



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

November 4, 2019

Factual Report

METEOROLOGY

ANC19FA033

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A. ACCIDENT

Location: Ketchikan, Alaska
Date: July 11, 2019
Time: about 1419 Alaska daylight time
2219 Universal Coordinated Time (UTC)
Airplane: Piper PA-24-180 Comanche; Registration: N5840P

B. METEOROLOGIST

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

C. SUMMARY

On July 11, 2019, about 1419 Alaska daylight time, a Piper PA-24-180 airplane, N5840P, sustained substantial damage after impacting terrain during a visual approach about 4 miles south of Ketchikan International Airport, (KTN) Ketchikan, Alaska. The airline transport pilot sustained fatal injuries. The airplane was registered to the Law Offices of Michael P. Nash PC and operated by the pilot, under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal visual flight rules (VFR) flight. Marginal visual meteorological conditions prevailed at the destination and a VFR flight plan had been filed. The flight departed Friday Harbor Airport (FHR), Friday Harbor, Washington, about 1010 Alaska daylight time.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation 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 from UTC, and UTC=Z. NWS airport and 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. 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.

The accident site was located at latitude 55.301070° N and longitude 131.652020° W, at an elevation of 363 ft. The accident site was located on the northwest side of Judy Hill where elevation reached approximately 814 ft and was on the southeast end of Gravina Island, Alaska.

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. 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 00-45H change 1.

1.1 Surface Analysis Chart

The Pacific northwest coastal section of the NWS Surface Analysis Chart for 1300 AKDT (2100Z) displaying the departure location and the accident site is included as figure 1, with the accident site located within the red circle. The chart depicted a high-pressure system at 1021-hectopascals (hPa) located southeast of the accident site over western British Columbia, Canada, which dominated over the southern portion of the route. Another high-pressure area at 1020-hPa was located west of the accident site over the Gulf of Alaska, with a ridge of high pressure extending eastward. The chart also depicted a low-pressure system at 1012-hPa in the Pacific Ocean off Washington with a trough of low pressure extending east-southeastward to near the Washington and Oregon coast. A col or natural point between two high and low pressure systems extended over southeast Alaska in the vicinity of the accident site, with a relatively weak pressure gradient over the region.

The station models on the chart depicted general south to south-southeast winds of 10 knots, variable cloud cover from scattered to broken clouds over the route, with temperatures in the mid to upper 60's degrees Fahrenheit (F), with dew points in the high 50's °F. A ship report in the Dixon Entrance approximately 40 miles south of Ketchikan depicted wind from the south at 10 knots, visibility restricted in mist, sky obscured, temperature 58° F, and a dew point temperature of 58° F.

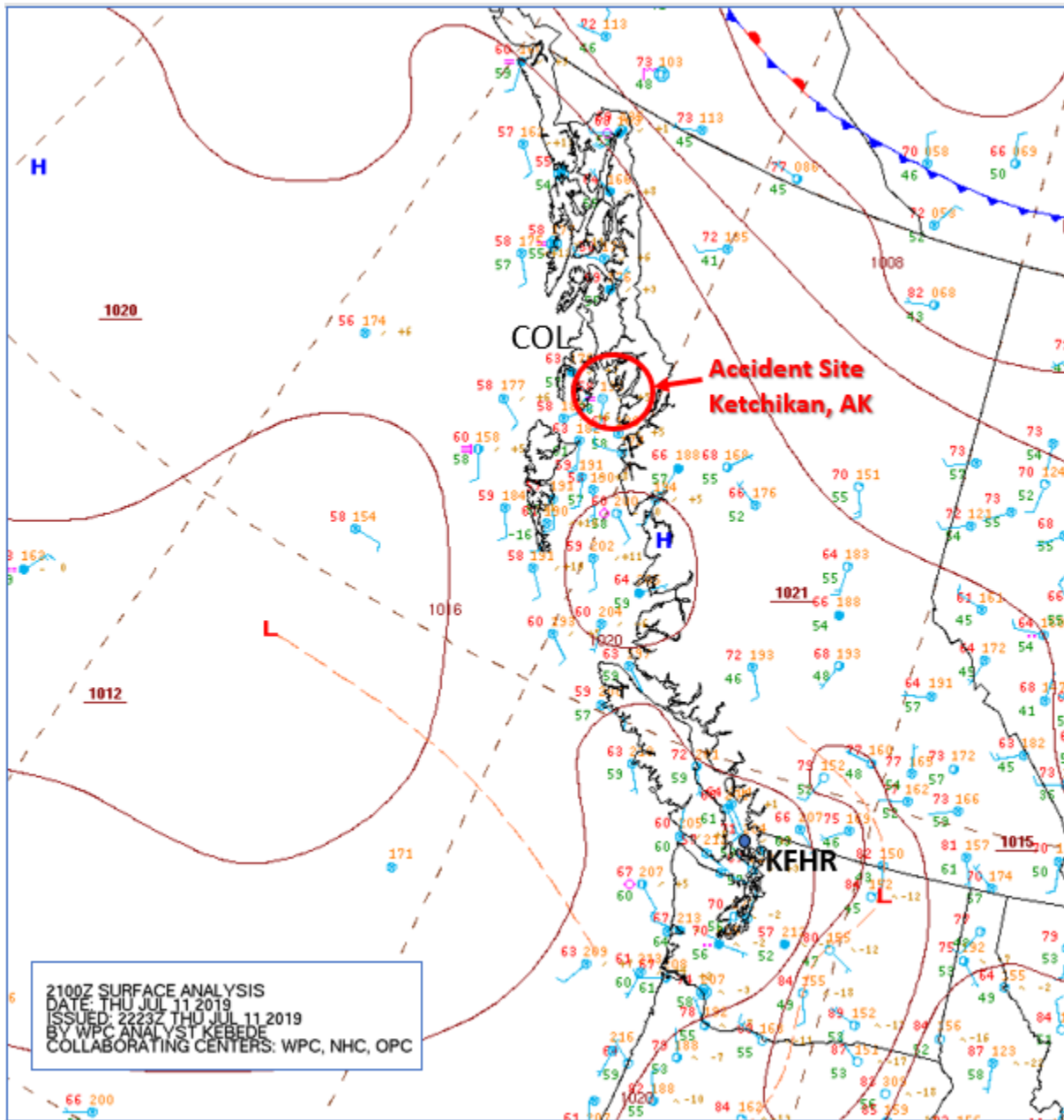


Figure 1 - Northwest section of the Surface Analysis Chart for 1300 AKDT

2.0 Observations

The official observations issued surrounding the accident site were documented using standard meteorological aerodrome reports (METARs) and specials (SPECI). Cloud heights are reported above ground level (agl) in the following section, and the magnetic variation was estimated at 21° east based on the latest sectional chart for the area.

2.1 Ketchikan, Alaska

The closest weather reporting location to the accident site was from the planned destination of Ketchikan International Airport (PAKT), Ketchikan, Alaska, located approximately 3 1/2 miles northwest of the accident site at a field elevation of 92 ft¹. The airport had an Automated Surface Observation System (ASOS) and was augmented by FAA Flight Service Station (FSS) personnel under a Limited Aviation Weather Reporting System (LAWRS). The airport did not have a FAA control tower, and FSS provided traffic advisories and required pilots to contact them and monitor the advisory frequency within 10 miles of the airport. The following conditions were reported at the approximate time of the accident.

PAKT weather observation at 1353 AKDT, wind from 110° at 13 knots, visibility 10 miles or more, scattered clouds at 900 ft agl, ceiling broken at 1,400 ft, overcast clouds at 3,500 ft, temperature 17° Celsius (C), dew point temperature 16° C, altimeter 30.09 inches of mercury (Hg). Remarks: sea-level pressure 1019.0-hPa, harbor wind from 130° at 13 knots, visibility east 4 miles, temperature 17.2° C, dew point 15.6° C, data entered via autodial system.

Accident 1419 AKDT.

PAKT weather observation at 1453 AKDT, wind from 140° at 10 knots, visibility 8 miles in light rain, scattered clouds at 900 ft agl, ceiling broken at 1,400 ft, overcast clouds at 2,100 ft, temperature 17° C, dew point temperature 15° C, altimeter 30.09 inches of mercury (Hg). Remarks: rain began at 1449 AKDT, sea-level pressure 1019.0-hPa, harbor wind from 150° at 11 knots, hourly precipitation less than 0.01 inches or a trace, temperature 16.7° C, dew point 15.0° C, maintenance indicator on², data entered via autodial system.

The general flight categories³ and raw observations from approximately 0000 through 1600 PDT were as follows and represent the time the accident pilot reviewed the weather through the time of the accident:

*MVFR SPECI PAKT 110805Z AUTO 13009KT 10SM BKN019 BKN025 OVC032 16/14 A3000 RMK T01610139
TSNO VIA AUTODIAL*

¹ The airport elevation is the highest elevation of the highest point on any of the runways of the airport.

² The maintenance indicator (\$) came on at approximately 2153Z due to the present weather sensor data quality error, which cleared itself in one minute, but was flagged for routine maintenance and was corrected at 1341Z on July 12, 2019 by the technician.

³ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

MVFR METAR PAKT 110853Z AUTO 14009KT 10SM BKN020 BKN025 OVC035 16/14 A3000 RMK SLP160 T01610139 402390094 51015 TSNO VIA AUTODIAL

MVFR SPECI PAKT 110936Z AUTO 13008KT 5SM -RA BR BKN013 OVC018 16/14 A3001 RMK RAB31 P0000 T01560144 TSNO VIA AUTODIAL

MVFR SPECI PAKT 111017Z AUTO 15008KT 5SM BR OVC015 15/14 A3002 RMK RAE17 P0001 T01500139 TSNO VIA AUTODIAL

MVFR SPECI PAKT 111039Z AUTO 14006KT 3SM BR OVC013 14/14 A3002 RMK RAE17 P0001 T01440139 TSNO VIA AUTODIAL

MVFR METAR PAKT 111053Z AUTO 13007KT 7SM FEW008 BKN013 OVC021 14/14 A3002 RMK RAE17 SLP167 P0001 T01440139 TSNO VIA AUTODIAL

IFR SPECI PAKT 111110Z AUTO 12008KT 9SM SCT003 BKN008 OVC021 14/14 A3003 RMK CIG 007V012 T01440144 TSNO VIA AUTODIAL

IFR SPECI PAKT 111139Z AUTO 13006KT 2 1/2SM BR BKN006 OVC010 14/14 A3003 RMK T01440144 TSNO VIA AUTODIAL

MVFR SPECI PAKT 111148Z AUTO 13006KT 3SM BR SCT008 OVC012 14/14 A3003 RMK TSNO

MVFR METAR PAKT 111153Z AUTO 13006KT 3SM BR SCT008 OVC012 14/14 A3003 RMK SLP168 60001 70001 T01440144 10161 20144 51008 TSNO VIA AUTODIAL

IFR SPECI PAKT 111206Z AUTO 13007KT 2SM -RA BR OVC010 14/14 A3003 RMK RAB05 P0000 T01440144 TSNO VIA AUTODIAL

IFR SPECI PAKT 111213Z AUTO 13005KT 2 1/2SM -RA BR OVC009 14/14 A3003 RMK RAB05 P0001 T01440144 TSNO VIA AUTODIAL

LIFR SPECI PAKT 111239Z AUTO 12007KT 3SM BR BKN003 BKN010 OVC015 15/14 A3003 RMK RAB05E15 P0001 T01500144 TSNO VIA AUTODIAL

LIFR SPECI PAKT 111246Z AUTO 12007KT 1 3/4SM BR BKN003 BKN010 OVC019 15/14 A3003 RMK VIS 1V4 RAB05E15 P0001 T01500144 TSNO VIA AUTODIAL

LIFR METAR PAKT 111253Z AUTO 12007KT 1 1/4SM BR BKN003 BKN010 OVC018 15/15 A3003 RMK RAB05E15 SLP169 P0001 T01500150 TSNO VIA AUTODIAL

IFR SPECI PAKT 111315Z AUTO 12007KT 2 1/2SM BR BKN006 OVC016 15/15 A3003 RMK VIS 1 1/2V4 T01500150 TSNO VIA AUTODIAL

IFR SPECI PAKT 111322Z AUTO 12007KT 5SM BR BKN006 OVC016 15/14 A3003 RMK T01500144 TSNO VIA AUTODIAL

LIFR SPECI PAKT 111332Z AUTO 13007KT 1 3/4SM R11/5500VP6000FT BR OVC005 15/14 A3004 RMK T01500144 TSNO VIA AUTODIAL

LIFR SPECI PAKT 111348Z AUTO 13009KT 1SM R11/5000VP6000FT BR BKN004 OVC010 15/14 A3004 RMK TSNO VIA AUTODIAL

LIFR METAR PAKT 111353Z AUTO 13009KT 1SM R11/5000VP6000FT BR BKN004 OVC012 15/14 A3004 RMK SLP171 T01500144 TSNO VIA AUTODIAL

IFR SPECI PAKT 111413Z 13009KT 3SM -RA BR BKN006 OVC012 15/15 A3004 RMK RAB08 HARBOR WIND 13010KT P0000 T01500150 VIA AUTODIAL=

IFR SPECI PAKT 111451Z 14006KT 2 1/2SM R11/6000VP6000FT -RA BR BKN005 BKN017 OVC022 15/15 A3004 RMK RAB08E18B43 HARBOR WIND 15010KT P0001 VIA AUTODIAL=

IFR METAR PAKT 111453Z 14007KT 3SM -RA BR BKN005 BKN017 OVC022 15/14 A3004 RMK RAB08E18B43 SLP173 HARBOR WIND 15010KT P0001 60002 T01500144 52003 VIA AUTODIAL=

IFR SPECI PAKT 111551Z 14008KT 1SM R11/4500V6000FT -RA BR OVC021 16/15 A3005 RMK RAE1454B15 HARBOR WIND 15009KT P0001 VIA AUTODIAL=

IFR METAR PAKT 111553Z 13008KT 1SM R11/4500V6000FT -RA BR OVC021 15/15 A3005 RMK RAE1454B15 SLP177 HARBOR WIND 15009KT P0001 T01500150 VIA AUTODIAL=

IFR SPECI PAKT 111651Z 13011KT 1 1/2SM R11/4500VP6000FT BR SCT006 OVC023 16/15 A3006 RMK RAE10 HARBOR WIND 14011KT VIS 1V2 P0001 VIA AUTODIAL=

IFR METAR PAKT 111653Z 13010KT 1 1/2SM R11/4500VP6000FT BR SCT006 BKN023 OVC029 16/15 A3006 RMK RAE10 SLP180 HARBOR WIND 14011KT VIS 1V2 P0001 T01560150 VIA AUTODIAL=

IFR METAR PAKT 111753Z 14009KT 1 1/2SM R11/5500VP6000FT -RA BR SCT006 OVC023 16/15 A3007 RMK RAB52 SLP182 HARBOR WIND 14010KT VIS 1V2 P0000 60004 T01560150 10156 20144 51009 VIA AUTODIAL=

IFR METAR PAKT 111853Z 14009KT 1 1/4SM R11/5500VP6000FT -RA BR BKN023 OVC029 16/15 A3007 RMK SLP183 HARBOR WIND 15013KT P0001 T01560150 VIA AUTODIAL=

MVFR SPECI PAKT 111924Z 13010KT 4SM BR FEW007 BKN035 OVC041 16/16 A3008 RMK RAE06 P0001 T01610156 VIA AUTODIAL=

MVFR SPECI PAKT 111951Z 14008KT 10SM SCT007 BKN011 OVC034 16/16 A3008 RMK RAE06 HARBOR WIND 13010KT P0001 VIA AUTODIAL=

MVFR METAR PAKT 111953Z 14008KT 10SM SCT007 BKN011 OVC034 16/16 A3008 RMK RAE06 SLP186 HARBOR WIND 13010KT P0001 T01610156 VIA AUTODIAL=

MVFR METAR PAKT 112053Z 12011KT 10SM SCT007 OVC011 17/16 A3008 RMK SLP187 HARBOR WIND 14012KT 60002 T01720156 53006 VIA AUTODIAL=

MVFR METAR PAKT 112153Z 11013KT 10SM SCT009 BKN014 OVC035 17/16 A3009 RMK SLP190 HARBOR WIND 13013KT VIS E 4 T01720156 VIA AUTODIAL=

Accident 2219Z

MVFR METAR PAKT 112253Z 14010KT 8SM -RA SCT009 BKN014 OVC021 17/15 A3009 RMK RAB49 SLP190 HARBOR WIND 15011KT P0000 T01670150 \$ VIA AUTODIAL=

VFR SPECI PAKT 112255Z 13012KT 9SM -RA FEW009 OVC035 17/15 A3009 RMK P0000 T01670150 \$ VIA AUTODIAL=

MVFR SPECI PAKT 112302Z 13010KT 10SM FEW007 OVC019 17/15 A3009 RMK RAE2258 HARBOR WIND 15013KT VIS E 4 P0000 T01670150 \$ VIA AUTODIAL=

MVFR METAR PAKT 112353Z 14011KT 8SM SCT005 BKN018 OVC026 17/15 A3009 RMK RAE2258 SLP190 HARBOR WIND 15013KT VIS E 4 P0000 60002 T01720150 10178 20156 50002 \$ VIA AUTODIAL=

MVFR METAR PAKT 120053Z 11013KT 10SM SCT008 BKN018 OVC034 18/15 A3008 RMK SLP186 HARBOR WIND 11010KT T01830150 \$ VIA AUTODIAL=

2.1.1 Ketchikan 5-minute Observations

The 5-minute ASOS observations were collected immediately surrounding the time of the accident to determine if there were any significant variations in visibility or sky cover during the period. The observation recorded at the approximate time of the accident was as follow.

PAKT 5-minute observation at 1320 AKDT, wind from 130° at 10 knots gusting to 17 knots, visibility 10 miles or more, scattered clouds at 900 ft agl, ceiling broken at 1,400 ft, overcast at 2,100 ft, temperature 18° C, dew point 15° C, altimeter 30.09 inches of Hg, pressure altitude of -60 feet, relative humidity of 83%, density altitude of 300 feet, magnetic wind direction of 110° at 10 knots with gusts to 17 knots. Remarks; automated station with a precipitation discriminator, temperature of 17.2° C and a dew point temperature of 15.0° C.

The observations from 1400 through 1430 AKDT⁴ were as follows.

14:00:31 AKDT 5-MIN PAKT 112200Z 12012KT 10SM SCT009 BKN014 OVC021 17/15 A3009 -60 87 200 100/12 RMK AO2 T01720150 \$

14:05:31 AKDT 5-MIN PAKT 112205Z 11012KT 10SM SCT009 BKN014 OVC021 18/16 A3009 -60 87 300 090/12 RMK AO2 T01780156 \$

14:10:31 AKDT 5-MIN PAKT 112210Z 11012KT 10SM SCT009 BKN014 OVC021 17/15 A3009 -60 87 200 090/12 RMK AO2 T01720150 \$

14:15:31 AKDT 5-MIN PAKT 112215Z 13012KT 10SM SCT009 BKN014 OVC021 17/15 A3009 -60 87 200 110/12 RMK AO2 T01720150 \$

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14:20:31 AKDT 5-MIN PAKT 112220Z 13010G17KT 10SM SCT009 BKN014 OVC021 18/15 A3009 -60 83 300 110/10G17 RMK AO2 T01780150 \$

14:25:31 AKDT 5-MIN PAKT 112225Z 14011KT 10SM SCT009 BKN014 OVC021 18/15 A3009 -60 83 300 120/11 RMK AO2 T01780150 \$

14:30:31 AKDT 5-MIN PAKT 112230Z 14011KT 10SM SCT009 BKN014 OVC021 17/15 A3009 -60 87 200 120/11 RMK AO2 T01720150 \$

⁴Original 5-minute observations recorded the time in AKST and UTC, which was converted to AKDT for consistency.

2.2 Metlakatla, Alaska

Next closest reporting location was from Metlakatla Seaplane Base (PAMM), Metlakatla, AK, located approximately 14 miles south of PAKT at an elevation at sea level. The airport had an AWOS but reported irregularly. The observation issued prior to the accident was as follows.

PAMM weather observation at 1056 AKDT, automated, wind from 160° at 8 knots, wind 120° variable 180°, visibility 10 miles or more, ceiling overcast at 600 ft agl, temperature 16° C, dew point 15° C, altimeter 30.09 inches of Hg. Remarks; automated station with a precipitation discriminator, rain ended at 1043 AKDT, sea-level pressure 1017.9-hPa, hourly precipitation 0.01 inches, temperature 15.6° C, dew point 15.0° C, maintenance indicator.

The following general flight categories and observations were reported surrounding the time of the accident.

IFR SPECI PAMM 111747Z AUTO 16007KT 140V200 3SM -RA BR BKN006 BKN015 OVC024 16/14 A3008 RMK AO2 CIG 004V009 P0002 \$=

IFR METAR PAMM 111856Z AUTO 16008KT 120V180 10SM OVC006 16/15 A3009 RMK AO2 RAE43 SLP179 P0001 T01560150 \$=

Accident 2219Z

IFR SPECI PAMM 120012Z AUTO 16007KT 10SM BKN006 OVC010 16/15 A3010 RMK AO2 CIG 005V009\$

2.3 Annette, Alaska

The next closest reporting station was from Annette Island Airport (PANT), Annette, Alaska, located approximately 20 miles south of PAKT at an elevation of 119 ft. The airport had an AWOS and reported the following conditions at the approximate time of the accident.

PANT weather observation at 1353 AKDT, automated, wind from 150° at 7 knots, visibility 5 miles in mist, ceiling overcast at 200 ft agl, temperature 15° C, dew point 15° C, altimeter 30.09 inches of Hg. Remarks: sea-level pressure 1019.2-hPa, temperature 15.0° C, dew point 15.0° C, thunderstorm sensor inoperative, obtained through autodial system.

The general flight categories and raw observations surrounding the period were as follows.

LIFR SPECI PANT 111840Z AUTO 15009KT 1 1/2SM -RA BR OVC002 15/15 A3007 RMK P0001 T01500150 TSNO VIA AUTODIAL=

LIFR METAR PANT 111853Z AUTO 15007KT 1 1/4SM BR OVC002 15/15 A3007 RMK RAE51 SLP185 P0001 T01500150 TSNO VIA AUTODIAL=

LIFR METAR PANT 112053Z AUTO 16008KT 1/2SM FG VV002 14/14 A3009 RMK RAE08B30E39 SLP190 P0000 60001 T01440144 53005 TSNO VIA AUTODIAL=

LIFR SPECI PANT 112135Z AUTO VRB06KT 1 1/2SM BR OVC002 15/15 A3009 RMK T01500150 TSNO VIA

AUTODIAL=

LIFR SPECI PANT 112143Z AUTO 16006KT 3SM BR OVC002 15/15 A3009 RMK T01500150 TSNO VIA AUTODIAL=

LIFR METAR PANT 112153Z AUTO 15007KT 5SM BR OVC002 15/15 A3009 RMK SLP192 T01500150 TSNO VIA AUTODIAL=

Accident 2220Z

LIFR METAR PANT 120053Z AUTO 16007KT 6SM BR OVC003 16/15 A3009 RMK SLP189 T01560150 TSNO VIA AUTODIAL=

LIFR SPECI PANT 120104Z AUTO 15005KT 1 3/4SM BR OVC003 15/15 A3009 RMK T01500150 TSNO VIA AUTODIAL=

LIFR SPECI PANT 120115Z AUTO 15005KT 3/4SM BR VV002 15/15 A3009 RMK T01500150 TSNO VIA AUTODIAL=

LIFR SPECI PANT 120122Z AUTO 17004KT 2SM BR OVC002 15/15 A3009 RMK T01500150 TSNO VIA AUTODIAL=

2.4 Prince Rupert, British Columbia

Prince Rupert Airport (CYPR), Prince Rupert, British Columbia, Canada, was located approximately 78 miles southeast of PAKT and was along the general route of flight at an elevation of 116 ft. The following conditions were reported at the time the accident airplane was in the vicinity of the station.

CYPR special weather observation at 1401 AKDT, automated, wind from 150° at 4 knots, wind 120° variable 210°, visibility 4 miles in light rain and mist, ceiling broken at 2,400 ft agl, broken clouds at 2,800 ft, and overcast clouds at 3,700 ft, temperature 16° C, dew point 15° C, altimeter 30.10 inches of Hg. Remarks; sea-level pressure 1019.4-hPa.

The general flight categories and raw observations surrounding the period were as follows.

MVFR SPECI CYPR 111903Z AUTO 18005KT 120V200 9SM SCT024 BKN030 OVC037 17/15 A3008 RMK SLP188 DENSITY ALT 200FT=

VFR METAR CYPR 112000Z AUTO 19007KT 120V210 9SM FEW043 OVC049 19/14 A3008 RMK SLP188 DENSITY ALT 400FT=

VFR METAR CYPR 112100Z AUTO 20004KT 140V230 9SM OVC070 18/14 A3009 RMK SLP190 DENSITY ALT 300FT=

MVFR SPECI CYPR 112128Z AUTO 21005KT 170V280 9SM BKN020 BKN025 OVC065 17/14 A3009 RMK SLP193 DENSITY ALT 200FT=

MVFR SPECI CYPR 112147Z AUTO 16006KT 130V260 8SM -RA BKN022 OVC026 16/14 A3009 RMK SLP193=

MVFR SPECI CYPR 112157Z AUTO 17004KT 120V210 4SM -RA BR BKN022 OVC028 16/15 A3010 RMK SLP194=

*MVFR METAR CYPR 112200Z AUTO 15004KT 120V210 4SM -RA BR SCT022 BKN028 OVC037 16/15 A3010
RMK SLP194=*

*MVFR SPECI CYPR 112201Z AUTO 15004KT 120V210 4SM -RA BR BKN024 BKN028 OVC037 16/15 A3010
RMK SLP194=*

*MVFR SPECI CYPR 112207Z AUTO 14004KT 120V180 3SM -RA BR BKN026 OVC035 16/15 A3010 RMK
SLP194=*

MVFR SPECI CYPR 112214Z AUTO 17004KT 120V210 7SM -RA SCT025 OVC033 17/16 A3009 RMK SLP193=

Accident 2219Z

*VFR SPECI CYPR 112220Z AUTO 15005KT 120V210 9SM FEW025 BKN035 OVC041 17/16 A3009 RMK
SLP193 DENSITY ALT 200FT=*

*VFR METAR CYPR 112300Z AUTO 16004KT 110V210 9SM SCT035 OVC055 18/15 A3009 RMK SLP192
DENSITY ALT 200FT=*

2.5 Friday Harbor, Washington

The accident airplane departed from Friday Harbor Airport (KFHR), Friday Harbor, Washington, at approximately 1010 AKDT. The airport had a reported elevation of 113 ft and had an ASOS system which was not augmented by any human observer. The following conditions were reported surrounding the period.

*LIFR METAR KFHR 111453Z AUTO 00000KT 5SM BR OVC003 14/14 A3014 RMK AO2 RAB10E25 SLP208
P0000 60000 T01440139 53009*

*LIFR SPECI KFHR 111509Z AUTO 00000KT 2SM -RA BR BKN002 OVC014 14/14 A3015 RMK AO2 RAB03
P0000 T01440139*

*MVFR SPECI KFHR 111515Z AUTO 00000KT 3SM -RA BR SCT002 BKN024 OVC055 14/14 A3015 RMK AO2
RAB03 P0000 T01440144*

*LIFR SPECI KFHR 111526Z AUTO 18004KT 6SM BR BKN004 BKN020 OVC050 15/14 A3015 RMK AO2
RAB03E20 P0000 T01500144*

*LIFR METAR KFHR 111553Z AUTO 18004KT 8SM OVC004 16/15 A3016 RMK AO2 RAB03E20 SLP212
P0000 T01560150*

IFR SPECI KFHR 111624Z AUTO VRB03KT 10SM BKN005 OVC012 16/15 A3016 RMK AO2 T01610150

*IFR METAR KFHR 111653Z AUTO 12003KT 10SM BKN005 OVC070 16/15 A3015 RMK AO2 SLP211
T01610150*

VFR SPECI KFHR 111733Z AUTO 12003KT 10SM SCT005 OVC050 17/15 A3015 RMK AO2 T01670150

*VFR METAR KFHR 111753Z AUTO 12004KT 10SM FEW005 OVC049 16/15 A3015 RMK AO2 SLP211 60000
T01610150 10167 20122 50003*

Departure 1810Z

VFR METAR KFHR 111853Z AUTO 14004KT 10SM OVC049 17/15 A3016 RMK AO2 SLP211 T01670150

VFR METAR KFHR 111953Z AUTO 12006KT 10SM BKN050 OVC085 18/14 A3016 RMK AO2 SLP212 T01830144

2.6 METAR Display

A display of the observations from the NWS Aviation Weather Centers (AWC) website for 1500 AKDT (2300Z) immediately after the accident is included as figure 2 with the approximate accident site noted by a red star. The display depicted general VFR conditions being reported over the region from the two reporting sites in the area, with all the surrounding stations reporting southeasterly winds of 15 knots or less, overcast cloud cover, with visibility 9 miles or more with several stations reporting light rain, with temperatures in the low 60's °F, and dew points 50's °F or less.

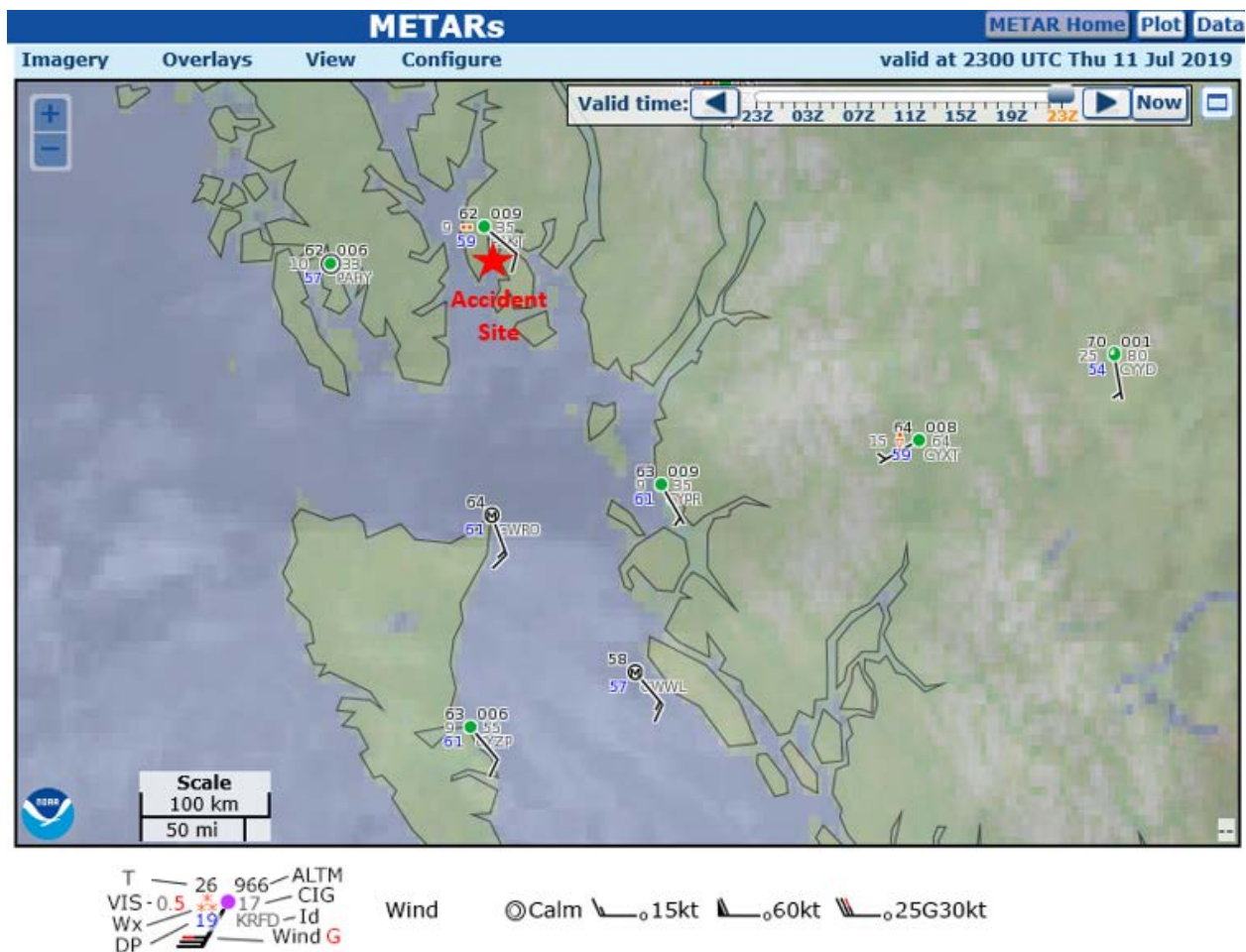


Figure 2 - NWS Aviation Weather Centers website METAR display for 1500 AKDT

The observations from Rose Split (CWRO) and Bonilla Island (CWWL), British Columbia, Canada, approximately 63 miles south and 115 miles south-southeast of the accident site,

respectively, provided wind, temperature, and dew point temperature information only and did not report visibility, present weather or sky cover required for determining the general flight category. In addition, the observations for PANT and PAMM listed above, which were reporting LIFR to IFR conditions during the period, were also not included in the display.

3.0 Sounding

The closest upper air site to the accident site was from the NWS Annett Island (PANN) Weather Forecast Office (WFO), site number 70398, located about 20 miles south of the accident site. The PANN 1600 AKDT sounding was obtained and plotted on a standard Skew T log P diagram⁵ using the complete Rawinsonde Observation RAOB program software⁶ from the surface through approximately 450-hPa or 21,000 ft. The PANT 1600 AKDT sounding is included as figure 3 with a station elevation of 108 ft. The sounding depicted a surface temperature of 15° C (59° F), a dew point of 14.6° C (58° F), with a relative humidity of 96% and a precipitable water content of 1.23 inches. The lifted condensation level (LCL)⁷ and the level of free convection (LFC)⁸ were identified at 251 ft agl, with the convective condensation level (CCL)⁹ at 1,680 ft agl, with sounding supported multiple layers of clouds from the LCL through 15,000 ft where the relative humidity was greater than 90%. At about 15,000 ft a temperature inversion was noted, and drier air was indicated through 17,000 ft. The freezing level was at 9,890 ft and supported icing in clouds above this level. The atmosphere was characterized as stable with a lifted index of +3.0 and a Convective Available Potential Energy (CAPE) of 9 Joules/kilogram, which supported nimbostratus type clouds and light rain.

⁵ 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.

⁶ RAOB software – The complete RAOB program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data

⁷ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically, and generally represents the base of the clouds.

⁸ 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.

⁹ 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.

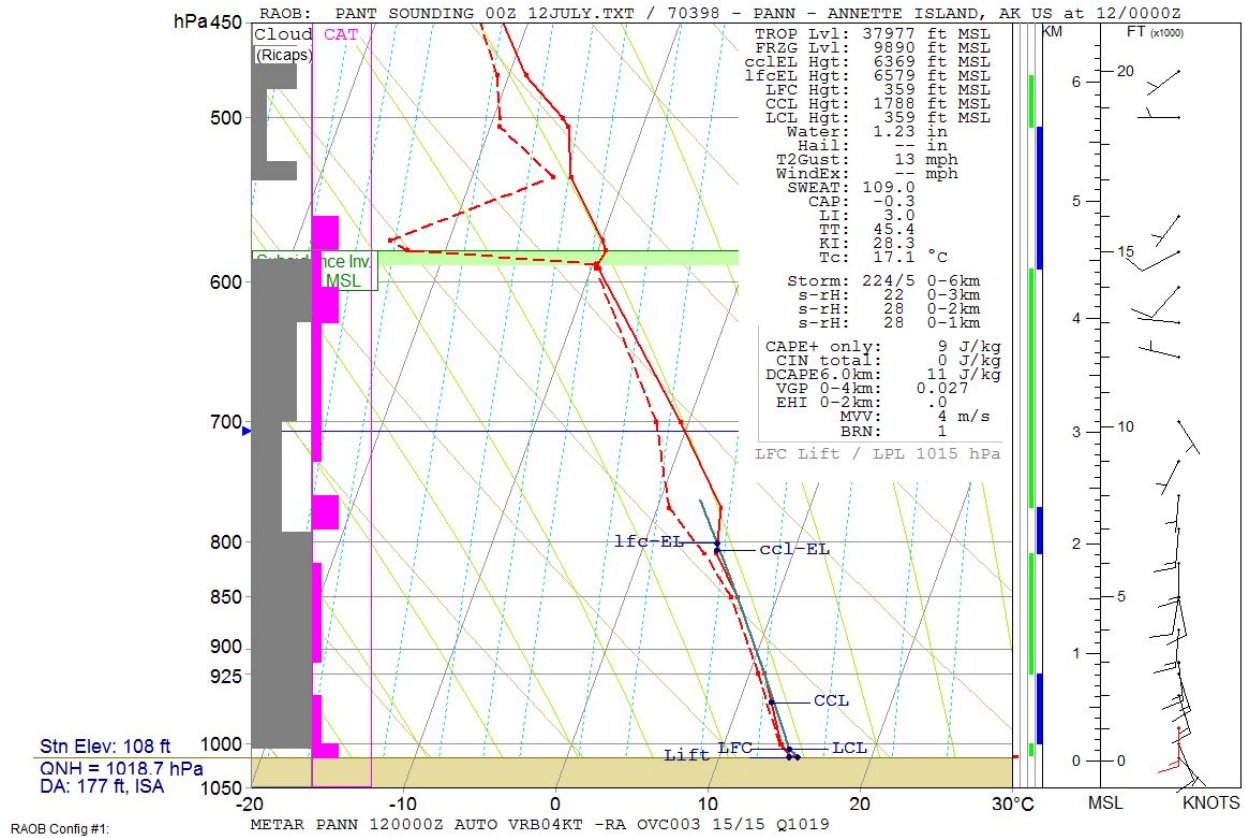


Figure 3 - PANN 1600 AKDT sounding

The sounding wind profile indicated a surface wind from the southeast or 140° at 6 knots with wind veering to the south immediately above 1,000 ft where a low-level wind maximum from 180° at 15 knots was identified with winds from the south through 9,000 ft with little directional variation. Above 9,000 ft the winds veered to the west with speeds of approximately 10 knots or less. The mean 0 to 6 kilometer (18,000 ft) steering wind was from approximately 190° at 13 knots, and no strong jet streams were identified on the sounding. The tropopause was at approximately 38,000 ft. The sounding indicated a potential for moderate turbulence near 160 ft and near 7,600 ft due to moderate vertical wind shears near those levels.

Figure 4 is a table of the PANN sounding parameters of height, temperature (T), dew point temperature (Td), relative humidity (RH), wind direction (DD) and speed (FF), and the RAOB derived clear air turbulence (CAT), low-level wind shear (LLWS), and icing intensity and type.

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
108	1015	15.2	14.6	96	140 / 4			
163	1013	14.6	14.6	100		MDT	LIGHT	
522	1000	13.8	13.7	99	160 / 12	LGT	LIGHT	
1000	983				180 / 15	LGT		
2000	948				165 / 14			
2673	925	11.0	10.6	97	165 / 14			
3000	914				175 / 15	LGT		
4000	881				185 / 13	LGT		
4978	850	7.4	7.0	97	170 / 10	LGT		
6000	818				180 / 13			
6277	810	5.0	4.2	95				
7000	788				185 / 13			
7633	770	4.2	0.8	79		MDT		
8000	759				185 / 7			
9000	731				205 / 7	LGT		
10159	700	-0.5	-2.1	89	150 / 5	LGT		LGT Clear

Figure 4 - PANN sounding parameters and derived CAT, LLWS, and icing potential

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 17 (GOES-17) 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 (McIDAS) software. The infrared long wave and visible imagery were obtained surrounding the time of the accident, with the images closest to the time of the accident documented below. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (μm) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km. The visible (band 2) at a wavelength of 0.64 μm at a nominal resolution of 0.5 km.

Figure 5 is the GOES-17 infrared image for 1420 AKDT at 4X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops, with the accident site marked by the red square. The area was covered by low to mid-level clouds with approximate cloud tops near 9,500 ft.

Figure 6 is the GOES-17 visible image for the same period at 2X magnification showing more details of the low and mid-level broken to overcast cloud cover over the accident site.

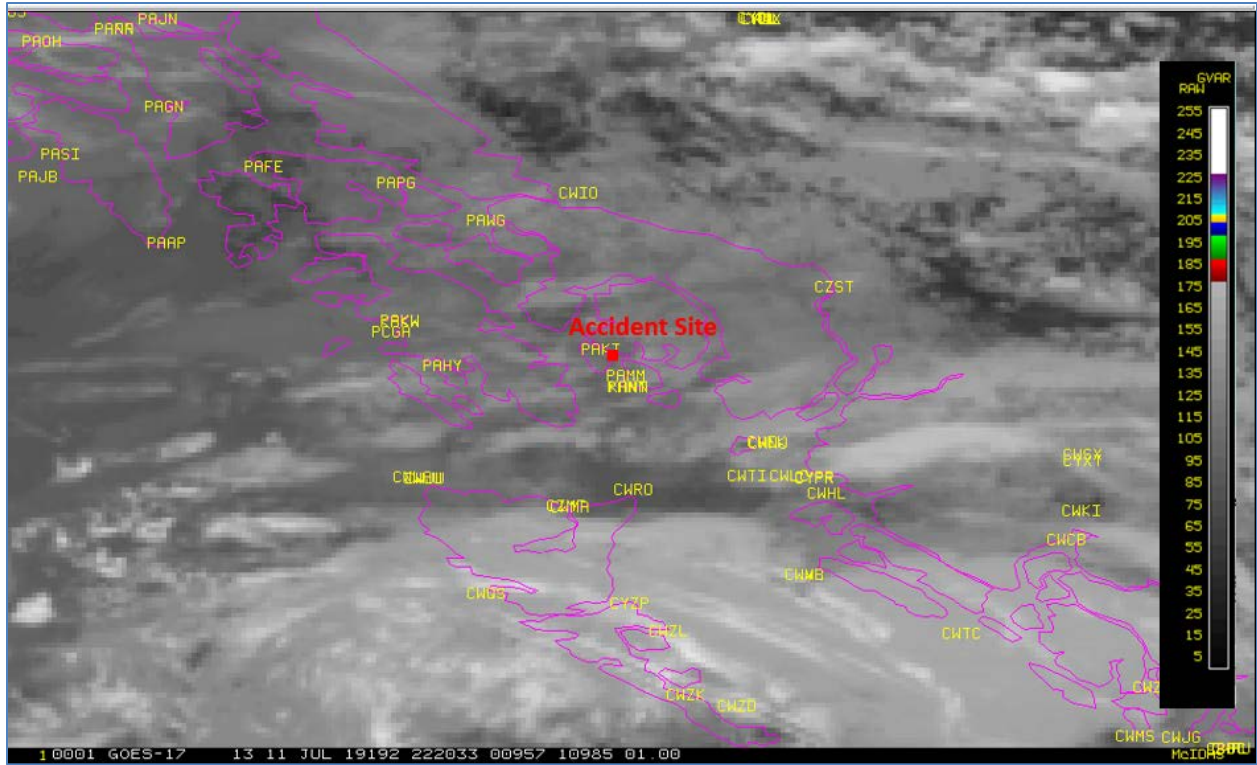


Figure 5 - GOES-17 infrared image at 1420 AKDT at 4X magnification with a standard enhancement curve

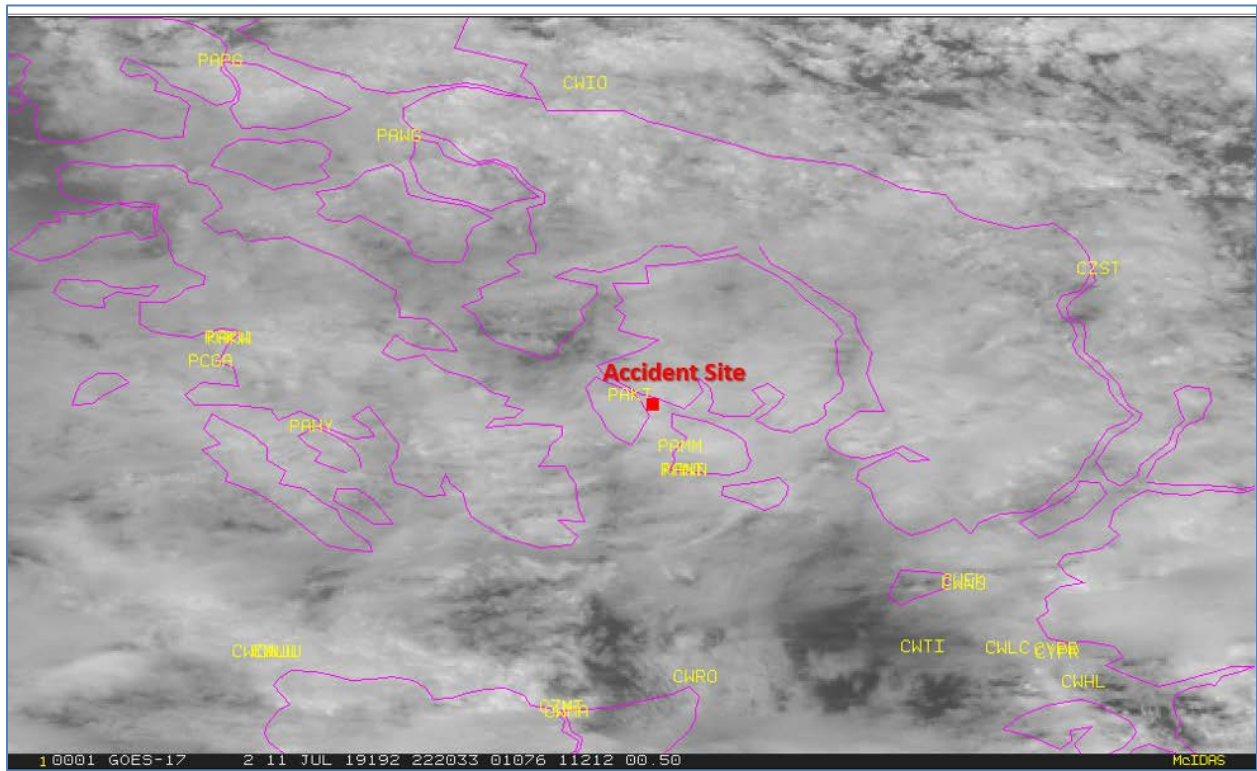


Figure 6 - GOES-17 visible image at 1420 AKDT at 2X magnification

5.0 Pilot Reports

The only pilot reports (PIREPs) noted over southeast Alaska surrounding the period were as follows, provided in standard code and abbreviations, and then decoded with time converted to local.

KTN UA /OV KTN /TM 1510 /FLUNKN /TP C208 /SK OVC012 /RM DURD =

KTN routine pilot report; Over – KTN; Time – 0710 AKDT; Altitude – unknown; Type aircraft – Cessna Caravan (C208) single engine turboprop aircraft; Sky cover – overcast clouds at 1,200 ft; Remarks – during descent.

KTN UA /OV KTN /TM 1520 /FLUNKN /TP C208 /SK OVC007-TOPUNKN /TA UNKN /TB CONS LGT /IC NEG /RM DURD FAP RY11=

KTN routine pilot report; Over – KTN; Time – 0720 AKDT; Altitude – unknown; Type aircraft – Cessna Caravan (C208) single engine turboprop aircraft; Sky cover – overcast clouds with bases at 700 ft with tops unknown; Temperature – unknown; Turbulence – continuous light turbulence; Icing – negative; Remarks – during final approach to runway 11.

6.0 NWS Forecasts

6.1 Terminal Aerodrome Forecasts

The NWS Juneau (PAJN), Weather Forecast Office (WFO) was responsible for the issuance of the PAKT TAF. A TAF is only valid for a 5 mile radius around the airport center point and is typically issued every 6-hours with amendments as necessary, and valid for a 24-hour period. Cloud heights are reported in agl heights as in METARs. The forecasts issued surrounding the period were as follows, with the forecast period valid for the estimated time of arrival in bold italic print:

*TAF PAKT 111139Z 1112/1212 14006KT P6SM OVC015
TEMPO 1112/1114 3SM BR OVC008
FM111700 14009KT P6SM VCSH OVC018=*

*AMD TAF PAKT 111423Z 1114/1212 13009KT P6SM SCT004 OVC015
TEMPO 1114/1116 1SM BR BKN004 OVC008
FM111700 14009KT P6SM VCSH OVC018=*

*AMD TAF PAKT 111611Z 1116/1212 13009KT P6SM -SHRA SCT010 OVC020
TEMPO 1116/1119 1SM BR BKN010 OVC020
FM111900 14009KT P6SM VCSH OVC018=*

*TAF PAKT 111723Z 1118/1218 13010KT 3SM -SHRA BR SCT010 OVC025
TEMPO 1118/1120 1 1/2SM BR BKN010 OVC020
FM112000 14009KT P6SM VCSH OVC025
FM121200 15004KT 4SM BR VCSH BKN010 OVC020=*

Time of departure at 1810Z

AMD TAF PAKT 112001Z 1120/1218 13010KT 3SM -SHRA BR SCT010 OVC025
TEMPO 1120/1124 1 1/2SM -SHRA BR BKN010 OVC020
FM120000 14009KT P6SM VCSH OVC025
FM121200 15004KT 4SM BR VCSH BKN010 OVC020=

The forecasts for PAKT issued at 0923 AKDT (1723Z) which was current at the time of departure and expected general MVFR conditions to prevail with a southeast wind from 140° at 9 knots, visibility greater than 6 miles, with rain showers in the vicinity, with a ceiling overcast at 2,500 ft agl. The forecast was amended at 1201 AKDT (2001Z) and expected MVFR to temporary IFR conditions. The forecast was for wind from 130° at 10 knots, visibility 3 miles in light rain showers and mist, scattered clouds at 1,000 ft agl, and a ceiling overcast at 2,500 ft with a temporary¹⁰ period from 1200 through 1600 AKDT of visibility 1 ½ miles in light rain showers and mist, with a ceiling broken at 1,000 ft, and overcast clouds at 2,000 ft.

6.2 Area Forecast

The Area Forecast (FA) for southeast Alaska at 0914 AKDT and available at the time of departure was as follows, the bold italic print is the section applying to the PAKT area.

FAAK47 PAWU 111714 AAA
FA7H
JNUH FA 111709 AMD
EASTERN GULF COAST AND SE AK...

AIRMETS VALID UNTIL 112015
CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.

SYNOPSIS VALID UNTIL 120600
HI PRES OVR SRN SE AK WL PRST. A WK INVERTED TROF OVR THE SERN
GLFALSK WITH LITTLE ASSOCD WEATHER WL ALSO PRST.

LYNN CANAL AND GLACIER BAY JB...VALID UNTIL 120000 UPDT
...CLOUDS/WX...UPDT
****AIRMET MT OBSC***MTS OBSC IN CLDS. NC...*
SCT015 BKN035 TOP 070. OCNL BKN015. VCY CROSS SOUND OCNL VIS 3-5SM BR.
OTLK VALID 120000-120600...MTS AND PAGES SW MVFR CIG SHRA. ELSW VFR SHRA.
PASSES...UPDT
WHITE...CHILKOOT...MVFR CIG.
...TURB...
NIL SIG.
...ICE AND FZLVL...
NIL SIG. FZLVL 110.

CNTRL SE AK JC...VALID UNTIL 120000 UPDT
...CLOUDS/WX...UPDT
****AIRMET MT OBSC***MTS OBSC IN CLDS. IMPR...*
SCT020 BKN035 TOP 070. W CHATHAM STRAIT OCNL BKN020. OCNL VIS 6SM HZ.
OTLK VALID 120000-120600...UPDT

¹⁰ Temporary conditions - fluctuations to forecast conditions which are expected to last less than one hour in each instance and, in the aggregate, to cover less than half of the indicated period. FAA regulations requires a pilot to consider the worst case scenario when determining if destination minimums or an alternate airport is required.

W CHATHAM STRAIT MVFR CIG. ELSW VFR.
 ...TURB...
 NIL SIG.
 ...ICE AND FZLVL...
 NIL SIG. FZLVL 100.
 .
 SRN SE AK JD...VALID UNTIL 120000
 ...CLOUDS/WX...
 AIRMET IFRPAKT S OCNL CIG BLW 010 ISOL VIS BLW 3SM BR. NC...
 AIRMET MT OBSCMTS OCNL OBSC IN CLDS/ISOL PCPN. NC...
 SCT015 BKN035 TOPS 060 LYRS ABV TO FL210.
 OCNL SCT003 OVC015. PAKT S OCNL VIS 3-5SM -DZ/BR.
 OTLK VALID 120000-120600...MVFR CIG SHRA.
 ...TURB...
 NIL SIG.
 ...ICE AND FZLVL...
 PAKT S ISOL MOD ICEIC 140-FL210. FZLVL 100.
 .
 JAM/DH JUL 2019 AAUW

The forecast for southeast Alaska from PAKT and south expected occasional ceilings below 1,000 ft with isolated visibilities below 3 miles in mist, with no changes expected. As a result, an AIRMET for IFR conditions and mountain obscuration extended over the region. The general forecast for the area was for scattered clouds at 1,500 ft, broken clouds at 3,500 ft with tops to 6,000 ft with additional layers above to 21,000 ft. Occasional scattered clouds at 300 ft and overcast clouds at 1,500 ft. From PAKT south occasional visibility 3 to 5 miles in light drizzle and mist. No significant turbulence was expected during the period. Isolated moderate icing in clouds was expected between 14,000 and 21,000 ft, with the freezing level near 10,000 ft.

The forecast was updated at about 1200 AKDT and was as follows.

FAAK47 PAWU 112012
 FA7H
 JNUH FA 112015
 EASTERN GULF COAST AND SE AK...
 .
 AIRMETS VALID UNTIL 120415
 CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
 NON MSL HEIGHTS NOTED BY AGL OR CIG.
 .
 SYNOPSIS VALID UNTIL 121400
 HI PRES RDG WL PRST OVER THE GULF OF AK THRU THE FCST PD.
 .
 LYNN CANAL AND GLACIER BAY JB...VALID UNTIL 120800
 ...CLOUDS/WX...
 AIRMET MT OBSCMTS OBSC IN CLDS. NC...
 SCT015 BKN040 TOP 070. S PAHN OCNL BKN015. VCY CROSS SOUND OCNL VIS
 3-5SM BR. ELSW OCNL VIS 6SM HZ. PAHN N SFC WND E-S G25KT.
 OTLK VALID 120800-121400...MVFR CIG BR.
 PASSES...
 WHITE...CHILKOOT...MVFR CIG.
 ...TURB...
 NIL SIG.
 ...ICE AND FZLVL...

NIL SIG. FZLVL 110.

*.
CNTRL SE AK JC...VALID UNTIL 120800*

...CLOUDS/WX...

****AIRMET MT OBSC***MTS OBSC IN CLDS. NC...*

SCT020 BKN040 TOP 070. W CHATHAM STRAIT OCNL BKN020. ALL SXNS OCNL

VIS 6SM HZ. ISOL -SHRA.

OTLK VALID 120800-121400...MVFR CIG.

...TURB...

NIL SIG.

...ICE AND FZLVL...

NIL SIG. FZLVL 100.

*.
SRN SE AK JD...VALID UNTIL 120800*

...CLOUDS/WX...

****AIRMET IFR***TIL 00Z PAKT S OCNL CIGS BLW 010/VIS BLW 3SM BR. IMPR...*

****AIRMET MT OBSC***MTS OBSC IN CLDS. NC...*

TIL 00Z PAKT S BKN008 OVC015 TOP 120 W/CI ABV. VIS 3SM BR. ELSW/OTRW

SCT015 BKN035 TOP 120 W/CI ABV. OCNL BKN015. ISOL -SHRA.

OTLK VALID 120800-121400...IFR CIG BR.

...TURB...

NIL SIG.

...ICE AND FZLVL...

NIL SIG. FZLVL 100.

*.
JAM JUL 2019 AAWU*

The updated forecast for southeast Alaska continued the AIRMET for IFR conditions over PAKT and south expected occasional ceilings below 1,000 ft and visibility below 3 miles in mist, with conditions expected to improve after 1400 AKDT. Mountain obscuration conditions were expected to continue through 2400 AKDT. The advisory for mountain obscuration was expected to continue unchanged. The forecast called for the area from PAKT south to have ceilings broken at 800 ft, overcast clouds at 1,500 ft with tops to 12,000 ft with higher cirrus clouds above, and visibility 3 miles in mist. The forecast indicated that no significant turbulence or icing conditions were expected, with the freezing level near 10,000 ft.

FAAK47 PAWU 112116 CCA

FA7H

JNUH FA 112115 COR

EASTERN GULF COAST AND SE AK...

*.
AIRMETS VALID UNTIL 120415*

CB IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.

NON MSL HEIGHTS NOTED BY AGL OR CIG.

*.
SYNOPSIS VALID UNTIL 121400*

HI PRES RDG WL PRST OVER THE GULF OF AK THRU THE FCST PD.

*.
SRN SE AK JD...VALID UNTIL 120800 UPDT*

...CLOUDS/WX...UPDT

****AIRMET IFR***TIL 00Z PAKT S OCNL CIGS BLW 010/VIS BLW 3SM BR. IMPR...*

****AIRMET MT OBSC***MTS OBSC IN CLDS/ISOL PCPN. NC...*

TIL 00Z PAKT S BKN008 OVC015 TOP 120 W/CI ABV. VIS 3SM BR. ELSW/OTRW

SCT015 BKN035 TOP 120 W/CI ABV. OCNL BKN015. ISOL -SHRA.

OTLK VALID 120800-121400...IFR CIG BR.

...TURB...

NIL SIG.

...ICE AND FZLVL...

NIL SIG. FZLVL 100.

JAM JUL 2019 AAWU

A corrected forecast was issued at 1316 AKDT with the AIRMET for IFR and mountain obscuration conditions continued through 1600 AKDT. The forecast for PAKT and south was for broken clouds at 800 ft, overcast clouds at 1,500 ft with tops above 12,000 ft with higher cirrus clouds above, and visibility 3 miles in mist. No significant turbulence or icing were expected over the region.

7.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in Alaska are issued by the Anchorage Aviation Weather unit (PAWU). There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the AIRMET, and the Center Weather Advisory (CWA). Inflight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft.

During the period the only advisories being issued for the area were AIRMET Sierra for IFR and mountain obscuration conditions. The advisories were as follows.

WAAK47 PAWU 112012

WA70

JNUS WA 112015

AIRMET SIERRA FOR IFR AND MT OBSC VALID UNTIL 120415

LYNN CANAL AND GLACIER BAY JB

MTS OBSC IN CLDS. NC.

CNTRL SE AK JC

MTS OBSC IN CLDS. NC.

SRN SE AK JD

TIL 00Z PAKT S OCNL CIGS BLW 010/VIS BLW 3SM BR. IMPR.

ERN GLF CST JE

OCNL CIGS BLW 010/VIS BLW 3SM BR. NC.

ERN GLF CST JE

MTS OBSC IN CLDS. NC.

SE AK CSTL WTRS JF

OFSHR OCNL CIGS BLW 010. NC.

SE AK CSTL WTRS JF

MTS OBSC IN CLDS. NC.

.
=*JNUT WA 112015*
AIRMET TANGO FOR TURB/STG SFC WINDS VALID UNTIL 120415

.
NONE

.
=*JNUZ WA 112015*
AIRMET ZULU FOR ICING VALID UNTIL 120415

.
NONE

.
JAM JUL 2019 AAWU

8.0 Weather Briefing Information

A search of the FAA Automated Flight Service Station (AFSS) contract provider Leidos indicated that they had a contact from the pilot at approximately 0940 AKDT on July 11, 2019 to file a VFR flight plan only. The estimated time of departure was 1000 AKDT with an estimated time enroute of 4:30, total fuel on board 6:30, and a planned cruising altitude of 3,500 ft. When asked if the pilot wanted an update of the adverse conditions, the pilot indicated “I think we’re good to go” and the call terminated.

A separate check of third-party vendor ForeFlight indicated that the pilot did have an account but did not request any specific weather briefings or review any static weather imagery prior to the flight. The accident pilot did enter a route string into the app at approximately 1800 AKDT on July 10, 2019, with the route string of KFHR, CYJQ¹¹, and PAKT. ForeFlight indicated that the pilot had viewed those airports prior to the flight, which could have included airport information such as frequencies or runways, or weather (METAR/TAF), but ForeFlight did not have a record of what the pilot viewed on each airport’s page. It is therefore unknown what weather information the pilot viewed prior to the flight.

9.0 FAA Weather Cameras

The FAA has deployed 230 weather cameras across the region. The FAA weather camera program is intended as a supplementary product used to improve situational awareness, but may not be used to comply with regulatory requirements to determine weather minimums. The camera images are updated every 10 minutes and have been critical to help pilots make better safety decisions.

Each of the weather cameras is identified by a point on the map¹². Several camera angle views are available for most of the cameras.

¹¹ Denny Island Airport (CYJQ), Bella Bella Island, British Columbia, previously called Bella Bella Airport.

¹² <https://avcams.faa.gov/>

9.1 Ketchikan Camera

The FAA Ketchikan southeast (128°) and south (165°) viewing weather cameras surrounding the period were obtained and are documented below. Figure 7 is a depiction from the FAA website indicating the approximate viewing area of the cameras, with the accident site located within the overlapping views between the two southeast and south viewing cameras.

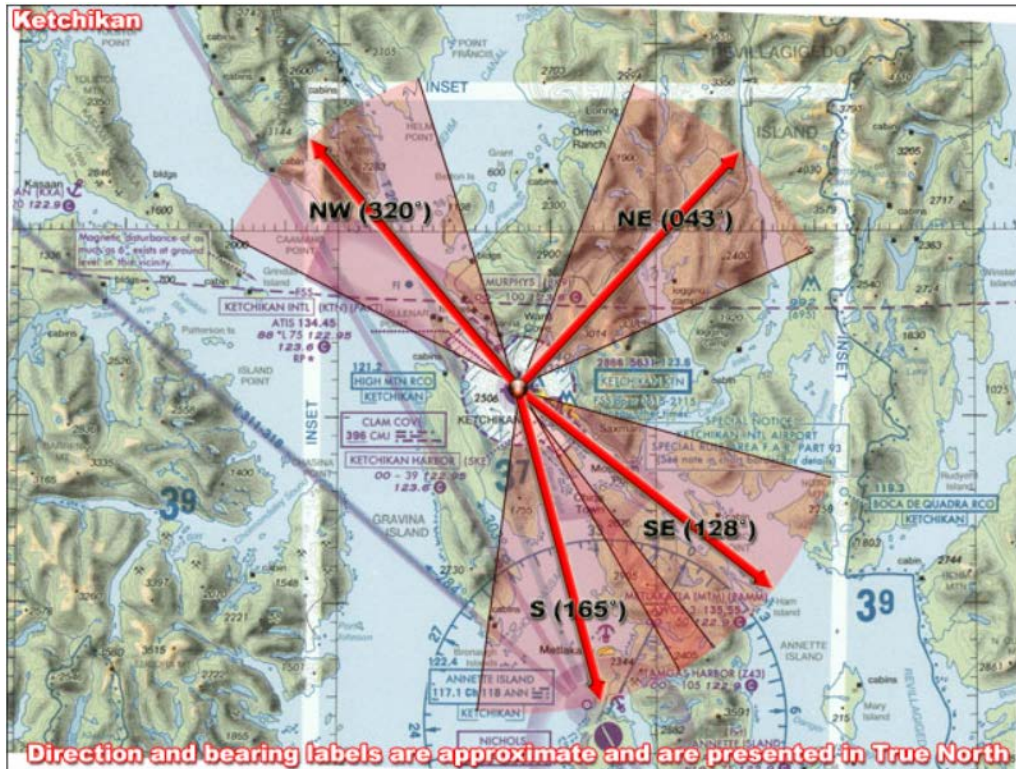


Figure 7 - FAA Weather Cameras for Ketchikan and viewing directions over a sectional chart

Figure 8 is the Ketchikan southeast camera view on a clear day with the various landmarks and elevations noted. The approximate accident site location is marked approximately 4.3 statute miles (SM) off to the bottom right of the image. Pennock Island was located approximately 2.5 SM southeast and was referenced as Island Shore and Judy Hill is also visible in the image, with higher terrain on Annett Island at 9.0 SM at an elevation of 2,000 ft. The camera is mounted on the airport terminal at a height of 31 ft msl.

Weather observers are taught that visibility is the greatest horizontal distance at which selected objects can clearly be seen and identified, and to base the visibility estimate on the sharpness with which the most distant markers can be seen. If the markers can be seen clearly, with little loss of color, and with the sharp outlines, it means that the visibility is much greater than the distance to the markers. If the object is not clearly identified, visibility is less than that distance.

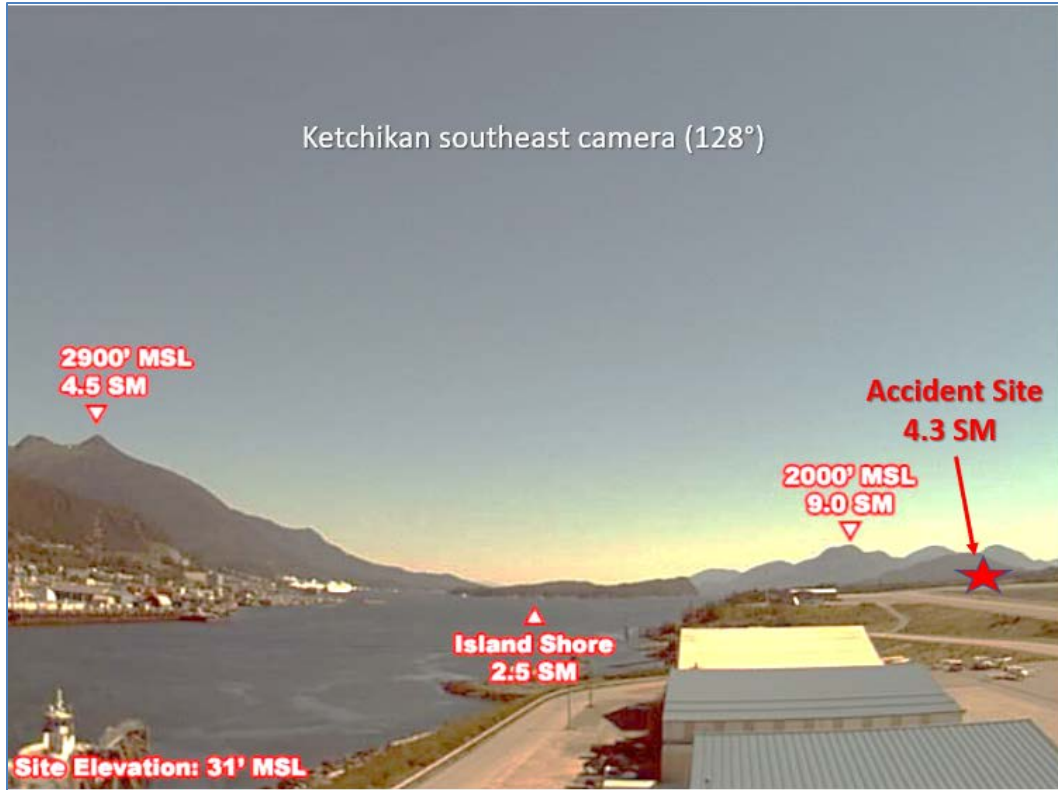


Figure 8 - Ketchikan southeast camera view on a clear day

Figures 9 through 14 are the Ketchikan southeast camera views for 1340, 1350, 1400, 1410, 1420, and 1430 AKDT.

Thu 11 Jul 2019 21:40:27 UTC
Thu 11 Jul 2019 13:40:27 AKDT

Ketchikan - SouthEast
See <https://avcams.faa.gov> for more information



FAA advisory weather product

Figure 9 - Ketchikan southeast camera view at 1340 AKDT

Thu 11 Jul 2019 21:50:28 UTC
Thu 11 Jul 2019 13:50:28 AKDT

Ketchikan - SouthEast
See <https://avcams.faa.gov> for more information



FAA advisory weather product

Figure 10 - Ketchikan southeast camera views at 1350 AKDT

Thu 11 Jul 2019 22:00:28 UTC
Thu 11 Jul 2019 14:00:28 AKDT

Ketchikan - SouthEast
See <https://avcams.faa.gov> for more information



Figure 11 - Ketchikan southeast camera view at 1400 AKDT

Thu 11 Jul 2019 22:10:27 UTC
Thu 11 Jul 2019 14:10:27 AKDT

Ketchikan - SouthEast
See <https://avcams.faa.gov> for more information



Figure 12 - Ketchikan southeast camera view at 1410 AKDT

Thu 11 Jul 2019 22:20:29 UTC
Thu 11 Jul 2019 14:20:29 AKDT

Ketchikan - SouthEast
See <https://avcams.faa.gov> for more information



Figure 13 - Ketchikan southeast camera view at 1420 AKDT

Thu 11 Jul 2019 22:30:29 UTC
Thu 11 Jul 2019 14:30:29 AKDT

Ketchikan - SouthEast
See <https://avcams.faa.gov> for more information



Figure 14 - Ketchikan southeast camera view at 1430 AKDT

Figure 15 is the Ketchikan south camera view on a clear day with the visual references noted and the approximate accident site located near the bottom left side of the image about 4.3 SM or near the base of Judy Hill.

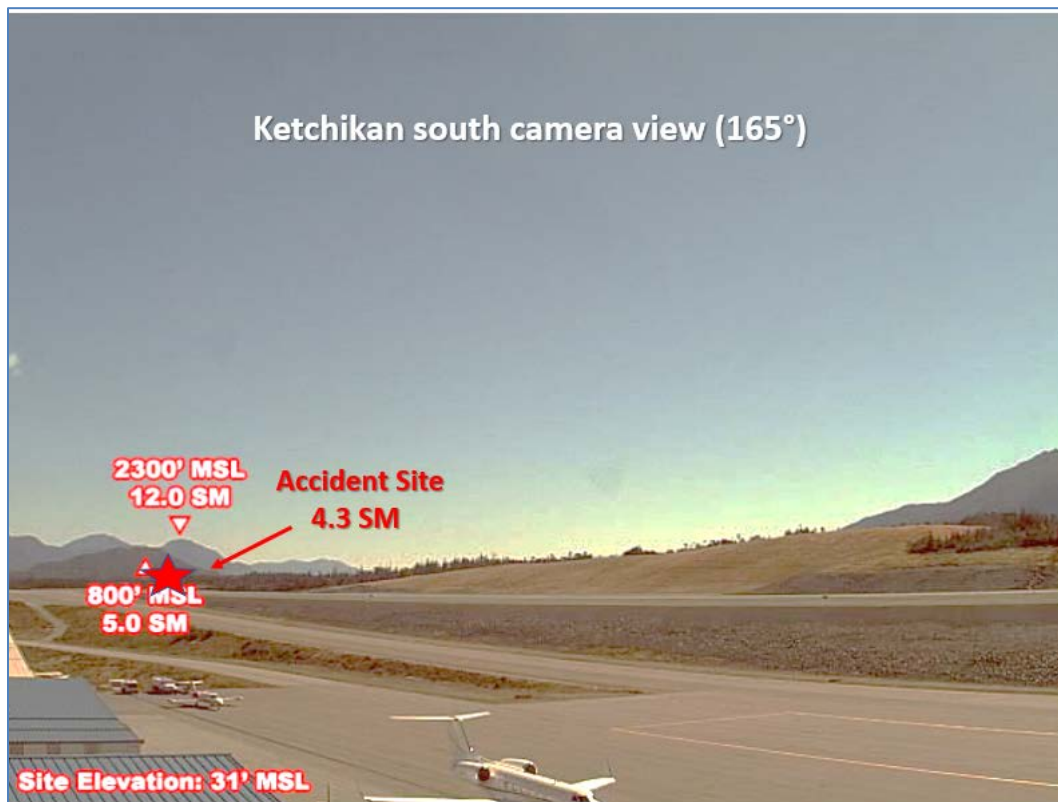


Figure 15 - Ketchikan south camera view on a clear day

Figures 16 through 21 are the Ketchikan south camera views at 1342, 1352, 1402, 1412, 1422, and 1432 AKDT on July 11, 2019 surrounding the time of the accident.



Figure 16 - Ketchikan south camera view at 1342 AKDT



Figure 17 - Ketchikan south camera view at 1352 AKDT

Thu 11 Jul 2019 22:02:46 UTC
Thu 11 Jul 2019 14:02:46 AKDT

Ketchikan - South
See <https://avcams.faa.gov> for more information



FAA advisory weather product

Figure 18 - Ketchikan south camera view at 1402 AKDT

Thu 11 Jul 2019 22:12:41 UTC
Thu 11 Jul 2019 14:12:41 AKDT

Ketchikan - South
See <https://avcams.faa.gov> for more information



FAA advisory weather product

Figure 19 - Ketchikan south camera view at 1412 AKDT



Figure 20 - Ketchikan south camera view at 1422 AKDT



Figure 21 - Ketchikan south camera view at 1432 AKDT

9.2 Mountain Point Camera

A third party weather camera site run by Taquan Air was located near Mountain Point located about 4 miles east-southeast of the accident site at an elevation of 183 ft and provided a camera view viewing southeast down the Revillagigedo Channel and depicting the conditions approaching the Ketchikan area. Figure 22 is a sectional map with the Mountain Point camera location and southeast view, with figure 23 the southeast view towards 130° reference points on a clear day with the camera at an elevation of 183 ft msl.



Figure 22 - Mountain Point southeast camera view

Figures 24 through 29 are the Mountain Point southeast camera views at 1347, 1357, 1407, 1417, 1427, and 1437 AKDT on July 11, 2019.

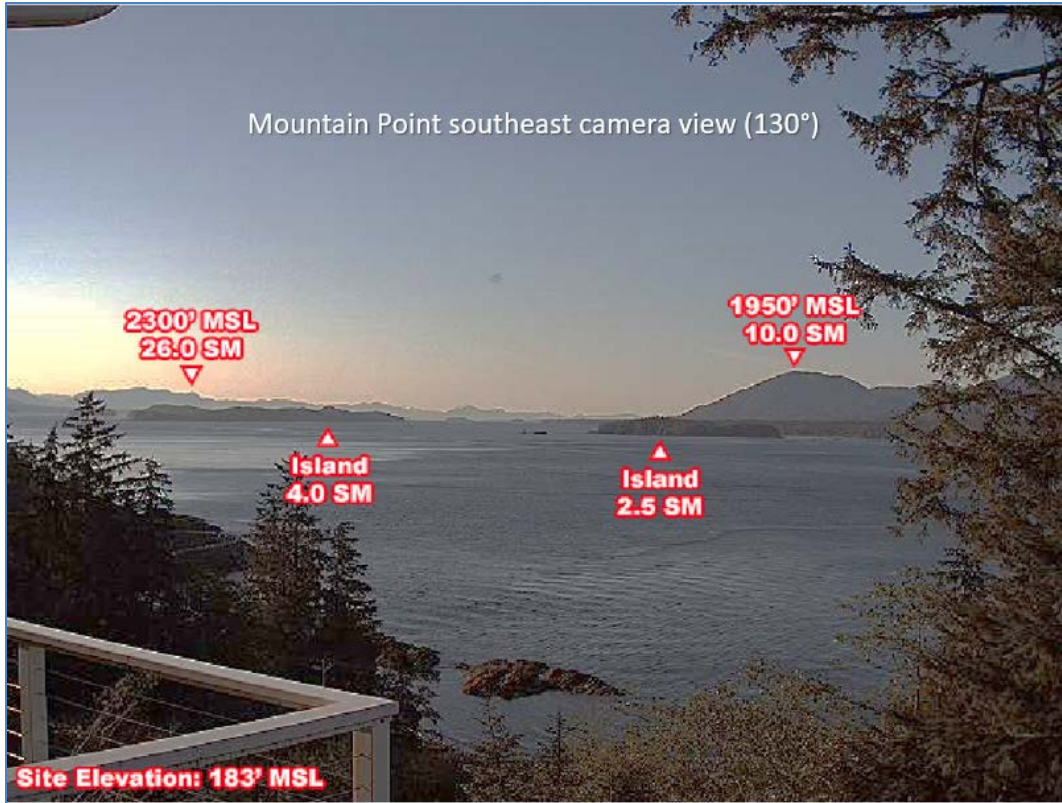


Figure 23 - Mountain Point southeast camera view on a clear day

Thu 11 Jul 2019 21:47:27 UTC
Thu 11 Jul 2019 13:47:27 AKDT

Mountain Point - SouthEast
See <https://avcams.faa.gov> for more information



Figure 24 - Mountain Point southeast camera view at 1347 AKDT

Thu 11 Jul 2019 21:57:27 UTC
Thu 11 Jul 2019 13:57:27 AKDT

Mountain Point - SouthEast
See <https://avcams.faa.gov> for more information



Figure 25 - Mountain Point southeast camera view at 1357 AKDT

Thu 11 Jul 2019 22:07:27 UTC
Thu 11 Jul 2019 14:07:27 AKDT

Mountain Point - SouthEast
See <https://avcams.faa.gov> for more information



Figure 26 - Mountain Point southeast camera view at 1407 AKDT



Figure 27 - Mountain Point southeast camera view at 1417 AKDT



Figure 28 - Mountain point southeast camera view at 1427 AKDT



Figure 29 - Mountain Point southeast camera view at 1437 AKDT

10.0 Astronomical Conditions

The United States Naval Observatory’s website was used to determine the astronomical conditions for Ketchikan, Ketchikan Gateway Borough, Alaska on the day of the accident. The time of the accident has been added in bold italic print for reference.

<u>SUN</u>	
Begin of civil twilight	0325 AKDT
Sunrise	0420 AKDT
Sun transit	1252 AKDT
<i>Accident</i>	<i>1419 AKDT</i>
Sunset	2123 AKDT
End of civil twilight	2218 AKDT

At the time of the accident the Sun was 52° above the horizon at an azimuth of 215°.

Submitted by:

Don Eick
Senior Meteorologist