



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 6, 2021

Specialist's Factual Report

METEOROLOGY

ANC21FA065

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A. ACCIDENT

Location: Eagle River, Alaska
Date: July 26, 2021
Time: about 1320 Alaska daylight time
2120 universal coordinated time (UTC)
Airplane: Cessna 172P; Registration: N65698

B. METEOROLOGIST

Don Eick
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On July 26, 2021, about 1320 Alaska daylight time, a Cessna 172P airplane, N65698, was substantially damaged when it was involved in an accident near Eagle River, Alaska. The flight instructor and private pilot received fatal injuries. The flight was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC), the National Center for Environmental Information (NCEI), and the Alaska Aviation Weather Unit (AAWU). All times are Alaska daylight saving time (AKDT) based upon the 24 hour clock, local time is +8 hours to UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

This report provides a meteorological review on the weather conditions and NWS aviation weather products applicable to the region around the accident time. The accident site was based on the coordinates at latitude 61.198351° N and longitude 149.13063° W, at an elevation of approximately 3,100 ft.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

The synoptic or large-scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP) located in College Park, Maryland, and the Alaska Aviation Weather Unit (AAWU) located in Anchorage, Alaska (AK). These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts and other weather products documented in this report can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45H change 2.

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over southcentral Alaska for 1300 AKDT is included as figure 1 with the approximate accident site marked by a red star. The chart depicted high-pressure systems to the west and southwest of the accident site over southwest Alaska and in the northern Gulf of Alaska at 1019- and 1017-hectopascals (hPa)¹ respectively, which prevailed over southcentral Alaska. The chart depicted a weak pressure gradient² based on the spacing of the isobars with generally light winds over the region. The station models surrounding the accident site depicted southwest to westerly winds of 10 knots or less, with temperatures in the range of 58° to 63° Fahrenheit (F).

¹ Hectopascal (hPa) is the standard term for reporting pressure and is interchangeable with the former term millibar (mb), where 1 hPa = 1 mb. Standard sea-level pressure is 1013.25-hPa at a temperature of 59° Fahrenheit (F) or 15° Celsius (C).

² Pressure gradient – is the rate of variation of pressure in a given direction, specifically the rate of variation in a direction normal to an isobar.

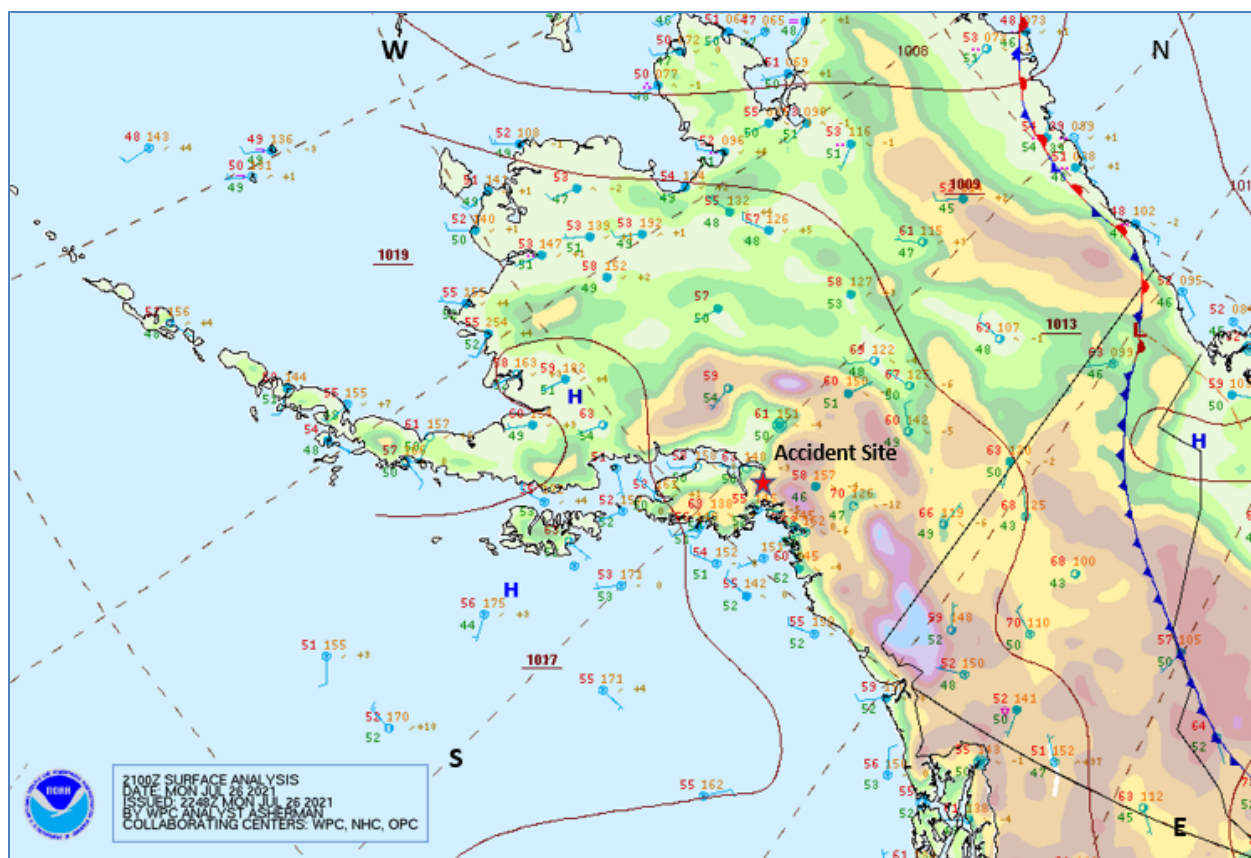


Figure 1 - NWS Surface Analysis Chart for 1300 AKDT with the accident site marked by the red star.

2.0 Observations

The area was documented using official Aviation Routine Weather Reports (METARs³) and Special Reports (SPECI) issued surrounding the period. Cloud heights in the following section are reported above ground level (agl), and the magnetic variation was estimated as 16° east based on the latest sectional chart for the area. Figure 2 below includes a depiction of the weather reporting locations and the accident site.

2.1 NWS METAR Display

The NWS Aviation Weather Center's Helicopter Emergency Medical Services Tool⁴ display of METARs was documented near the time of the accident and provided a graphical display of the weather conditions and general flight categories⁵ with the local terrain. Figure 2 is the 1315 AKDT display of the METARs over the area with the approximate accident site marked by the red star.

³ Meteorological Aerodrome Report (METAR) the international standard weather observation.

⁴ <https://www.aviationweather.gov/hemst>

⁵ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories based on weather conditions reported:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.

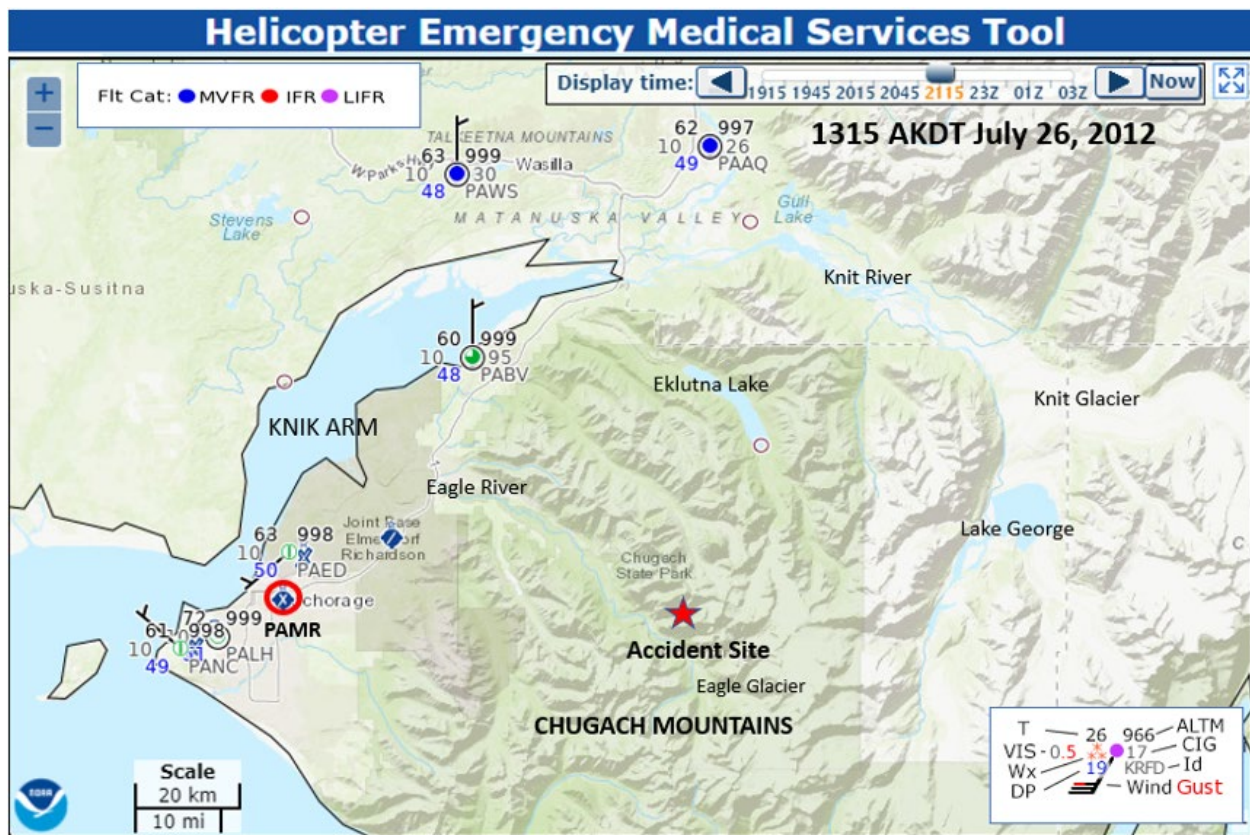


Figure 2 - NWS AWC HEMS Weather Tool display of METARs at 1315 AKDT and accident site.

2.2 Merrill Field Airport, Anchorage, AK

The accident airplane departed from Merrill Field Airport (PAMR), Anchorage, AK, at approximately 1215 AKDT, which was located 21 miles west of the accident site at an elevation of 137 ft. The airport had a federally installed and maintained Automated Surface Observation System (ASOS), but due to faulty communication equipment⁶ was not transmitting the data for dissemination longline at the time of the accident.

- 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.

⁶ The local NWS equipment technician working with the local communication provider found the faulty communication equipment and corrected the issue on August 5, 2021. The problem impacted the dissemination of observations from PAMR for the period from May 25 through August 5, 2021.

2.3 Birchwood Airport, Birchwood, AK

The closest weather reporting facility to the accident site was from Birchwood Airport (PABV), Birchwood, AK, which was located 17 miles northwest of the accident site at an elevation of 83 ft. The airport had an Automated Weather Observation System (AWOS) whose observations were not augmented by any human observers. The following conditions were reported at the approximate time of the accident.

PABV weather observation at 1256 AKDT, automated, wind variable at 3 knots, visibility 10 miles or more, ceiling broken at 9,500 ft agl, temperature 16° C, dew point temperature 9° C, altimeter 29.99 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, sea-level pressure 1016.1-hPa, temperature 15.6° C, dew point temperature 8.9° C, 3-hour pressure tendency fallen 0.4-hPa.

The general flight categories and raw observations reported from 0956 through 1556 AKDT were as follows, with the observation bold italic print the observation decoded above.

MVFR METAR PABV 261756Z AUTO 34003KT 10SM OVC029 14/09 A3000 RMK AO2 SLP165 T01390094 10144 20117 58006=

MVFR METAR PABV 261856Z AUTO 00000KT 10SM OVC027 14/09 A3000 RMK AO2 SLP163 T01440094=

VFR SPECI PABV 261935Z AUTO 32004KT 10SM SCT027 14/10 A3000 RMK AO2=

VFR METAR PABV 261956Z AUTO VRB03KT 10SM FEW095 15/11 A2999 RMK AO2 SLP161 T01500106=

VFR METAR PABV 262056Z AUTO VRB03KT 10SM BKN095 16/09 A2999 RMK AO2 SLP161 T01560089 56004=

Accident 2120Z

VFR METAR PABV 262156Z AUTO VRB03KT 10SM CLR 17/10 A2998 RMK AO2 SLP157 T01720100=

VFR METAR PABV 262256Z AUTO VRB04KT 10SM CLR 18/11 A2997 RMK AO2 SLP154 T01830106=

VFR METAR PABV 262356Z AUTO VRB04KT 10SM CLR 19/09 A2996 RMK AO2 SLP150 T01940094 10194 20139 58011=

2.4 Elmendorf Air Force Base, Anchorage, AK

The next closest weather reporting facility was from Elmendorf Air Force Base (PAED), Anchorage, AK, which was located 20 miles west of the accident site at an elevation of 213 ft. The airport had the military equivalent of an ASOS⁷ and was augmented by observers. The following conditions were reported at the approximate time of the accident.

PAED weather observation at 1256 AKDT, wind from 230° at 4 knots, visibility 10 miles or more, a few clouds at 5,000 ft agl, temperature 17° C, dew point temperature 10° C, altimeter 29.98 inHg.

The general flight categories and raw observations surrounding the period from 0956 through 1556 AKDT were as follows.

⁷ Military ASOS is designated as FMQ-19 is equivalent to the NWS ASOS system.

VFR METAR PAED 261756Z 26005KT 10SM SCT039 BKN060 14/09 A2999=

VFR METAR PAED 261856Z 27006KT 10SM FEW050 SCT090 15/09 A2998=

VFR METAR PAED 261956Z 23005KT 10SM FEW050 FEW180 16/10 A2998=

VFR METAR PAED 262056Z 23004KT 10SM FEW050 17/10 A2998=

Accident 2120Z

VFR METAR PAED 262156Z 24007KT 10SM FEW050 FEW210 18/09 A2997 RMK AO2A SLP144 T01800091 \$=

VFR METAR PAED 262256Z 25007KT 10SM FEW050 SCT190 19/10 A2996=

VFR METAR PAED 262356Z 26007KT 10SM FEW050 SCT190 19/09 A2995=

2.5 Palmer Municipal Airport, Palmer, AK

The next closest weather reporting facility was from Palmer Municipal Airport (PAAQ), Palmer, AK, located 24 miles north of the accident site at 249 ft. The airport had an ASOS whose observations were augmented by tower personnel during normal operating hours. The following conditions were reported.

PAAQ weather observation at 1253 AKDT, wind calm, visibility 10 miles or more, ceiling overcast at 2,600 ft agl, temperature 17° C, dew point temperature 9° C, altimeter 29.97 inHg. Remarks: automated station with a precipitation discriminator, sea-level pressure 1015.1-hPa, temperature 16.7° C, dew point temperature 9.4° C, 3-hour pressure tendency fallen 0.4-hPa.

The general flight categories and raw observations surrounding the period from 0953 through 1553 AKDT were as follows.

VFR METAR PAAQ 261753Z 23005KT 10SM FEW018 SCT026 BKN034 16/09 A2998 RMK AO2 SLP155 T01560094 1015620106 58007=

MVFR SPECI PAAQ 261800Z 00000KT 10SM BKN020 OVC026 15/09 A2998 RMK AO2 T01500094=

MVFR METAR PAAQ 261853Z 18005KT 10SM OVC027 16/09 A2998 RMK AO2 SLP153 T01560094=

MVFR METAR PAAQ 261953Z 17003KT 10SM OVC028 16/09 A2997 RMK AO2 SLP150 T01560094=

MVFR METAR PAAQ 262053Z 00000KT 10SM OVC026 17/09 A2997 RMK AO2 SLP151 T01670094 55004=

Accident 2120Z

MVFR METAR PAAQ 262153Z 00000KT 10SM OVC029 17/09 A2996 RMK AO2 SLP148 T01720094=

VFR SPECI PAAQ 262209Z VRB05KT 10SM OVC031 18/09 A2996 RMK AO2 T01780094=

VFR METAR PAAQ 262253Z 11003KT 10SM OVC033 17/09 A2995 RMK AO2 SLP144 T01720094=

VFR METAR PAAQ 262353Z 01003KT 10SM BKN033 18/10 A2994 RMK AO2 SLP141 T01830100 10189 20150 58010=

2.6 Ted Stevens Anchorage International Airport, Anchorage, AK

The next closest reporting site was from Ted Stevens Anchorage International Airport (PANC), Anchorage, AK, located 25 miles west of the accident site at an elevation of 151 ft. The airport had a federally installed and maintained ASOS whose observations were augmented by observers during the period. The following conditions were reported at the approximate time of the accident.

PANC weather observation at 1253 AKDT, wind from 310° at 4 knots, visibility 10 miles or more, a few clouds at 3,600 ft agl, few clouds at 20,000 ft, temperature 16° C, dew point temperature 9° C, altimeter 29.98 inHg. Remarks: automated station with a precipitation discriminator, sea-level pressure 1015.1-hPa, temperature 16.1° C, dew point temperature 9.4° C, 3-hour pressure tendency fallen 0.5-hPa.

The general flight categories and raw observations surrounding the period from 0953 through 1553 AKDT were as follows.

VFR METAR PANC 261753Z VRB05KT 10SM FEW039 SCT060 14/08 A2999 RMK AO2 SLP156 T01440078 10144 20106 58005=

VFR METAR PANC 261853Z 30005KT 10SM FEW039 SCT060 15/08 A2998 RMK AO2 SLP154 T01500083=

VFR METAR PANC 261953Z 32004KT 10SM CLR 16/09 A2998 RMK AO2 SLP151 T01610089=

VFR METAR PANC 262053Z 31004KT 10SM FEW036 FEW200 16/09 A2998 RMK AO2 SLP151 T01610094 56005=

Accident 2120Z

VFR METAR PANC 262153Z 33004KT 10SM CLR 17/11 A2997 RMK AO2 SLP150 T01720106=

VFR SPECI PANC 262155Z VRB05KT 10SM FEW035 FEW200 17/11 A2997 RMK AO2 T01720106=

VFR METAR PANC 262253Z 32006KT 10SM FEW035 FEW200 17/11 A2996 RMK AO2 SLP147 T01720106=

VFR METAR PANC 262353Z 31007KT 10SM FEW040 FEW200 18/10 A2995 RMK AO2 SLP144 T01830100 10183 20144 58008=

2.7 Eagle River RAWS

A Remote Automated Weather Station (RAWS) site at Eagle River, station #ERVA2, was located approximately 15 miles northwest of the accident site at coordinates of 61.287278° N, 149.470889° W, at an elevation of 464 ft. At 1256 AKDT the system reported a calm wind, with a peak wind gust from 150° at 4 knots, a temperature of 67° F, a dewpoint temperature of 51° F, with a relative humidity of 57%. The system reported winds less than 10 knots surrounding the period, with the highest gust of 6 knots at approximately 1356 AKDT.

3.0 Sounding

The NWS PANC upper air sounding for 1600 AKDT on July 26, 2021, plotted on a standard Skew T log P diagram⁸ from the surface to 450-hPa or approximately 20,000 ft is included as figure 3 using the RAOB software program⁹.

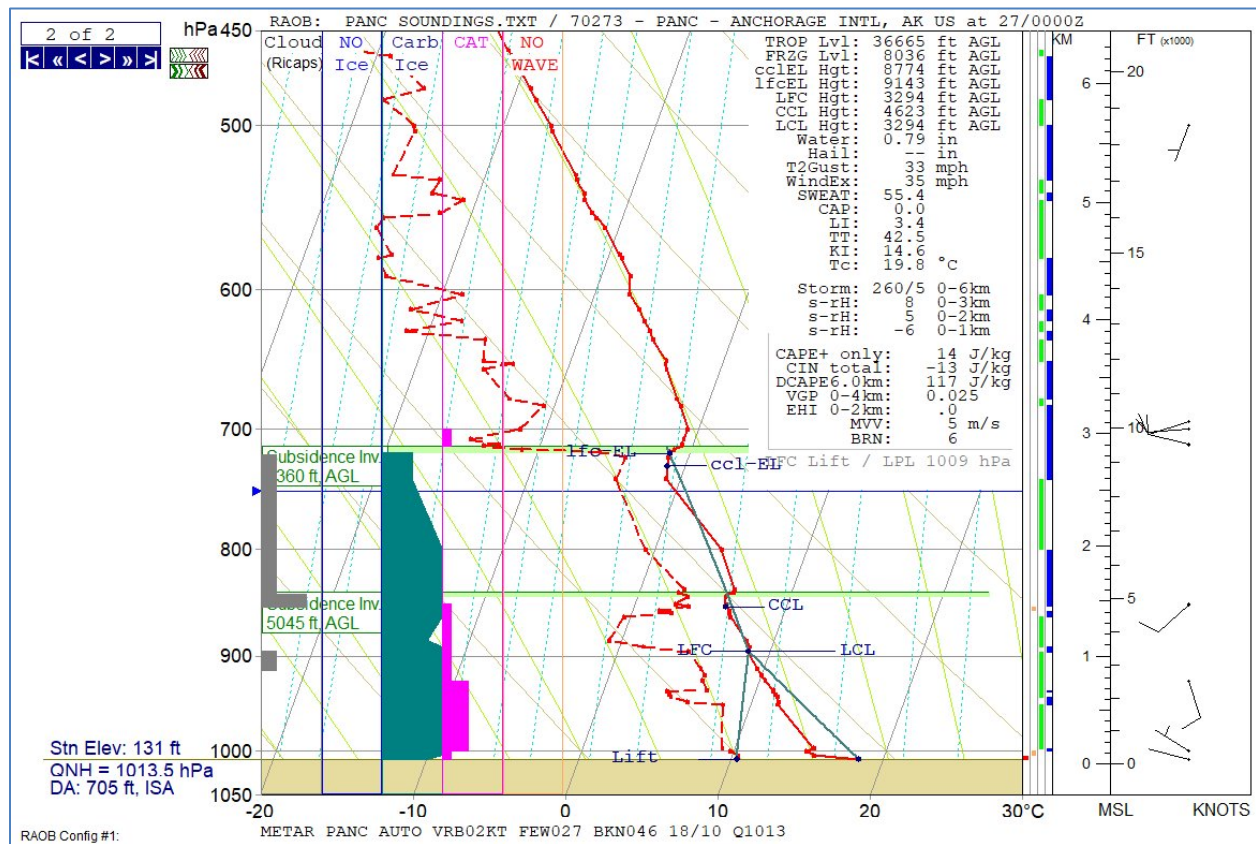


Figure 3 – NWS PANC 1600 AKDT sounding.

The NWS PANC 1600 AKDT sounding depicted a lifted condensation level (LCL)¹⁰ and level of free convection (LFC)¹¹ at 3,294 ft agl, with a convective condensation level (CCL)¹² at 4,623 ft agl, which support a few to scattered clouds at the LCL at approximately 2,700 ft agl and a broken layer at approximately 4,600 ft agl as depicted on the left of the diagram in gray as determined by the RAOB analysis program. The freezing level was identified above 8,000 ft. The sounding indicated several temperature inversions below 10,000 ft, with the atmosphere

⁸ Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram 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.

⁹ RAOB – (The Universal RAWinsonde OBServation program) is an interactive sounding analysis program developed by Eosonde Research Services (ERS) previously known as Environmental Research Services, The Villages, Florida.

¹⁰ Lifting Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

¹¹ Level of free convection (LFC) - is the altitude in the atmosphere where the temperature of the environment decreases faster than the moist adiabatic lapse rate of a saturated air parcel at the same level.

¹² Convective Condensation Level (CCL) - The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.

characterized as stable with a lifted index¹³ of 3.4, and the precipitable water content of 0.79 inches. The sounding supported a moderate to severe risk¹⁴ of carburetor type icing from the surface through 7,000 ft, based on the temperature and relative humidity profiles which is depicted in dark green on the left side of the profile (see section 10.0). The wind profile indicated light variable near-surface winds generally from the west at 10 knots between 5,000 and 10,000 ft. The mean 0 to 6 km (or 18,000 ft) wind was from 230° at 7 knots.

A table of the observed sounding data of height, pressure (Pres), temperature (T), dew point temperature (Td), relative humidity (RH%), wind direction and speed (DD/FF), and derived RAOB parameters for Clear Air Turbulence (CAT), Low-Level Wind Shear (LLWS), Icing type and intensity, and mountain wave potential is included in figure 4.

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)	Wave/x---W---Turb nm fpm max
131	1009	18.4	10.4	60	285 / 2				
242	1005	15.4	10.4	72		LGT	LIGHT		
381	1000	14.8	9.8	72	305 / 6				
465	997	15.2	9.2	67					
1801	950	11.8	8.2	79					
1888	947	11.8	5.8	67					
2033	942	11.6	4.6	62					
2121	939	11.4	4.4	62					
2209	936	11.2	4.2	62					
2238	935	11.2	6.8	74		MDT			
2533	925	10.4	6.3	76	165 / 9				
2711	919	10.0	6.3	78					
2890	913	9.6	5.9	78					
3402	896	8.6	4.7	76					
3554	891	8.6	1.6	61					
3737	885	8.2	-0.8	53					
4449	862	6.6	-0.4	61					
4574	858	6.4	2.6	77					
4637	856	6.4	1.8	72					
4763	852	6.0	3.6	85		LGT			
4826	850	6.0	2.7	79	225 / 8				
5048	843	5.8	3.3	84					
5176	839	6.2	2.6	78					
5272	836	6.2	2.9	79					
6453	800	4.4	-0.6	70					
8518	740	-0.9	-4.2	78					
9163	722	-1.3	-4.1	81					

Figure 4 - PANC sounding parameters from the surface through 9,000 ft.

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 17 (GOES-17) data were obtained from the National Center for Atmospheric Research website¹⁵. The infrared, water vapor, and visible band imagery were reviewed surrounding the period, and the closest images to the

¹³ Lifted Index (LI) - the difference between the lifted parcel temperature at 500 mb and the 500 mb temperature in the sounding. Negative values denote parcels that are warmer than the background 500 mb temperatures and are thus buoyant or "unstable".

¹⁴ Severe Risk identifies a high probability of carburetor icing at cruise or climb power. Based on DOT/FAA-CT-82/110 "ENGINE PERFORMANCE COMPARISON ASSOCIATED WITH CARBURETOR ICING", published May 1983.

¹⁵ <http://weather.rap.ucar.edu/satellite/>

accident time were documented. The infrared long wave imagery (band 14) at a wavelength of 11.2 microns (μm) provided radiative cloud top temperatures, and the low-level water vapor (band 10) at a wavelength of 7.3 μm , both provided a nominal spatial resolution of 2 km, while the visible (bands 1,2 and 3) GeoColor¹⁶ image provided a resolution of 0.5 km. Figure 5-7 are the GOES-17 infrared, low-level water vapor, and visible images for 1305 AKDT, respectively. The infrared imagery depicted clear conditions and warm low-level clouds as bright red to orange colors with the colder clouds in blue shades. While the moisture channel depicted dark colors as dry air and moisture as white to purple layers. The visible image depicted clouds and snow cover as different shades of white, with the clear conditions the true ground cover. The images depicted relatively clear skies over the Anchorage and Knik Arm areas with scattered to broken low-stratocumulus type clouds over the interior sections of southcentral Alaska.

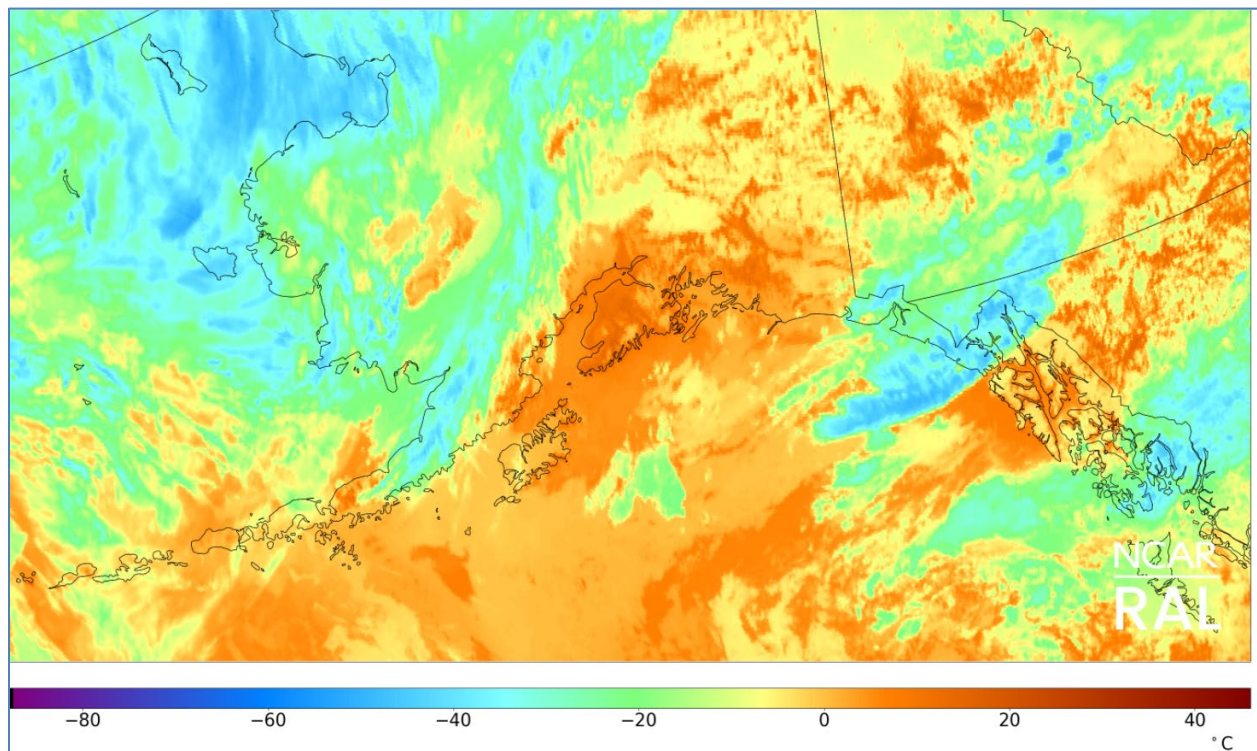


Figure 5 - GOES-17 infrared satellite image for 1305 AKDT.

¹⁶ GeoColor - is a multispectral product composed of True Color (using a simulated green component) during the daytime, and an Infrared product that uses bands 7 and 13 at night. During the day, the imagery looks approximately as it would appear when viewed with human eyes from space. At night, the blue colors represent liquid water clouds such as fog and stratus, while gray to white indicate higher ice clouds, and the city lights come from a static database that was derived from the VIIRS Day Night Band. Developed at the Cooperative Institute for Research (CIRA) and the Regional and Mesoscale Meteorology Branch (RAMMB).

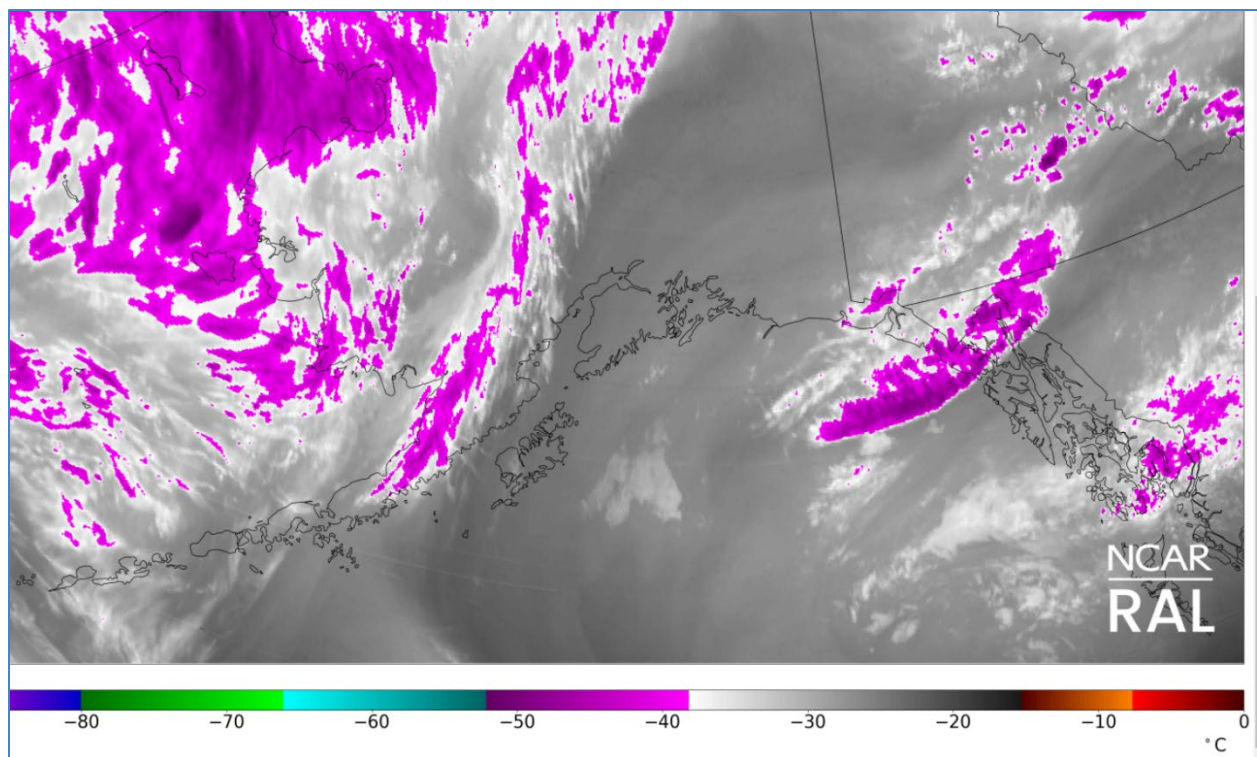


Figure 6 - GOES-17 low-level water vapor image for 1305 AKDT.

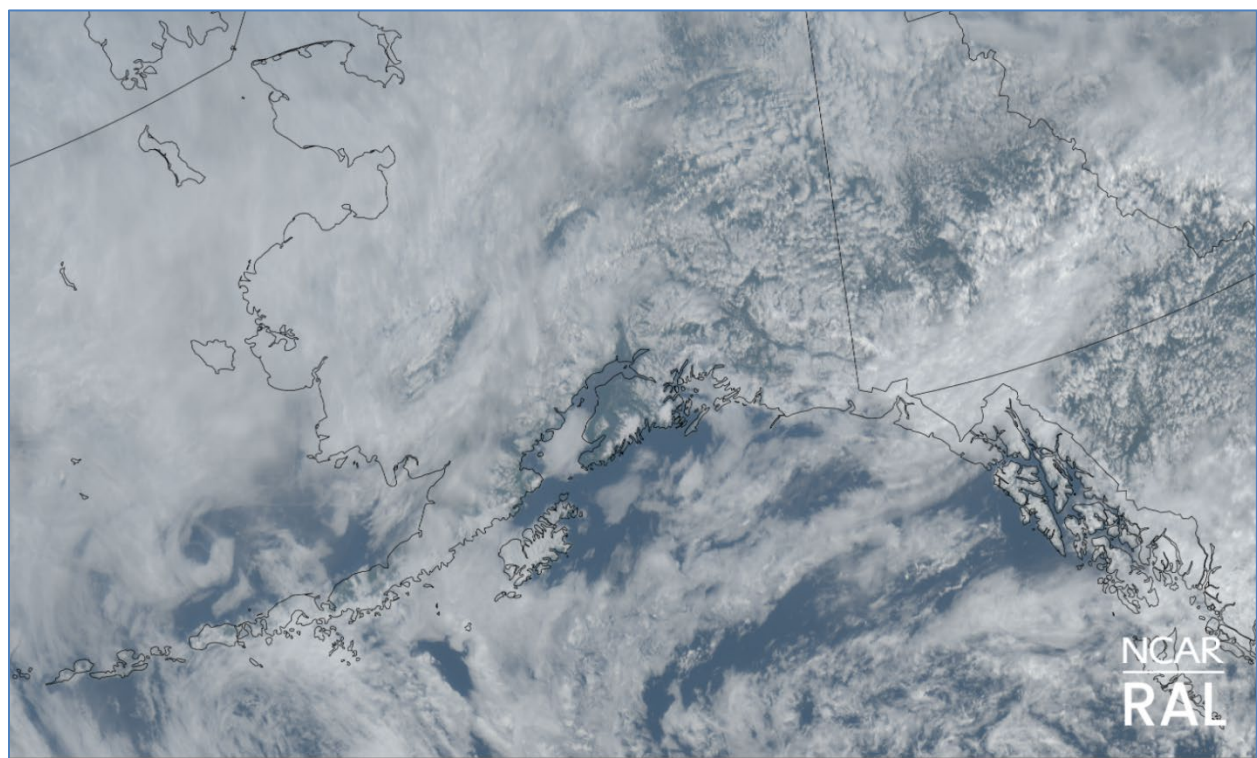


Figure 7 - GOES-17 GeoColor visible image for 1305 AKDT.

5.0 FAA Weather Camera Imagery

The FAA weather camera¹⁷ images from Palmer (PAAQ), Portage Glacier (PATO), and Whittier (IEM) were reviewed and depicted a broken layer of stratocumulus clouds over the region with no significant visibility restrictions. Most of the mountains were still partially covered in snow and with only the tallest mountains south of Portage Glacier and from Whittier were obscured by clouds during the period. Figures 8-10 are the FAA weather camera images from Portage Glacier viewing northwest at 1319 AKDT, Whittier viewing north at 1320 AKDT, and Palmer viewing southeast at 1318 AKDT respectively. None of the camera's views extended over the accident site.

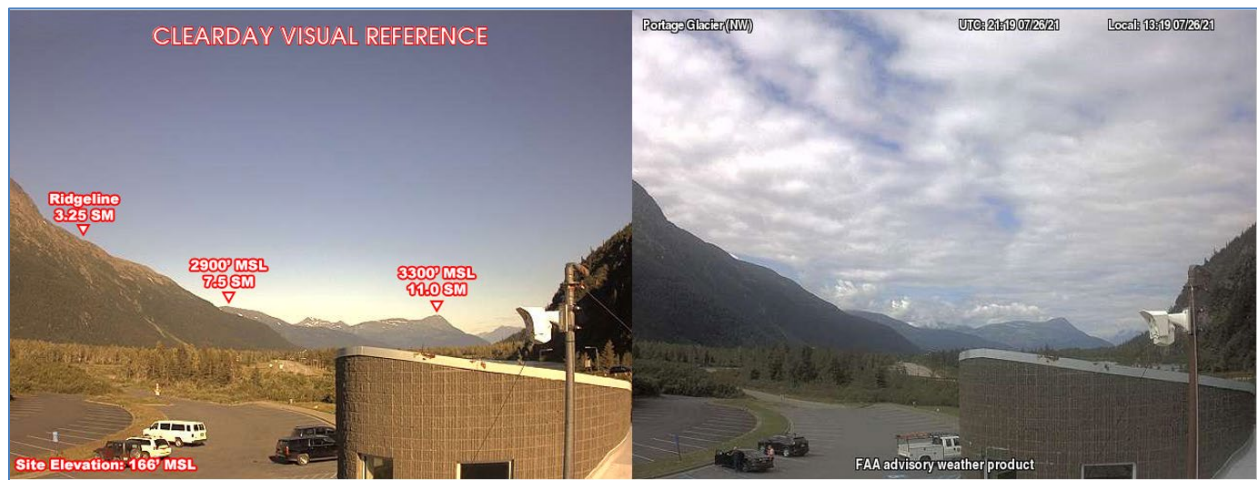


Figure 8 - FAA Portage Glacier northwest camera view on a clear day and at 1319 AKDT.

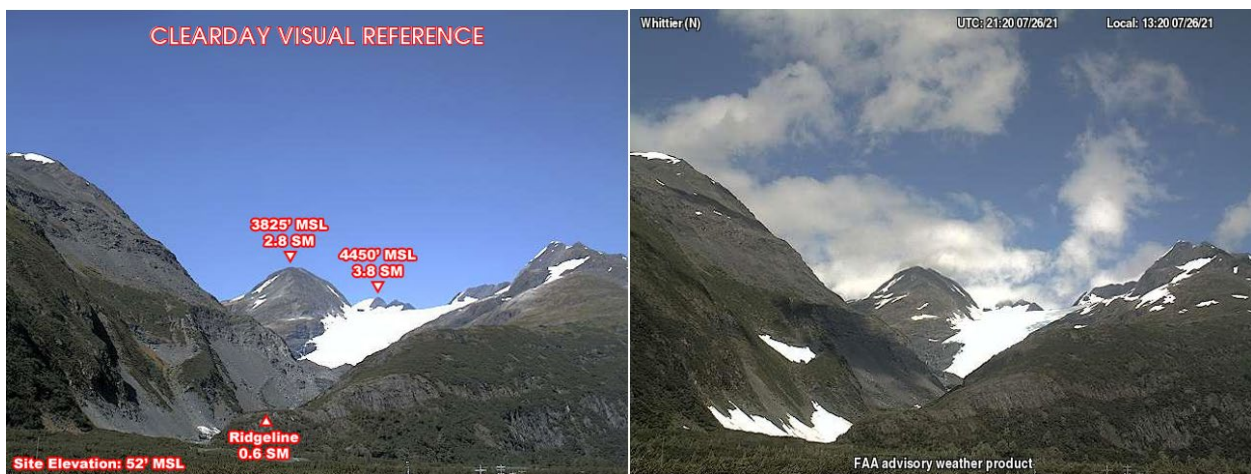


Figure 9 - FAA Whittier north camera view on a clear day and at 1320 AKDT with mountain obscured above 4,450 ft at 3.8 miles.

¹⁷ <https://avcams.faa.gov/>

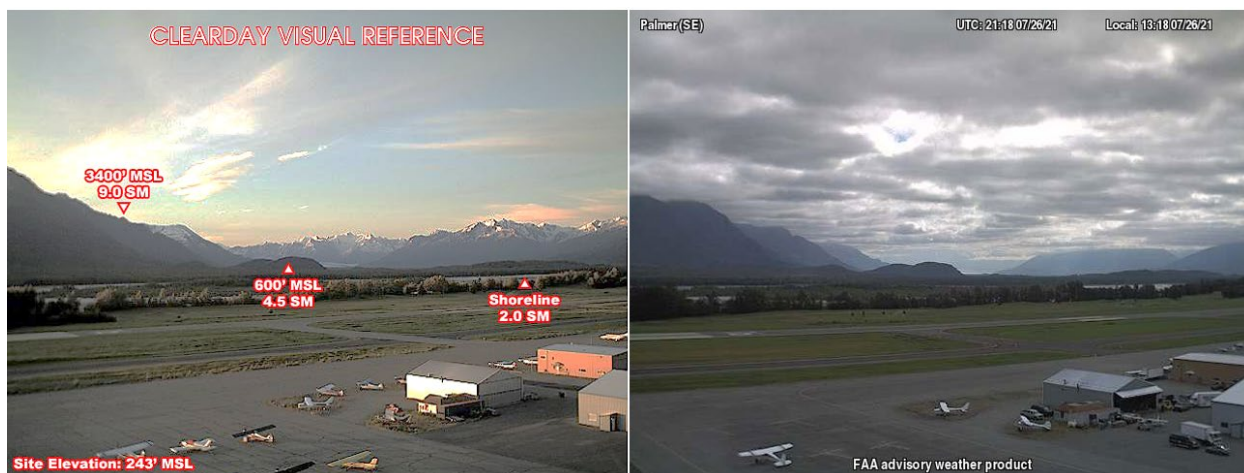


Figure 10 - FAA Palmer southeast weather camera view on clear day and at 1318 AKDT.

6.0 Pilot Reports

A search of pilot reports (PIREPs) indicated only a single report within 120 miles of the accident site between 1000 and 1600 AKDT. The report is included below in raw format and abbreviations, and then decoded in plain language.

ENA UA /OV IYS-BGQ /TM 2004 /FL014 /TP C172 /SK BKN020 /RM(AKFSS)

7.0 NWS Forecasts and Advisories

A review of the basic NWS aviation forecasts issued during the period and applicable for the flight were as follows. The NWS Anchorage Weather Forecast Office (WFO) was responsible for the region, while the AAWU was responsible for issuing tailored aviation weather graphics, products, and warnings.

7.1 Terminal Aerodrome Forecast

The NWS does not issue a Terminal Aerodrome Forecast (TAF) for PAMR. PANC was the next closest station that issued a TAF. The TAF is a concise statement of the expected meteorological conditions at an airport during a specified period, usually 24 hours. TAFs are valid for a 5-mile radius around an airport's center point. Cloud heights are in ft agl. The TAF current for PANC at the time of the accident was as follows:

*TAF PANC 261753Z 2618/2724 VRB03KT P6SM FEW040 BKN090
 FM261900 31006KT P6SM FEW050 BKN100
 FM270600 VRB04KT P6SM SCT025 BKN080
 FM272100 30005KT P6SM FEW025=*

The forecast current at the time expected from 1100 through 2200 AKDT wind from 310° at 6 knots, visibility 6 miles or more, a few clouds at 5,000 ft agl, and a ceiling broken at 10,000 ft.

7.2 Area Forecast

The Anchorage Area Forecast (FA) current for the period was issued at 0518 AKDT and was valid until 1600 AKDT, the forecast was as follows. The Kodiak Island section of the forecast was not reproduced.

*FAAK48 PAWU 261318 AAA
FA8H
ANCH FA 261315 AMD
AK SRN HLF EXCP SE AK...*

*.
AIRMETS VALID UNTIL 262015
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.*

*.
SYNOPSIS VALID UNTIL 270600
A 1009 MB LOW 70NM S PAVC WL MV TO 400NM S PASD AT 1011 MB BY 06Z. A SFC TROF
OVER THE WRN ALUTN CHAIN WL DRIFT TO THE CENTRAL CHAIN BY END OF PD. OTRW HI
PRES RDG WL PRST OVER THE SRN AK MAINLAND AND NRN GULF OF AK THRU THE PD.*

*.
COOK INLET AND SUSITNA VLY AB...VALID UNTIL 270000
...CLOUDS/WX..
AIRMET MT OBSCMTS OBSC IN CLDS. IMPR..
SCT015 BKN050 TOP 120. VCY AK RANGE OCNL BKN015/ISOL -SHRA. TIL 18Z LOW LYING
AREAS ISOL CIGS BLW 010/VIS BLW 3SM BR.
OTLK VALID 270000-270600...VFR.
PASSES..
LAKE CLARK...MERRILL...RAINY...MVFR CIG BR.
PORTAGE...IFR CIG BR.
WINDY...TIL 18Z IFR CIG BR. OTRW MVFR CIG.
...TURB..
NIL SIG.
...ICE AND FZLVL..
NIL SIG. FZLVL 080.*

*.
COPPER RIVER BASIN AC...VALID UNTIL 270000 UPDT
...CLOUDS/WX..
AIRMET MT OBSCMTS OBSC IN CLDS. NC..
SCT020 BKN060 TOP 120. VCY MTS E-S PAGK OCNL BKN020.
OTLK VALID 270000-270600...VFR.
PASS...UPDT
TAHNETA...IFR CIG BR. AFT 22Z MVFR CIG.
...TURB..
NIL SIG.
...ICE AND FZLVL..
ISOL MOD ICEIC 120-160. FZLVL 090.*

*.
CNTRL GLF CST AD...VALID UNTIL 270000
...CLOUDS/WX...*

AIRMET IFROCNL CIGS BLW 010/ISOL VIS BLW 3SM BR. IMPR...
 AIRMET MT OBSCMTS OBSC IN CLDS/ISOL -SHRA. NC...
 OTRW SCT008 OVC020 TOP ST EST 050 W/LYRS ABV TO FL180. OCNL VIS 5SM BR. ISOL -SHRA.
 OTLK VALID 270000-270600...BLIGH ISLAND S MVFR CIG EXC S MONTAGUE ISLAND IFR CIG BR.
 ELSW VFR.
 ...TURB...
 NIL SIG.
 ...ICE AND FZLVL...
 TIL 18Z SE PAVD-PAWD LN ISOL MOD ICEIC 120-160. FZLVL 080.
 .
 JAM JUL 2021 AAWU

The synoptic conditions indicated that a high pressure ridge was expected to persist over southern Alaska mainland and the northern Gulf of Alaska through the period. The Cook Inlet and Susitna Valley region included the Anchorage area with the Copper River Basin region extended over the Knit Glacier and Lake George area. The Cook Inlet forecast area warned of an AIRMET Sierra was current for mountain obscuration in clouds with improving conditions with time, the main forecast was for scattered clouds at 1,500 ft msl, and broken clouds at 5,000 ft with tops near 12,000 ft. In the vicinity of the Alaska Range occasional broken clouds at 1,500 ft with isolated light rain showers till 1000 AKDT were expected. Low lying areas were forecast to see isolated ceilings below 1,000 ft and visibility below 3 miles in mist. The outlook between 1600 and 2200 AKDT expected VFR conditions to prevail. The forecast also indicated that no significant turbulence or icing was expected over the region, with the freezing level identified near 8,000 ft.

The forecast for the Cooper River Basin also warned of mountain obscuration conditions due to clouds with no significant change expected during the period. The main forecast was for scattered clouds at 2,000 ft, and broken clouds at 6,000 ft with tops near 12,000 ft. In the vicinity of mountains east and south of Gulkana (PAGK) occasional broken clouds at 2,000 ft were expected. No significant turbulence was expected, with potential isolated moderate icing in-clouds between 12,000 and 16,000 ft, with the freezing level near 9,000 ft.

The next Area Forecast was issued at 1210 AKDT or immediately prior the accident airplane's departure. The forecast was as follows.

FAAK48 PAWU 262010
 FA8H
 ANCH FA 262015
 AK SRN HLF EXCP SE AK...
 .
 AIRMETS VALID UNTIL 270415
 CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
 NON MSL HEIGHTS NOTED BY AGL OR CIG.
 .
 SYNOPSIS VALID UNTIL 271400
 1010MB LOW S PASD MOV'S SE INTO SRN GULF AK. WK TROF EXTEND N-S OVR
 WRN ALUTN SLOWLY MOV'S E TO VCYPADK BY END PD.
 OTRW HI PRES RDG WL PRST OVER THE SRN AK MAINLAND AND NRN GULF AK
 THRU THE PD.
 .
 COOK INLET AND SUSITNA VLY AB...VALID UNTIL 270800
 ...CLOUDS/WX...
 AIRMET MT OBSCMTS OBSC IN CLDS. IMPR...

PANC N SCT030 SCT060 BKN090 TOPS FL180.
 TIL 22Z W PATK-PANC LN OCNL BKN030. OVR AK RANGE N PAPT ISOL -SHRA.
 TIL 03Z OVR COOK INLET ISOL CIG BLW 010/VIS BLW 3SM BR.
 ELSW SCT100 SCT200.
 OTLK VALID 270800-271400...WRN COOK INLET MVFR CIG. ELSW VFR.
 PASSES...
 LAKE CLARK...MERRILL...MVFR CIG.
 RAINY...WINDY... MVFR CIG ISOL SHRA.
 PORTAGE...VFR.
 ...TURB...NIL SIG.
 ...ICE AND FZLVL...
 AFT 23Z N PAUO ISOL MOD ICEIC 100-FL180. FZLVL 090.
 .
 COPPER RIVER BASIN AC...VALID UNTIL 270800
 ...CLOUDS/WX...
 AIRMET MT OBSCMTS OBSC IN CLDS. NC...
 SCT050 SCT-BKN100 TOPS 160. VCY MTS E PAGK OCNL BKN050.
 PAGK E ISOL BKN050TCU TOP FL200 -SHRA.
 OTLK VALID 270800-271400...VFR.
 PASS...UPDT
 TAHNETA...VFR.
 ...TURB...NIL SIG. EXC VCY TCU.
 ...ICE AND FZLVL...
 NIL SIG. EXC VCY TCU. FZLVL 090.
 .
 CNTRL GLF CST AD...VALID UNTIL 270800
 ...CLOUDS/WX...
 AIRMET IFROFSHR S MONTAGUE IS OCNL CIGS BLW 010/ISOL VIS BLW 3SM BR. NC...
 AIRMET MT OBSCMTS OBSC IN CLDS/ISOL -SHRA. NC...
 NW PAVD-MONTAGUE IS FEW035 SCT100. ISOL BKN035.
 OFSHR S MONTAGUE IS OCNL CIG BLW 010/ ISOL VIS BLW 3SM BR.
 ELSW SCT008 BKN030 BKN100 TOPS 160.
 OTLK VALID 270800-271400...MONTAGUE IS-PACV LN SE IFR CIG BR.
 ELSW VFR.
 ...TURB...NIL SIG.
 ...ICE AND FZLVL...
 NIL SIG. FZLVL 090.
 .
 AB JUL 2021 AAWU

7.3 NWS Aviation Weather Unit Graphics

The NWS Anchorage AAWU issued the following aviation weather graphics during the period; the Flying Weather (figure 11) or depiction of the general flight categories, the Convective Outlook (figure 12), Low-Level Turbulence (figure 13), and Icing Forecast Summary (figure 14). The charts depicted generally VFR conditions expected to prevail over the region, with no thunderstorms or towering cumulus clouds expected, and no significant low-level turbulence or structural icing over the region during the period.

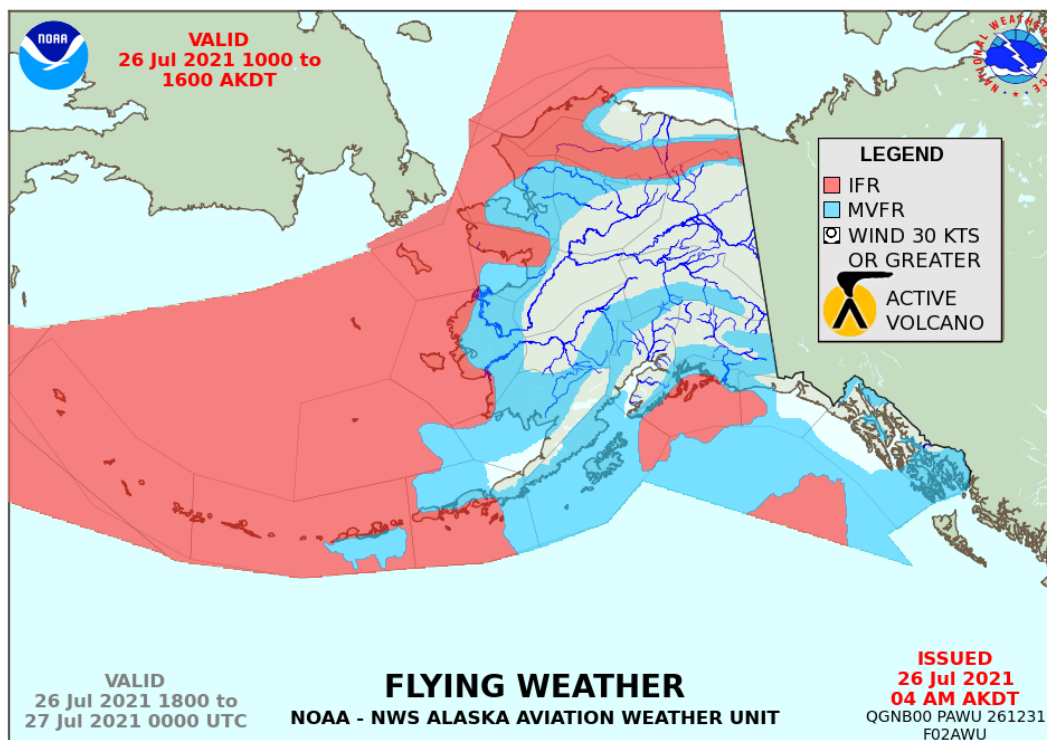


Figure 11 - NWS AAWU Flying Weather general flight categories valid for the period.

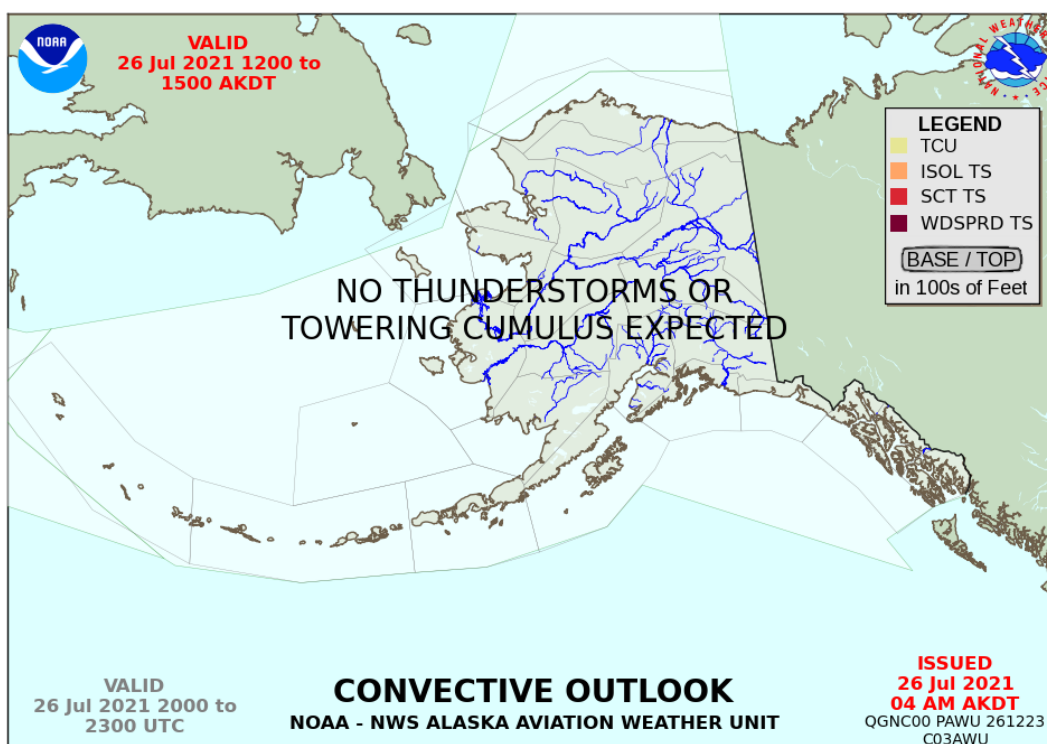


Figure 12 - NWS AAWU Convective Outlook for the period.

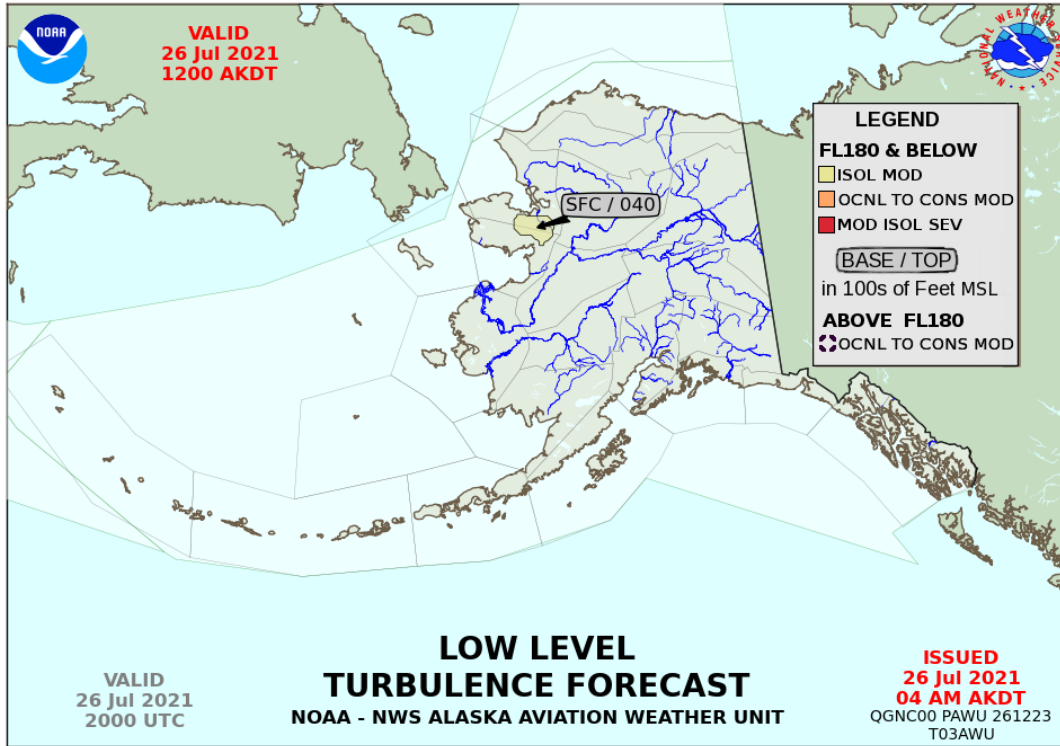


Figure 13 - NWS AAWU Low-Level Turbulence Forecast.

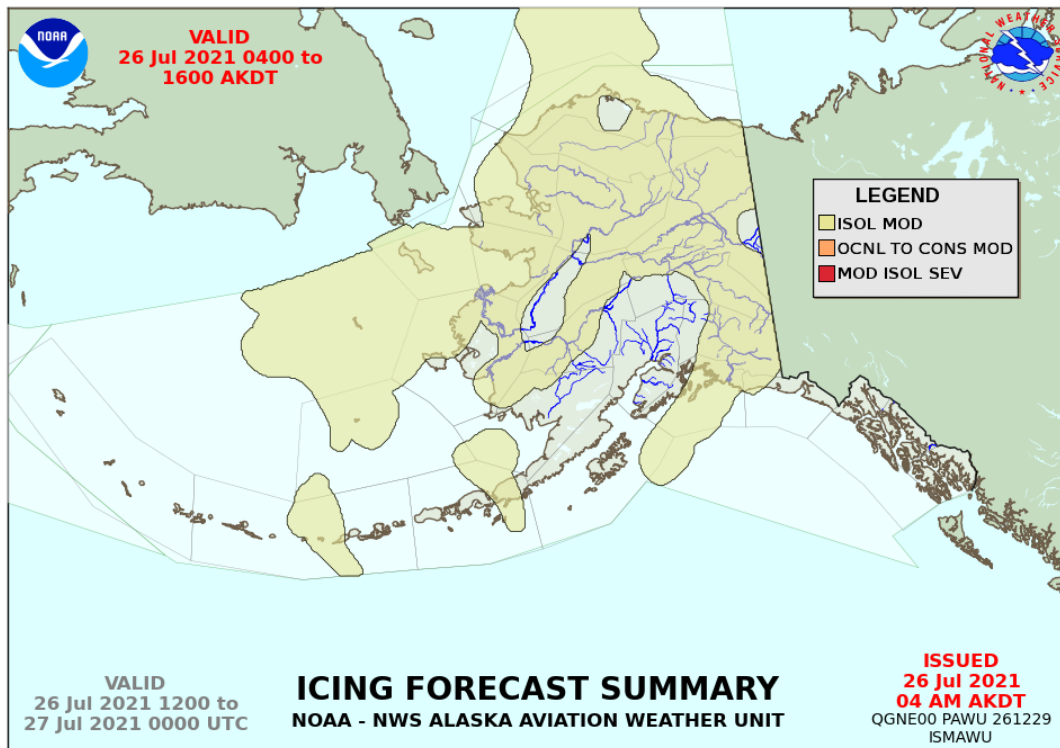


Figure 14 - NWS AAWU Icing Forecast Summary.

8.0 Weather Briefing

A search of the FAA Alaska Flight Service Station records indicated that they had no contact with the accident pilot or aircraft on July 26th for any weather briefing, flight plans, or flight contacts. The accident pilot did have an account with ForeFlight; however, a search of their records indicated the accident pilot did not file any flight plans or put in any specific routes or access any weather imagery on July 26, 2021. The last time the accident pilot accessed ForeFlight was at 0842 AKDT on July 24th. It is therefore unknown what the pilot may have used to familiar himself with weather information prior to departure.

9.0 Astronomical Conditions

The astronomical conditions for Anchorage on July 26th were calculated using the United States Naval Observatory Multiyear Interactive Computer Almanac (MICA) software program¹⁸. The approximate time of the accident is included for reference in bold italic print.

<u>Sun</u>	<u>Time</u>
Begin civil twilight	0405 AKDT
Sunrise	0518 AKDT
<i>Accident</i>	<i>1300 AKDT</i>
Culmination	1406 AKDT
Sunset	2252 AKDT
End civil twilight	0007 AKDT July 27th

At the approximate time of the accident the Sun was 46° above the horizon at an azimuth of 157°.

10.0 Carburetor Ice Potential

Carburetor icing is a condition which can affect any carburetor under certain atmospheric conditions. Carburetor icing is caused by the temperature drop in the carburetor, as an effect of fuel vaporization, and the temperature drop associated with the pressure drop in the venturi. If the temperature drops below freezing, water vapor will freeze onto the throttle valve, and other internal surfaces of the carburetor causing a reduction in power, and in severe cases power failure. The Venturi effect can drop the ambient air temperature by 70° F (38.9° C).

The FAA Advisory Circular 20-113 “Pilot precautions and procedures to be taken in preventing aircraft reciprocating engine induction system and fuel system icing”, was issued in October 1981, and advises pilots to be aware of the potential of carburetor ice when the relative humidity is above 50% and the temperature is below 70° F.

¹⁸ The MICA computes many of the astronomical quantities that are tabulated in the “The Astronomical Almanac” and “The Air Almanac”.

Figure 15 is an icing probability chart based on the Department of Transportation (DOT) and FAA research on engine performance at various temperature and relative humidity ranges, and the potential for carburetor icing¹⁹. A red star represents the conditions reported at PABV at the time of the accident, which were also similar to the conditions reported at PANC, PAED, and PAAQ. The chart indicated a moderate risk of serious carburetor icing (green) conditions at cruise power and severe at glide power and bordered the severe category (blue) for serious icing at any power setting.

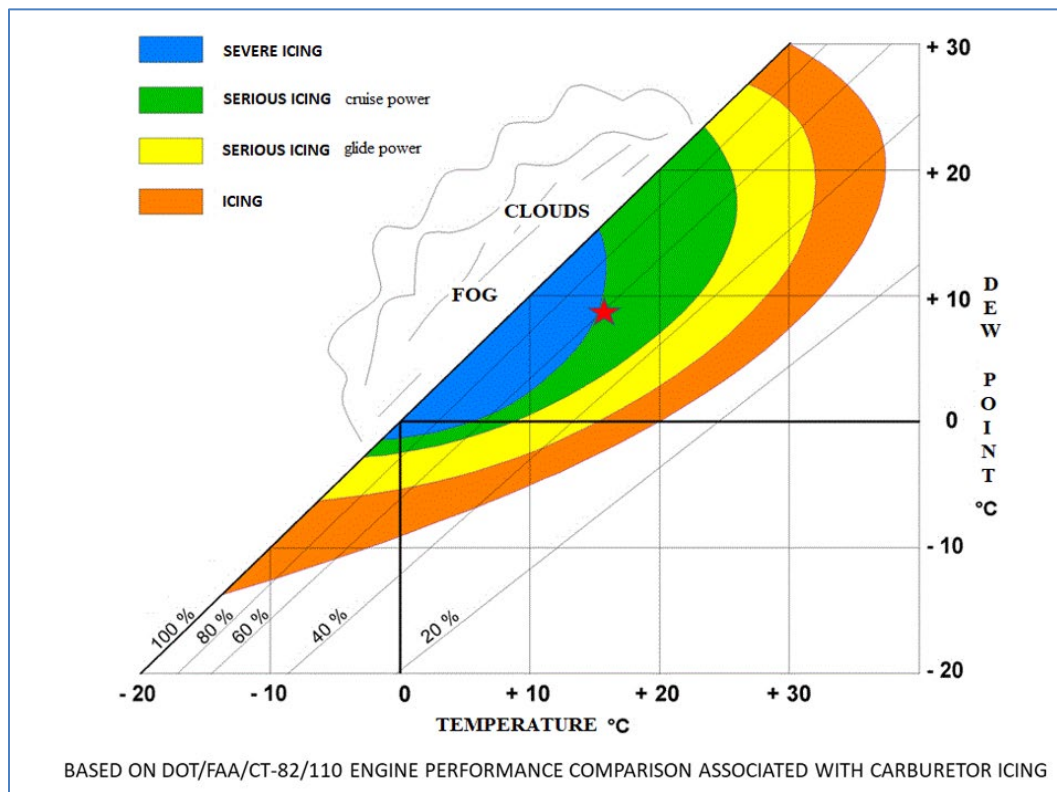


Figure 15 – Carburetor Icing Potential given temperature, dew point, and relative humidity.

Submitted by:

Don Eick
Senior Meteorologist

¹⁹ DOT/FAA-CT-82/110 “ENGINE PERFORMANCE COMPARISON ASSOCIATED WITH CARBURETOR ICING”, published May 1983.

