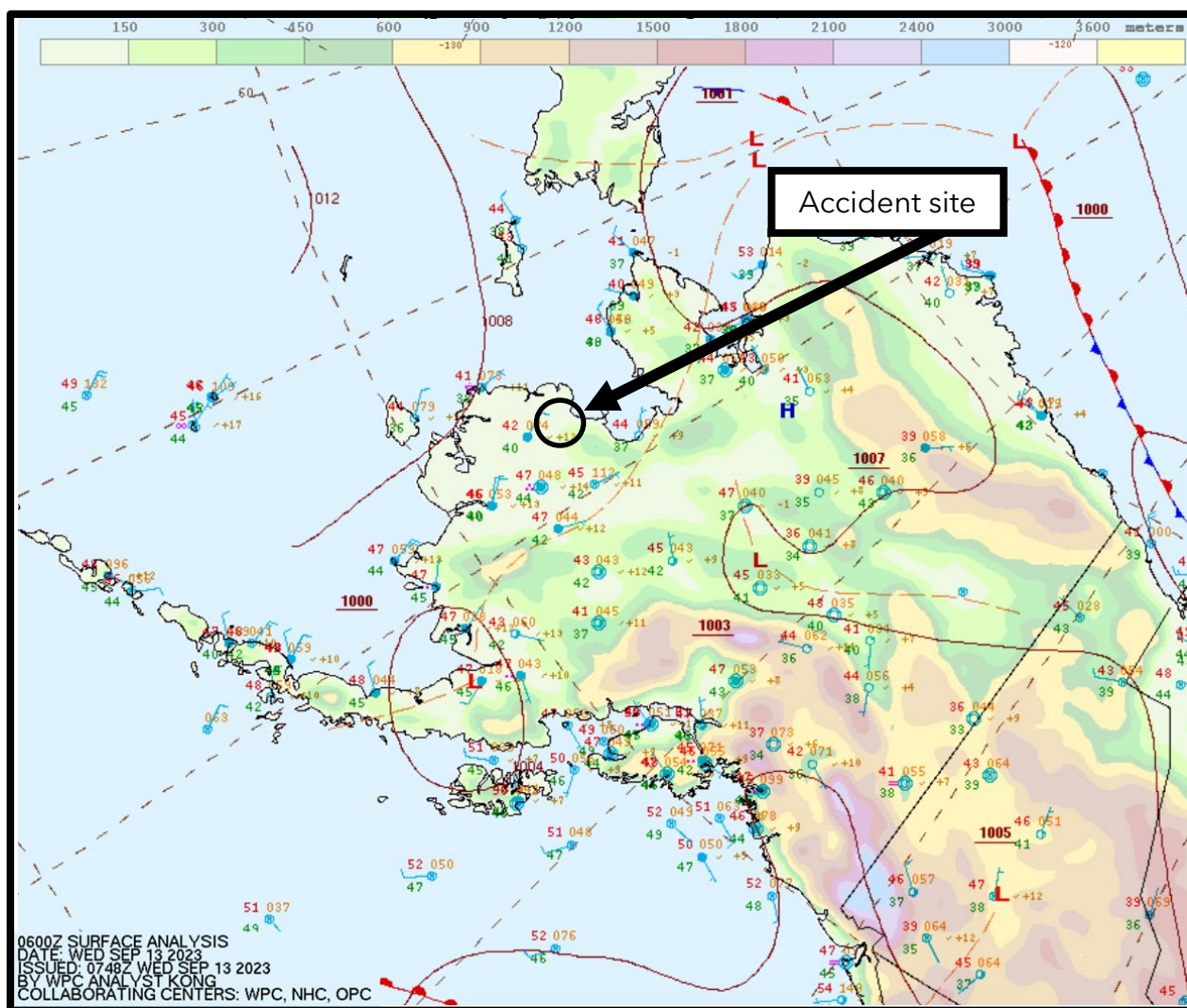


Figure 1. NWS Surface Analysis Chart for 2200 ADKT.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Special Reports (SPECIs)⁴. 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 locations marked. A magnetic variation⁵ of 11° east was indicated over the area.

⁴ Latest criteria for SPECIs can be found in the Federal Meteorological Handbook: [Federal Meteorological Handbook Number 1, Surface Weather Observations and Reports \(icams-portal.gov\)](https://www.federalregister.gov/documents/2018/01/16/2018-01-16-federal-meteorological-handbook-number-1-surface-weather-observations-and-reports)

⁵ Magnetic variation - The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

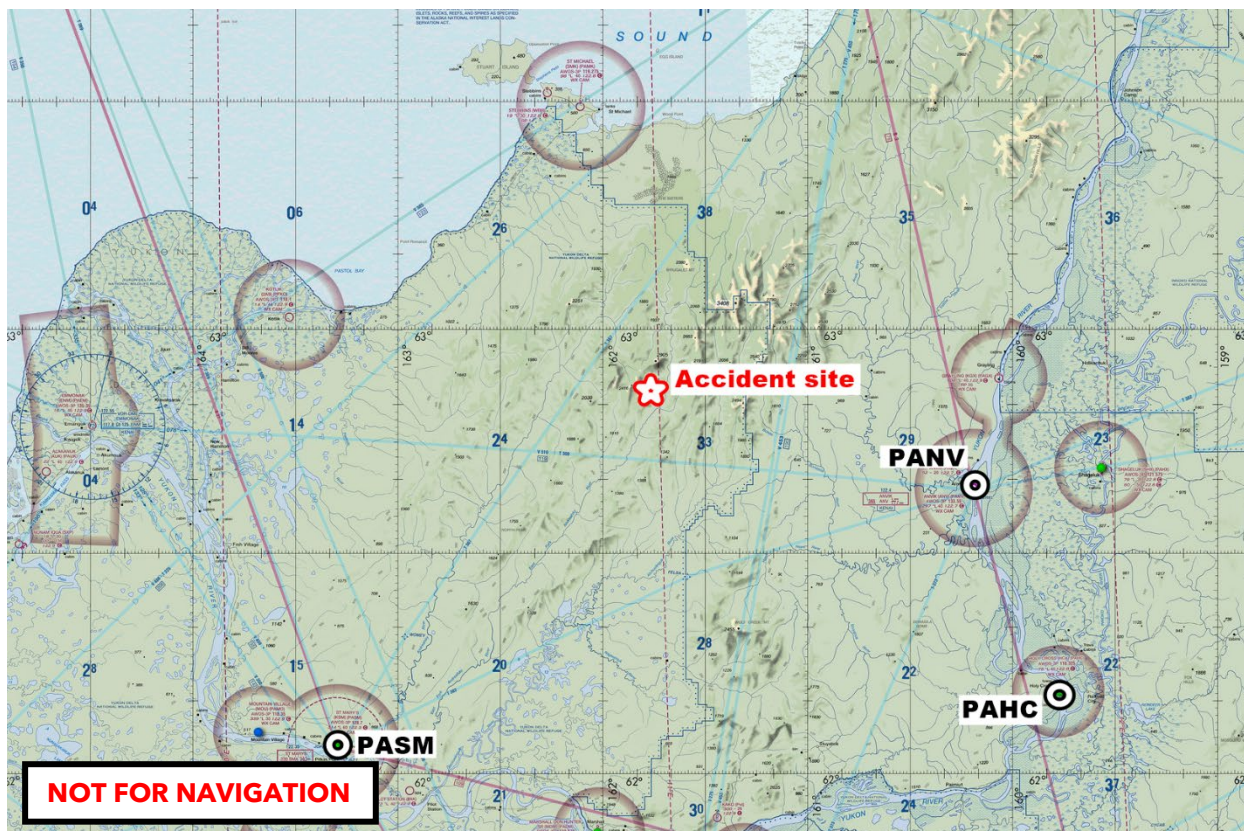


Figure 2. FAA sectional aeronautical chart of the accident area with the location of the accident site and surface observation sites noted.

Anvik Airport (PANV) had the closest official weather station to the accident site. PANV had an Automated Weather Observing System (AWOS⁶) and its longline⁷ reports were not augmented. The PANV AWOS was located 45 miles east-southeast of the accident site (figure 2), at an elevation of 297 ft, and issued the following observations surrounding the period of the accident:⁸

⁶ 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.

⁷ "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.

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

[1556 ADKT] METAR PANV 122356Z AUTO 06003KT 10SM 11/04 A2959 RMK
AO2 SLP084 T01110044 10122 20050 58002 TSNO \$=

[1656 ADKT] METAR PANV 130056Z AUTO 15007KT 7SM RA 10/05
A2960 RMK AO2 RAB42 SLP088 P0002 T01000050 TSNO \$=

[1756 ADKT] METAR PANV 130156Z AUTO 07004KT 10SM -RA 10/07
A2960 RMK AO2 SLP090 P0000 T01000067 TSNO \$=

[1856 ADKT] METAR PANV 130256Z AUTO 36006KT 10SM 09/06
A2962 RMK AO2 RAE01B19E35 SLP096 P0000 60002 T00940061
53008 TSNO \$=

**[1956 ADKT] METAR PANV 130356Z AUTO VRB03KT 10SM 09/06
A2963 RMK AO2 SLP100 T00890056 TSNO \$=**

ACCIDENT TIME 2046 ADKT

**[2056 ADKT] METAR PANV 130456Z AUTO 36004KT 10SM 08/06
A2963 RMK AO2 SLP104 T00780056 TSNO \$=**

[2156 ADKT] METAR PANV 130556Z AUTO 01004KT 10SM 07/06
A2965 RMK AO2 SLP112 60002 T00720056 10117 20072 53011 TSNO
\$=

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

PANV weather at 1956 ADKT, automated, wind variable at 3 knots, visibility 10 miles or greater, temperature of 9°C, dew point temperature of 6°C, and an altimeter setting of 29.63 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator, sea level pressure of 1010.0 hPa, temperature 8.9°C, dew point temperature 5.6°C, thunderstorm information not available, maintenance is needed on the system.

PANV weather at 2056 ADKT, automated, wind from 360° at 4 knots, visibility 10 miles or greater, temperature of 8°C, dew point temperature of 6°C, and an altimeter setting of 29.63 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure of 1010.4 hPa, temperature 7.8°C, dew point temperature 5.6°C, thunderstorm information not available, maintenance is needed on the system.

St. Mary's Airport (PASM) had the closest official weather station southwest of the accident site. PASM had an AWOS and its longline reports were not augmented. The PASM AWOS was located 64 miles southwest of the accident site (figure 2), at an elevation of 314 ft, and issued the following observations surrounding the period of the accident:

[1556 ADKT] METAR PASM 122356Z AUTO 33010KT 10SM SCT011 OVC026 07/04 A2968 RMK AO2 RAE15 SLP058 P0000 60002 T00670044 10067 20039 51001=

[1656 ADKT] METAR PASM 130056Z AUTO 35010KT 10SM OVC017 07/04 A2968 RMK AO2 SLP058 T00720044=

[1756 ADKT] METAR PASM 130156Z AUTO 33010KT 10SM BKN015 OVC025 07/04 A2968 RMK AO2 SLP058 T00720044=

[1856 ADKT] METAR PASM 130256Z AUTO 34010KT 10SM OVC025 07/04 A2969 RMK AO2 SLP062 T00720044 53003=

[1956 ADKT] METAR PASM 130356Z AUTO 34009KT 10SM OVC025 07/04 A2970 RMK AO2 SLP065 T00670039=

ACCIDENT TIME 2046 ADKT

[2056 ADKT] METAR PASM 130456Z AUTO 34008KT 10SM OVC027 06/04 A2971 RMK AO2 SLP070 T00610044=

[2143 ADKT] SPECI PASM 130543Z AUTO 33009KT 10SM BKN010 OVC032 06/04 A2972 RMK AO2=

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

PASM weather at 1956 ADKT, automated, wind from 340° at 9 knots, visibility 10 miles or greater, overcast ceiling at 2,500 ft above ground level (agl), temperature of 7°C, dew point temperature of 4°C, and an altimeter setting of 29.70 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure of 1006.5 hPa, temperature 6.7°C, dew point temperature 3.9°C.

PASM weather at 2056 ADKT, automated, wind from 340° at 8 knots, visibility 10 miles or greater, overcast ceiling at 2,700 ft agl, temperature of 6°C, dew point temperature of 4°C, and an altimeter setting of 29.71 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure of 1007.0 hPa, temperature 6.1°C, dew point temperature 4.4°C.

Holy Cross Airport (PAHC) was the intended destination airport. PAHC had an AWOS and its longline reports were not augmented. The PAHC AWOS was located 69 miles southeast of the accident site (figure 2), at an elevation of 75 ft, and issued the following observations surrounding the period of the accident:

[1556 ADKT] METAR PAHC 122356Z AUTO 05004KT 10SM CLR 13/04 A2959
RMK AO2 SLP026 T01280039 10128 20067 58003

[1656 ADKT] METAR PAHC 130056Z AUTO VRB05KT 10SM FEW050
SCT100 13/03 A2960 RMK AO2 SLP027 T01330033

[1756 ADKT] METAR PAHC 130156Z AUTO 03003KT 10SM -RA BKN045
OVC055 09/07 A2962 RMK AO2 RAB15 SLP035 P0002 T00890067

[1856 ADKT] METAR PAHC 130256Z AUTO 00000KT 10SM OVC095
09/07 A2962 RMK AO2 RAE24 SLP033 P0001 60003 T00940067 50007

**[1956 ADKT] METAR PAHC 130356Z AUTO 00000KT 10SM BKN095
09/07 A2963 RMK AO2 SLP037 T00890067**

ACCIDENT TIME 2046 ADKT

**[2056 ADKT] METAR PAHC 130456Z AUTO 00000KT 10SM OVC060
09/07 A2964 RMK AO2 SLP041 T00890072**

[2156 ADKT] METAR PAHC 130556Z AUTO 00000KT 10SM BKN100
07/06 A2965 RMK AO2 SLP045 60003 T00670061 10139 20067 53011

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

PAHC weather at 1956 ADKT, automated, wind calm, visibility 10 miles or greater, broken ceiling at 9,500 ft agl, temperature of 9°C, dew point temperature of 7°C, and an altimeter setting of 29.63 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure of 1003.7 hPa, temperature 8.9°C, dew point temperature 6.7°C.

PAHC weather at 2056 ADKT, automated, wind calm, visibility 10 miles or greater, overcast ceiling at 6,000 ft agl, temperature of 9°C, dew point temperature of 7°C, and an altimeter setting of 29.64 inHg. Remarks, automated station with a precipitation discriminator, sea level pressure of 1004.1 hPa, temperature 8.9°C, dew point temperature 7.2°C.

The observations from the PASM AWOS around the accident time identified MVFR⁹ conditions with a northerly wind to 10 knots. At PAHC and PANV, VFR conditions were noted around the accident time with variable winds under 5 knots.

3.0 Upper Air Sounding

A Global Data Assimilation System (GDAS) model sounding was created for near the accident site coordinates for 2200 AKDT with a surface elevation of 984 ft.¹⁰ The GDAS sounding was plotted on a standard Skew-T Log P diagram¹¹ from the surface to 600-hPa (or approximately 14,000 ft) using the RAOB¹² software package and is included as figure 3. The sounding had a near-surface temperature of 4.8°C, a dew point temperature of 3.4°C, and a relative humidity of 91%. The sounding depicted the lifted condensation level (LCL)¹³ at 580 ft agl and the convective condensation level (CCL)¹⁴ at 2,001 ft agl. The freezing level was located at 3,443 ft. The precipitable water value at 0.53 inches.

⁹ 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 GDAS sounding was created using NOAA Air Resource Laboratory:

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

Closest point available was 64.53° N, 160.09° W.

¹¹ 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.

¹² RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.

¹³ LCL – The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁴ 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.

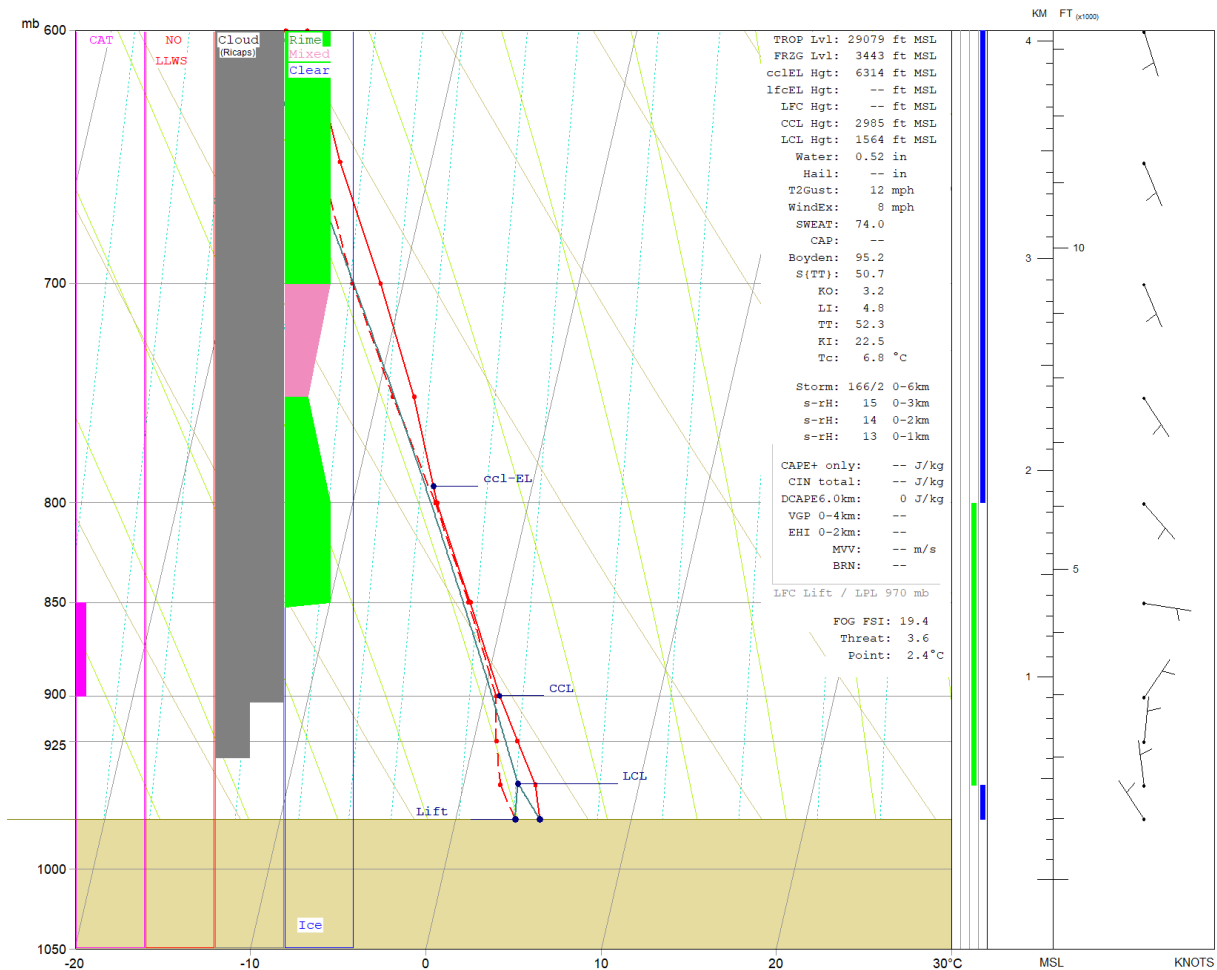


Figure 3. Skew-T Log P diagram of the 2200 ADKT GDAS sounding data.

The 2200 ADKT GDAS sounding indicated a stable to conditionally unstable environment from the surface through 14,000 ft. RAOB indicated clouds at ~1,000 ft agl (~2,000 ft msl) through 14,000 ft and light to moderate rime icing conditions above 4,200 ft.

The 2200 ADKT GDAS sounding wind profile indicated a near surface wind from 328° at 3 knots with the northerly winds continuing through 3,000 ft below 10 knots. Above 3,000 ft and through 14,000 ft the wind direction became easterly to southeasterly with a wind magnitude at or below 5 knots. RAOB did not indicate the possibility of low-level wind shear (LLWS), but RAOB did indicate very light clear air turbulence (CAT) between 3,000 and 4,500 ft.

4.0 Satellite Data

Geostationary Operational Environmental Satellite number 18 (GOES-18) 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-18 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 1700 AKDT through 2300 AKDT and reviewed. The closest images to the time of the accident were documented.

Figure 4 presents the GOES-18 visible image at 2050 AKDT at 2X magnification with the accident site highlighted with a red square. The visible imagery indicated cloud cover above the accident site at the accident time. Figure 5 presents the GOES-18 infrared image at 2050 AKDT at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (green colors; higher cloud tops) were located to the southeast of the accident site at the accident time. The brightness temperature of 259 Kelvin¹⁵ above the accident site would have been near 10,000 ft based on the vertical temperature profile provided by the 2200 AKDT GDAS sounding. It should be noted these figures have not been corrected for any parallax error.

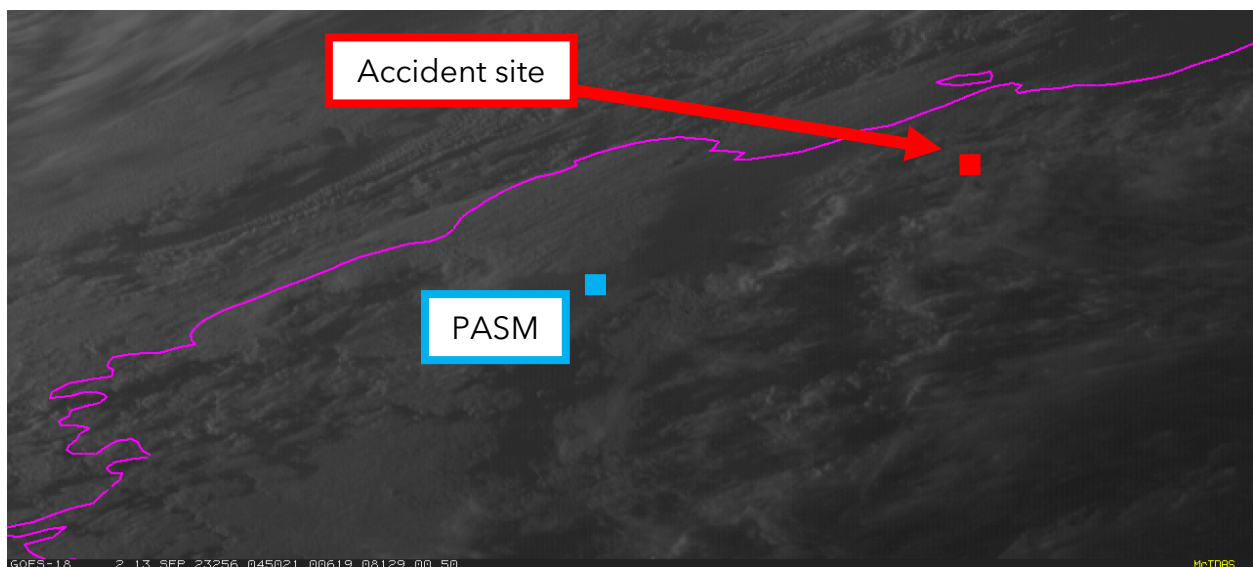


Figure 4. GOES-18 visible image at 2050 ADKT.

¹⁵ Around -14°C.

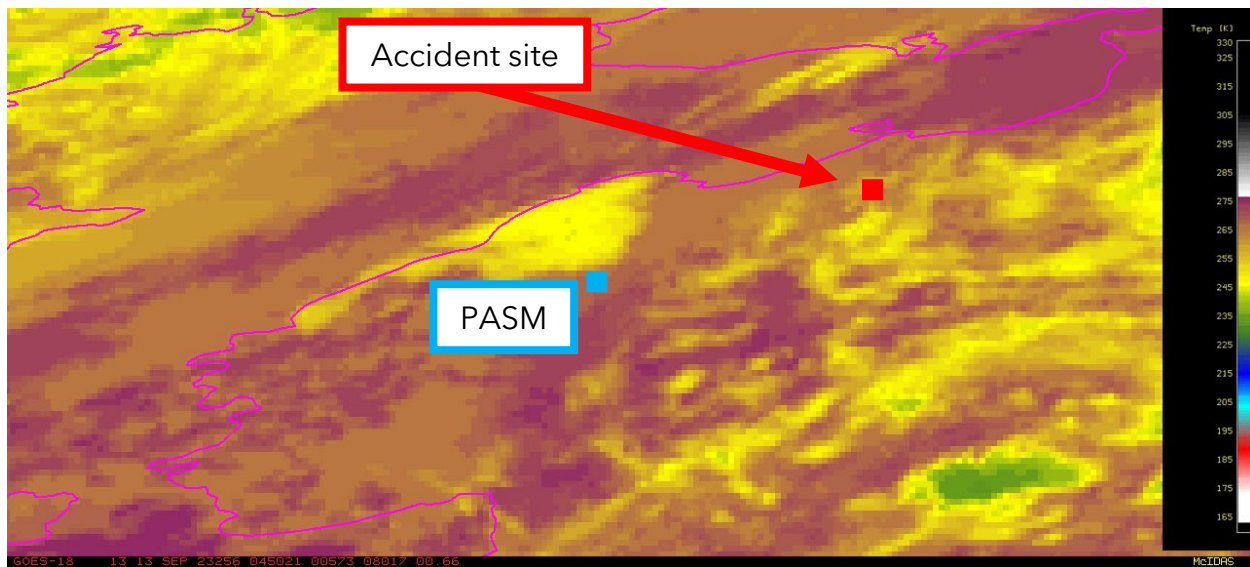


Figure 5. GOES-18 infrared image at 2050 AKDT.

5.0 Radar Imagery

The accident site was located 124 miles north of the closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁶ in Bethel, Alaska, (PABC). Assuming standard refraction¹⁷ of the PABC WSR-88D radar beam with the antenna elevation at 190 ft, and considering a beamwidth¹⁸ of 0.95°, the lowest elevation scans depicted conditions between 11,100 ft and 23,600 ft over the accident site. A review of weather radar data within an hour before and after the accident time revealed no echoes above the accident site.

6.0 Pilot Reports

There were no longline-disseminated pilot reports¹⁹ (PIREPs) distributed into the national airspace system (NAS) within two hours before and after the accident time and within 100 miles of the accident site at altitudes below 25,000.

¹⁶ 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.

¹⁷ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

¹⁸ Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

¹⁹ Only PIREPs 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 convective or non-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 for the accident site at the accident time.

9.0 Alaska Aviation Weather Unit Graphics

The Alaska Aviation Weather Unit (AAWU)²⁰ 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 VFR conditions. For more information please see attachment 1.

10.0 Airmen's Meteorological Information

There was Airmen's Meteorological Information (AIRMET) advisory Sierra issued by the AAWU at 2006 AKDT valid for the accident site at the accident time for mountain obscuration conditions in clouds and precipitation. A similar AIRMET was issued for the accident area earlier in the day at 1206 AKDT:

WAAK48 PAWU 130406
WA8O
ANCS WA 130415
AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 131215
.
COOK INLET AND SUSITNA VLY AB
MTS OBSC IN CLDS/PCPN. NC.
.
COPPER RIVER BASIN AC
MTS OBSC IN CLDS/ISOL 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

²⁰ [Alaska Aviation Weather Unit](#)

AK RANGE OBSC IN CLDS. NC.

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

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

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

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

.
=ANCT WA 130415
AIRMET TANGO FOR TURB/STG SFC WINDS VALID UNTIL 131215

.
YKN-KUSKOKWIM DELTA AG
AFT 09Z CST/OFSHR N PAKI OCNL MOD TURB FL250-FL320. INTSF.

.
=ANCZ WA 130415
AIRMET ZULU FOR ICING VALID UNTIL 131215

.
ADAK TO ATTU AK
W AMCHITKA OCNL MOD ICEIC 130-FL230.
FZLVL 090 E AND NE TO 130 W AND SW. NC.

.
JWC SEP 2023 AAWU

WAAK48 PAWU 122006
WA8O
ANCS WA 122015
AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 130415

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

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

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

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

.
KUSKOKWIM VLY AF
AK RANGE OBSC IN CLDS. NC.

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

.
BRISTOL BAY AH

MTS OBSC IN CLDS/PCPN. NC.
 .
 AK PEN AI
 MTS OCNL OBSC IN CLDS/PCPN. NC.
 .
 UNIMAK PASS TO ADAK AJ
 MTS OCNL OBSC IN CLDS/PCPN. NC.
 .
 =ANCT WA 122015
 AIRMET TANGO FOR TURB/STG SFC WINDS VALID UNTIL 130415
 .
 NONE
 .
 =ANCZ WA 122015
 AIRMET ZULU FOR ICING VALID UNTIL 130415
 .
 KODIAK IS AE
 AFT 02Z SW PAKH OCNL MOD ICEIC 060-140.
 FZLVL 040. INTSF.
 .
 BRISTOL BAY AH
 AKPEN PAPN S OCNL MOD ICEIC 060-140.
 FZLVL 040. NC.
 .
 AK PEN AI
 E PASD OCNL MOD ICEIC 060-140.
 FZLVL 040. NC.
 .
 MB SEP 2023 AAWU

11.0 Area Forecast

The AAWU issued an Area Forecast at 2008 AKDT valid for the accident site at the accident time. The Area Forecast did not forecast any turbulence or icing below 6,000 ft but did forecast scattered clouds at 2,500 ft with a broken ceiling at 5,000 ft and cloud tops to FL200²¹. Occasional ceilings with broken cloud cover at 2,000 ft agl with light rain showers were also forecast. Similar conditions were forecast in the Area Forecast issued at 1204 AKDT valid for the accident site:

FAAK58 PAWU 130408
 FA8W
 ANCC FA 130415
 AK SRN HLF EXCP SE AK...
 .
 AIRMETS VALID UNTIL 131215

²¹ 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.

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 131600
...CLOUDS/WX...
AIRMET MT OBSCAK RANGE OBSC IN CLDS. NC...
SCT020 BKN050 TOP FL200.
TIL 06Z E PASL ISOL BKN040TCU TOP FL200 -SHRA.
OTLK VALID 131600-132200...S PASL- PAFS LN MVFR CIG SHRA. ELSW VFR.
...TURB...
NIL SIG. EXC VCY TCU.
...ICE AND FZLVL...
S PAMC ISOL MOD ICEIC 060-140. FZLVL 040.

.
YKN-KUSKOKWIM DELTA AG...VALID UNTIL 131600
...CLOUDS/WX...
*****AIRMET MT OBSC***MTS OBSC IN CLDS/PCPN. NC...**
SCT025 BKN050 TOP FL200. OCNL BKN020/-SHRA.
OTLK VALID 131600-132200...S PABE MVFR CIG SHRA. ELSW VFR.
...TURB...
*****AIRMET TURB***AFT 09Z CST/OFSHR N PAKI OCNL MOD TURB FL250-FL320.**
INTSF...
...ICE AND FZLVL...
PARS-PABE LN SE ISOL MOD ICEIC 060-140. FZLVL 030.

.
BRISTOL BAY AH...VALID UNTIL 131600
...CLOUDS/WX...
AIRMET MT OBSCMTS OBSC IN CLDS/PCPN. NC...
PADL-PAJZ LN NW SCT005 BKN030 TOP FL200.
OCNL BKN020 /-SHRA VIS 3-5SM BR. OTRW SCT020 BKN040 TOP FL200.
TIL 06Z PAIG-PANW LN N ISOL BKN040TCU TOP FL200 -SHRA.
OTLK VALID 131600-132200...MVFR CIG SHRA.
...TURB...
NIL SIG. EXC VCY TCU.
...ICE AND FZLVL...
ISOL MOD ICEIC 060-140. FZLVL 040.

.
AK PEN AI...VALID UNTIL 131600
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
SCT020 BKN040 TOP 080 LYRS ABV TO 170. BERING SIDE OCNL BKN020/ISOL-
SHRA.
OTLK VALID 131600-132200...BERING SIDE OCNL MVFR CIG SHRA. ELSW/OTRW
VFR.
...TURB...
NIL SIG.
...ICE AND FZLVL...
AKPEN N ISOL MOD ICEIC 060-140. FZLVL 040.

.
UNIMAK PASS TO ADAK AJ...VALID UNTIL 131600
...CLOUDS/WX...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
FEW015 SCT025 BKN035 TOP 080 DCRG LYRS ABV TO 160. OCNL BKN025. ISOL -

SHRA.
PAKO W SFC WND NW G25KT. WKN.
OTLK VALID 131600-132200...W PAAK IFR CIG RA BR. OTRW MVFR CIG.
...TURB...
TIL 10Z PAAK TO PAKO ISOL MOD TURB BLW 030.
...ICE AND FZLVL...
NIL SIG. FZLVL 035 EXC 060 W.

.

JWC SEP 2023 AAWU
FAAK58 PAWU 122004
FA8W
ANCC FA 122015
AK SRN HLF EXCP SE AK...

.

AIRMETS VALID UNTIL 130415
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 130800
...CLOUDS/WX...
AIRMET MT OBSCAK RANGE OBSC IN CLDS. NC...
SCT030 BKN060 TOP FL200. OCNL BKN020/-SHRA
TIL 06Z E PASL ISOL BKN040TCU TOP FL200 -SHRA.
OTLK VALID 130800-131400...S PASL- PAFS LN MVFR CIG SHRA. ELSW VFR.
...TURB...
NIL SIG. EXC VCY TCU.
...ICE AND FZLVL...
ISOL MOD ICEIC 060-140. FZLVL 040.

.

YKN-KUSKOKWIM DELTA AG...VALID UNTIL 130800
...CLOUDS/WX...
*****AIRMET MT OBSC***MTS OBSC IN CLDS/PCPN. NC...**
SCT030 BKN045 TOP FL200. OCNL BKN020/-SHRA.
OTLK VALID 130800-131400...S PABE MVFR CIG SHRA. ELSW VFR.
...TURB...
NIL SIG.
...ICE AND FZLVL...
PARS-PABE LN SE ISOL MOD ICEIC 060-140. FZLVL 030.

.

BRISTOL BAY AH...VALID UNTIL 130800
...CLOUDS/WX...
AIRMET MT OBSCMTS OBSC IN CLDS/PCPN. NC...
PADL-PAJZ LN NW SCT005 BKN050 TOP FL200.
OCNL BKN020 /-SHRA VIS 3-5SM BR. OTRW SCT020 BKN040 TOP FL200.
TIL 06Z PAIG-PANW LN N ISOL BKN040TCU TOP FL200 -SHRA.
OTLK VALID 130800-131400...MVFR CIG SHRA.
...TURB...
NIL SIG. EXC VCY TCU.
...ICE AND FZLVL...
AIRMET ICEAKPEN PAPN S OCNL MOD ICEIC 060-140.
FZLVL 040. NC...
PAKN-PADL LN N ISOL MOD ICEIC 060-140.

.

AK PEN AI...VALID UNTIL 130800
 ...CLOUDS/WX...
 AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
 SCT020 BKN035 TOP 150. OCNL BKN020/-SHRA. PAC SIDE COND ISOL.
 OTLK VALID 130800-131400...MVFR CIG SHRA. PAC SIDE VFR.
 ...TURB...
 NIL SIG.
 ...ICE AND FZLVL...
 AIRMET ICEE PASD OCNL MOD ICEIC 060-140.
 FZLVL 040. NC...
 PASD W ISOL MOD ICEIC 060-140.
 .
 UNIMAK PASS TO ADAK AJ...VALID UNTIL 130800
 ...CLOUDS/WX...
 AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
 E PAKO SCT030 BKN045 TOP FL180. OCNL BKN030/-SHRA.
 ELSW SCT030 BKN045 TOP 140. ISOL BKN030/-SHRA.
 W PAKO SFC WND N-NW G25KT.
 OTLK VALID 130800-131400...OCNL MVFR CIG SHRA. OTRW VFR.
 ...TURB...
 SEGUAM W ISOL MOD TURB BLW 030.
 ...ICE AND FZLVL...
 E PAAK ISOL MOD ICEIC 060-140. FZLVL 040.
 .
 MB SEP 2023 AAWU

12.0 Terminal Aerodrome Forecast

There were no NWS Terminal Aerodrome Forecast²² (TAF) locations within 30 miles of the accident site.

13.0 National Weather Service Area Forecast Discussion

The NWS weather forecast office in Fairbanks, Alaska, (WFO AFG) was responsible for the public forecast in the accident region. WFO AFG issued the following Area Forecast Discussion (AFD) at 1444 ADKT:

901
 FXAK69 PAFG 122244
 AFDAFG

Northern Alaska Forecast Discussion
 National Weather Service Fairbanks AK

²² 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

244 PM AKDT Tue Sep 12 2023

.SYNOPSIS...

Another day passes with the broad upper level low continuing to spin over western Alaska. A couple of weaker surface lows are rotating around the parent low bringing precipitation to parts of the North Slope and Brooks Range. Another weaker low will try to make it into the Interior tonight though precipitation associated with it will struggle to make it over the Alaska Range. Cool and showery conditions persist along the West Coast.

&&

.DISCUSSION...

Upper Levels and Analysis...

A broad upper level low continues to spin over Western Alaska. A weak shortwave is moving north through the Prince William Sound with precipitation moving towards the Alaska Range. With higher peaks of the coastal mountains sticking up and diverting flow around them, the precipitation will likely struggle to make it over the Alaska Range in a few hours. Downsloping has helped clear out much of the Interior this afternoon. A low pressure trough has pushed off the Arctic Coast with winds along the north slope from NE to W so fog has at least cleared but low stratus persist. West coast continues to be under the upper level low with light winds, partly cloudy skies, and isolated showers popping up this afternoon.

Model Discussion...

Models are still in good agreement the next 3 days in the upper levels. Cold air wrapping around the upper level low from Russia will likely help the low go through a deepening phase starting tomorrow and lasting into the end of the week. 500 mb heights fall from the mid 530s dm to the mid 520s dm. Global models are also in good agreement with the location of the upper level low retrograding up towards the Bering Strait from its current location over the Yukon Delta. A negatively tilted trough forms on the South side of the upper level low and moves into the Gulf of Alaska that helps develop a stronger surface low near the Prince Williams Sound though the lack of cold air limits the baroclinicity and thus the strength and longevity of the surface low. Once the low occludes, models show an open shortwave passes over the Alaska Range Wednesday night into Thursday with an increased chance of precipitation north of the Alaska Range.

Central and Eastern Interior...

With the Central and Eastern Interior between two shortwaves, the skies have mostly cleared outside of some clouds in higher terrain. A few showers are trying to pop up in the White Mountains this afternoon with good low level moisture and just enough solar heating. Another shortwave in the Prince Williams Sound will try and make its way north tonight but given its presentation on water

vapor imagery, it is weaker than the shortwave that moved through yesterday. Precipitation will struggle to make it over the Alaska Range though a few high based showers will likely move through overnight into tomorrow morning that may wet the ground. While skies should cloud in, areas that manage to stay clear into the early evening or clear for a few hours overnight may get some valley fog formation.

West Coast and Western Interior...

Not much change from previous forecast. Upper level low will keep temperatures on the cooler side with partly to mostly cloudy skies. No significant low pressure systems expected over the next 3 days. As the upper level low starts to move towards the Bering Strait Thursday, winds will pick up towards 15 to 20 mph out of the south along the west coast.

North Slope and Brooks Range...

As a shortwave pushed up over the Brooks Range today, a trough of low pressure formed and moved off the coast that helped change the wind direction. This helped clear the fog for a bit though the low stratus has stuck around. Another shortwave moving in tomorrow will help reinforce the southerly flow so there is a chance by tomorrow afternoon for the low stratus to clear and get some sun all the way to the arctic coast. Any precipitation will likely be rain north of the Brooks range with not much cold air in place. Snow levels in the Brooks Range will also be pretty high so snow at pass level is unlikely, and if it does, it will be some wet flakes that mix with the rain and not accumulate.

Extended Forecast Days 4-7...

With the broad upper level low finally beginning to break down, increased storminess is expected through the Southern Bering Sea into the Gulf of Alaska, the trough should flatten out with lowering 500 mb heights across northern Alaska. Though next weekend, most of the storms will be in the Gulf of Alaska with some spill over precipitation across the Interior and West Coast. No significant precipitation is expected for our region.

Coastal Hazard Potential Days 3 and 4...None.

&&

.HYDROLOGY...

Recent rains have been moderate but not heavy, and not over large geographic areas. These rains are not anomalous and with rivers running mostly normal or low means no flooding concerns for the near future.

&&

.AFG WATCHES/WARNINGS/ADVISORIES...

AK...None.

PK...None.

&&

\$\$

14.0 Winds and Temperature Aloft Forecast

The NWS 1759 ADKT, Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

FBAK31 KWNO 130159
FD1AK1
-DATA BASED ON 130000Z
VALID 130600Z FOR USE 0200-0900Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BET	0212	9900-04	9900-10	9900-17	3106-29	3308-40	330550	300844	281041
CZF	3313	3308-07	3308-10	3510-16	3621-27	3523-39	332050	332445	332143
MCG	9900	1005-03	9900-09	1906-15	1715-28	1609-40	161451	151048	190644
UNK	9900	9900-04	9900-10	9900-16	1405-28	1507-39	160852	990047	990044

The accident site was in between the forecast points from Unalakleet (UNK), McGrath (MCG), Bethel (BET), and Cape Romanzof (CZF), Alaska. The forecast was valid for 2200 ADKT and for use between 1800 AKDT on September 12 and 0100 ADKT on September 13.

15.0 Weather Camera Imagery

Images from the FAA's Aviation Weather Cameras²³ were retrieved for the St. Michael, Anvik, Marshall, Mountain Village, and St. Mary's weather camera locations around the accident timeframe and are contained in attachment 2.

16.0 Pilot Weather Information

Title 14 *CFR* 91.103 states that "Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight." FAA Advisory Circular (AC) 91-92 "Pilot's Guide to a Preflight Planning" (dated March 15, 2021) provided pilot guidance on preflight self-briefings, including planning, weather interpretation, and risk identification/mitigation skills. The AC further stated in part:

Pilots adopting these guidelines will be better prepared to interpret and utilize real-time weather information before departure and en route, in the cockpit, via technology like Automatic Dependent Surveillance-Broadcast (ADS-B) and via third-party providers.²⁴

²³ [FAA WeatherCams](#)

²⁴ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf. The AC also listed

A search of archived information indicated that the accident pilot did not request weather information from Alaskan Flight Services²⁵ (AK FSS). A search of ForeFlight information indicated that the accident pilot did not have a ForeFlight account. It is unknown what weather information, if any, the accident pilot checked or received before or during the accident flight.

17.0 Additional Information

Archived Weather data were retrieved from the NWS Aviation Weather Center (AWC) experimental website for 2045 AKDT and included low-level wind data from the surface (figure 6). The low-level wind data indicated a 10- to 15-knot north wind over the accident site at 2045 AKDT near the surface. The archived Graphical Turbulence Guidance (GTG) was retrieved for 500 and 1,000 ft agl for the accident site for 2045 AKDT and those data can be found in figures 7 and 8. The GTG at 500 and 1,000 ft agl indicated no to light turbulence considering the Eddy Dissipation Rate (EDR)²⁶ for "Light" category aircraft.

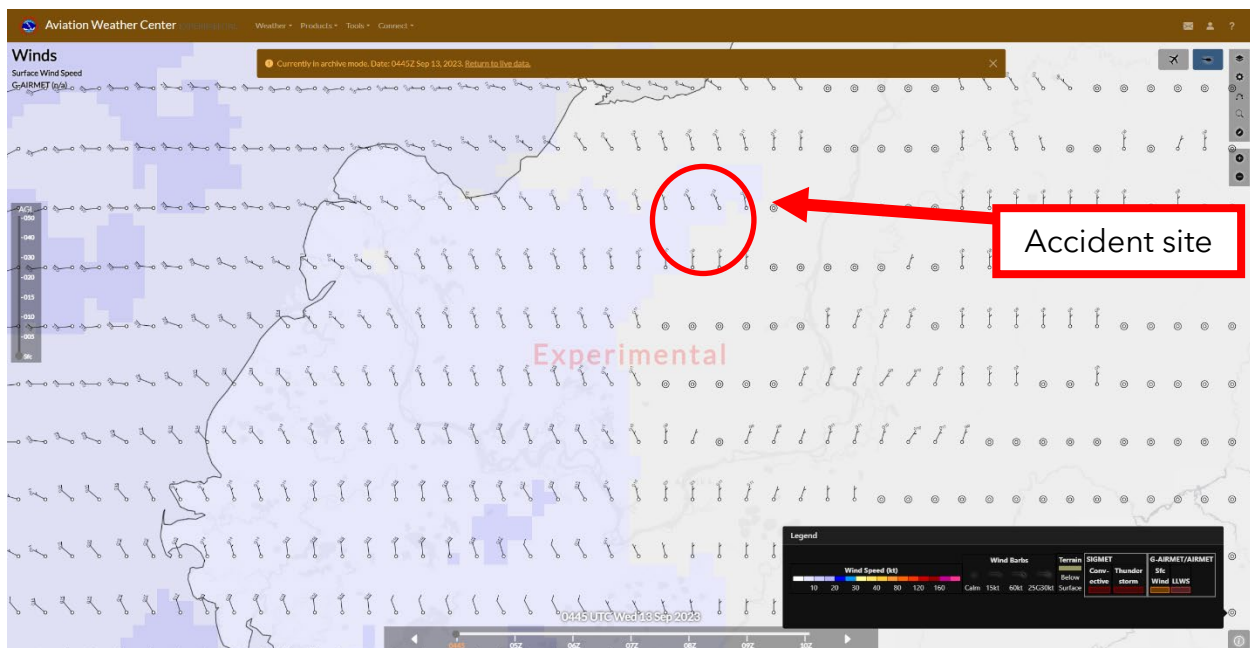


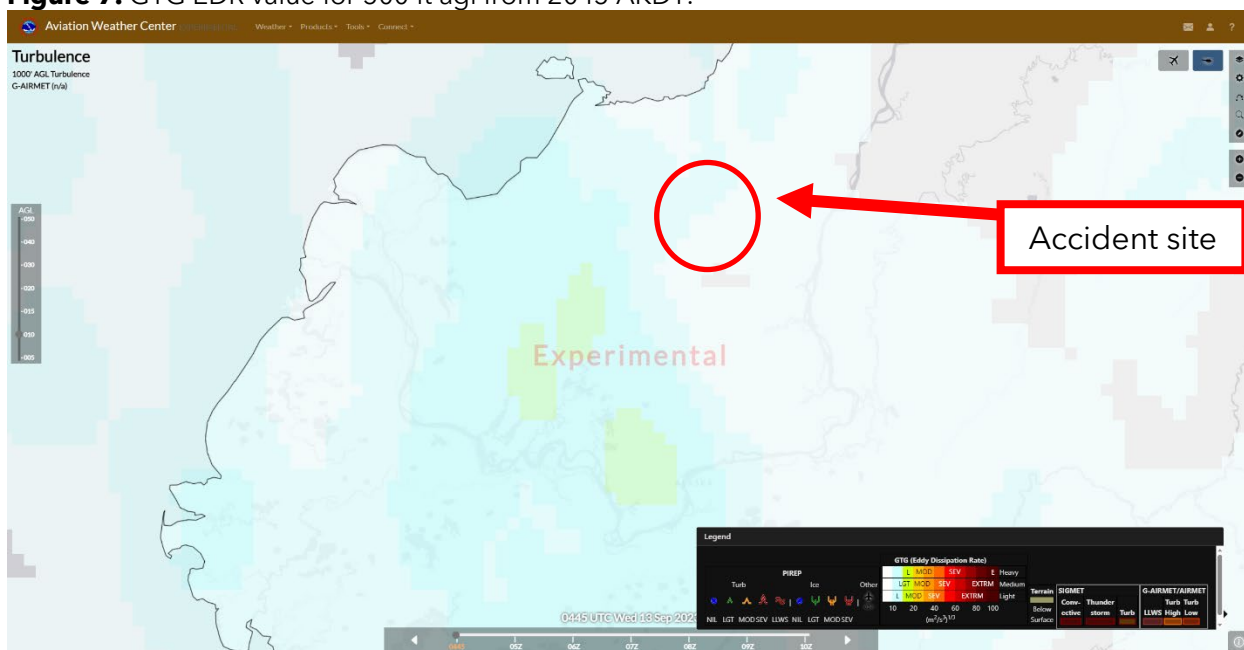
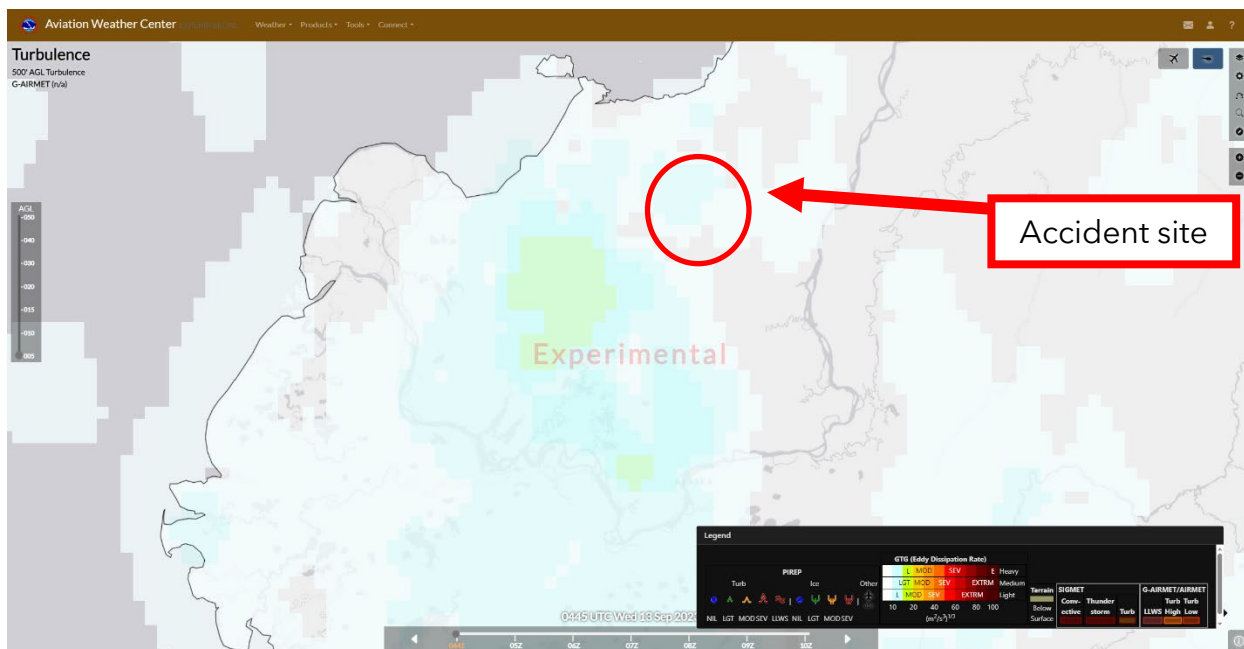
Figure 6. AWC experimental website surface wind speed graphic from 2045 AKDT.

multiple online FAA resources for aviation flight planning services for adverse weather.

²⁵

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

²⁶ All graphics display atmospheric turbulence intensity as energy (or eddy) dissipation rate to the 1/3 power, i.e. $EDR = \epsilon^{1/3}$ where ϵ is the eddy dissipation rate in units of m^2/s^3 . Typically EDR varies from close to 0, "smooth", to near 1, "extreme for most aircraft types. The display colors of EDR range from white near 0 to dark red near 1.



In addition to the weather data above, one of the witnesses provided a video of the accident flight's departure that contained views of the cloud cover and other weather characteristics. Screen captures of the video with views facing south, west, and north from approximately 2045 AKDT are provided in figures 9 through 11. For more information from the witnesses please see the docket for this investigation.



Figure 9. Accident flight departure facing the south at approximately 2045 AKDT.



Figure 10. Accident flight departure facing the west at approximately 2045 AKDT.



Figure 11. Accident flight departure facing the north at approximately 2045 AKDT.

18.0 Astronomical Data

The astronomical data obtained for the accident site on September 12, 2023, indicated the following:

SUN

Sunrise	0803 ADKT
Sun transit	1443 ADKT
Accident time	2046 ADKT²⁷
Sunset	2122 ADKT

At the time of the accident the Sun was had an altitude of 3.37° and azimuth of 272.40°.

²⁷ Inserted accident time for reference and context.

E. LIST OF ATTACHMENTS

Attachment 1 - AAWU graphical information valid at the accident time

Attachment 2 - FAA Weather Camera imagery around the accident time

Submitted by:

Paul Suffern
Senior Meteorologist