



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 31, 2014

Group Chairman's Factual Report

METEOROLOGY

DCA13MA121

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A. ACCIDENT

Location: On the grounds of the Soldotna Airport
Date: July 7, 2013
Time: approximately 1120 Alaska daylight time (1920 UTC¹)
Aircraft: De Havilland DHC-3, registration: N93PC

B. METEOROLOGY GROUP

Paul Suffern
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. SUMMARY

For a summary of the accident, refer to the *Accident Summary* report, which is available in the docket for this investigation.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist was not on scene for this investigation and gathered all the weather data for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are Alaska daylight time (AKDT) on July 7, 2013, and are based upon the 24-hour clock, where local time is -8 hours from UTC, and UTC=Z (unless otherwise noted). 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.

¹ UTC – is an abbreviation for Coordinated Universal Time.

E. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP), and the Weather Prediction Center (WPC) located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the, joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC-0045G CHG 1.

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 1000 AKDT is provided as figure 1, with the approximate location of the accident site marked. The chart depicted an occluded front near Homer, Alaska, stretched southeastward into the northeastern Pacific Ocean. A surface low pressure center with a pressure of 1002-hectopascals (hPa) was located just south of Homer, Alaska. The station models around the accident site depicted air temperatures in the upper 40's to mid 50's Fahrenheit (F), with temperature-dew point spreads of 6° F or less, variable winds less than 15 knots, mostly clouds skies, and rain.

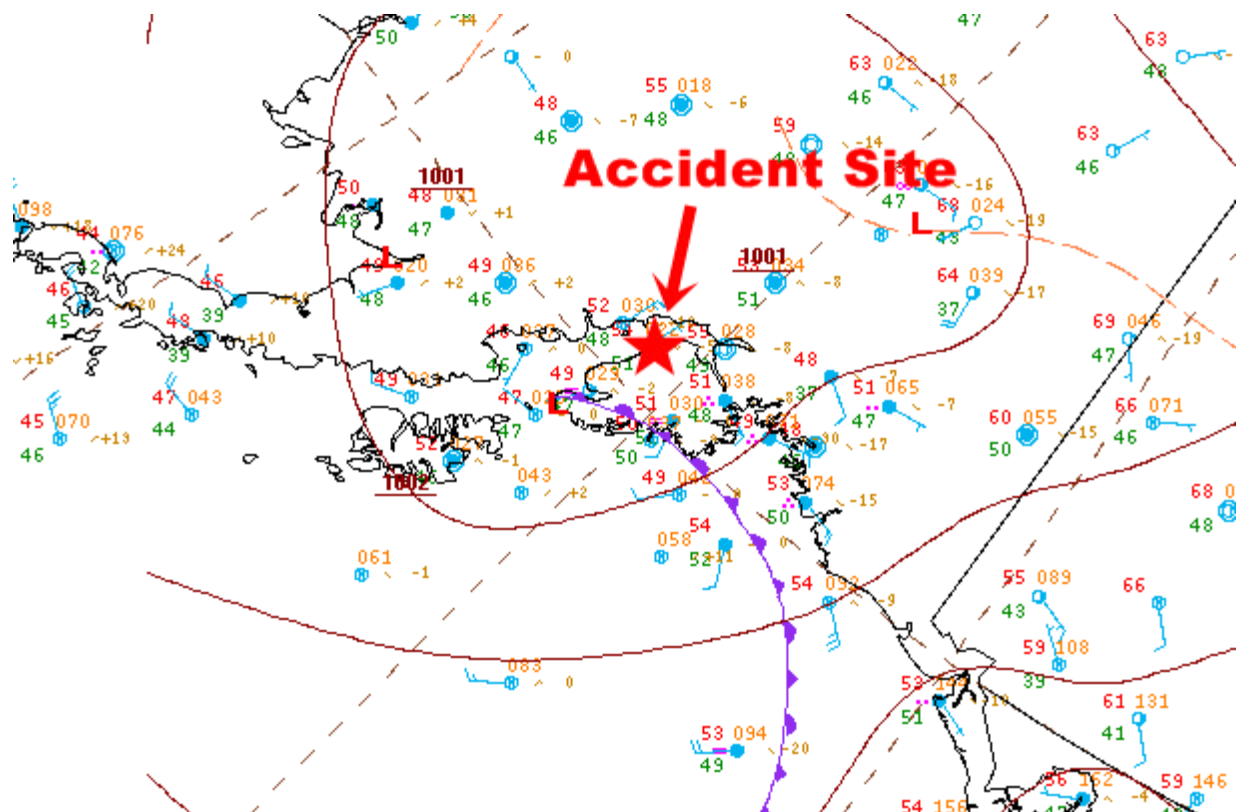


Figure 1 – NWS Surface Analysis Chart for 1000 AKDT

2.0 Storm Prediction Center Products

No thunderstorms or severe storms were forecast.

3.0 Surface Observations

The area surrounding the accident site was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language.



Figure 2 – Map of Alaska with the location of the accident site, surface observation sites, upper air sounding location, and weather radar site

Soldotna Airport (PASX) located 1 mile southeast of Soldotna, Alaska, and had an Automated Weather Observing System (AWOS²) whose reports were not supplemented by a human observer. PASX had an elevation of 113 feet and had a 19° easterly magnetic variation³ (figure 2, accident site). The following observations were taken and disseminated during the times surrounding the accident⁴:

² AWOS – Automated Weather Observing System is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to twelve thousand feet, and altimeter setting.

³ Magnetic variation – The angle (at a particular location) between magnetic north and true north.

⁴ The bold sections in this NWS product and the rest of products in the weather factual report are to highlight the individual sections that directly reference the weather conditions that are or will affect the accident location around the accident time.

[0936 AKDT] PASX 071736Z 00000KT 10SM 13/10 A2957 RMK AO1=

[0956 AKDT] PASX 071756Z 26005KT 10SM 13/11 A2957 RMK AO1 60001
10130 20090 57007=

[1016 AKDT] PASX 071816Z 26004KT 10SM 13/10 A2957 RMK AO1=

[1036 AKDT] PASX 071836Z 00000KT 10SM 13/09 A2957 RMK AO1=

[1056 AKDT] PASX 071856Z 20006KT 10SM 13/09 A2957 RMK AO1=

[1116 AKDT] PASX 071916Z 19006KT 10SM 12/08 A2958 RMK AO1=

ACCIDENT TIME 1120 AKDT

[1136 AKDT] PASX 071936Z 21006KT 10SM 12/08 A2958 RMK AO1=

[1156 AKDT] PASX 071956Z 27003KT 10SM 12/08 A2958 RMK AO1=

[1216 AKDT] PASX 072016Z 23003KT 10SM 12/09 A2959 RMK AO1=

[1236 AKDT] PASX 072036Z 23004KT 10SM 12/09 A2959 RMK AO1=

[1256 AKDT] PASX 072056Z 22005KT 10SM 13/08 A2959 RMK AO1 52007=

[1316 AKDT] PASX 072116Z 23006KT 10SM 13/08 A2959 RMK AO1=

[1336 AKDT] PASX 072136Z 23006KT 10SM 13/08 A2959 RMK AO1=

[1356 AKDT] PASX 072156Z 28005KT 10SM 13/09 A2960 RMK AO1=

[1416 AKDT] PASX 072216Z 33004KT 10SM 12/09 A2960 RMK AO1 P0001=

PASX weather at 1056 AKDT, wind from 200° at 6 knots, 10 miles visibility, temperature of 12° Celsius (C), dew point temperature of 8° C, and an altimeter setting of 29.57 inches of mercury. Remarks: automated station without a precipitation discriminator.

PASX weather at 1116 AKDT, wind from 190° at 6 knots, 10 miles visibility, temperature of 12° C, dew point temperature of 8° C, and an altimeter setting of 29.58 inches of mercury. Remarks: automated station without a precipitation discriminator.

PASX weather at 1136 AKDT, wind from 210° at 6 knots, 10 miles visibility, temperature of 12° C, dew point temperature of 8° C, and an altimeter setting of 29.58 inches of mercury. Remarks: automated station without a precipitation discriminator.

PASX weather at 1156 AKDT, wind from 270° at 3 knots, 10 miles visibility, temperature of 12° C, dew point temperature of 8° C, and an altimeter setting of 29.58 inches of mercury. Remarks: automated station without a precipitation discriminator.

The Soldotna AWOS ceiling sensor was broken at the accident time. NOTAM (SQX06-013) was entered into the log on July 6, 2013, that the ceiling sensor was broken. The reason for the outage was that the ceiling measurement was inoperative. All other measurements were functioning and the ceiling was missing. The needed replacement part was ordered and the ceiling measurement function was returned to service on August 11, 2013.

Kenai Municipal Airport (PAEN) was located near Kenai, Alaska, and had an Automated Surface Observing System (ASOS⁵) whose reports were supplemented by the air traffic control tower. PAEN was located 9 miles west-northwest of the accident site, at an elevation of 99 feet, and had a 19° easterly magnetic variation (figure 2). The following observations were taken and disseminated during the times surrounding the accident:

[0653 AKDT] PAEN 071453Z 02009KT 10SM FEW008 OVC060 11/10 A2961
RMK AO2 RAE10 SLP028 P0001 60005 T01060100 56014=

[0753 AKDT] PAEN 071553Z 01012G17KT 10SM -RA OVC065 11/10 A2959
RMK AO2 RAB38 SLP023 P0001 T01060100=

[0802 AKDT] PAEN 071602Z 01011KT 10SM FEW008 OVC065 11/10 A2959
RMK AO2 RAE1555 P0000=

[0853 AKDT] PAEN 071653Z 01010KT 10SM BKN055 OVC070 11/11 A2959
RMK AO2 RAE1555 SLP022 P0000 T01110106=

***[0953 AKDT] PAEN 071753Z 01005KT 10SM FEW043 OVC055 12/11 A2959
RMK AO2 SLP022 60006 T01220106 10122 20100 55005=***

***[1053 AKDT] PAEN 071853Z 35006KT 10SM FEW042 OVC050 13/11 A2959
RMK AO2 SLP020 T01280111=***

ACCIDENT TIME 1120 AKDT

***[1153 AKDT] PAEN 071953Z 35011KT 4SM -RA BR BKN008 BKN044 OVC055
12/11 A2959 RMK AO2 RAB29 SLP022 P0001 T01220111=***

***[1200 AKDT] PAEN 072000Z 35011KT 7SM -RA FEW029 BKN048 OVC060 12/11
A2960 RMK AO2 P0000=***

[1210 AKDT] PAEN 072010Z 34008KT 2 1/2SM RA BR FEW009 BKN023 OVC049
12/11 A2960 RMK AO2 VIS 1 1/4V5 P0004=

⁵ ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

[1248 AKDT] PAEN 072048Z 35008KT 2 1/2SM -RA BR SCT021 OVC028 12/11
A2960 RMK AO2 P0012=

[1249 AKDT] PAEN 072049Z 35008KT 2 1/2SM -RA BR SCT021 OVC028 12/11
A2960=

[1256 AKDT] PAEN 072056Z 34007KT 4SM BR FEW019 OVC028 12/11 A2961
RMK AO2 RAE56 P0000=

PAEN weather at 0953 AKDT, wind from 010° at 5 knots, 10 miles visibility, few clouds at 4,300 feet above ground level (agl), an overcast ceiling at 5,500 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1002.2 hPa, 6-hourly precipitation of 0.06 inches, temperature of 12.2° C, dew point temperature of 10.6° C, 6-hourly maximum temperature of 12.2° C, 6-hourly minimum temperature of 10.0° C, 3-hourly pressure decrease of 0.5 hPa.

PAEN weather at 1053 AKDT, wind from 350° at 6 knots, 10 miles visibility, few clouds at 4,200 feet agl, an overcast ceiling at 5,000 feet agl, temperature of 13° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1002.0 hPa, temperature of 12.8° C, dew point temperature of 11.1° C.

PAEN weather at 1153 AKDT, wind from 350° at 11 knots, 4 miles visibility, light rain and mist, a broken ceiling at 800 feet agl, broken skies at 4,400 feet agl, overcast skies at 5,500 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury. Remarks: automated station with a precipitation discriminator, rain began at 1129 AKDT, sea level pressure 1002.2 hPa, one-hourly precipitation of 0.01 inches, temperature of 12.2° C, dew point temperature of 11.1° C.

PAEN weather at 1200 AKDT, wind from 350° at 1 knots, 7 miles visibility, light rain, few clouds at 2,900 feet agl, a broken ceiling at 4,800 feet agl, overcast skies at 6,000 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.60 inches of mercury. Remarks: automated station with a precipitation discriminator, one-hourly precipitation of a trace.

3.1 Five Minute Weather Observations

The one-minute and five-minute PAEN ASOS surface data was provided by the NWS for the time surrounding the accident with the five-minute PAEN ASOS data listed below:

5-MIN PAEN 071905Z 35008KT 10SM BKN043 OVC049 13/11 A2959 400 89 300 330/08
RMK AO2

5-MIN PAEN 071910Z 34007KT 10SM OVC045 12/11 A2959 400 89 200 330/07 RMK AO2

**5-MIN PAEN 071915Z 35008KT 10SM BKN042 OVC049 12/11 A2959 400 89 200 330/08
RMK AO2**

5-MIN PAEN 071920Z 35008KT 10SM OVC042 12/11 A2959 400 89 200 340/08 RMK AO2

**5-MIN PAEN 071925Z 34008KT 10SM SCT038 OVC046 12/11 A2959 400 89 200 330/08
RMK AO2**

**5-MIN PAEN 071930Z 35007KT 10SM -RA FEW030 BKN039 OVC047 12/11 A2959 400
89 200 330/07 RMK AO2 RAB29 P0000**

5-MIN PAEN 071935Z 35008KT 7SM -RA SCT028 BKN037 OVC047 12/11 A2959 400 89
200 330/08 RMK AO2 RAB29 P0000

5-MIN PAEN 071940Z 35008KT 4SM -RA BR SCT028 BKN039 OVC047 12/11 A2959 400
93 200 330/08 RMK AO2 RAB29 P0000

PAEN weather at 1115 AKDT, wind from 350° at 8 knots, 10 miles visibility, a broken ceiling at 4,200 feet agl, overcast skies at 4,900 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury.

PAEN weather at 1120 AKDT, wind from 350° at 8 knots, 10 miles visibility, an overcast ceiling at 4,200 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury.

PAEN weather at 1125 AKDT, wind from 340° at 8 knots, 10 miles visibility, scattered clouds at 3,800 feet agl, an overcast ceiling at 4,600 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury.

PAEN weather at 1130 AKDT, wind from 350° at 7 knots, 10 miles visibility, light rain, few clouds at 3,000 feet agl, a broken ceiling at 3,900 feet agl, overcast skies at 4,700 feet agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 29.59 inches of mercury.

4.0 Upper Air Data

The closest official upper air sounding to the accident site was from Anchorage, Alaska (PANC), which was approximately 51 miles northeast of the accident site, with a site number 70273, and a station elevation of 151 feet (figure 2). The 1600 AKDT sounding from PANC was plotted on a standard Skew-T log P diagram⁶ with the derived stability parameters included in figure 3 (with data from the surface to 700-hPa, or 10,000 feet msl). This data was analyzed utilizing the RAOB⁷ software package. The sounding depicted a conditionally unstable vertical environment with the Lifted Condensation Level (LCL)⁸ at 2,610 feet msl, a Convective Condensation Level (CCL)⁹ of 5,470 feet, and a Level of Free Convection (LFC)¹⁰ at 3,562 feet. The freezing level was located at 7,011 feet msl. The precipitable water value was 0.69 inches.

⁶ Skew T log P diagram – is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

⁷ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

⁸ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

⁹ 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.

¹⁰ 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.

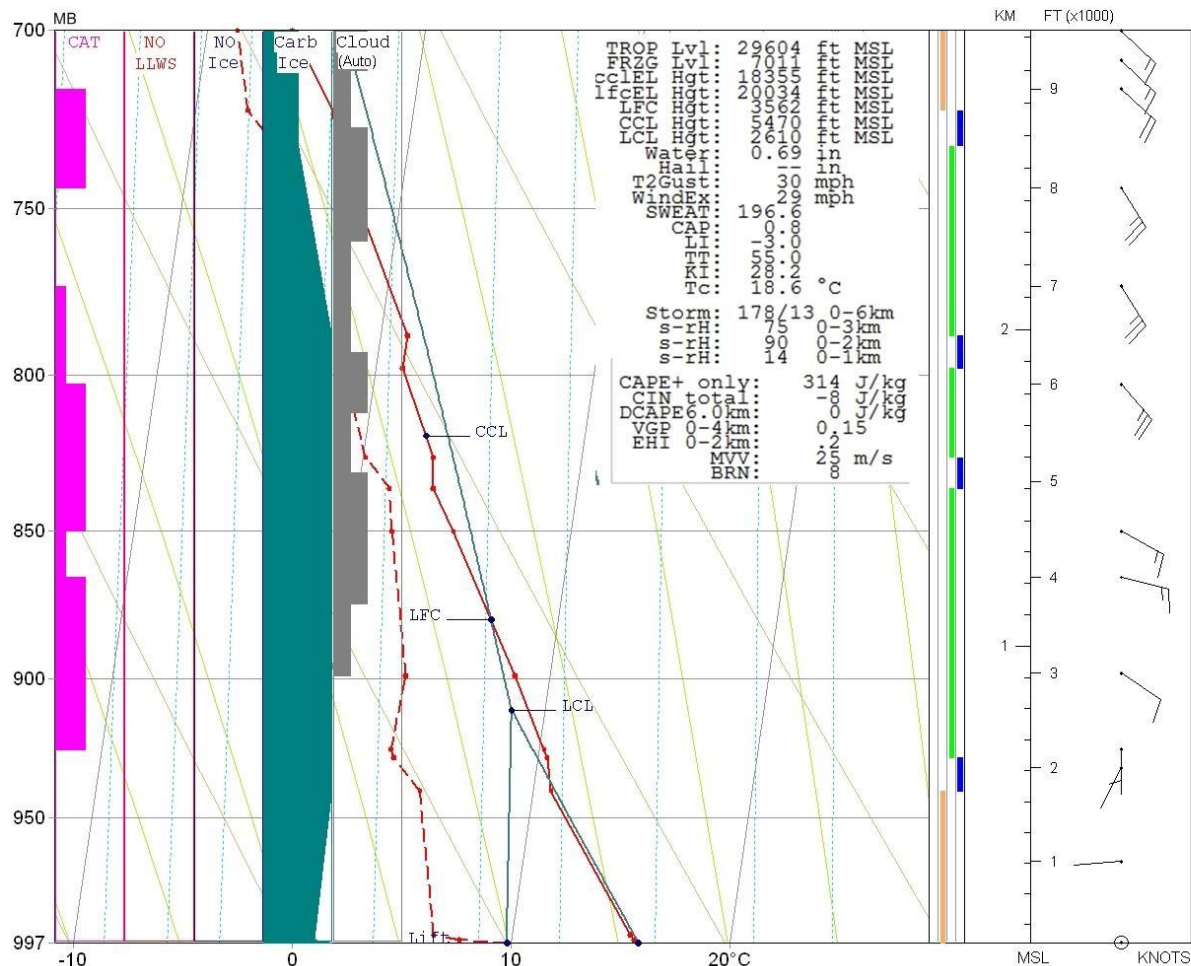


Figure 3 – 1600 AKDT PANC sounding

The 1600 AKDT PANC sounding indicated a conditionally unstable vertical environment from the surface through 10,000 feet msl with several areas of increased moisture, especially above 3,000 feet msl. This environment would have been conducive of cloud formation as indicated by RAOB, especially from 3,000 feet through 10,000 feet. Icing conditions were not indicated by RAOB below 10,000 feet.

The sounding wind profile indicated there was a calm surface wind and the wind did not increase to 10 knots till 3,000 feet out of the southeast. The wind continued to increase in strength through 10,000 feet out of the southeast with the strongest winds between 6,000 and 8,000 feet. Low-level wind shear (LLWS) was not indicated by RAOB. Several layers of possible clear-air turbulence were identified by RAOB from 2,500 feet through 9,000 feet.

5.0 Satellite Data

Visible and infrared data from the Geostationary Operational Environmental Satellite number 15 (GOES-15) data was obtained from the NCDC and processed with the NTSB's Man-computer Interactive Data Access System (McIDAS) workstation. Visible and infrared imagery (GOES-15 band 1 and 4) at a wavelength of 0.65 microns (μm) and 10.7 μm retrieved brightness temperatures for the scene. Satellite imagery surrounding the time of the accident, from 1000 AKDT through 1300 AKDT at approximately 15-minute intervals, were reviewed and the closest images to the time of the accident are documented here.

Figures 4 and 5 present the GOES-15 visible imagery from 1115 and 1130 AKDT at 2X magnification with the accident site highlighted with a red square. The visible imagery showed abundant cloud cover over and around the accident site at the accident time. Figure 6 presents the GOES-15 infrared imagery from 1115 AKDT at 6X magnification. Inspection of the infrared imagery indicated cloud cover over the accident site at the accident time with a brightness temperature of -7°C . Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the 1600 AKDT PANC sounding (figure 3), the approximate cloud-top heights over the accident site were 10,000 feet at 1115 AKDT.

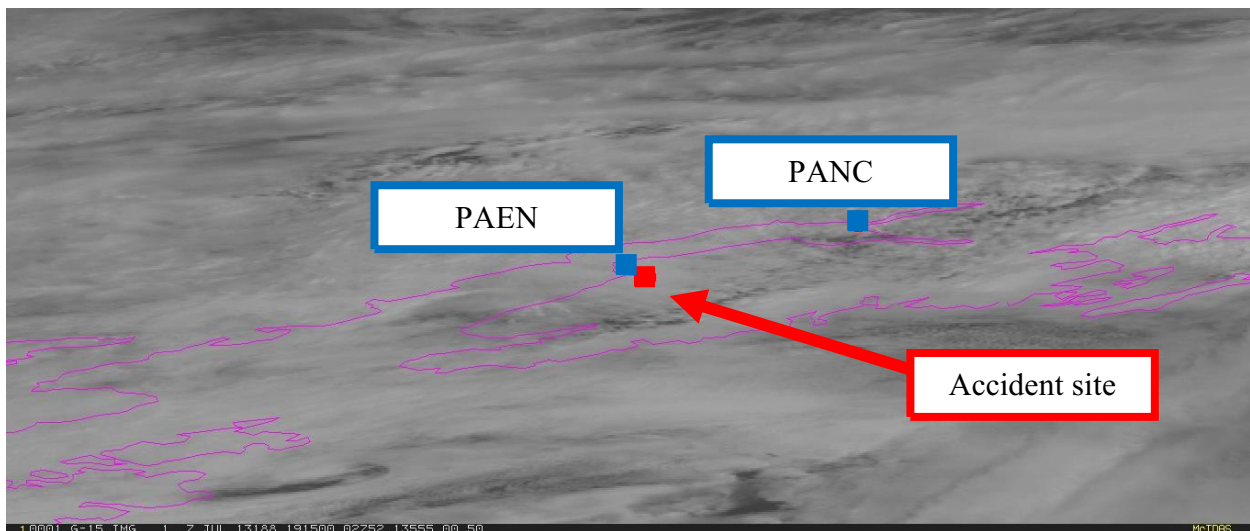


Figure 4 – GOES-15 visible image at 1115 AKDT

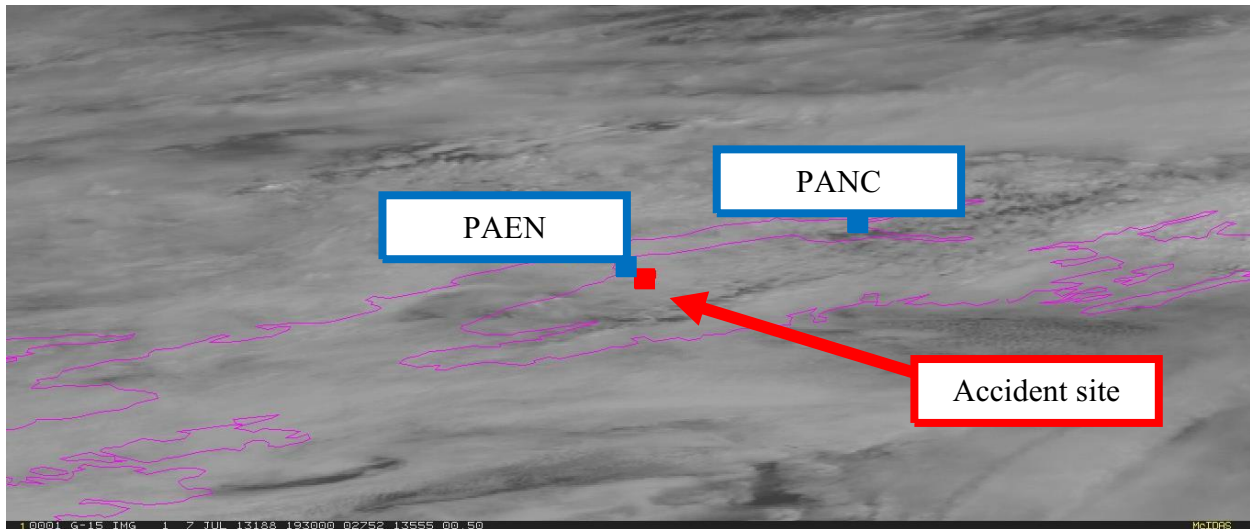


Figure 5 – GOES-15 visible image at 1130 AKDT

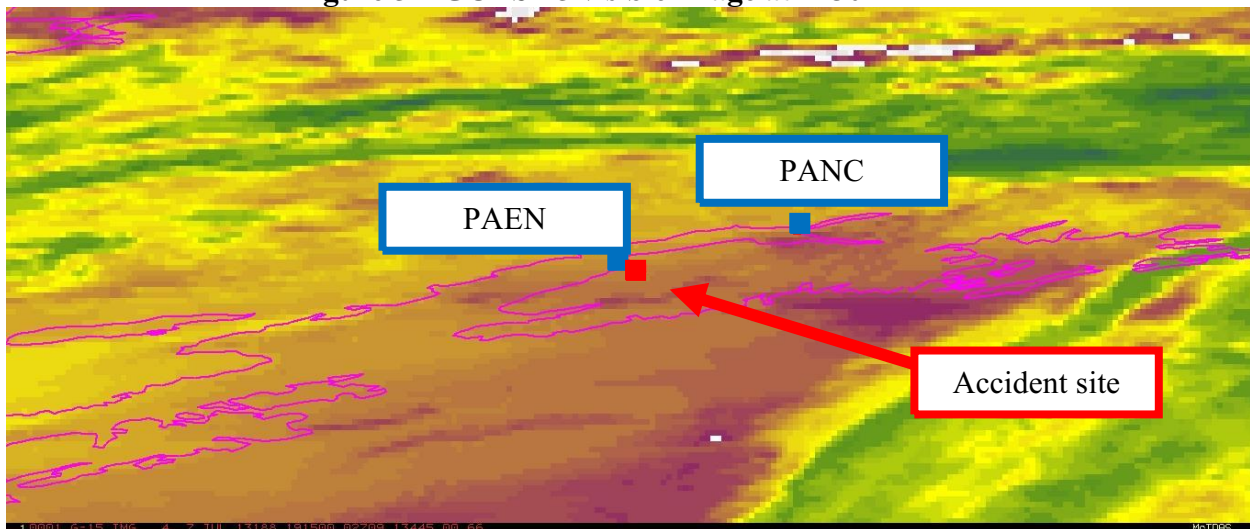


Figure 6 – GOES-15 infrared image at 1115 AKDT

6.0 Radar Imagery Information

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) was PAHG located near Nikiski, Alaska, approximately 18 miles northwest of the accident site at an elevation of 356 feet (figure 2). Level III archive radar data was obtained from the NCDC utilizing the NEXRAD Data Inventory Search and displayed using the NOAA's Weather and Climate Toolkit software.

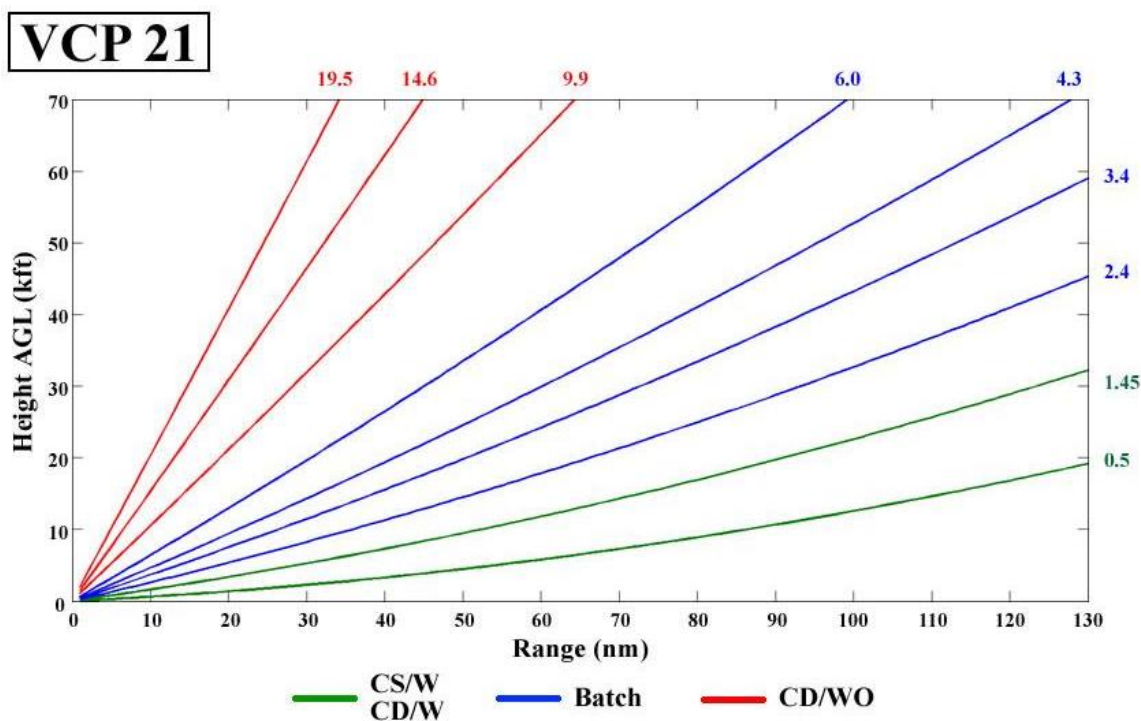
The WSR-88D is an S-band 10-centimeter wavelength radar with a power output of 750,000 watts, and with a 28-foot parabolic antenna that concentrates the energy between a 0.87° and 0.96° beam width¹¹. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

¹¹ Beam width – A measure of the angular width of a radar beam.

6.1 Volume Scan Strategy

The WSR-88D is a computer-controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D's Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has two common scanning strategies. The most common is where the radar makes 9 elevation scans from 0.5° to 19.5° every six minutes. This particular scanning strategy is documented as volume coverage pattern 21 (VCP-21). Mode B is the clear-air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the accident, the PAHG WSR-88D radar was operating in the precipitation mode (Mode A, VCP-21). The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



VCP-21 Precipitation Mode Scan Strategy

6.2 Beam Height Calculation

Assuming standard refraction¹² of the WSR-88D 0.95° wide radar beam, the following table shows the approximate beam height and width information¹³ of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5°	1,550 feet	660 feet	2,440 feet	1,780 feet

Based on the radar height calculations, the 0.5° elevation scan depicted the conditions between 660 feet and 2,440 feet msl over the accident site.

¹² Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

¹³ Beamwidth values are shown for legacy resolution products. Super resolution products would an effective beamwidth that would be approximately half these values.

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors¹⁴ it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ¹⁵), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0	< 5	
	1	5 to 9	
	2	10 to 14	
1 Very Light	3	15 to 19	.01 in/hr
	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2 Light to Moderate	6	30 to 34	.09 in/hr
	7	35 to 39	.21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11	55 to 59	>5.67 in/hr
	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

¹⁴ Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glazed ice.

¹⁵ dBZ – A non-dimensional “unit” of radar reflectivity which represents a logarithmic power ratio (in decibels , or dB) with respect to radar reflectivity factor, Z.

The Federal Aviation Administration (FAA) Advisory Circular AC 00-24B titled “Thunderstorms” dated January 2, 1983, also defines the echo intensity levels and potential weather phenomena associated with those levels. If the maximum VIP Level is 1 “weak” and 2 “moderate”, then light to moderate turbulence is possible with lightning. VIP Level 3 is “strong” and severe turbulence is possible with lightning. VIP Level 4 is “very heavy” and severe turbulence is likely with lightning. VIP Level 5 is “intense” with severe turbulence, lightning, hail likely, and organized surface wind gusts. VIP Level 6 is “extreme” with severe turbulence, lightning, large hail, extensive surface wind gusts and turbulence.

6.4 Base Reflectivity and Lightning Data

Figures 7 through 10 present the PAHG WSR-88D base reflectivity image for the 0.5° elevation scans initiated at 1114, 1119, 1125, 1131 AKDT with a resolution of 1.0° X 250 m. 10 to 15 dBZ reflectivity values occurred around the accident site between 1114 and 1131 AKDT, while 15 to 30 dBZ reflectivity values occurred around PAEN between 1114 and 1131 AKDT. There were no lightning strikes near the accident site at the accident time.

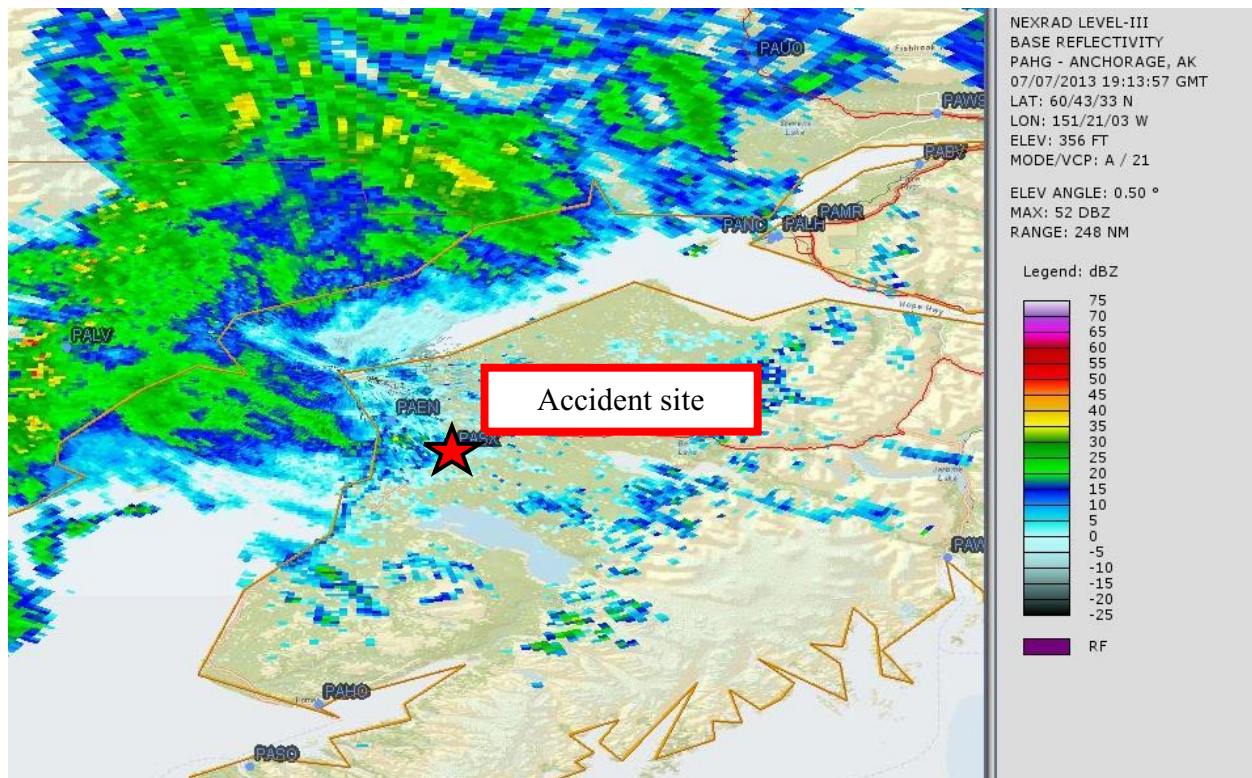


Figure 7 – PAHG WSR-88D reflectivity for the 0.5° elevation scan initiated at 1114 AKDT

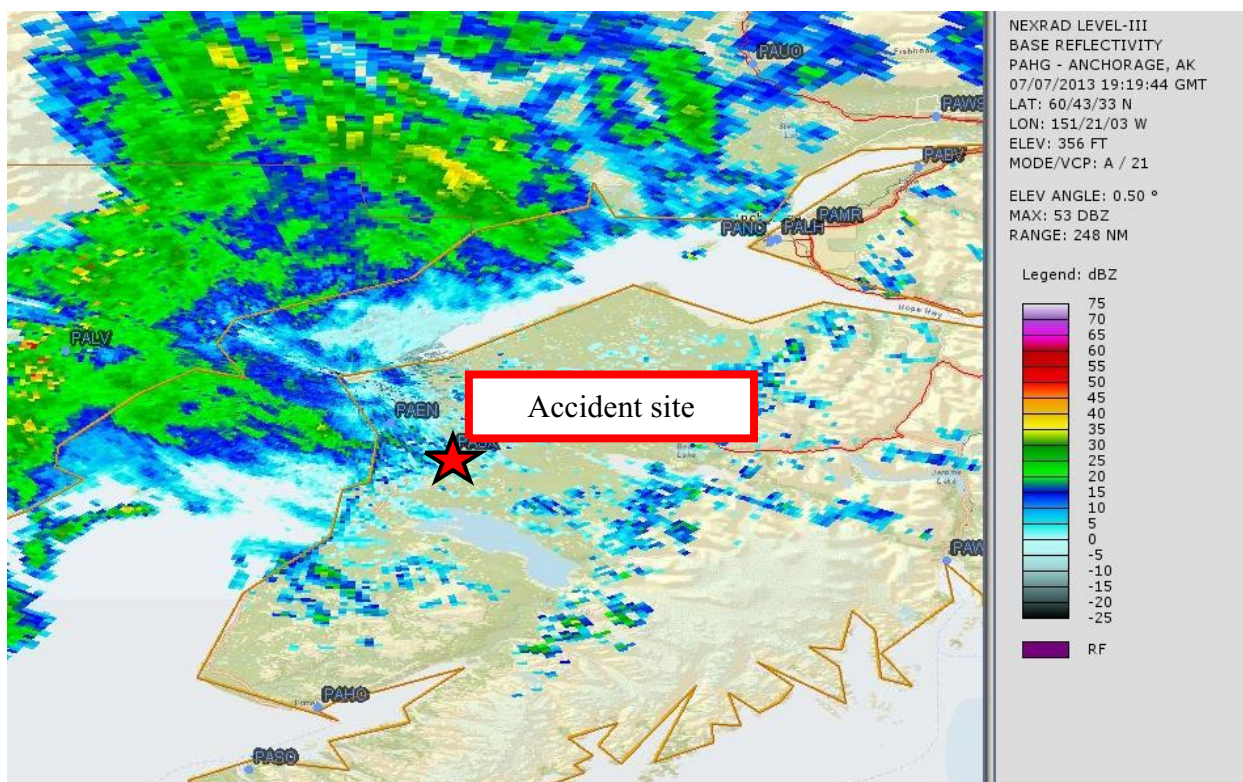


Figure 8 – PAHG WSR-88D reflectivity for the 0.5° elevation scan initiated at 1119 AKDT



Figure 9 – PAHG WSR-88D reflectivity for the 0.5° elevation scan initiated at 1125 AKDT

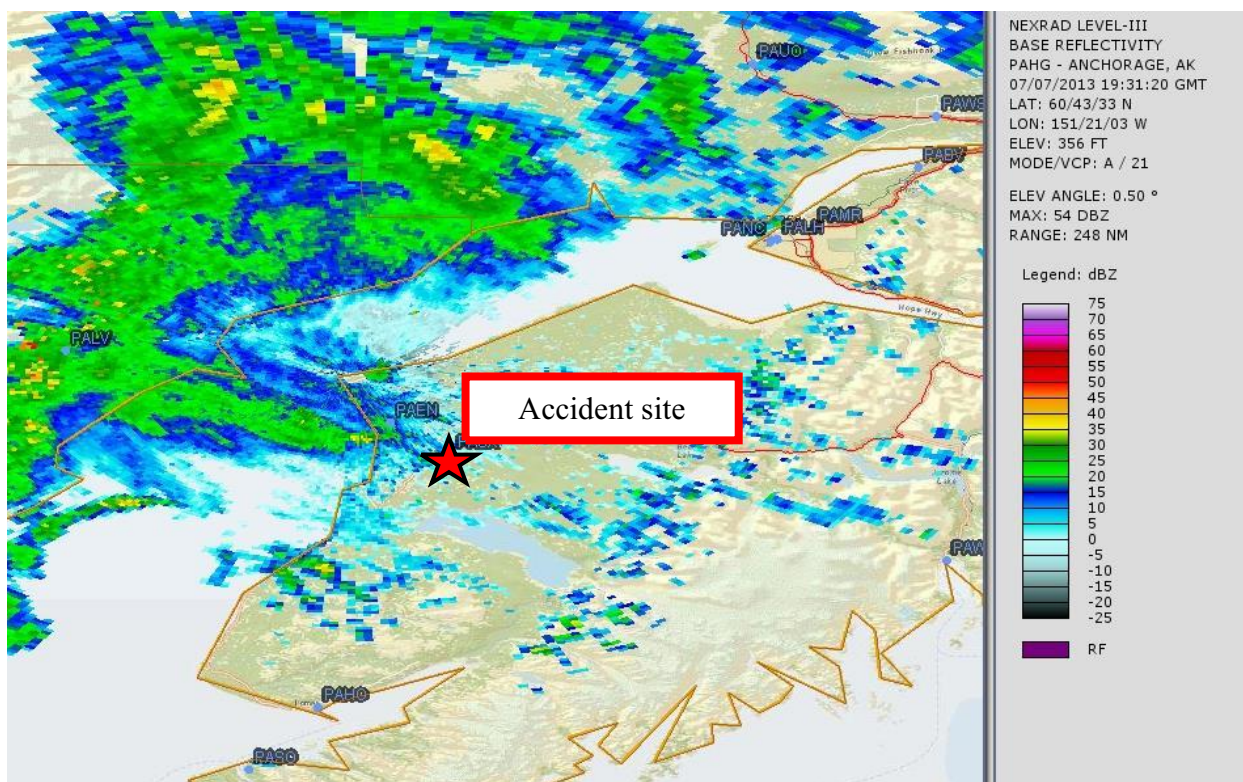


Figure 10 – PAHG WSR-88D reflectivity for the 0.5° elevation scan initiated at 1131 AKDT

7.0 Pilot Reports

Pilot reports (PIREPs) were reviewed close to the accident site from three hours prior to the accident time to around three hours after the accident time and these PIREPs were reported near the accident flight's altitude near the accident site:

ANC UA /OV TED282017 /TM 2044 /FLUNKN /TP C180 /TB NEG 005-012 /RM LIGHT WIND - RPRT OVR FIGURE EIGHT LAKE=

ANC UA /OV HOM-ANC /TM 2237 /FL030 /TP C170 /WX -SHRA /TB LGT /RM BETTER VFR NEAR ANC=

Routine pilot report (UA); 17 miles from Anchorage, Alaska, on the 282° radial; Time – 1244 AKDT (2044Z); Altitude – unknown; Type aircraft – Cessna 180; Turbulence – Negative between 500 and 1,200 feet; Remarks – Light wind, report over Figure Eight Lake.

Routine pilot report (UA); Between Homer and Anchorage, Alaska; Time – 1437 AKDT (2237Z); Altitude – 3,000 feet msl; Type aircraft – Cessna 170; Weather – Light rain shower; Turbulence – Light; Remarks – Better VFR¹⁶ near Anchorage.

¹⁶ Visual Flight Rules – Refers to the general weather conditions pilots can expect at the surface. VFR criteria means a ceiling greater than 3,000 feet agl and greater than 5 miles visibility.

8.0 SIGMET and CWSU Advisory

No SIGMET was valid for the accident site at the accident time.

No CWSU Advisory (CWA) was valid for the accident site at the accident time.

No Meteorological Impact Statement (MIS) was valid for the accident site at the accident time.

9.0 AIRMETs and Area Forecast

There were no AIRMETs valid for the accident site at the accident time by the Alaska Aviation Weather Unit (AAWU). The Area Forecast issued at 0540 AKDT, valid at the accident time, forecasted scattered clouds at 2,500 feet, a broken ceiling at 4,500 feet, overcast skies at 7,000 feet and layer clouds above to FL250¹⁷. Isolated areas of a broken ceiling at 2,500 feet and overcast skies at 4,500 feet with light rain, mist, and visibilities of 5 miles was expected:

FAAK48 PAWU 071340

FA8H

ANCH FA 071345

AK SRN HLF EXCP SE AK...

AIRMETS VALID UNTIL 072000

TS IMPLY POSSIBLE SEV OR GREATER TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HEIGHTS NOTED BY AGL OR CIG.

SYNOPSIS VALID UNTIL 080800

A 1003 MB LOW VCY PAKN REFORMS VCY PASO BY 18Z AND THEN QUICKLY
MOVS NWD TO 50 NW PAMH BY 08Z. ASSOCD OCFNT ARCING OVER THE CNTRL
GLFALSK MOVS INTO THE NERN GLFALSK BY END OF PD. A HI PRES RDG
OVER THE WRN ALUTNS EXPANDS SLOWLY EWD THRU PD.

COOK INLET AND SUSITNA VLY AB...VALID UNTIL 080200

...CLOUDS/WX...

AIRMET MT OBSCAK RANGE OCNL OBSC IN CLOUDS AND PCPN. NC...

NR AK RANGE AND PAHO S SCT015 BKN035 LYRD ABV TO FL250 -RA.

OCNL BKN015 VIS 3SM -RA BR. ISOL CIG BLW 010 VIS BLW 3SM -RA

COOK INLET SCT025 BKN045 OVC070 LYRS ABV TO FL250 -RA.

ISOL BKN025 OVC045 VIS 5SM -RA BR.

THRU TURNAGAIN ARM SFC WND E 20G35 KTS.

ELSW SCT045 SCT-BKN070 LYRS ABV TO FL250. OCNL -RA.

OTLK VALID 080200-080800...AK RANGE IFR CIG RA. W SIDE OF

COOK INLET AND WRN SUSITNA VLY MVFR CIG SHRA. ELSW VFR SHRA.

PASSES...LK CLARK...MERRILL...RAINY...IFR CIG RA BR.

WINDY...VFR SHRA. PORTAGE...MVFR CIG RA. OCNL IFR CIG RA BR. TURB.

...TURB...

AIRMET TURBPANC N OCNL MOD TURB FL270-370. NC...

AIRMET TURBVCY CHUGACH/KENAI MTS OCNL MOD TURB BLW 060. WKN...

¹⁷ Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

...ICE AND FZLVL...
 AIRMET ICEOCNL MOD RIME ICEIC BTN 090-170. FZLVL 060. WKN...
 .
 COPPER RIVER BASIN AC...VALID UNTIL 080200
 ...CLOUDS/WX...
 SCT040 BKN060 LYRS ABV TO FL250. ISOL -SHRA BECMG AFT 20Z OCNL.
 OTLK VALID 080200-080800...VFR SHRA. MTS MVFR CIG SHRA.
 PASS...TAHNETA...VFR. ISOL SHRA.
 ...TURB...
 AIRMET TURBVCY CHUGACH MTS OCNL MOD TURB FL270-370. WKN...
 ...ICE AND FZLVL...
 NIL SIG. FZLVL 070.
 .
 CNTRL GLF CST AD...VALID UNTIL 080200
 ...CLOUDS/WX...
 AIRMET IFROFSHR OCNL CIGS BLW 010 VIS BLW 3SM -RA BR.
 NC...
 AIRMET MT OBSCMTS OCNL OBSC IN CLOUDS AND PCPN. NC...
 OTRW OFFSHORE SCT007 OVC015 LYRS ABV TO FL250 VIS 4SM -RA BR.
 ELSW SCT015 BKN025 LYRS ABV TO FL250 -RA.
 OCNL BKN015 OVC035 VIS 4SM -RA BR. PRINCE WILLIAM SOUND ISOL CIG
 BLW 010 VIS BLW 3SM RA BR.
 OTLK VALID 080200-080800...MVFR CIG SHRA.
 PRINCE WILLIAMM SOUND IFR CIG RA BR.
 ...TURB...
 AIRMET TURBOCNL MOD TURB FL270-370. NC...
 ...ICE AND FZLVL...
 AIRMET ICEOCNL MOD RIME ICEIC BTN 090-170. FZLVL 060 W TO 080 E.
 WKN...
 .
 KODIAK IS AE...VALID UNTIL 080200
 ...CLOUDS/WX...
 AIRMET IFRSWRN EXPOSURES OCNL CIGS BLW 010 VIS BLW 3SM -RA BR.
 IMPR...
 OTRW SCT005 BKN015 OVC035 LYRD ABV TO FL250 OCNL -RA.
 SWRN EXPOSURES OCNL VIS 4SM -RA BR.
 OTLK VALID 080200-080800...MVFR CIG SHRA.
 ...TURB...
 NIL SIG.
 ...ICE AND FZLVL...
 NIL SIG. FZLVL 050.
 .

10.0 Terminal Aerodrome Forecast

PAEN was the closest site with a NWS TAF. The TAF valid at the time of the accident was issued at 0940 AKDT and was valid for a 24-hour period beginning at 1000 AKDT. The TAF forecast for PAEN was as follows:

TAF PAEN 071740Z 0718/0818 **03015KT P6SM SHRA BKN050**
 FM072200 19008KT P6SM BKN060
 FM081200 18006KT 5SM BR BKN010=

The forecast expected wind from 030° at 15 knots, visibility greater than 6 miles, rain showers, and a broken ceiling at 5,000 feet agl around the time of the accident.

11.0 National Weather Service Area Forecast Discussion

The National Weather Service Office in Anchorage, Alaska, issued the following Area Forecast Discussion at 0530 AKDT which discussed the occluded front south of Anchorage moving northward with areas of steady across south central Alaska transitioning to showers:

FXAK68 PAFC 071328

AFDAFC

SOUTHCENTRAL AND SOUTHWEST ALASKA FORECAST DISCUSSION

NATIONAL WEATHER SERVICE ANCHORAGE AK

530 AM AKDT SUN JUL 7 2013

.ANALYSIS AND UPPER LEVELS...

THE UPPER-LOW PARKED NEAR THE BERING STRAIT THE PAST FEW DAYS IS NOW STARTING TO DIP SOUTH TOWARD SAINT LAWRENCE ISLAND. THE MORE DOMINANT FEATURE IN THE AOR IS A LARGE LOW CENTERED NEAR PORT HEIDEN EJECTING EAST TO THE WESTERN GULF OF AK. RAIN FALLS AROUND THE LOW IN BRISTOL BAY WITH VARIOUS SHORTWAVES PINWHEELING AROUND IT KEEPING THINGS CLOUDY AND WET THROUGH THE LOWER KUSKOKWIM VALLEY AND KUSKOKWIM DELTA AS WELL. **AN OCCLUDED FRONT APPROACHES SOUTHCENTRAL AK WITH A SLUG OF RAIN AND A REINFORCING SHOT OF STRONG SOUTH TO EAST WINDS ALONG THE NORTHERN GULF.** THE NOSE OF THE SUPPORTING UPPER-LVL JET TAKES AIM AT EASTERN PRINCE WILLIAM SOUND WHERE PRECIP IS HEAVIEST. WEAK SOUTHEAST FLOW IS PRODUCING ONLY PIECEMEAL DOWNSLOPING FROM THE MATANUSKA VALLEY BACK THROUGH THE NORTHERN KENAI PENINSULA BASED ON RADAR TRENDS...WITH SURFACE OBSERVATIONS CONFIRMING SOME RAIN (ALBEIT LIGHT) ACROSS THE ANCHORAGE BOWL. FURTHER WEST...BRISK WEST WINDS ARE HANGING ON ACROSS THE EASTERN CHAIN AND AKPEN IN A MODESTLY SQUEEZED PRESSURE GRADIENT. THERE IS ALSO A LOW AROUND 450 MILES WST OF ATTU SLOWLY DRIFTING EAST.

.MODEL DISCUSSION...

MODELS HAVE A BIT MORE AGREEMENT AND CONSISTENCY TODAY WITH THE MAIN WEATHER FEATURES. IT SHOULD BE NOTED THAT THE FRONT IN THE GULF HAS BEEN MOVING FASTER THAN MODEL DEPICTIONS. THE PARENT UPPER-LOW NEAR THE AKPEN MOVES TO JUST SOUTH OF MIDDLETON ISLAND ON MON...THEN TO NEAR YAKUTAT ON TUE. HOT ON IT'S HEELS MODELS SHOW THE LOW NEARING SAINT LAWRENCE ISLAND SWINGING THROUGH THE KUSKOKWIM DELTA AND BRISTOL BAY MON NIGHT AND TO THE CENTRAL GULF ON TUE. THERE ARE HINTS OF SOME VERY WEAK TRANSITORY RIDGING POKING INTO THE SOUTHERN MAINLAND IN THE WAKE OF THIS SECOND LOW...BUT IT IS NOT WELL DEFINED. THERE IS STILL AMPLE UPPER-LVL ENERGY ACROSS THE IN YUKON TERRITORY AND EAST CENTRAL AK WHICH COULD STILL PINWHEEL DOWN INTO SOUTHCENTRAL BEHIND THE LOW COMPLEX PUSHING EAST OF THE AOR. FURTHER WEST...THE LOW JUST EAST OF THE KAMCHATKA PENINSULA IS INITIALLY DEPICTED HAVING TROUBLE MAKING HEADWAY EAST DUE TO THE SLOW TO MOVE TROUGH IN THE EASTERN HALF OF THE BERING/SOUTHERN MAINLAND HOLDING A BLOCKING RIDGE IN THE CENTRAL BERING SEA/CHAIN. THIS RIDGE IS NARROW HOWEVER...AND THE ALEUTIAN LOW EVENTUALLY PUSHES TO NEAR KISKA EARLY WED.

.SHORT TERM FORECAST...

SOUTHCENTRAL/GULF...

AS MENTIONED EARLIER...THE FRONT HAS BEEN MOVING FASTER THAN PROGGED **BUT THIS SPEED SHOULD SLOW WITH TIME AS THE FRONT STRETCHES AND**

ELONGATES THIS AFTERNOON/EVENING. A DOWN INLET PRESSURE GRADIENT REVERSES EARLY THIS AFTERNOON...AND WITH FROPA SHOULD SEE SOME OF THE GUSTY WINDS EXPERIENCED THROUGH TURNAGAIN ARM AND PORTAGE VALLEY SNEAKING INTO SOUTH TO WEST ANCHORAGE AND THE KNIK VALLEY. **RAIN STILL LOOKS TO BE FOCUSED MORE OVER PRINCE WILLIAM SOUND DUE TO THE FRONT HANGING AROUND LONGER THROUGH THAT AREA BEFORE DISSIPATING. ELSEWHERE SHOULD SEE STEADY PRECIP TAPER TO SHOWERS.** THE PARENT LOW SWINGING INTO THE GULF IS STILL CLOSE ENOUGH TO KODIAK ISLAND TO KEEP SOME PASSING SHOWERS A THREAT THERE...THOUGH A BETTER CHANCE OF RAIN EXISTS WITH THE SECOND LOW THAT EJECTS OUT OF THE SW MAINLAND ON TUE. SOUTHWEST/AKPEN...

THE TWO UPPER-LOWS ROTATING THROUGH THE SW MAINLAND LOOK TO KEEP THINGS UNSETTLED IN TERMS OF PRECIP AND AMPLE CLOUDINESS...THOUGH IN GENERAL RAIN SHOULD BECOME LESS WIDESPREAD AFTER THE FEATURES ROTATE THROUGH. FOCUS OF THE STRONGEST WINDS WILL BE ALONG THE AKPEN AND WESTERN CAPES AS BOTH LOWS HAVE A SLIGHTLY SQUEEZED PRESSURE GRADIENT.

BERING SEA/ALEUTIANS...

PERSISTENT FOG/STRATUS REGIME PREVAILS OVER MUCH OF THE BERING AND CHAIN. THE PRIBILOFS MAY SEE SOME LIGHT RAIN WITH A DISTURBANCE CLIPPING IT THIS AFTERNOON/EVENING. OTHERWISE BEST CHANCES WILL BE OVER THE WESTERN CHAIN WITH THE LOW TO THE WEST OF ATTU. RIDGING OVER THE CENTRAL BERING BEGINS TO BREAK DOWN MON TO TUE...EXPOSING MORE OF THE CHAIN TO SOME CHANCES FOR RAIN.

.LONG TERM FORECAST...

THE LATTER PART OF THE WEEK FEATURES THE REMAINS OF THE ALEUTIAN SYSTEM SLIDING EAST THROUGH THE CHAIN. ACROSS THE MAINLAND...THE LOW COMPLEX SHOULD BE WELL SOUTHEAST OF THE AOR INTO BRITISH COLUMBIA... LEAVING THE REGION IN BETWEEN DOMINANT WEATHER FEATURES. THE FLOW ALOFT HOWEVER IS RATHER COMPLEX...WITH OPERATIONAL MODELS HAVING TROUBLE RESOLVING IT. HINTS OF ENERGY DIPPING OUT OF NORTHERN AK INTERACTING WITH THE AFOREMENTIONED ALEUTIAN SYSTEM ARE HANDLED MUCH MORE AGGRESSIVELY BY THE ECMWF AT THIS JUNCTURE.

.AER/ALU...WATCH/WARNING SUMMARY

PUBLIC...NONE

MARINE...GALE...120

FIRE WEATHER...NONE

12.0 National Weather Service Zone Forecast Product

The National Weather Service Office in Anchorage, Alaska, issued the updated Zone Forecast Product (ZFP) at 1037 AKDT, but the forecast for the accident site had not been updated since 0500 AKDT. The ZFP portion for the accident area forecasted rain tapering to scattered showers by midday with a northeast wind at 15 mph shifting to the south in the afternoon:

FPAK51 PAFC 071839 AAB
 ZFPAER
 ALASKA ZONE WEATHER FORECASTS FOR ALASKA...UPDATED
 NATIONAL WEATHER SERVICE ANCHORAGE AK
 1037 AM AKDT SUN JUL 7 2013
 UPDATED ZONE 111
 SPOT TEMPERATURES AND PROBABILITIES OF MEASURABLE PRECIPITATION
 ARE FOR TODAY...TONIGHT...AND MONDAY.

AKZ101-080000-

ANCHORAGE-

INCLUDING...ANCHORAGE...EAGLE RIVER...INDIAN...EKLUTNA

500 AM AKDT SUN JUL 7 2013

.TODAY...MOSTLY CLOUDY. PERIODS OF SPRINKLES OR LIGHT RAIN. HIGHS IN THE MID 50S TO LOWER 60S. NORTHEAST WIND 5 TO 15 MPH BECOMING SOUTHEAST 10 TO 25 MPH DURING THE AFTERNOON. ALONG TURNAGAIN ARM AND HIGHER ELEVATIONS...SOUTHEAST WIND 25 TO 40 MPH.

.TONIGHT...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. LOWS IN THE MID 40S TO LOWER 50S. SOUTHEAST WIND 10 TO 20 MPH. ALONG TURNAGAIN ARM AND HIGHER ELEVATIONS...SOUTHEAST WIND 20 TO 35 MPH DECREASING TO 10 TO 20 MPH AFTER MIDNIGHT.

.MONDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. HIGHS IN THE UPPER 50S TO MID 60S. LIGHT WINDS.

.MONDAY NIGHT...MOSTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOWS AROUND 50. VARIABLE WIND 10 MPH.

.TUESDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. HIGHS IN THE UPPER 50S TO MID 60S. LIGHT WINDS.

.TUESDAY NIGHT...MOSTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOWS 45 TO 55.

.WEDNESDAY THROUGH THURSDAY...MOSTLY CLOUDY. HIGHS 65 TO 75. LOWS 45 TO 55.

.THURSDAY NIGHT...MOSTLY CLOUDY WITH A CHANCE OF RAIN. LOWS IN THE 50S.

.FRIDAY AND FRIDAY NIGHT...MOSTLY CLOUDY. A CHANCE OF SHOWERS. HIGHS 65 TO 75. LOWS IN THE 50S.

.SATURDAY...MOSTLY CLOUDY WITH A CHANCE OF RAIN. HIGHS IN THE 60S.

&&

TEMPERATURE / PRECIPITATION

ANCHORAGE 61 50 61 / 80 50 40

\$\$

AKZ111-080000-

MATANUSKA VALLEY-

INCLUDING...PALMER...WASILLA...SUTTON...CHICKALOON

625 AM AKDT SUN JUL 7 2013

.TODAY...MOSTLY CLOUDY WITH A CHANCE OF RAIN. HIGHS AROUND 60. EAST WIND 10 TO 15 MPH. GUSTS TO 25 MPH OUT OF THE KNIK RIVER VALLEY.

.TONIGHT...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. LOWS IN THE MID 40S TO LOWER 50S. SOUTHEAST WIND 10 TO 25 MPH IN THE EVENING BECOMING LIGHT.

.MONDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. HIGHS IN THE UPPER 50S TO MID 60S. LIGHT WINDS.

.MONDAY NIGHT...MOSTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOWS IN THE MID 40S TO LOWER 50S. LIGHT WINDS.

.TUESDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. HIGHS IN THE UPPER 50S TO MID 60S. LIGHT WINDS.

.TUESDAY NIGHT...MOSTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOWS 45 TO 55.

.WEDNESDAY THROUGH THURSDAY...MOSTLY CLOUDY. HIGHS 65 TO 75. LOWS 45 TO 55.

.THURSDAY NIGHT...MOSTLY CLOUDY WITH A CHANCE OF RAIN. LOWS 45 TO 55.

.FRIDAY AND FRIDAY NIGHT...MOSTLY CLOUDY. A CHANCE OF SHOWERS. HIGHS 65 TO 75. LOWS 45 TO 55.

.SATURDAY...MOSTLY CLOUDY WITH A CHANCE OF RAIN. HIGHS IN THE

60S.

&&

TEMPERATURE / PRECIPITATION

PALMER 61 49 59 / 60 50 40

WASILLA 59 48 59 / 70 50 40

\$\$

AKZ121-080000-

WESTERN KENAI PENINSULA-

INCLUDING...KENAI...SOLDOTNA...HOMER...COOPER LANDING

500 AM AKDT SUN JUL 7 2013

.TODAY...RAIN...TAPERING TO SCATTERED SHOWERS BY MIDDAY. HIGHS IN THE MID 50S TO LOWER 60S. NORTHEAST WIND 15 MPH SHIFTING TO THE SOUTH IN THE AFTERNOON.

.TONIGHT...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. LOWS IN THE MID 40S TO LOWER 50S. VARIABLE WIND 10 MPH.

.MONDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. HIGHS IN THE MID 50S TO LOWER 60S. SOUTHWEST WIND 10 TO 15 MPH.

.MONDAY NIGHT...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. LOWS IN THE MID 40S TO LOWER 50S. SOUTH WIND 10 TO 15 MPH.

.TUESDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS. HIGHS IN THE UPPER 50S EXCEPT IN THE MID 60S INLAND. SOUTHWEST WIND 15 MPH.

.TUESDAY NIGHT...MOSTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOWS 45 TO 55.

.WEDNESDAY THROUGH THURSDAY...MOSTLY CLOUDY. HIGHS IN THE 60S. LOWS 45 TO 55.

.THURSDAY NIGHT...MOSTLY CLOUDY WITH A CHANCE OF RAIN. LOWS 45 TO 55.

.FRIDAY AND FRIDAY NIGHT...MOSTLY CLOUDY. A CHANCE OF SHOWERS. HIGHS 55 TO 65. LOWS 45 TO 55.

.SATURDAY...MOSTLY CLOUDY WITH A CHANCE OF RAIN. HIGHS 55 TO 65.

&&

TEMPERATURE / PRECIPITATION

KENAI 55 48 56 / 80 40 50

SOLDOTNA 57 47 58 / 80 40 50

HOMER 56 49 58 / 80 50 50

\$\$

13.0 Web Camera Images

Images from the FAA weather camera in Soldotna were obtained around the accident time. Figures 11 through 14 show the northeast facing view of the weather camera at 1102, 1112, 1122, and 1132 AKDT. The figures reveal a high overcast cloud deck with less lower clouds from 1102 to 1132 AKDT. In the weather camera image from 1132 AKDT a smoke plume is visible with the smoke moving from south to north away from the camera. The FAA weather camera in Soldotna was located 1 mile southwest of the accident site and PASX.

Sun 07 Jul 2013 19:02:15 UTC
Sun 07 Jul 2013 11:02:15 AKDT

Soldotna - NorthEast
See <http://avcams.faa.gov> for more information



Figure 11 – FAA weather camera from Soldotna northeast looking view from 1102 AKDT

Sun 07 Jul 2013 19:12:31 UTC
Sun 07 Jul 2013 11:12:31 AKDT

Soldotna - NorthEast
See <http://avcams.faa.gov> for more information



Figure 12 – FAA weather camera from Soldotna northeast looking view from 1112 AKDT

Sun 07 Jul 2013 19:22:50 UTC
Sun 07 Jul 2013 11:22:50 AKDT

Soldotna - NorthEast
See <http://avcams.faa.gov> for more information



Figure 13 – FAA weather camera from Soldotna northeast looking view from 1122 AKDT

Sun 07 Jul 2013 19:32:19 UTC
Sun 07 Jul 2013 11:32:19 AKDT

Soldotna - NorthEast
See <http://avcams.faa.gov> for more information

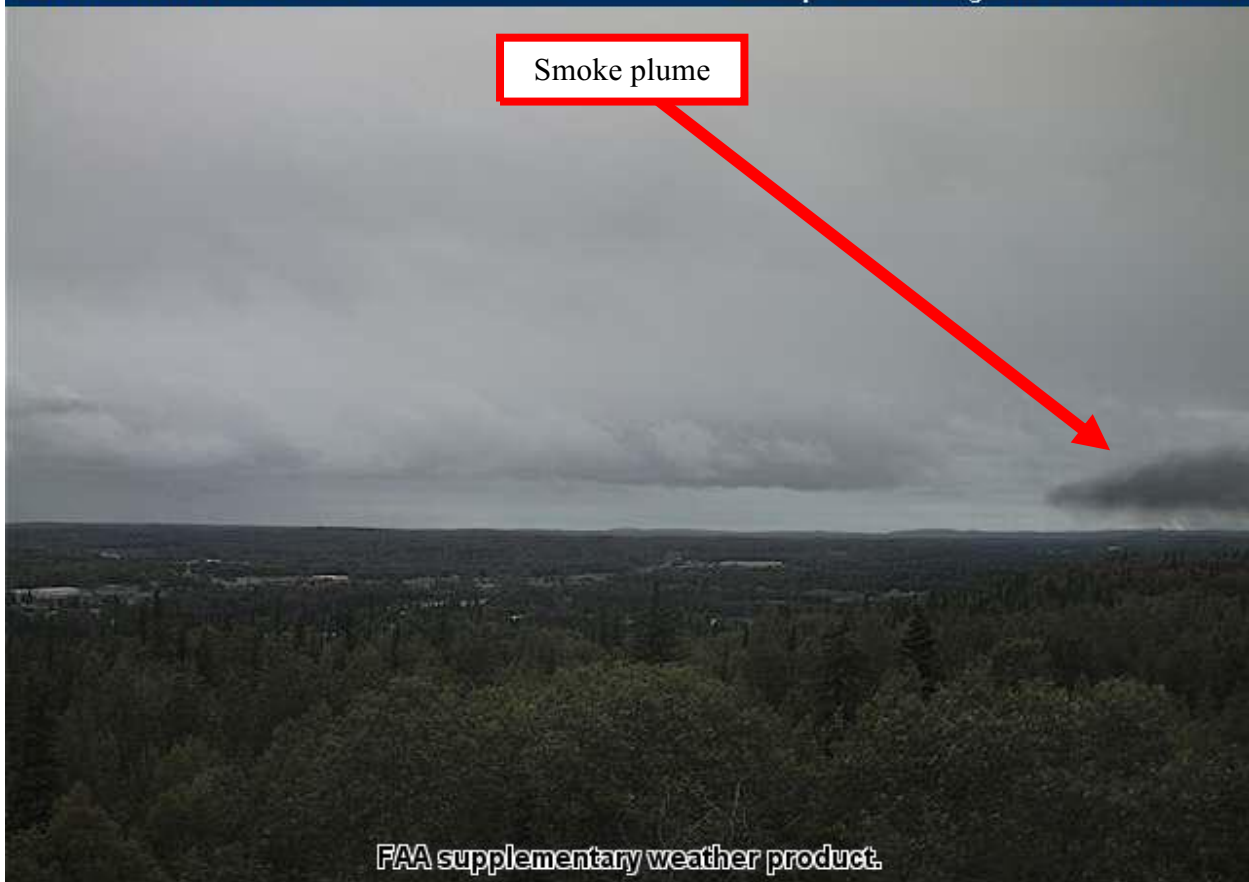


Figure 14 – FAA weather camera from Soldotna northeast looking view from 1132 AKDT

14.0 Pilot Weather Briefing

The pilot did not receive a preflight weather briefing from an official source. There was no other record or knowledge of additional weather information received by the accident pilot.

15.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on July 7, 2013, indicated the following:

SUN	
End civil twilight	0106 AKDT
Begin civil twilight	0313 AKDT
Sunrise	0450 AKDT
Sun transit	1409 AKDT
Sunset	2327 AKDT
End civil twilight	0103 AKDT on following day

F. LIST OF ATTACHMENTS

None

Paul Suffern
NTSB, AS-30