



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 18, 2016

Weather Study

METEOROLOGY

ANC16FA057

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A. AIRCRAFT ACCIDENT

Location: Chugiak, Alaska
Date: August 13, 2016
Time: 1330 Alaska daylight time (AKDT)
2130 Coordinated Universal Time
Airplane: Champion 7ECA; Registration: N9541S

B. METEOROLOGIST

Don Eick
Group Chairman
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On August 13, 2016 about 1330 Alaska daylight time, a tailwheel-equipped Champion 7ECA (Citabria) airplane, N9541S, was destroyed following a loss of engine power and subsequent loss of control just after takeoff from the Birchwood Airport, Chugiak, Alaska. The sole occupant, the private pilot, sustained fatal injuries. The flight was operated as a visual flight rules (VFR) personal flight under the provisions of Title 14 *Code of Federal Regulations* Part 91 when the accident occurred. Visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed. The flight originated from the Birchwood Airport, about 1330.

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) and the National Center for Environmental Information (NCEI). All times are Alaska daylight 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 above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport Association (IATA) 3-letter identifiers which deletes the initial country code designator "K" for the lower 48 U.S. airports and "P" for Alaska and other Pacific stations. Both codes are both used intermittently in this report. The accident site was located at latitude 61.4205° N and longitude 149.4950° W.

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 Camp Springs, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45G.

1.1 Surface Analysis Chart

The Alaska region of the NWS Weather Prediction Center’s National Surface Analysis Chart for 1300 AKDT (2100Z) on August 13, 2016 is included as figure 1 with the accident site located within the red circle. The chart depicted a closed 994-hectopascal (hPa)¹ contour over the eastern Aleutian Islands to the southwest of the accident site associated with a dissipating occluded front which stretched northeastward along the southern Alaska coastal sections between Kodiak Island and the Kenai Peninsula immediately south of the Anchorage area, and then southeastward off southeastern Alaska’s coast. Further north a trough of low pressure extended over central Alaska to another low pressure system at 1000-hPa north of the accident site. The resultant pressure pattern resulted in a mesoscale ridge of high pressure then to extend over the accident site region with relatively light surface winds.

The station model closest to the accident site was from Anchorage and indicated a wind from the southwest at 10 knots or less, broken to overcast sky conditions, with a temperature near 58° Fahrenheit (F), and a dew point temperature of 54° F.

¹ Hectopascal (hPa) is the new standard reference for sea level pressure and is interchangeable with the older term millibars (mb), with the standard sea level pressure of 1013.2-hPa.

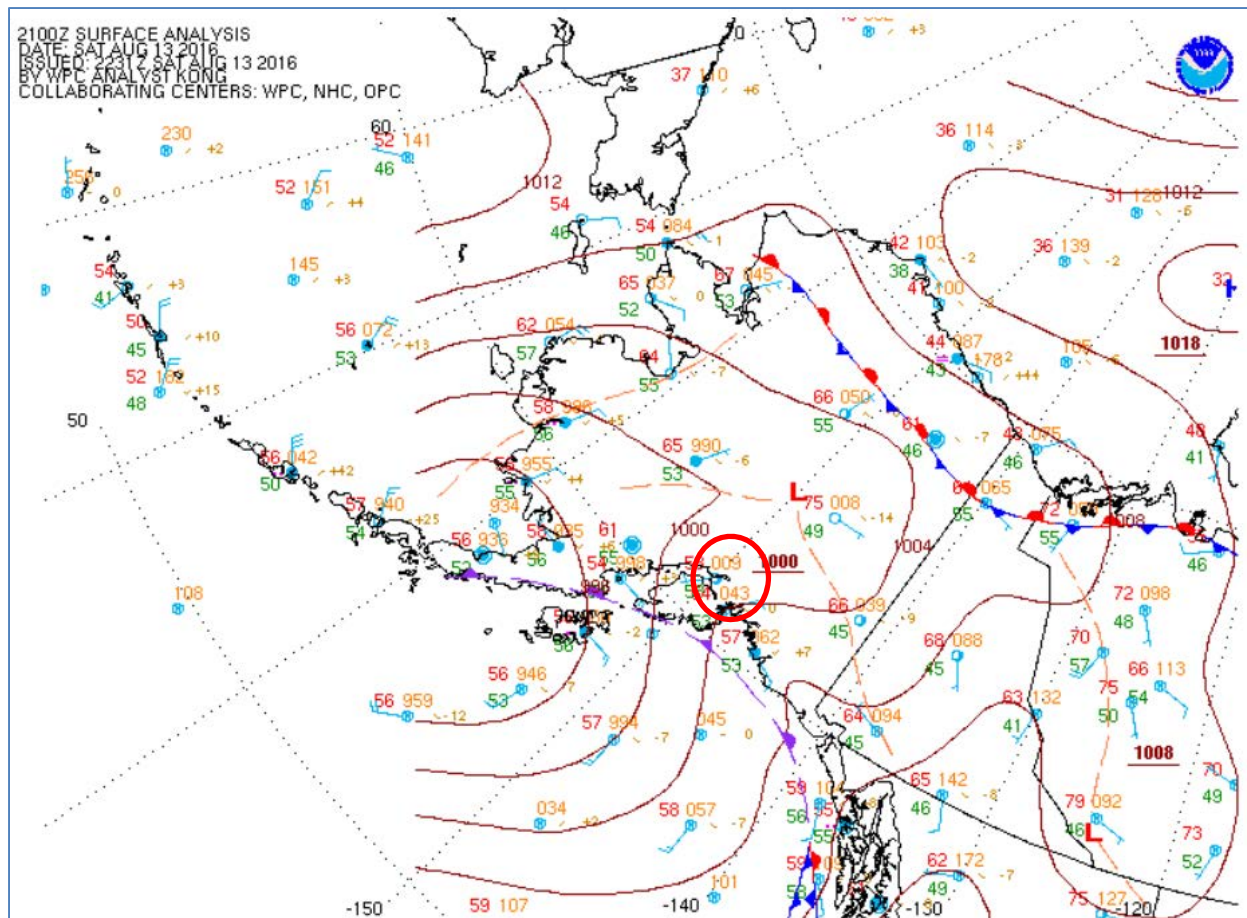


Figure 1 - NWS Alaska Surface Analysis Chart for 1300 AKDT on August 13, 2016

1.2 Surface Prognostic Chart

The NWS Alaska Aviation Weather Unit (AAWU) located in Anchorage weather products were also reviewed and documented. Figure 2 is the NWS AAWU Surface Prognostic Chart valid for 1800 AKDT on August 13, 2016 identifying the primary surface features and forecast precipitation over Alaska during the afternoon on the day of the accident. The chart depicted a low pressure system at 992-hPa over the eastern Aleutian Islands near Kodiak Island moving east-southeast at 5 knots, with a trough of low pressure extending along the southern Alaska coastal sections. Over interior Alaska to the north of the accident site a second low pressure system at 998-hPa was indicated with a similar trough of low pressure extending northeastward. The chart depicted most of southern Alaska and the accident site expected continuous rain and mist, while further north near the second low pressure area a risk of thunderstorms were noted.

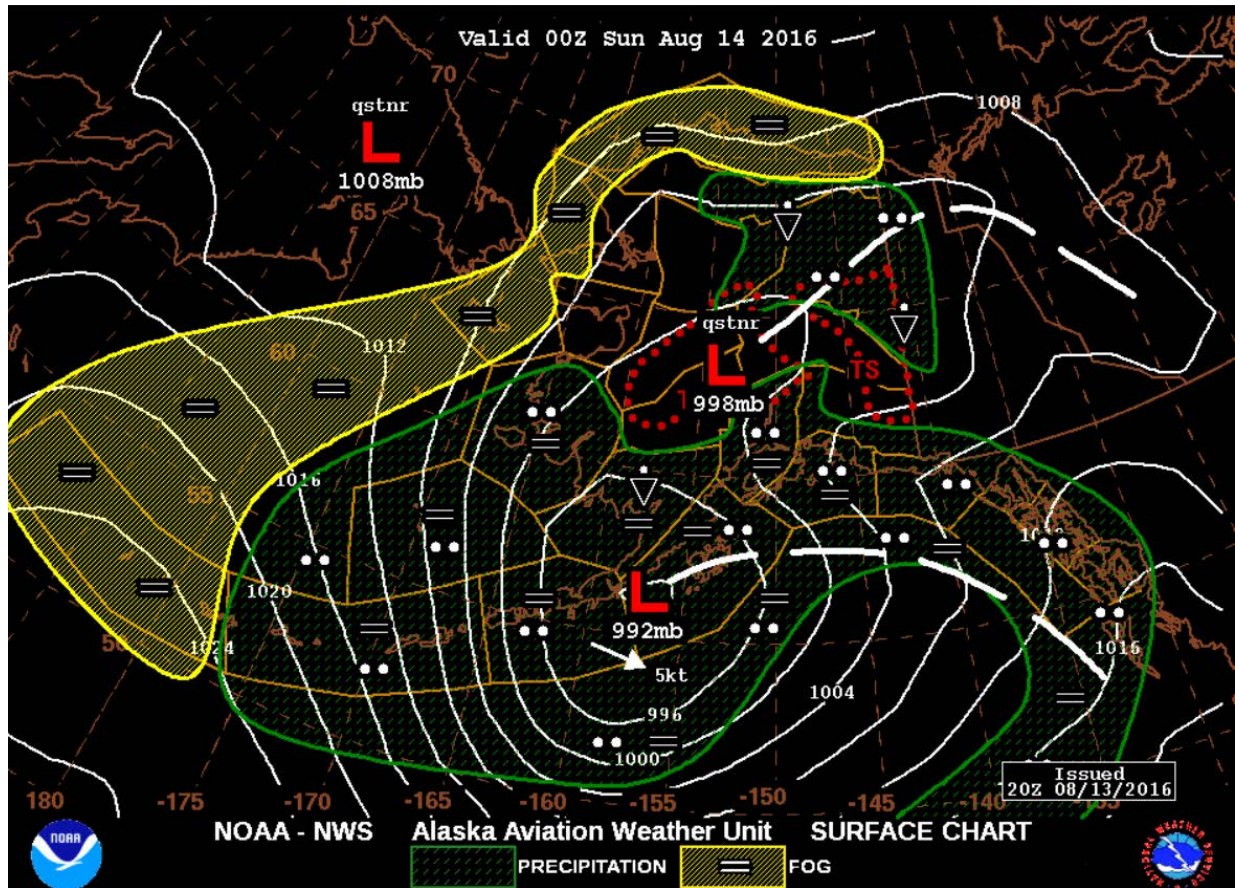


Figure 2 - NWS Alaska Aviation Weather Center's 1800 AKDT Surface Prognostic Chart

2.0 Surface Observations

The official NWS Meteorological Aerodrome Reports (METARs) or aviation routine weather report and special reports (SPECIs) surrounding the period were documented for the departure and the closest airports to the accident site. The cloud heights are reported above ground level (agl) in the observations. Figure 3 is a regional plot of the NOAA sectional chart for the region with the closest airports and weather facilities noted.

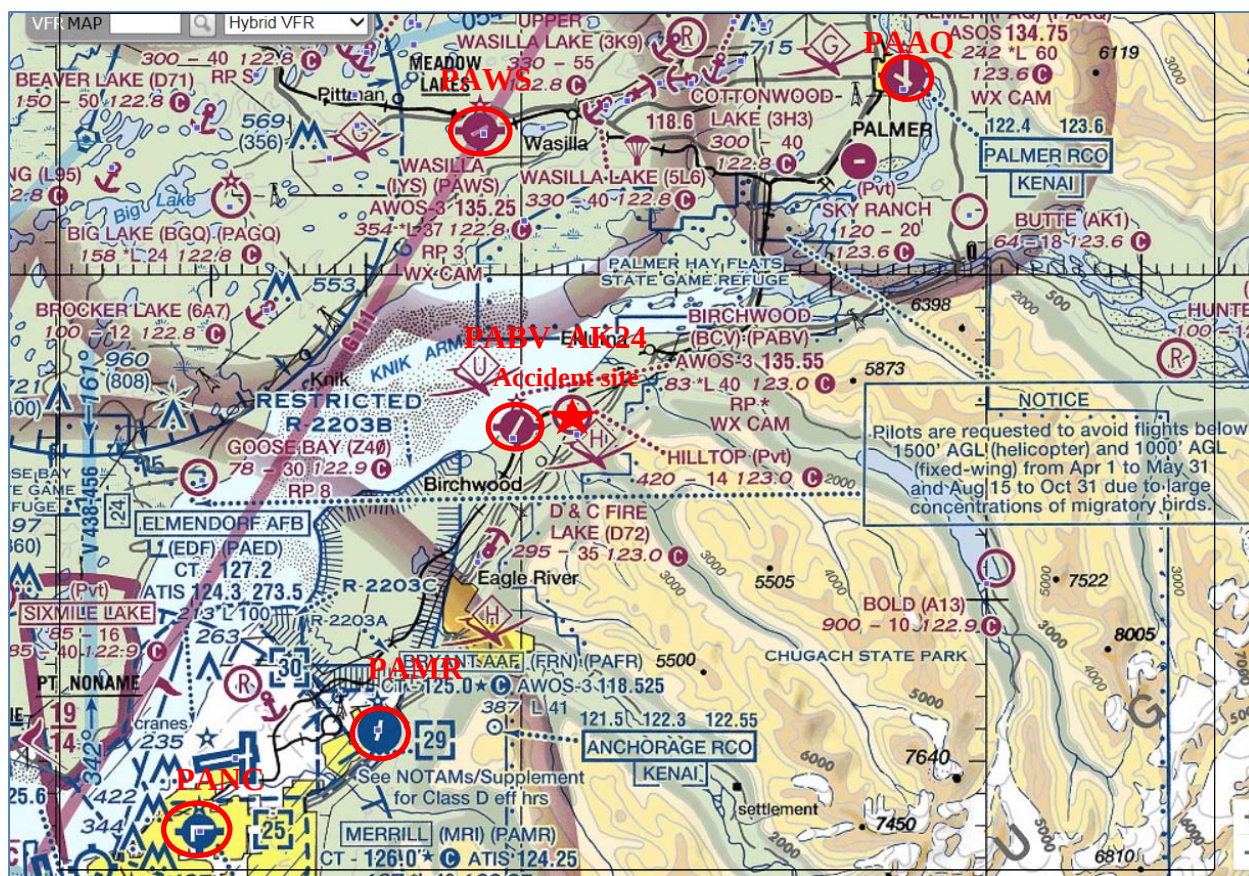


Figure 3 - Sectional map of the general region and weather reporting locations

2.1 Hilltop Airport (AK24), Chugiak, AK

The accident airplane departed from Hilltop Airport (AK24), Chugiak, AK which lists an elevation of 420 feet and a magnetic variation of 25° East. It is listed as a private airport and other than a wind indicator does not have any weather reporting systems installed that disseminates weather conditions. The airport had a single gravel runway 3/21 which was 1,400 feet long X 22 feet wide, with trees listed on both ends of the runway.

2.2 Birchwood Airport (PABV), Birchwood, AK

The nearest weather reporting facility was from Birchwood Airport (PABV) located approximately 2 miles west of Hilltop Airport at an elevation of 83 feet, and a magnetic variation of 25° east. The airport had an Automated Weather Observation System (AWOS); however, the system was inoperative between 0200 AKDT on August 5th through 1056 AKDT on August 15, 2016 due to sensor issues.

2.3 Wasilla Airport (PAWS), Wasilla, AK

The next closest weather reporting facility was located approximately 10 miles north at Wasilla Airport (PAWS), Wasilla, AK at an elevation of 354 feet, and a magnetic variation of

18° east. The airport had an AWOS and issued observations every 20-minutes. The following weather conditions were reported at the approximate time of the accident:

Wasilla Airport weather at 1336 AKDT, wind from 090° at 5 knots, visibility 10 statute miles, a few clouds at 8,000 feet agl, scattered clouds at 12,000 feet, temperature 18° Celsius (C), dew point temperature 9° C, altimeter 29.56 inches of mercury (Hg). Remarks: automated observation system without a precipitation discriminator.

The raw observations issued immediately in the hour surrounding the time of the accident were as follows:

METAR PAWS 132036Z 08006KT 10SM FEW080 19/09 A2955 RMK AO1

METAR PAWS 132056Z 12006KT 10SM SCT090 18/09 A2956 RMK AO1 57003

METAR PAWS 132116Z 09006KT 10SM FEW090 SCT120 18/09 A2956 RMK AO1

METAR PAWS 132136Z 09005KT 10SM FEW080 SCT120 18/09 A2956 RMK AO1

METAR PAWS 132156Z 09004KT 10SM FEW080 BKN110 19/09 A2956 RMK AO1

METAR PAWS 132216Z 07005KT 10SM SCT120 18/09 A2956 RMK AO1

METAR PAWS 132236Z 07006KT 10SM BKN110 18/09 A2956 RMK AO1

2.4 Bryant Air Force Base (PAFR), Fort Richardson/Anchorage, AK

The next closest weather reporting facility was Bryant Air Force Base (PAFR) located approximately 11 miles southwest of the accident site at an elevation of 387 feet, and a magnetic variation of 19° east. The airport also had an AWOS and issued observations every 20 minutes. The observation closest to the time of the accident was as follows:

Bryant Field weather observation at 1334 AKDT, automated, wind from 210° at 4 knots, visibility 10 miles, ceiling overcast at 7,000 feet agl, temperature 15° C, dew point temperature 14° C, altimeter 29.58 inches of Hg. Remarks: automated observation system without a precipitation discriminator.

The raw observations in the hours surrounding the time of the accident were as follows:

METAR PAFR 132034Z AUTO 00000KT 10SM SCT040 SCT070 14/14 A2957 RMK AO1

METAR PAFR 132054Z AUTO 22004KT 10SM CLR 15/14 A2958 RMK AO1

METAR PAFR 132114Z AUTO 00000KT 10SM BKN070 14/13 A2958 RMK AO1

METAR PAFR 132134Z AUTO 21004KT 10SM OVC070 15/14 A2958 RMK AO1

METAR PAFR 132154Z AUTO 19003KT 10SM OVC070 16/14 A2958 RMK AO1

METAR PAFR 132216Z AUTO 20003KT 10SM OVC070 16/13 A2958 RMK AO1

METAR PAFR 132134Z AUTO 21004KT 10SM OVC070 15/14 A2958 RMK AO1

2.5 Palmer Municipal Airport (PAAQ), Palmer, AK

Palmer Municipal Airport (PAAQ) was located approximately 15 miles northeast of the accident site in Palmer, AK at an elevation of 242 feet, and a magnetic variation of 20° east. The airport had a federally installed and maintained Automated Surface Observation System (ASOS) and reported the following conditions at the approximate time of the accident:

Palmer Municipal Airport weather at 1253 AKDT, wind from 130° at 13 knots, visibility 10 miles, scattered clouds at 8,000 feet agl, ceiling broken at 10,000 feet, and broken at 20,000 feet, temperature 18° C, dew point 11° C, altimeter 2956 inches of Hg. Remarks: sea level pressure 1001.2-hPa, temperature 18.3° C, dew point 10.6° C, 3-hour pressure tendency decreased 0.8-hPa.

The raw observations surrounding the period were as follows:

METAR PAAQ 131953Z 13014KT 10SM SCT090 BKN120 17/11 A2957 RMK SLP013 T01720106 VIA AUTODIAL=

METAR PAAQ 132053Z 13013KT 10SM SCT080 BKN100 BKN200 18/11 A2956 RMK SLP012 T01830106 56008 VIA AUTODIAL=

METAR PAAQ 132153Z 15012KT 10SM SCT080 BKN100 BKN200 17/09 A2956 RMK SLP013 T01720094 VIA AUTODIAL=

METAR PAAQ 132253Z 13014KT 10SM SCT080 BKN100 BKN200 19/10 A2956 RMK SLP012 T01890100 VIA AUTODIAL=

2.6 Ted Stevens Anchorage International Airport (PANC), Anchorage, AK

Ted Stevens Anchorage International Airport (PANC), Anchorage was located approximately 22 miles southwest of the accident site at an elevation of 151 feet, and a 18° east magnetic variation. The airport also had a federally installed and maintained ASOS system and reported the following condition at the approximate time of the accident:

Ted Stevens Anchorage International Airport weather at 1253 AKDT, wind from 320° at 3 knots, visibility 10 miles, a few clouds at 300 feet agl, scattered clouds at 4,500 feet, ceiling broken at 9,000 feet, broken at 13,000 feet, temperature 16° C, dew point 13° C, altimeter 29.57 inches of Hg. Remarks: automated weather observation system, rain ended at 1219 AKDT, sea level pressure 1001.5-hPa, hourly precipitation less than 0.01 inches, 3-hour precipitation 0.04 inches, temperature 16.1° C, dew point 13.3° C, 3-hour pressure tendency falling 0.1-hPa.

The raw observations surrounding the period were as follows:

METAR PANC 131953Z 27003KT 10SM -RA FEW003 SCT045 BKN090 BKN130 15/13 A2957 RMK AO2 SLP014 LOW ST NW AND E-SE P0002 T01500128=

*METAR PANC 132053Z 32003KT 10SM FEW003 SCT045 BKN090 BKN130 16/13 A2957 RMK AO2 RAE19
SLP015 P0000 60004 T01610133 58001=*

*METAR PANC 132153Z 34005KT 10SM FEW003 SCT060 BKN100 BKN140 17/14 A2957 RMK AO2 SLP015
T01670139=*

*METAR PANC 132253Z 31003KT 10SM -RA FEW003 SCT060 BKN100 BKN140 BKN200 16/14 A2957 RMK
AO2 RAB14 SLP014 P0000 T01610144=*

*METAR PANC 132353Z 00000KT 10SM -RA FEW010 SCT060 BKN090 BKN140 OVC200 16/14 A2957 RMK
AO2 SLP013 P0002 60006 T01610139 10167 20133 58002=*

3.0 Upper Air Sounding

The closest upper air sounding or rawinsonde observation (RAOB) was from the NWS Anchorage Forecast Office (PANC), located at Ted Stevens Anchorage International Airport, site number 70273, and located approximately 22 miles southwest of the accident site at an elevation of 151 feet. The 1600 AKDT (0000Z on August 14, 2016) sounding was plotted on a standard Skew-T log P diagram² from the surface to 500-hPa or 18,000 feet utilizing RAOB software³, and is included as figure 4.

The sounding reported a calm surface wind at the surface with a temperature of 14.8° C (58° F), a dew point of 14.2° C (57.6° F), with a relative humidity of 96%, and a density altitude of 772 feet. A surface based temperature inversion due to subsidence was identified to 394 feet agl or 525 feet msl, where temperature increased with altitude and slightly drier air was identified. The lifted condensation level (LCL)⁴ was identified at 250 feet agl, the level of free convection (LFC)⁵ at 4,520 feet agl, and the convective condensation level (CCL)⁶ at 5,225 feet agl. The layer between CCL through 16,000 feet had a relative humidity of 75% or greater and supported clouds development. The freezing level or 0° C was identified at approximately 8,100 feet and supported icing in-clouds above this level. The temperature and humidity profiles supported a high probability of severe carburetor icing from the surface through 7,000 feet.

² 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.

³ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

⁴ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

⁵ Level of Free Convection (LFC) -The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

⁶ Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation starts. This is typically used to identify the base of cumuliform clouds, which are normally produced from surface heating and thermal convection.

The sounding stability indices indicated a conditional unstable atmosphere with a Lifted Index (LI)⁷ of -1.0, and a K-index⁸ of 29.2, which indicated an approximate 60% probability of air mass type convection. The precipitable water content of the sounding was 0.91 inches.

The sounding wind profile indicated calm surface wind with winds from the east immediately above the surface inversion veering to the southeast with height. A low level wind maximum was identified at approximately 5,000 feet with winds from 130° at 24 knots. The mean 0 to 6 kilometer or 18,000 feet wind was from 140° at 17 knots. A minimal low-level wind shear (LLWS) condition was identified below 525 feet due to the inversion and winds increasing immediately above. A strong shear was also noted at approximately 3,000 and 4,500 feet due to strong vertical wind shears of 8 knots per 1,000 feet or more.

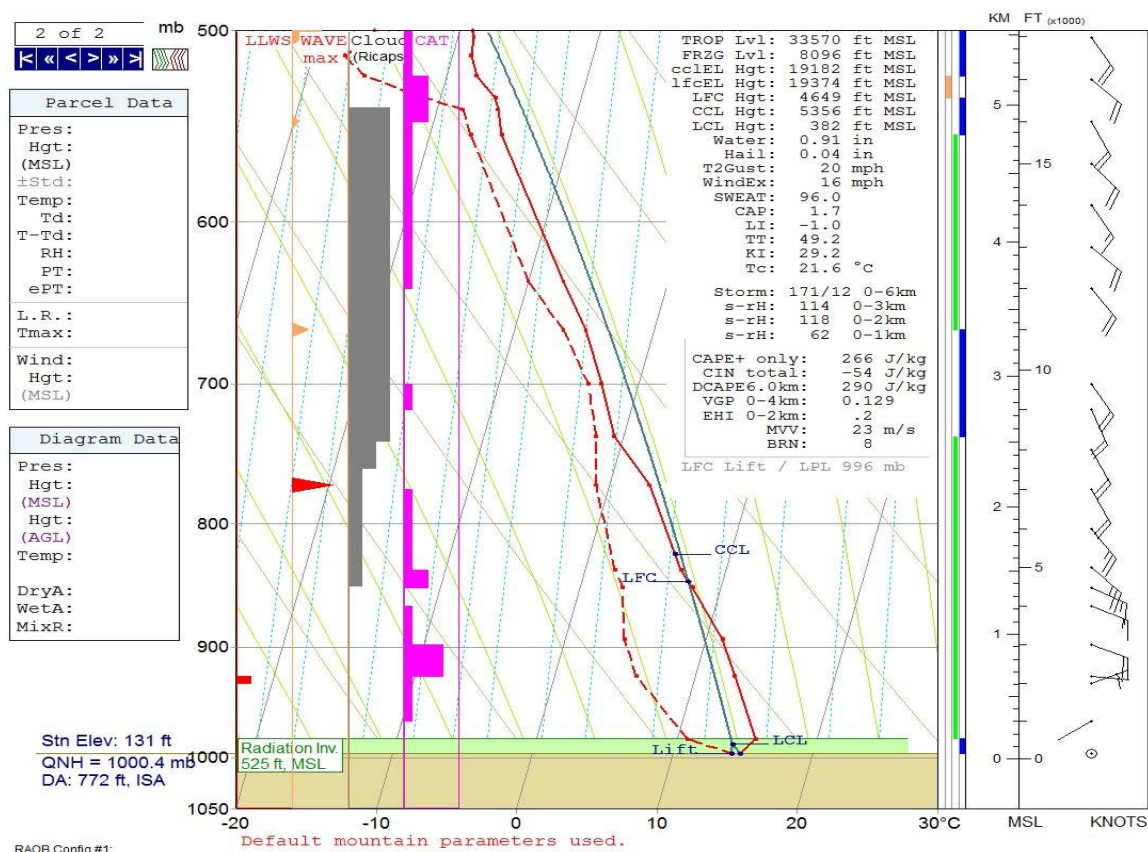


Figure 4 - Anchorage 1600 AKDT sounding

⁷ Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to 500-hPa or approximately 18,000 feet and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

⁸ K-Index - The measure of thunderstorm potential based on the vertical temperature lapse rate, the moisture content of the lower atmosphere and the vertical extent of the moist layer. The higher the K-Index value the greater the probability of air mass type thunderstorm development across the region.

Figure 5 is a table of the observed sounding data of height, pressure, temperature, dew point temperature, relative humidity, wind direction and speed, and derived clear air turbulence (CAT), LLWS, icing, and mountain wave turbulence potential to 12,000 feet. The sounding indicated a high potential of moderate turbulence and greater between 3,000 and 4,500 feet due to the low-level wind maximum, with light winds below 2,000 feet and light LLWS and turbulence potential.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD/FF (deg/ kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)	Wave/x-W-Turb nm fpm max
131	996	14.8	14.2	96	0/0				
525	982	15.6	10.7	73					
1000	965				240/1	LGT			
2000	931				70/4	LGT	LIGHT		
2183	925	12.8	5.8	62	95/7	SVR			
3000	898				110/19				
3151	893	11.2	4.2	62		LGT			
4000	866				110/15				
4497	850	8.0	3.0	71	115/17	MDT			
4946	836	6.8	2.1	72	130/24	LGT			
6000	804				140/23	LGT			
7000	774				150/22				
7114	771	2.8	-1.0	76					7.25 2004 MD-SV
8000	746				150/22				
8342	736	-0.7	-2.0	91				TRC Rime	
9000	718				155/21	LGT			
9654	700	-2.7	-3.6	94	145/20			LGT Rime	
10985	665	-4.9	-6.5	89				LGT Clear	3.18 539 LT-MD
12000	639				140/19				

Figure 5 - sounding parameters

4.0 Aircraft Sounding

A search of the NOAA Global System Division's Aircraft Meteorological Data Relay (AMDARs) reports surrounding the period provided additional sounding information from instrumented aircraft operating in and out of Anchorage International Airport near the time of the accident. Figure 6 is a plot of aircraft identified as #10538 departing at 1305 AKDT (2105Z) and providing a vertical plot of temperature and the wind field through 6,000 feet. A defined temperature inversion is noted near 1,710 feet with winds less than 10 knots below this layer. The highest wind observed was 21 knots at 6,900 feet.

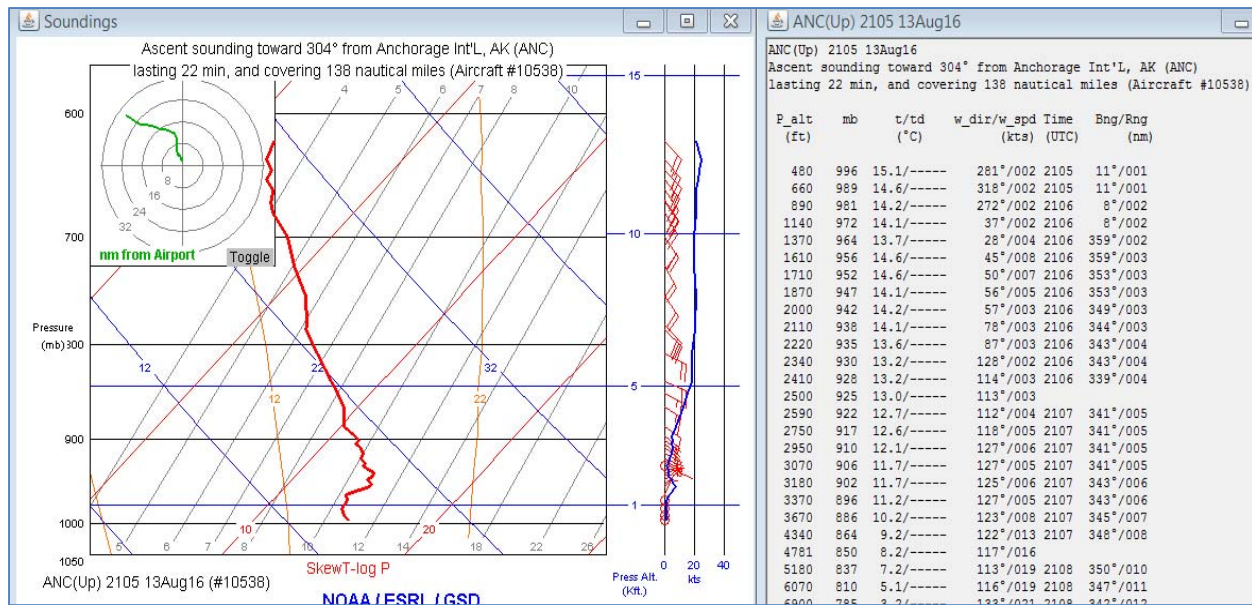


Figure 6 - Aircraft ascent sounding from Anchorage at 1305 AKDT

5.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 15 (GOES-15) data was obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident. The infrared long wave imagery (band 4) at a wavelength of 10.7 microns (μm) provided standard satellite image with radiative cloud top temperatures with a resolution of 4 km. The visible imagery (band 1) at a wavelength of 0.65 μm provided a resolution of 1 km.

Figure 7 is the GOES-15 visible image at 2X magnification for 1330 AKDT over the region and with the accident site marked by the red square on the image. The image depicted an extensive area of broken to overcast low to mid-level stratiform type clouds over southcentral Alaska coastal region, which extended over the accident site. Further north over the interior section of Alaska the cloud cover is more broken in coverage with some vertical extensive towering cumulus clouds. The GOES-15 infrared image for the same period indicated a radiative cloud top temperature of 253° Kelvin or -20.16° C over the accident site, which corresponded to cloud tops near 18,500 feet based on the Anchorage sounding.

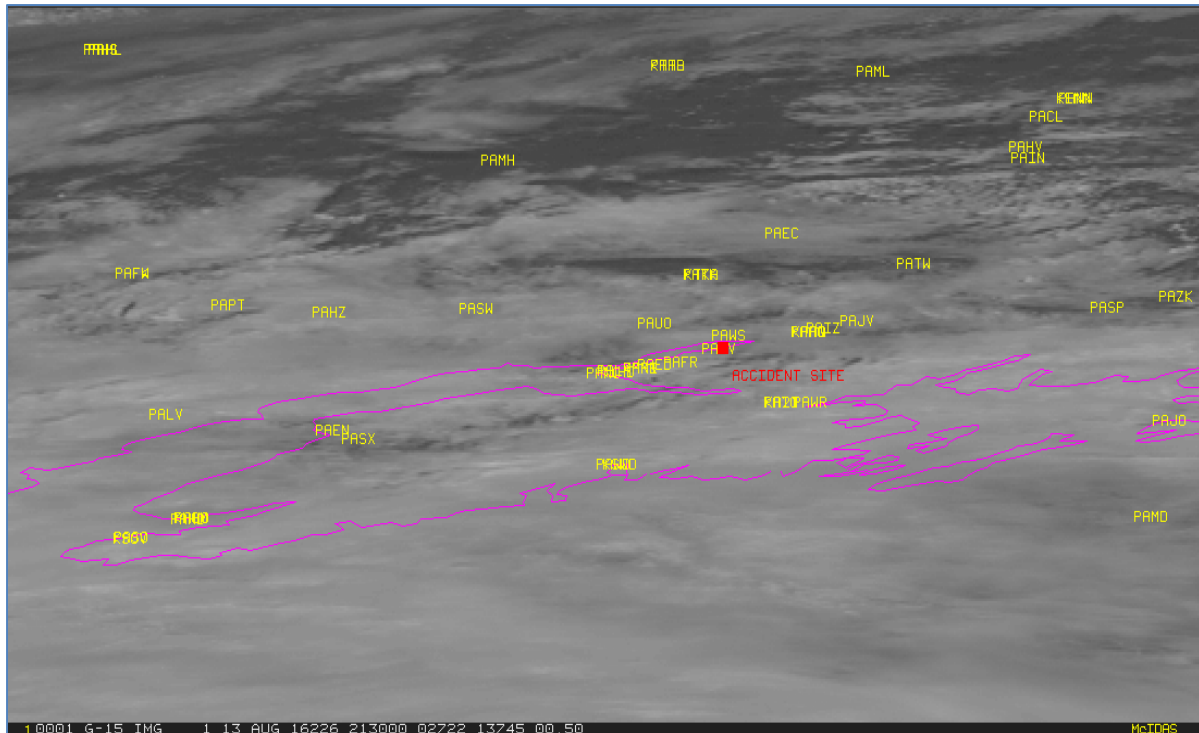


Figure 7 - GOES-15 visible image at 1330 AKDT

6.0 Weather Radar Imagery

The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) to the accident site was from the NWS Anchorage (AHG) located 68 miles southwest of the accident site. The level II archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

The WSR-88D is a S-band 10 centimeter wavelength radar with a power output of 750,000 watts, with a 28-foot parabolic antenna concentrating the energy into a 0.95° beam width. The radar produces three basic types of products reflectivity, radial velocity, and spectral width.

Figure 8 is the NWS Anchorage WSR-88D lowest level base reflectivity scan at 0.44° which depicted an area of precipitation to the west of Anchorage with only very light reflectivity values associated with cumulus clouds over the area. No significant weather echoes were depicted over the accident site.

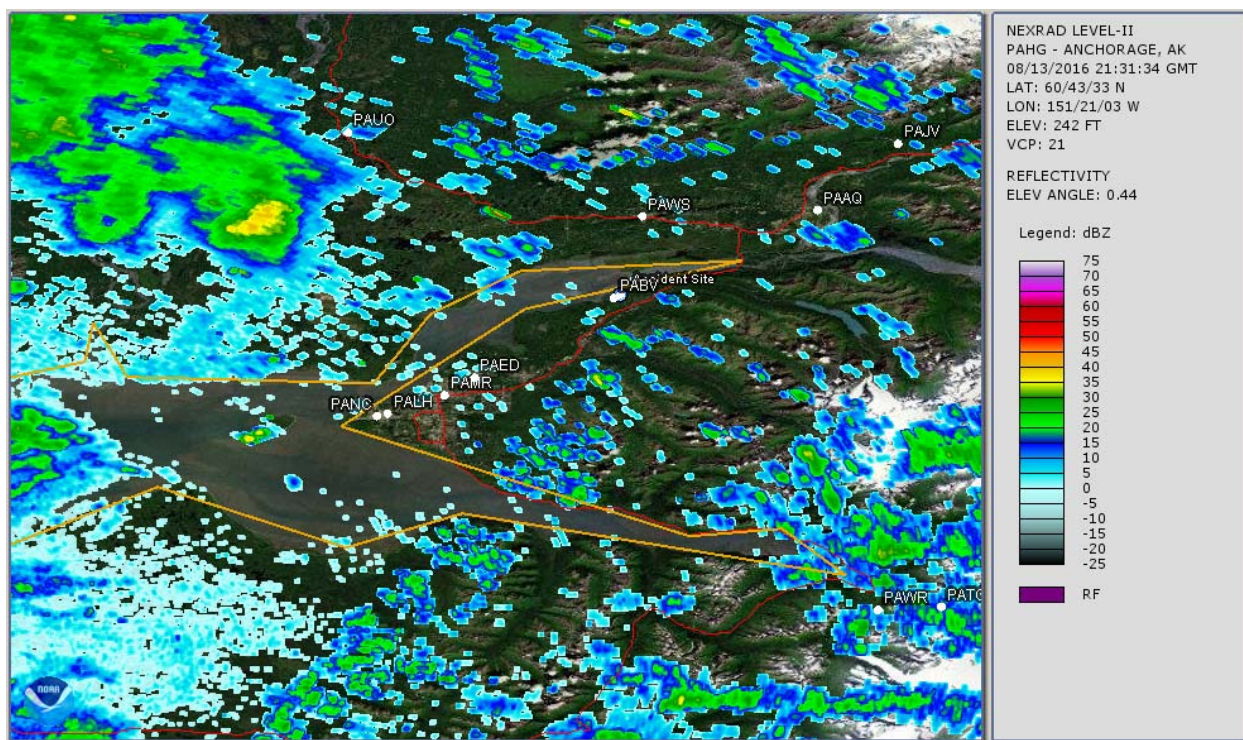


Figure 8 - NWS Anchorage 0.44° base reflectivity image for 1331 AKDT

7.0 Pilot Reports

A review of the pilot reports or PIREPs in the immediate vicinity surrounding the period, provided several reports. The reports are in raw format and use IATA 3-letter airport codes; where PAQ is Palmer (PAAQ), ANC – Anchorage (PANC), the reports are as follows:

PAQ UA /OV PAQ110020 /TM 1832 /FL019 /TP C170 /WX FV99SM /TA 15 /WV 09020KT /TB LGT /RM KNIK GLACIER=

PAQ UA /OV PAQ110020-PAQ125025 /TM 1929 /FL015-020 /TP C172 /TB ISOL LGT /RM KNIK GLACIER LAKE GEORGE=

ANC UA /OV GKN214056/TM 2019/FL220/TP B777/TB MOD/RM DURC/ SMOOTH ABV FL250/ ZAN=

ANC UA /OV TED138012 /TM 2025 /FL010 /TP PA18 /WX FV20SM -SHRA /TB LGT /RM LGT TB ANC-TURNAGAIN ARM NEG TB S BARABARA LAKE=

ANC UA /OV TED305040/TM 2028/FL110/TP DC93/SK TOP175/TA M6 /IC TRACE /RM DURD ZAN=

ANC UA /OV TED148022/TM 2242/FL150/TP B737/SK TOPS170/TA M16/IC LGT RIME 150-170/RM ZAN=

PAQ UA /OV PAQ110020 /TM 2337 /FL015-020 /TP C172 /TB LGT /RM KNIK GLACIER=

PAQ UA /OV AK1 /TM 2337 /FL015 /TP C172 /TB LGT OCNL MOD /RM VCTY BODENBURG BUTTE=

The reports indicated multiple reports of light turbulence between 1,000 and 2,000 feet, with one report of light to occasional moderate turbulence after the accident in the vicinity of Akiak (AIK) after the accident. There were also several icing reports above the freezing level.

8.0 Terminal Forecast

The closest Terminal Aerodrome Forecast (TAF) issued for a civilian airports in the immediate vicinity of the accident site were from Palmer Municipal Airport (PAAQ) located approximately 15 miles northeast of the accident site and Ted Stevens Anchorage International Airport (PANC) 22 miles southwest. While the forecasts are only valid for a 5 mile radius around the airports, the forecast provide more time specific forecast of wind, visibility, weather, and cloud cover than the Area Forecast (FA), which is the controlling forecast for airports without a TAF issued. The forecasts current at the time of the accident were as follows:

*TAF PAAQ 131739Z 1318/1418 12008KT P6SM VCSH OVC080
FM140700 04005KT P6SM OVC080=*

*TAF PANC 131740Z 1318/1424 VRB04KT P6SM RA FEW002 SCT030 BKN050
FM132200 16008KT P6SM -RA SCT030 BKN090
FM140800 02005KT P6SM -RA OVC070=*

9.0 Area Forecast

The NWS AAWU Area Forecast issued at 0515 and 1215 AKDT are included below and include an AIRMET for mountain obscuration in clouds and precipitation:

*FAAK48 PAWU 131310 AAA
FA8H
ANCH FA 131305 AMD
AK SRN HLF EXCP SE AK...*

*.
AIRMETS VALID UNTIL 132015
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.
.*

*.
SYNOPSIS VALID UNTIL 140600
A 991MB LOW VCY PACD WL WL MOV TO JUST SW KODIAK IS BY 06Z. ASSOCD
TROF ARCS OVR ERN AKPEN-KODIAK ISLAND- GULF OF AK. WI MOVEMENT
TO THE NE THRU PD. A TROF WL PRST FM INTERIOR SWRN AK NEWD INTO
THE TANANA VLY.
.*

*.
COOK INLET AND SUSITNA VLY AB...VALID UNTIL 140000 UPDT
...CLOUDS/WX...*

****AIRMET IFR***TIL 18Z VCY PANC OCNL CIG BLW 010 VIS BLW 1SM BR.
IMPR...*

****AIRMET MT OBSC***MTS OCNL OBSC IN CLDS/PCPN. NC...
SCT015 BKN060 OVC080 LYRS ABV TO FL250. OCNL -RA. AK RANGE SCT015
BKN035 OVC050 OCNL VIS 5SM -RA BR. ISOL CIG BLW 010/VIS BLW 3SM -RA BR.
AFT 21Z N PATK ISOL BKN050CB TOP FL250 -TSRA.
OTLK VALID 140000-140600...AK RANGE MVFR CIG SHRA BR. OTRW VFR SHRA.*

PASSES...LK CLARK...MERRILL...RAINY...IFR CIG SHRA BR.
 WINDY...VFR. OCNL MVFR CIG SHRA SRN APCH.
 PORTAGE...IFR CIG RA BR.
 ...TURB...
 TIL 21Z PAAQ S ALG ERN MTS ISOL MOD TURB BLW 040.
 ...ICE AND FZLVL...
 ISOL MOD ICEIC 100-FL190. FZLVL 080.
 .
 COPPER RIVER BASIN AC...VALID UNTIL 140000
 ...CLOUDS/WX...
 AIRMET MT OBSCSRN AND WRN MTS OCNL OBSC IN CLDS/PCPN. NC...
 SCT050 BKN100 LYRS ABV TO FL250.
 AK RNG PAXON W OCNL BKN050 -RA.
 CHUGACH MTS SCT030 BKN050 OVC080 OCNL -RA.
 AFT 21Z NE PAGK ISOL BKN050CB TOP FL250 -TSRA.
 OTLK VALID 140000-140600...VFR. CHUGACH MTS MVFR CIG SHRA.
 PASS...TAHNETA...VFR. ISOL IFR CIG BR.
 ...TURB...
 NIL SIG. EXC VCY CB.
 ...ICE AND FZLVL...
 ISOL MOD ICEIC 100-FL190. FZLVL 080.
 .
 CNTRL GLF CST AD...VALID UNTIL 140000
 ...CLOUDS/WX...
 AIRMET IFROFSHR/ERN KENAI OCNL CIG BLW 010 VIS BLW 3SM -RA BR.
 NC...
 AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
 OTRW SCT008 BKN015 OVC055 LYRS ABV TO FL250 VIS 3-5SM -RA BR.
 OFSHR PACV SE SFC WND SE G25 KT DMSHG.
 OTLK VALID 140000-140600...IFR CIG RA/BR.
 ...TURB...
 AIRMET TURBTIL 18Z PAVD-PACV LN NE OCNL MOD TURB BLW 040. WKN...
 ...ICE AND FZLVL...
 ISOL MOD ICEIC 100-FL190. FZLVL 080.
 .
 KODIAK IS AE...VALID UNTIL 140000
 ...CLOUDS/WX...
 AIRMET IFRSERN EXPOSURES OCNL CIG BLW 010 VIS BLW 3SM -RA BR.
 DTRT...
 AIRMET MT OBSCMTS OCNL OBSC BY CLDS/PCPN. NC...
 OTRW SCT015 BKN-OVC035 LYRS ABV TO FL250 -RA.
 OCNL BKN015 VIS 3-5SM -RA BR.
 OTLK VALID 140000-140600...SE EXPOSURES IFR CIG RA BR. ELSW
 MVFR CIG SHRA BR.
 ...TURB...
 AFT 21Z N PADQ ISOL MOD TURB BLW 040.
 ...ICE AND FZLVL...
 ISOL MOD ICEIC 090-FL180. FZLVL 080.
 .

Area Forecast issued at approximately 1215 AKDT immediately prior to the accident.

FAAK48 PAWU 132008
 FA8H
 ANCH FA 132015
 AK SRN HLF EXCP SE AK...

.
AIRMETS VALID UNTIL 140415
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.

.
SYNOPSIS VALID UNTIL 141400
A 992MB LOW OVR AKPEN WL MOV TO JUST S KODIAK ISLAND BY 14Z.
AN ASSOC TROF FM THE LOW-NR PAMC-PAMH-NE WL MOV TO KODIAK I-
PAMC-PFYU BY 14Z. A WK RDG OVR THE WRN ALUTNS WL MOV TO CNTRL
BERING/ALUTNS BY THE END OF THE PD.

.
COOK INLET AND SUSITNA VLY AB...VALID UNTIL 140800
...CLOUDS/WX...
AIRMET IFRTIL 23Z AK RANGE PAPT-S OCNL CIG BLW 010 VIS
BLW 3SM BR. IMPR...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC... OTRW
AK RANGE PAPT S SCT005 BKN015 OVC050. OCNL VIS 5SM -RA BR.
BY 23Z ISOL CIG BLW 010/VIS BLW 3SM -RA BR.
ELSW SCT025 BKN060 OVC080 LYRS ABV TO FL250. OCNL -RA.
N PATK AND ERN MTS PANC N ISOL BKN050TCU TOP FL180 -SHRA.
AFT 23Z N PATK ISOL BKN050CB TOP FL250 -TSRA.
TURNAGAIN ARM SFC WND SE G25 KT.
OTLK VALID 140800-141400...AK RANGE W PATK AND ERN MTS PAPQ S
MVFR CIG SHRA BR. ELSW VFR SHRA.
PASSES...LK CLARK...MERRILL...RAINY...IFR CIG SHRA BR.
WINDY...VFR. OCNL MVFR CIG SHRA SRN APCH.
PORTAGE...IFR CIG RA BR.
...TURB...
AFT 23Z PAEN S AND E ISOL MOD TURB BLW 040.
...ICE AND FZLVL...
ISOL MOD ICEIC 110-FL190. FZLVL 080.

.
COPPER RIVER BASIN AC...VALID UNTIL 140800
...CLOUDS/WX...
AIRMET MT OBSCN AND WRN MTS OCNL OBSC IN CLDS/PCPN. NC...
SCT050 SCT-BKN090 TOPS 150/CI ABV E. ISOL BKN050 -SHRA.
AK RANGE AND WRN MTS OCNL BKN050 -RA.
CHUGACH MTS SCT030 BKN050 OVC080 OCNL -RA.
TIL 23Z NE PAGK ISOL BKN050TCU TOP FL180 -SHRA.
FM 23Z-05Z NE PAGK ISOL BKN050CB TOP FL250 -TSRA.
OTLK VALID 140800-141400...SE PAGK MVFR CIG SHRA. ELSW VFR.
PASS...TAHNETA...VFR. ISOL IFR CIG BR.
...TURB...
NIL SIG. EXC VCY CB/TCU.
...ICE AND FZLVL...
TILS 02Z S PAGK ISOL MOD ICEIC 110-FL190. FZLVL 090.

.
CNTRL GLF CST AD...VALID UNTIL 140800
...CLOUDS/WX...
AIRMET IFRINLAND OCNL CIG BLW 010/ISOL VIS BLW 3SM
-RA BR. NC...
AIRMET MT OBSCMTS OCNL OBSC IN CLDS/PCPN. NC...
OTRW SCT008 BKN015 OVC050 LYRS ABV TO FL250 VIS 3-5SM -RA BR.
OFSHR ISOL CIG BLW 010 VIS BLW 3SM -SHRA BR.
OTLK VALID 140800-141400...INLAND IFR CIG RA BR. OFSHR MVFR
CIG SHRA.

...TURB...
 AFT 23Z PAWD-PACV LN S ISOL MOD TURB BLW 040.
 ...ICE AND FZLVL...
 ISOL MOD ICEIC 110-FL190. FZLVL 080.
 .
 KODIAK IS AE...VALID UNTIL 140800
 ...CLOUDS/WX...
 AIRMET IFRSERN EXPOSURES OCNL CIG BLW 010 VIS BLW 3SM
 -RA BR. NC...
 AIRMET MT OBSCMTS OCNL OBSC BY CLDS/PCPN. NC... OTRW
 SCT005 BKN-OVC015 TOPS TO FL250 -RA. OCNL VIS 3-5SM -RA BR.
 ISOL CIG BLW 010 VIS BLW 3SM -RA BR.
 OTLK VALID 140800-141400...MVFR CIG SHRA.
 ...TURB...
 23Z-02Z N KODIAK ISLAND ISOL MOD TURB BLW 040.
 ...ICE AND FZLVL...
 SW PAKH ISOL MOD ICEIC 100-FL180.
 PAKH NE ISOL MOD ICEIC 110-FL190.
 FZLVL 070.

The forecast warned of higher terrain occasionally obscured by clouds and precipitation with the main forecast expecting scattered clouds at 5,000 feet, with higher scattered to broken clouds at 9,000 feet with tops to 15,000 feet with higher cirriform clouds above. Isolated ceilings broken at 5,000 feet with light rain showers.

10.0 Flying Weather

The NWS AAWU Flying Weather prognostic chart valid for 1200 to 1800, and from 1800 to 0000 AKDT on August 14, 2016 are included as figure 9 and 10 respectively. These charts are a graphical representation of the clouds and visibility included in the Area Forecast, but with greater spatial detail. This includes areas of IFR and MVFR conditions, areas of surface winds at least 30kts, and an icon for active volcanoes. The IFR and MVFR areas depicted represent the worst occasional or continuous conditions expected during the valid time of the graphic.

The charts indicated that visual flight rule (VFR) conditions⁹ were expected to prevail over the region, with marginal VFR¹⁰ and instrument flight rule (IFR) conditions¹¹ over the higher terrain to the west through northwest of the area over higher terrain and along the southeastern Alaska coastal range to the south through southeast of the accident site. Strong winds of 30 knots or greater were depicted over the mid-point of the Aleutian Islands in the general vicinity behind the location of the low pressure system on the surface analysis and prognostic charts in section 1.0 of this report.

⁹ VFR conditions – are defined as no ceiling or a ceiling greater than 3,000 feet agl and visibility greater than 5 miles. A ceiling is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration.

¹⁰ MVFR conditions – are defined as a ceiling between 1,000 and 3,000 feet agl inclusive and/or visibility 3 to 5 miles inclusive.

¹¹ IFR conditions – are defined as a ceiling less than 1,000 feet agl and/or visibility less than 3 miles.

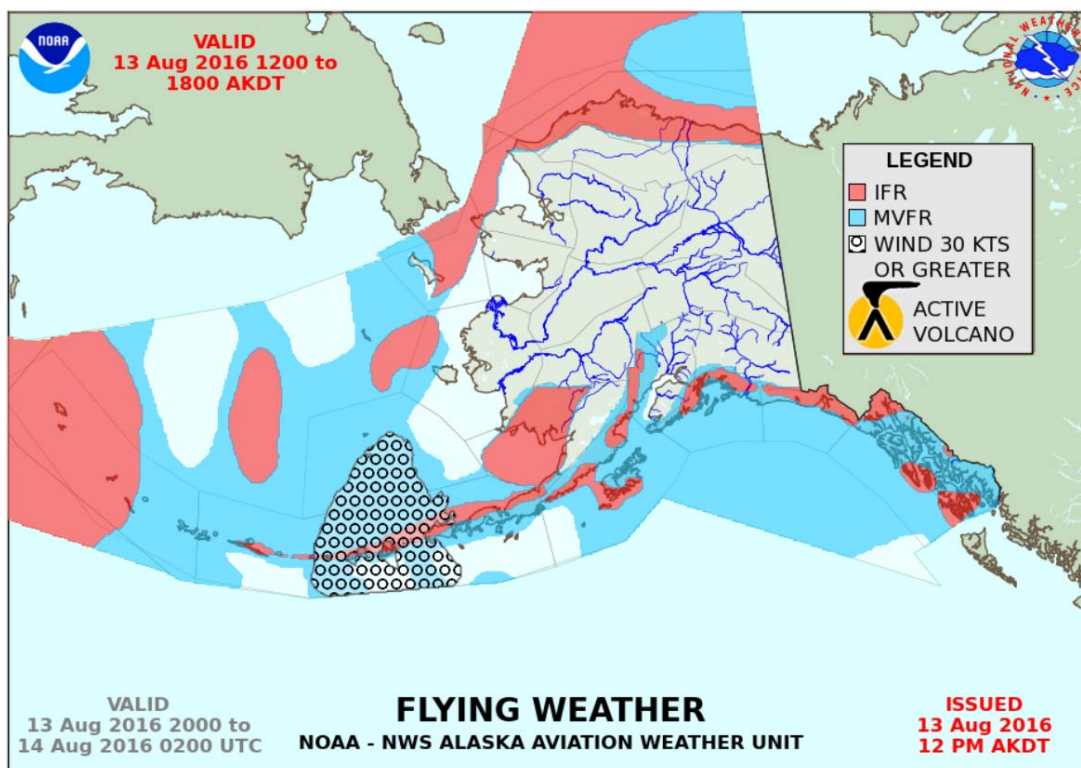


Figure 9 - NWS AAWU Flying Weather valid from 1200 to 1800 AKDT

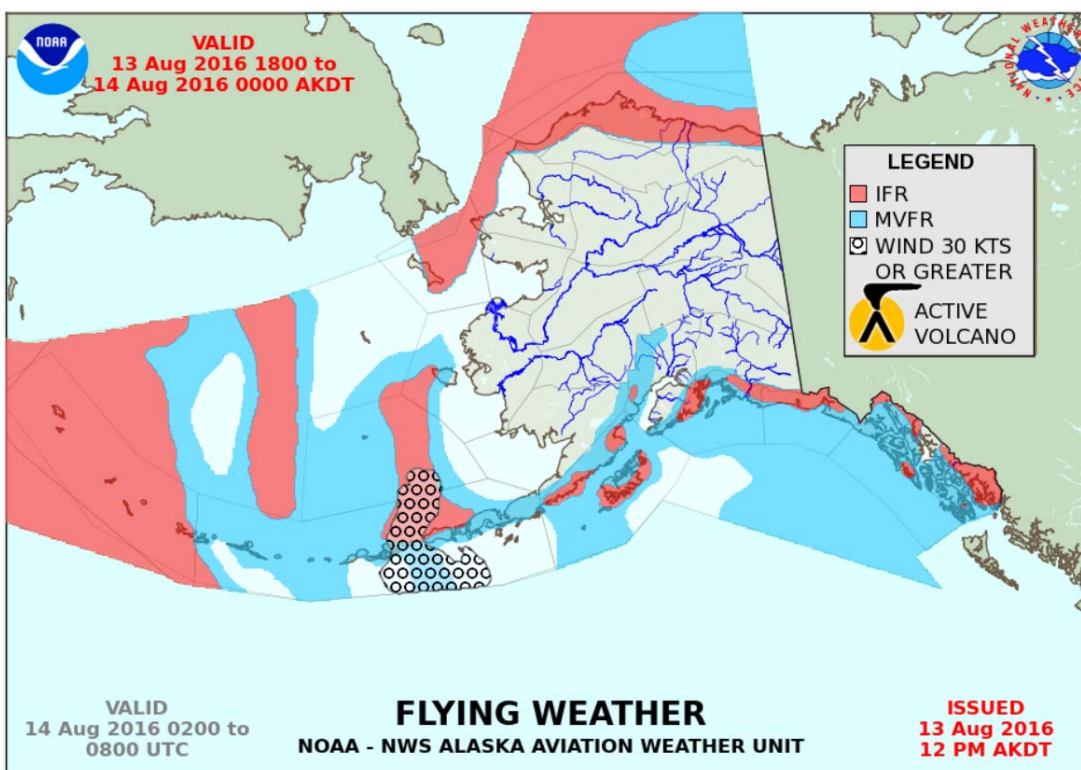


Figure 10 - NWS AAWU Flying Weather valid from 1800 to 0000 AKDT

11.0 Turbulence Forecast

The NWS AAWU Low-Level Turbulence Forecast Charts valid for the period surrounding the time of the accident at 1200, 1500, and 1800 AKDT are included as figures 11 through 13. The chart valid for 1200 AKDT did not expect any significant turbulence over the region below 24,000 feet; however, the charts valid for 1500 and 1800 AKDT introduced an area of isolated moderate turbulence from the surface to 4,000 feet over and immediately south of the accident site along the Kenai Peninsula and then westward over at the beginning of Cook Inlet. An area of occasional to continuous moderate turbulence was expected over the central Aleutian Islands.

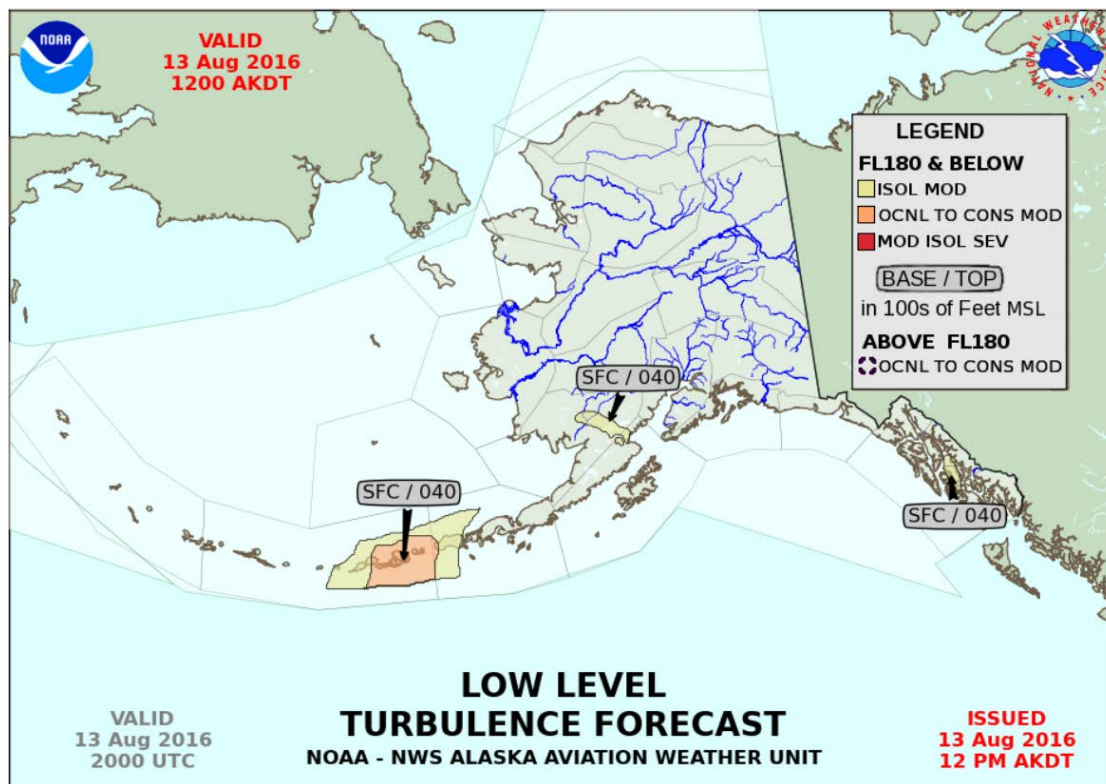


Figure 11 - NWS AAWU Low-Level Turbulence Forecast valid at 1200 AKDT

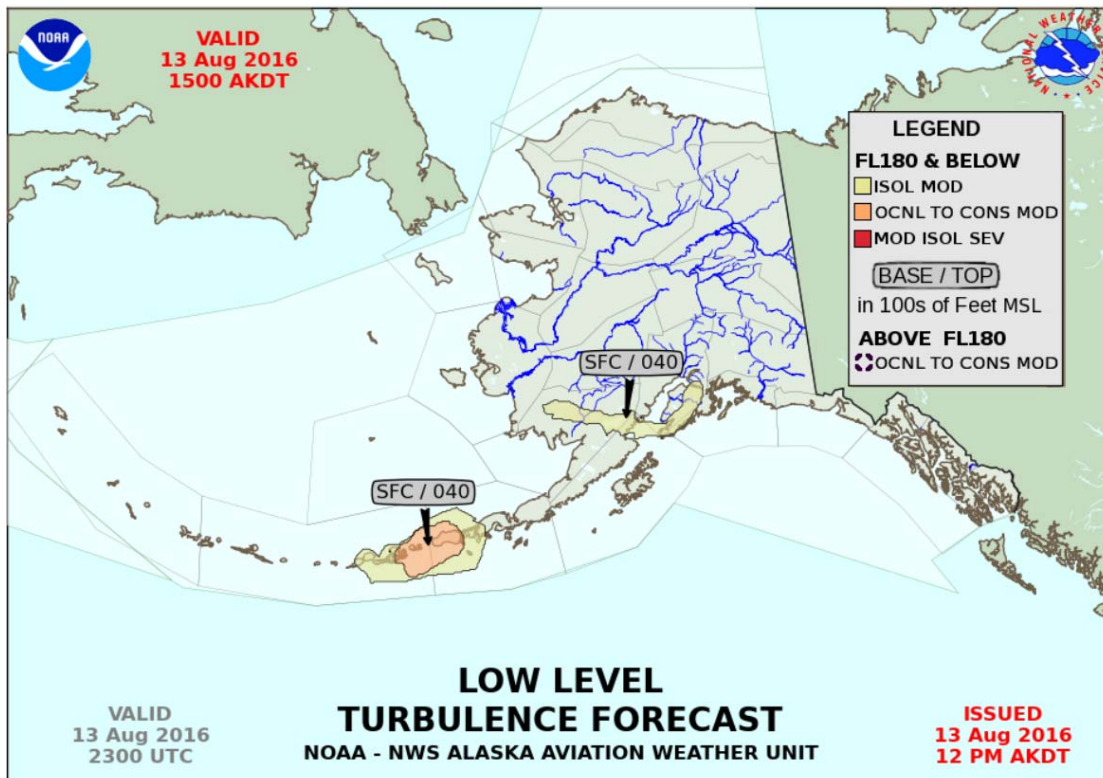


Figure 12 - NWS AAWU Low-Level Turbulence Forecast valid at 1500 AKDT

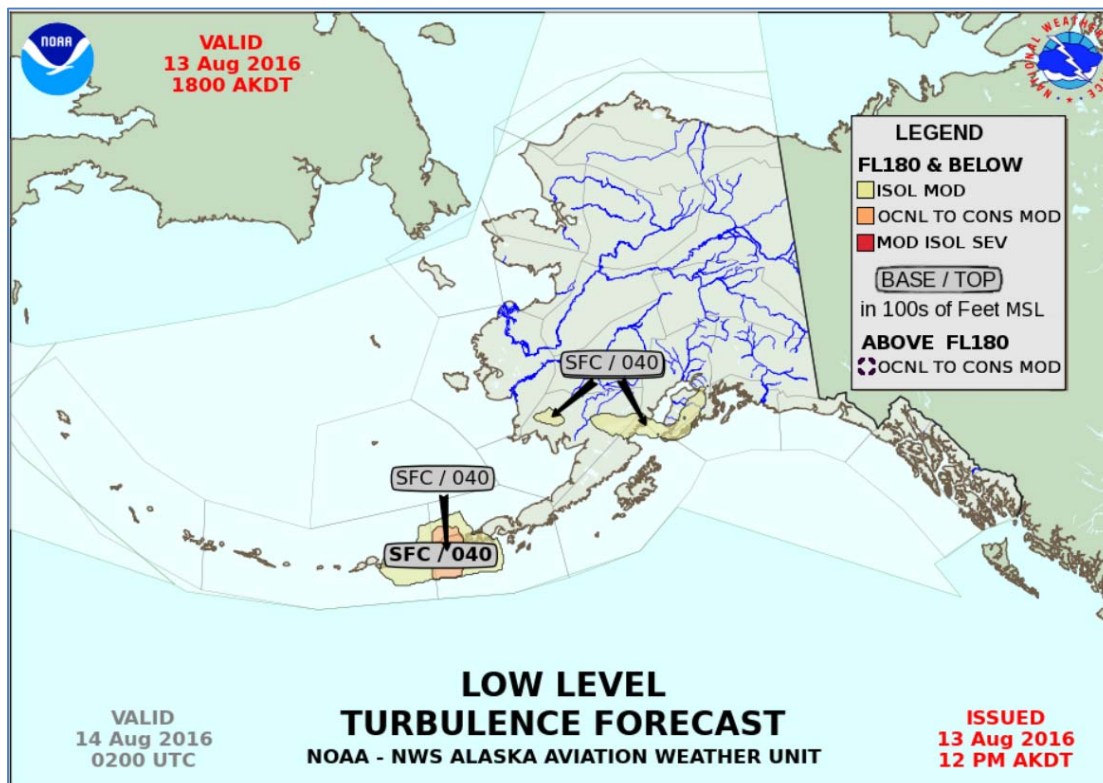


Figure 13 - NWS AAWU Low-Level Turbulence Forecast valid at 1800 AKDT

12.0 Astronomical Conditions

The United States Naval Observatory's web site (<http://www.usno.navy.mil/USNO/>) provided the following astronomical conditions for Chugiak, Anchorage Borough, Alaska on August 13, 2016.

Beginning civil twilight	0506 AKDT
Sunrise	0602 AKDT
Sun transit	1403 AKDT
Sunset	2201 AKDT
End of civil twilight	2231 AKDT

Submitted by:

Don Eick
Senior Meteorologist