



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 13, 2019

Weather Study

METEOROLOGY

WPR17LA084

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A. AIRCRAFT ACCIDENT

Location: Brinnon, Washington
Date: April 2, 2017
Time: 1529 Pacific daylight time
2229 coordinated universal time (UTC)
Airplane: Cirrus SR22; Registration: N167CB

B. METEOROLOGIST

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

C. SUMMARY

On April 2, 2017, at 1529 Pacific daylight time (PDT), a Cirrus Design Corporation SR22, N167CB, impacted mountainous terrain near Mount Christie, in Jefferson County, Washington. The airplane was operated by The Flight Academy under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91. The certified flight instructor (CFI) and student pilot sustained serious injuries. The airplane sustained substantial damage during the accident sequence. The instructional flight departed Langley (W10), Washington, about 1400. Visual meteorological conditions prevailed and no flight plan had been filed.

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 Pacific daylight time (PDT) based upon the 24 hour clock, local time is +7 hours to UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are reported 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 47.692340° N and longitude 123.222000° W, which was located in the Olympic National Forest and 13 miles east of Mount Christie at an elevation of 5,349 ft.

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 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 00-45H.

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for the continental United States at 1400 PDT is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a high pressure system at 1036-hectopascals (hPa)¹ off the northwest Pacific coast with the isobars or lines of equal pressure indicating a ridge of high pressure extending eastward over southern Washington and northern Oregon. Further east-northeast, a deep low pressure system at 996-hPa associated with an occluded front was located over Manitoba, Canada, with a cold front extending southwestward across extreme northwest Minnesota, the Dakota’s, into Nebraska, and became stationary extending westward into Wyoming. Another low pressure system at 1009-hPa was located over western Wyoming with another frontal wave, with the cold front extending southwestward into Utah, and then westward into Nevada, and northern California. A weak trough of low pressure was depicted immediately east of the accident site extending across Washington into northern Idaho, and southern British Columbia and Alberta, Canada.

Figure 2 is the northwest section of the NWS Surface Analysis Chart for the same period at 1400 PDT showing more detail with the station models and shows a slightly stronger localized pressure gradient over western Washington by the isobars, or lines of equal pressure at 4-hPa intervals. The closest reporting station model to the accident site in figure 2 was Port Angeles, immediately north, which depicted a northwesterly wind at 15 to 20 knots, overcast clouds, with temperature of 50° Fahrenheit (F), dew point 36° F, with a sea level pressure of 1026.5-hPa. A station to the east of the accident believed to be Stampede Pass, which was located near the trough reported overcast clouds with precipitation in the form of light snow with a temperature of 31° F, a dew point of 30° F, and a sea level pressure 1023.1-hPa.

¹ Hectopascal (hPa) is the new standard reference for sea level pressure and is interchangeable with the former term millibar with the same units. Standard sea level pressure is 1013.25-hPa at 15° Celsius (C).

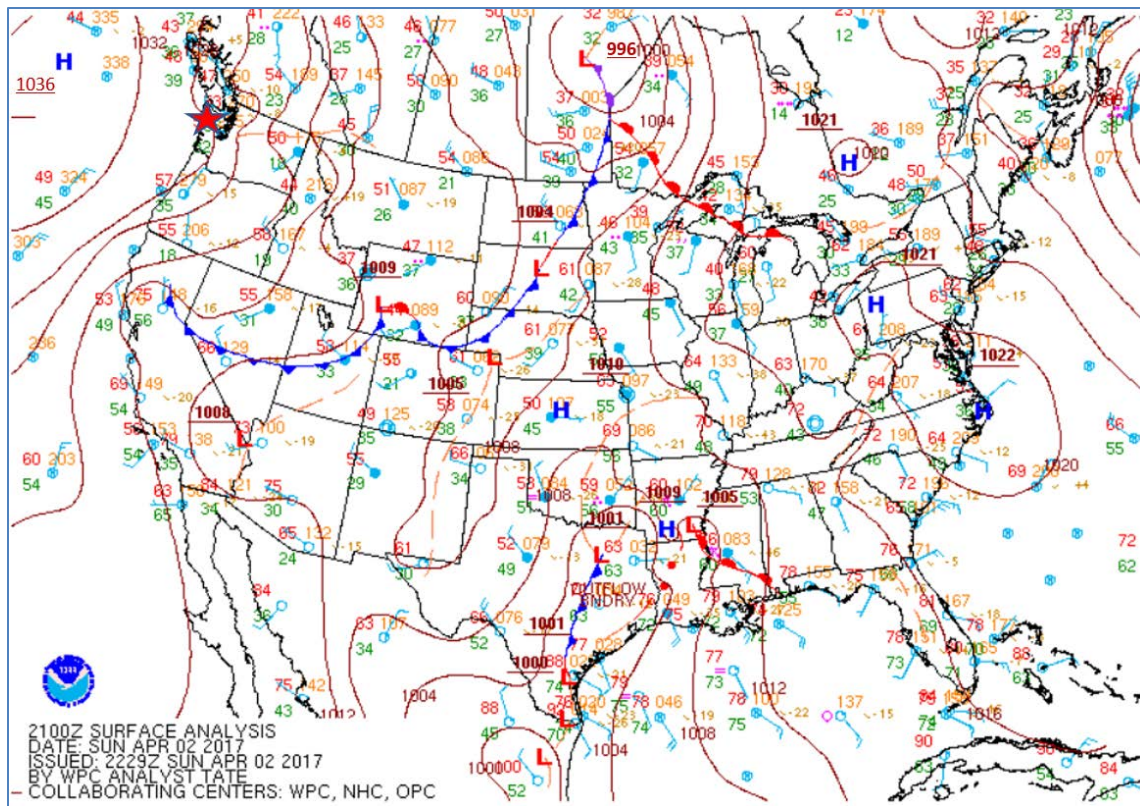


Figure 1 - NWS Surface Analysis for 1400 PDT

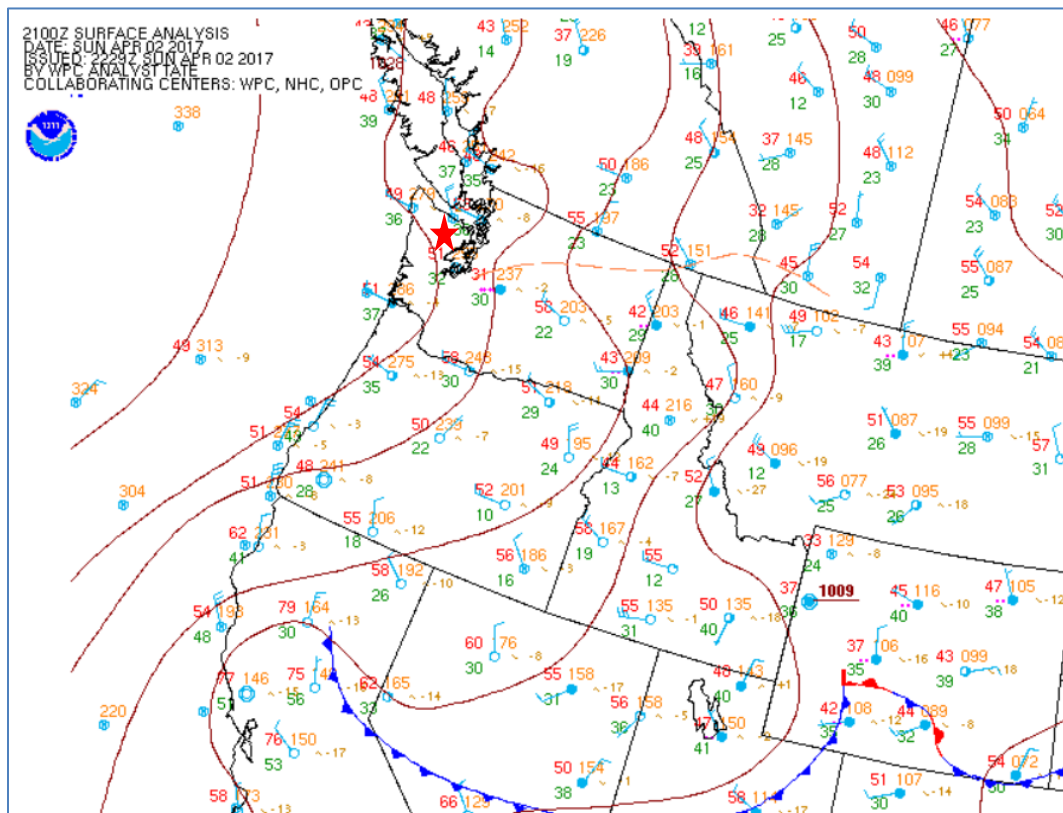


Figure 2 - Northwest section of the Surface Analysis Chart for 1400 PDT

1.2 National Composite Radar Mosaic

Figure 3 is the National Composite Radar Mosaic for 1530 PDT obtained through the NCEI archive data, with the approximate accident site marked by the red star. The image depicted scattered very light intensity echoes over Washington during the period, with several small areas of echoes immediately west and north of the accident site. The echoes confirmed scattered light rain showers over the region during the period and confirmed the report of light snow further east at higher elevations. No significant echoes were identified over the accident site during the hour immediately prior to the time of the accident.

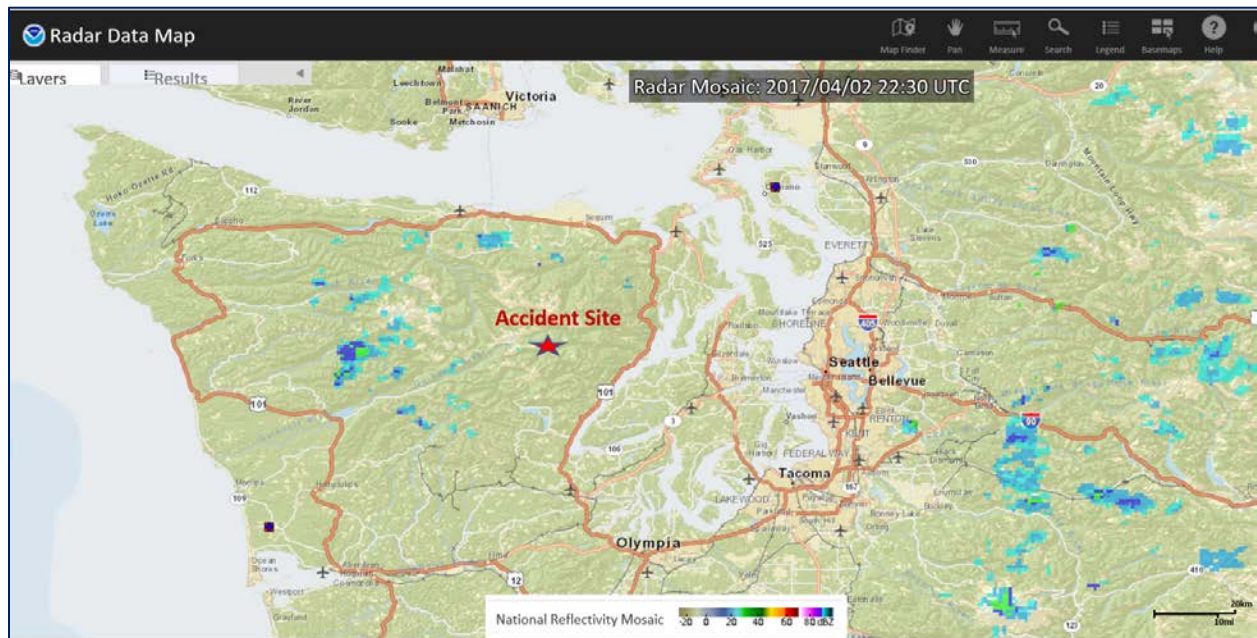


Figure 3 - National Composite Radar Mosaic for 1530 PDT

1.3 12-Hour Surface Prognostic Chart

A review of the 12-hour Surface Prognostic Chart provided the expected conditions during the evening hours and any precipitation, with the valid time of the chart at 2300 PDT. Figure 4 is the 12-hour Prognostic Chart which depicted no significant boundaries over the region at that time, with several small areas of expected light precipitation mainly in the form of light snow (light blue) and mixed precipitation (purple) in the Olympic area immediately south of the accident site and along the higher terrain immediately east of the Seattle area. Further east over northern Idaho and western Montana a large area of mixed precipitation and snow was expected with a greater than 50% probability or likely snow (dark blue).

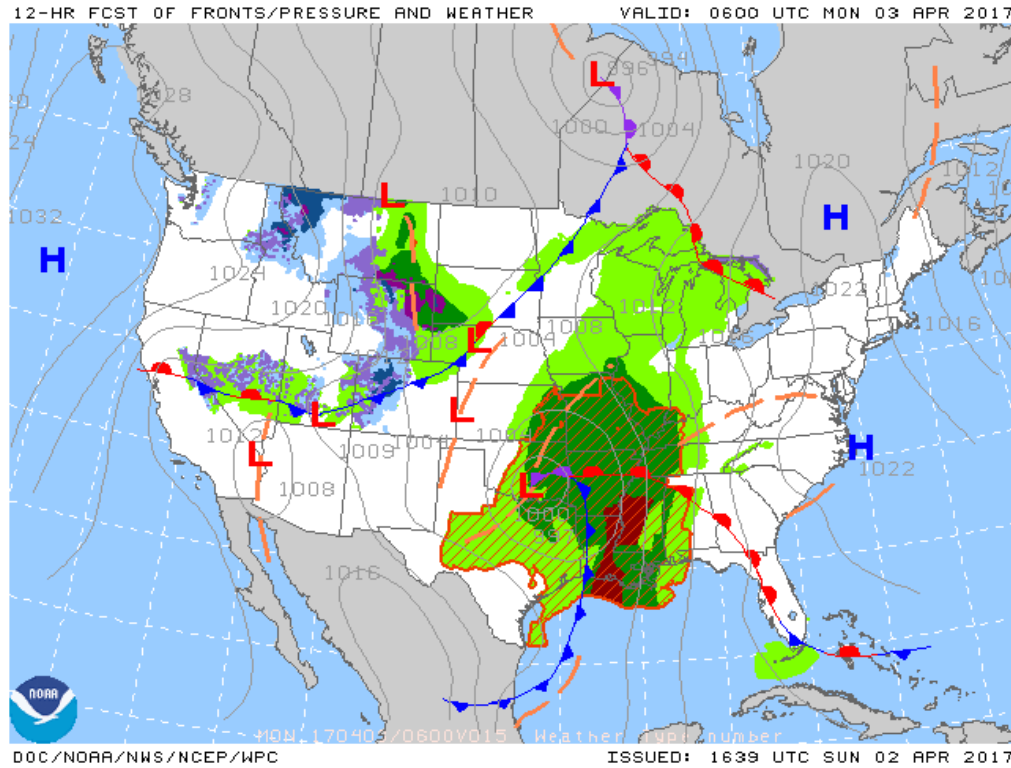


Figure 4 - 12-hour Surface Prognostic Chart for 2300 PDT

2.0 Surface Observations

The surrounding area was documented utilizing official Meteorological Aerodrome Reports (METARs) and special reports across the region. The magnetic variation over the area was estimated at 17° East based on the local sectional chart. Cloud heights are reported in ft above ground level (agl) in this section.

2.1 Whidbey Air Park, Langley, Washington

The accident airplane departed from Whidbey Air Park (KW10), Langley, WA, which was located about 43 miles northeast of the accident site at an elevation of 271 ft. The airport had a single asphalt runway 16/34 and had no official weather reporting capability other than a wind indicator.

2.2 Bremerton National Airport (KPWT), Bremerton, Washington

The closest official weather reporting location to the accident site was from Bremerton National Airport (KPWT) located about 25 miles southeast of the accident site at an elevation of 444 ft. The airport had an Automated Weather Observation System (AWOS) without a precipitation discriminator. However, for unknown reasons the station went off line and stopped reporting on April 1st, after 2015 PDT and did not start reporting again until April 3rd at 1015 PDT.

2.3 William R. Fairchild International Airport (KCLM), Port Angeles, Washington

The next closest reporting station was from William R. Fairchild International Airport (KCLM), Port Angeles, WA, located about 32 miles north-northwest of the accident site at an elevation of 291 ft. The airport had an Automated Surface Observation System (ASOS), and reported the following conditions surrounding the time of the accident:

KCLM weather observation at 1453 PDT, automated, wind from 310° at 9 knots, visibility unrestricted at 10 miles or more, a few clouds at 3,100 ft, ceiling broken at 4,000 ft, overcast at 6,500 ft, temperature 8° C, dew point 4° C, altimeter 30.31 inches of mercury (Hg). Remarks: automated observation system with a precipitation discriminator, rain began at 1430 and ended at 1444 PDT, sea level pressure 1026.5-hPa, hourly precipitation less than 0.01 of an inch, temperature 8.3° C, dew point 3.9° C.

KCLM weather observation at 1553 PDT, automated, wind from 300° at 18 knots gusting to 24 knots, visibility unrestricted at 10 miles or more, a few clouds at 4,700 ft, ceiling broken at 5,500 ft, overcast at 7,000 ft, temperature 9° C, dew point 3° C, altimeter 30.29 inches of Hg. Remarks: automated observation system with a precipitation discriminator, peak wind from 300 at 27 knots occurred at 1537 PDT, rain began at 1516 and ended at 1525 PDT, sea level pressure 1026.1-hPa, hourly precipitation 0.01 of an inch, temperature 8.9° C, dew point 3.3° C.

A review of the observations surrounding the period noted several periods of intermittent light rain and gusting northwesterly winds. The raw observations in standard code and abbreviations surrounding the period were as follows:

METAR KCLM 021853Z AUTO 33012G18KT 10SM FEW032 BKN043 08/03 A3033 RMK AO2 SLP273 T00830033

METAR KCLM 021953Z AUTO 30015KT 10SM CLR 09/04 A3032 RMK AO2 SLP269 T00940039

METAR KCLM 022053Z AUTO 30014G23KT 10SM OVC065 10/02 A3031 RMK AO2 SLP265 T01000022 58006

***METAR KCLM 022153Z AUTO 31009KT 10SM FEW031 BKN040 OVC065 08/04 A3031 RMK AO2 RAB30E44
SLP265 P0000 T00830039***

Accident 2229Z

***METAR KCLM 022253Z AUTO 30018G24KT 10SM FEW047 BKN055 BKN070 09/03 A3029 RMK AO2 PK
WND 30027/2237 RAB16E25 SLP261 P0001 T00890033***

*METAR KCLM 022353Z AUTO 30015G22KT 10SM SCT055 08/03 A3029 RMK AO2 PK WND 31027/2259
SLP260 60001 T00780028 10100 20078 58005*

*METAR KCLM 030053Z AUTO 28011G19KT 9SM -RA SCT046 BKN055 07/03 A3029 RMK AO2 RAB52 SLP259
P0000 T00720028*

2.4 Snohomish County Airport -Paine Field (KPAE), Everett, Washington

The next closest reporting station was from Snohomish County Airport (KPAE), Everett, Washington, located about 46 miles east-northeast from the accident site at an elevation of 608

ft. The airport had an ASOS and was also augmented by weather observers. The following conditions were reported surrounding the time of the accident:

KPAE weather observation at 1553 PDT, wind from 340° at 6 knots, visibility unrestricted at 10 miles or more, a few clouds at 4,400 ft, ceiling overcast at 6,000 ft, temperature 9° C, dew point 2° C, altimeter 30.27 inches of Hg. Remarks: automated observation system with a precipitation discriminator, sea level pressure 1025.4-hPa, temperature 8.9° C, dew point 1.7° C.

A review of the observation surrounding the period, also noted short period of MVFR conditions² due to lower ceiling and light intermittent rain. While the winds were more variable in direction and wind speeds less than 10 knots during the period. The raw observations reported surrounding the period were as follows:

METAR KPAE 021753Z 13005KT 10SM -RA SCT009 BKN015 BKN070 07/04 A3032 RMK AO2 RAB1654 SLP272 P0002 60009 T00720044 10072 20050 56002

METAR KPAE 021853Z VRB03KT 10SM SCT018 BKN026 BKN036 08/04 A3032 RMK AO2 RAE1755 SLP270 P0000 T00830039

SPECI KPAE 021939Z 19004KT 10SM SCT027 BKN036 OVC047 07/03 A3032 RMK AO2 RAB13E23 P0000 T00720028

METAR KPAE 021953Z 23006KT 10SM -RA FEW030 BKN039 OVC047 07/03 A3032 RMK AO2 RAB13E23B52 SLP270 P0000 T00720028

METAR KPAE 022053Z 29004KT 10SM FEW047 SCT065 BKN080 09/02 A3030 RMK AO2 RAE07 SLP262 P0000 60000 T00890022 58008

METAR KPAE 022153Z 00000KT 10SM OVC060 09/02 A3028 RMK AO2 SLP258 T00890022

Accident 2229Z

METAR KPAE 022253Z 34006KT 10SM FEW044 OVC060 09/02 A3027 RMK AO2 SLP254 T00890017

METAR KPAE 022353Z 32007KT 10SM OVC060 08/03 A3026 RMK AO2 SLP250 60000 T00830033 10094 20072 56013

METAR KPAE 030053Z VRB06KT 10SM OVC055 08/03 A3026 RMK AO2 RAB26E35 SLP249 P0000 T00780033

2.5 Boeing Field/King County International Airport (KBFI), Seattle, Washington

Boeing Field/King County International Airport (KBFI), Seattle, WA, was located about 44 miles east-southeast of the accident site at an elevation of 22 ft. The airport had an ASOS and was also augmented by human observers. The following conditions were reported surrounding the period:

² MVFR – marginal visual flight rule conditions is defined as a ceiling between 1,000 to 3,000 ft agl inclusive and/or visibility 3 to 5 miles inclusive.

KBFI weather observation at 1553 PDT, wind variable at 4 knots, visibility unrestricted at 10 miles or more, ceiling broken at 6,500 ft, temperature 12° C, dew point 3° C, altimeter 30.27 inches of Hg. Remarks: automated observation system with a precipitation discriminator, sea level pressure 1024.8-hPa, temperature 11.7° C, dew point 2.8° C.

A review of the observation surrounding the period did not report rain during the period or any strong wind gusts during the period. The raw observations surrounding

METAR KBFI 021853Z 19005KT 10SM FEW025 SCT060 11/04 A3032 RMK AO2 SLP267 T01060039

METAR KBFI 021953Z 04006KT 10SM BKN038 11/03 A3031 RMK AO2 SLP262 T01060033

*METAR KBFI 022053Z AUTO 04007KT 10SM FEW030 BKN070 12/03 A3029 RMK AO2 SLP257 T01170033
57015 TSNO*

METAR KBFI 022153Z VRB05KT 10SM SCT030 OVC060 11/03 A3029 RMK AO2 SLP256 T01110028

Accident 2229Z

METAR KBFI 022253Z COR VRB04KT 10SM BKN065 12/03 A3027 RMK AO2 SLP248 T01170028

METAR KBFI 022353Z 06005KT 10SM BKN050 12/04 A3026 RMK AO2 SLP245 T01170039 10128 20089 58012

METAR KBFI 030053Z 07007KT 10SM BKN050 OVC060 11/03 A3025 RMK AO2 SLP243 T01060033

3.0 Sounding

The closest sounding to the accident site was from Quillayute (KUIL), Washington, site number 72797, located miles west-northwest from the accident site, at an elevation of 203 ft. The 1700 PDT sounding (0000Z on April 3, 2017) was plotted on a Skew-T log P diagram³ from the surface to 500-hPa or 18,000 ft utilizing RAOB software⁴, and is included as figure 5. The sounding depicted a freezing level (indicated by a blue line) at 3,000 ft with a lifted condensation level (LCL) and level of free convection immediately above it at 3,060 ft (2,858 ft agl), and a (CCL) at 4,099 ft (3,896 ft agl). A shallow temperature inversion due to subsidence was identified at 6,750 ft, where temperature increased with height and acted as a cap to any cloud formation. The atmosphere was characterized as stable with a lifted index of +7.0, while the lowest layer from the surface to the inversion was conditionally unstable and supported fair weather stratocumulus type clouds, with little vertical development. The precipitable water content was low at 0.28 inches, with a surface relative humidity of 60%.

³ 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.

⁴ RAOB software – The complete Rawinsonde Observation program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

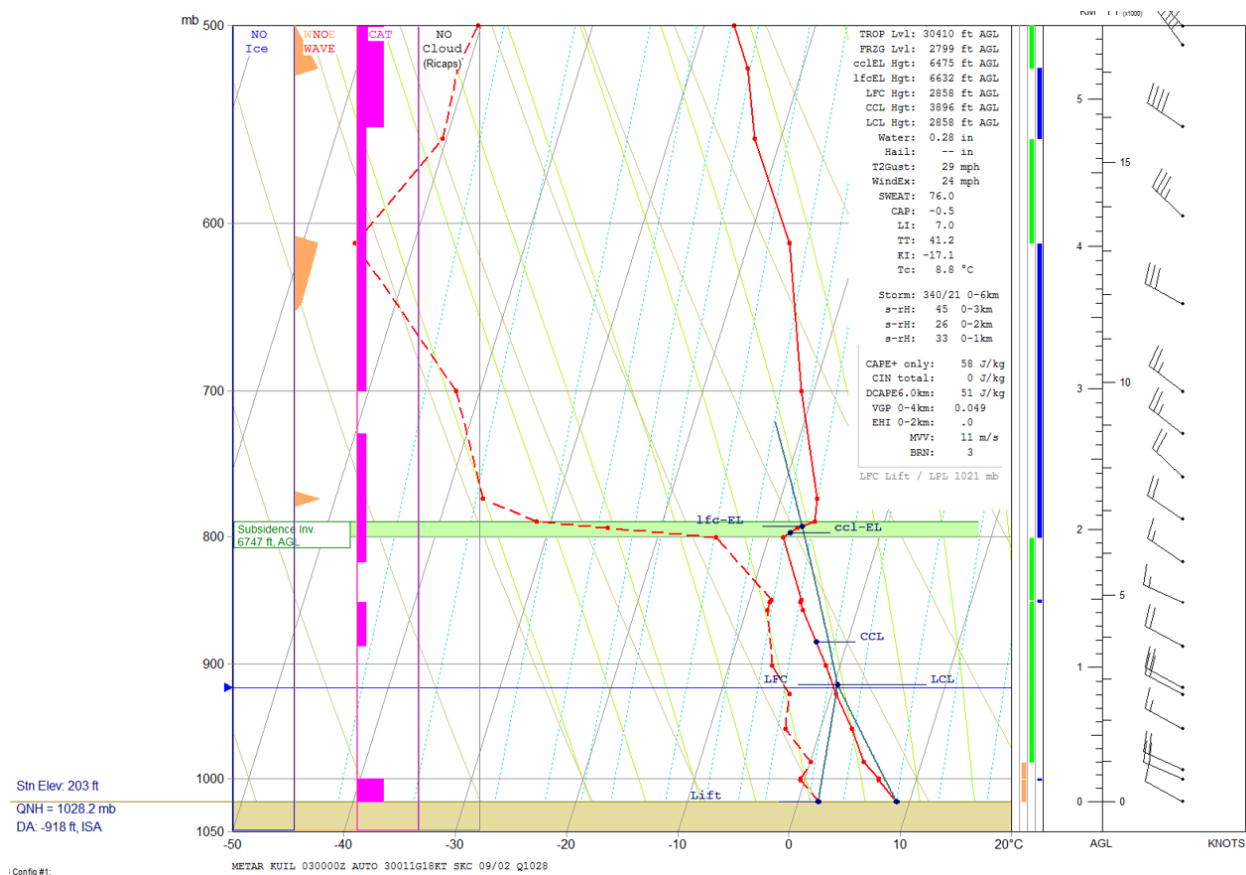


Figure 5 - Quillayute 1700 PDT sounding

The wind profile indicated a surface wind from northwest or 300° at 11 knots with little directional variation with height, with winds speeds increasing with height. The mean 0 to 6 kilometer or 18,000 ft wind was identified from 310° at 28 knots. The maximum wind was identified at 30,000 ft from 290° at 52 knots, with the tropopause at 30,600 ft. At 6,300 ft or at the approximate height of Mount Christie located 13 mile west of the accident site was from 305° at 16 knots, and would have resulted in a downslope wind over the accident site at about 5,350 ft.

The RAOB turbulence algorithm indicated immediately above the surface at approximately 700 ft there was a strong vertical shear of 8.1 knots per 1,000 ft and indicated a probability of 97% of moderate turbulence at and immediately below this level.

Figure 6 is the observed height, pressure, temperature, dew point temperature, relative humidity, wind direction and speed, and expected clear air turbulence (CAT), low-level wind shear (LLWS), icing, and mountain wave activity based on the RAOB algorithm.

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
203	1021	8.8	1.8	61	300 / 11				
738	1001	6.6	-0.4	61		MDT	LIGHT		
765	1000	6.6	-0.4	61	295 / 19				
1000	991				295 / 19				
1171	985	4.8	0.0	71					
1996	955	2.8	-3.2	65	300 / 17				
2840	925	0.4	-3.8	73	300 / 19				
3000	919				300 / 19				
3530	901	-1.3	-6.1	70					
4000	885				300 / 20				
4862	856	-4.9	-8.1	78		LGT			
5043	850	-5.3	-8.1	81	295 / 16				
5104	848	-5.3	-8.0	81					
6000	819				305 / 16				
6564	801	-8.7	-14.7	62					
6788	794	-7.7	-24.7	24		LGT			
6950	789	-6.3	-31.3	12	305 / 19				
7475	773	-6.7	-36.7	7		LGT			2.62 629 LT-MD
8000	757				315 / 21	LGT			
9000	728				310 / 24				
9994	700	-11.1	-42.1	6	310 / 25	LGT			
12000	646				300 / 32				4.36 220 LIGHT
13384	611	-16.3	-55.3	2		LGT			6.04 821 LT-MD
14000	596				315 / 35				
15729	555	-22.3	-50.3	6		LGT			
16000	549				305 / 38				
17291	520	-24.9	-50.9	7		MDT			7.47 872 LT-MD
18222	500	-27.3	-50.3	9	325 / 44				

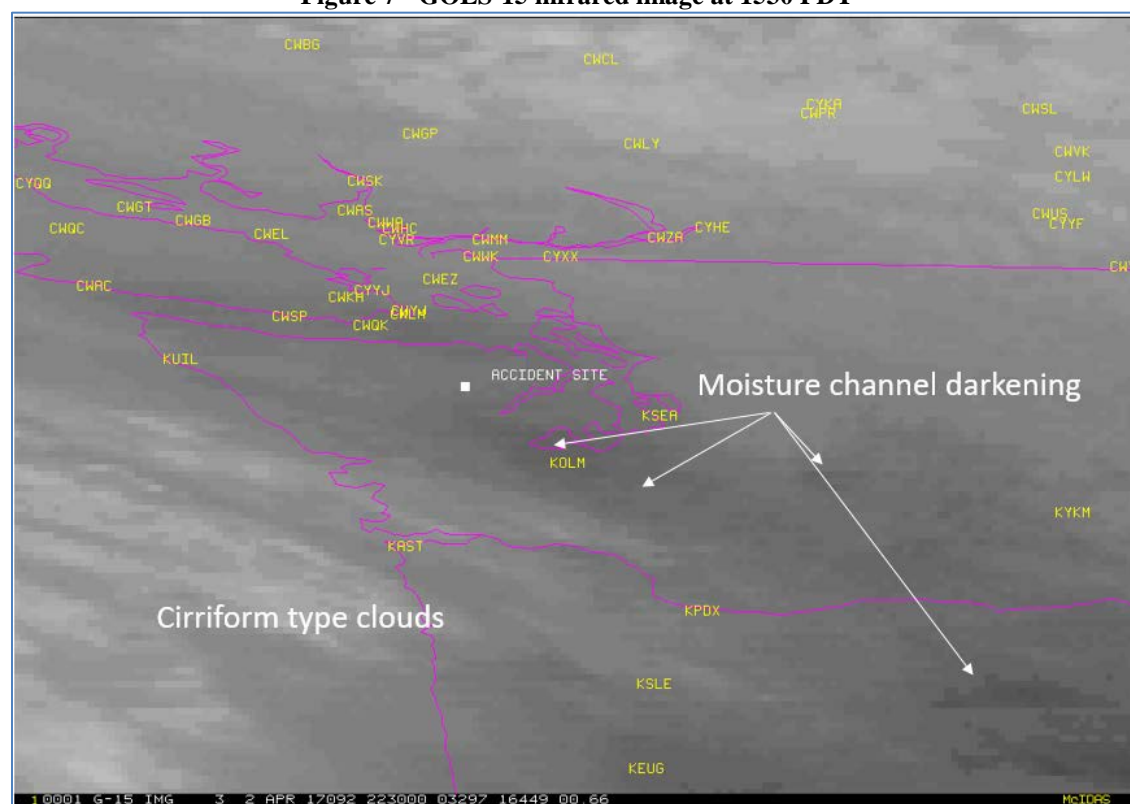
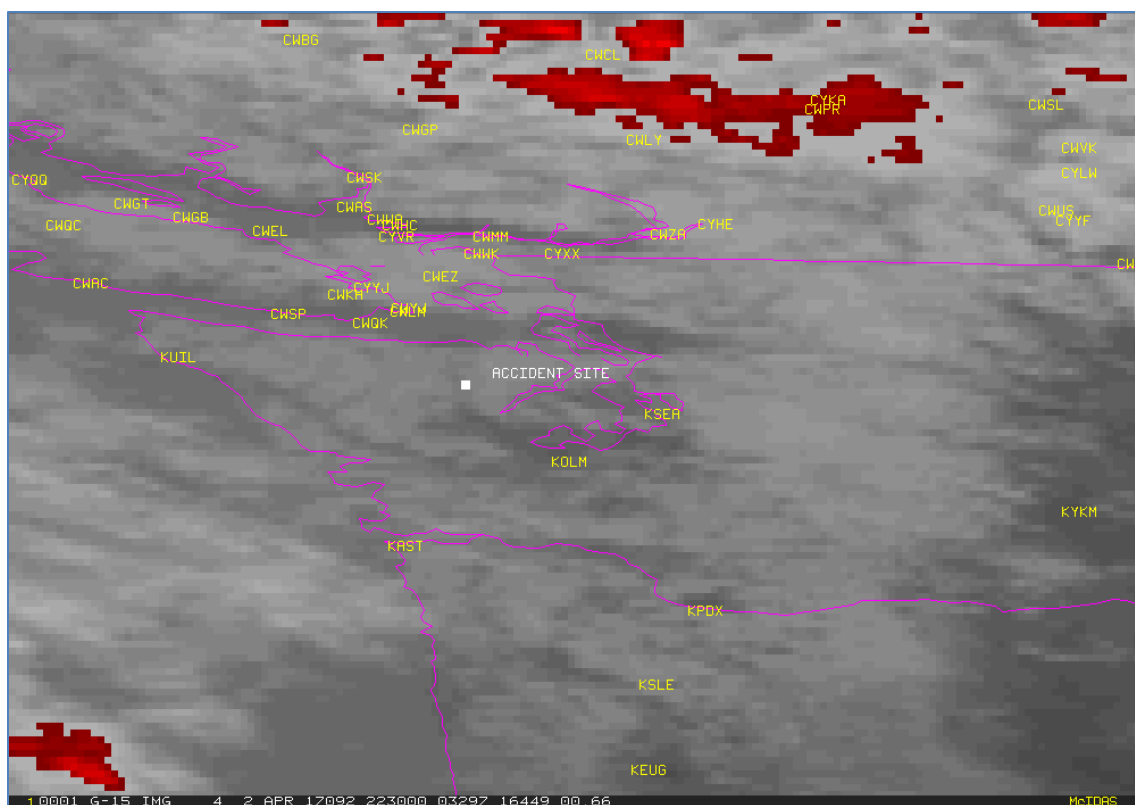
Figure 6 - Quillayute 1700 PDT sounding data

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 15 (GOES-15) data was 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. Both the infrared long wave, infrared water vapor, 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 infrared mid-level water vapor (band 3) at a wavelength of 6.5 μm and 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 infrared image at 6X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops associated with deep convection at 1530 PDT. The accident site is marked by a white square. The image depicted several layers of low to mid-level clouds over the region. The radiative cloud top temperature over the accident site was 271° Kelvin or -2.16° C, which corresponded to cloud tops near 4,000 ft based on the KUIL sounding.

Figure 8 is the GOES-15 water vapor channel image for the same period at 1530 PDT at 6X magnification. The image depicted some moisture channel darkening immediately southwest of the accident site over Washington and Oregon, which indicated descending motion and drying of the mid-level moisture, typically observed during turbulent conditions.



ACCIDENT SITE

10001 G-15 IMG 1 2 APR 17092 223000 03440 16592 00.25

Tri-Cities Airport (KPSC), Pasco, WA, routine pilot report (UA); Over – PSC; Time – 1055 PDT; Altitude – 7,000 ft; Type aircraft – de Havilland Dash 8 multiengine turboprop; Turbulence – light to occasional moderate turbulence; Remarks – during descent from 7,000 ft to 2,000 ft.

Spokane International Airport (KGEG), Spokane, WA, routine pilot report (UA); Over – 25 miles southeast of GEG; Time – 1205 PDT; Altitude – 13,000 ft; Type aircraft – Boeing 737 air carrier jet; Sky cover – overcast clouds with bases at 10,000 with tops at 13,000 ft; Temperature – minus 9° C; Icing – light rime icing.

Boeing Field/King County International Airport (KBFI), Seattle, WA routine pilot report (UA); Over – BFI; Time – 1440 PDT; Altitude – 800 ft; Type aircraft – Beechcraft Musketeer single engine piston airplane; Remarks – light to moderate chop on the right downwind for runway 13R.

Snohomish County Airport-Paine Field (PAE), Everett, WA, routine pilot report (UA); Over – between the route from Fort Jones (FJS), CA to PAE; Time – 1441 PDT; Altitude – 12,000 ft; Type aircraft – Beechcraft 33 Debonair, Bonanza single engine piston airplane; Sky cover – sky clear; Weather – flight visibility 10 miles; Temperature – minus 2° C; Wind – 311 at 34 knots; Turbulence – none; Icing – none.

SEA routine pilot report (UA); Over – 16 miles east of SEA; Time – 1750 PDT; Altitude – 8,000 ft; Type aircraft – Airbus A320 air carrier jet; Temperature – minus 10° C; Icing – light rime icing between 8,000 and 10,000 ft; Remarks – from ZSE ARTCC.

The raw PIREPs in standard code and abbreviations were as follows:

*ELN UA /OV ELN150015/TM 1419/FL290/TP B739/TB MTN WAVE +/-10KTS/RM ..ZSE=
SEA UA /OV SEA/TM 1718/FL100/TP B737/TA M13/IC LGT RIME/RM DURD 100-080=
PSC UA /OV PSC/TM 1755/FL070/TP DH8/TB LT TO OCASSIONAL MOD/RM DURD 070 TO 020=
GEG UA /OV KGEG130025/TM 1905/FL130/TP B732/SK OVC100-130 BASES 100/TA M09/IC LGT RIME=
BFI UA /OV BFI/TM 2140/FL008/TP BE24/RM LIGHT TO MODERATE CHOP ON THE RIGHT DOWNWIND
FOR RUNWAY 13R=
PAE UA /OV FJS-PAE /TM 2141 /FL120 /TP BE33 /SK SKC /WX FV10SM /TA M02 /WV 31134KT /TB NEG /IC
NEG=
SEA UA /OV SEA089016/TM 2150/FL080/TP A320/TA M10/IC LGT RIME 080-100/RM ..ZSE=*

6.0 NWS Forecasts and Advisories

The Area Forecast (FA) is a forecast of visual flight rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS AWC located in Kansas City, Missouri, issues the FA at regular intervals and issues specials reports as necessary usually in the form of an AIRMET.

The forecasts current at the time of the accident was issued at 1245 PDT and was valid through 0100 PDT on April 3, 2017, and was as follows:

FAUS46 KPCI 021945
FA6W
SFOC FA 021945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 031400
CLDS/WX VALID UNTIL 030800...OTLK VALID 030800-031400
WA OR CA AND CSTL WTRS

SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.

SYNOPSIS...ALF...20Z ZONAL FLOW ACRS THE FA AREA. MOD WLY WND
OVR SRN OR AND NRN CA WITH LIGHTER WND ELWS. 14Z SHRTWV TROF FM
THE ID PNHDL THRU SE OR TO THE CNTRL CA CST. MOD-STG NWLY WND
FLOW ALG THE NRN PAC CST AND OVR ADJACENT CSTL WTRS. AT THE
SFC...20Z STNR FNT ALG A 40N OAL-SAC-125SW PYE LN. UPR RDG
BUILDING ACRS WA AND OR. OTRW...LTL CG EXPD DURG THE PD.

WA CASCDS WWD
CSTLN...SCT030 BKN040 TOPS 070. WDLY SCT -SHRA. WND SW G25-30KT.
03Z BKN030. OTLK...MVFR CIG 10Z VFR.
RMNDR...SCT025 BKN045 TOPS 100. SCT -SHRA. OTLK...MVFR CIG THRUT
EXC VFR SRN SXNS.

WA E OF CASCDS
W HLF...SKC. OCNL SCT080. WND NW G25-30KT NRN-CNTRL SXNS. 03Z
SKC. OCNL SCT CI. OTLK...VFR.
E HLF...BKN070-080 TOPS 100. WDLY SCT -SHRASN. WND W G25-30KT.
BECMG 0102 SCT080 SCT150. OTLK...VFR.

The following inflight weather advisories were current during the period. Figure 10 is the current Convective SIGMETs, no advisories current for Washington were in effect during the period, and none required by NWS criteria. A review of non-convective SIGMETs and Center Weather Advisories indicated no advisories issued during the period.

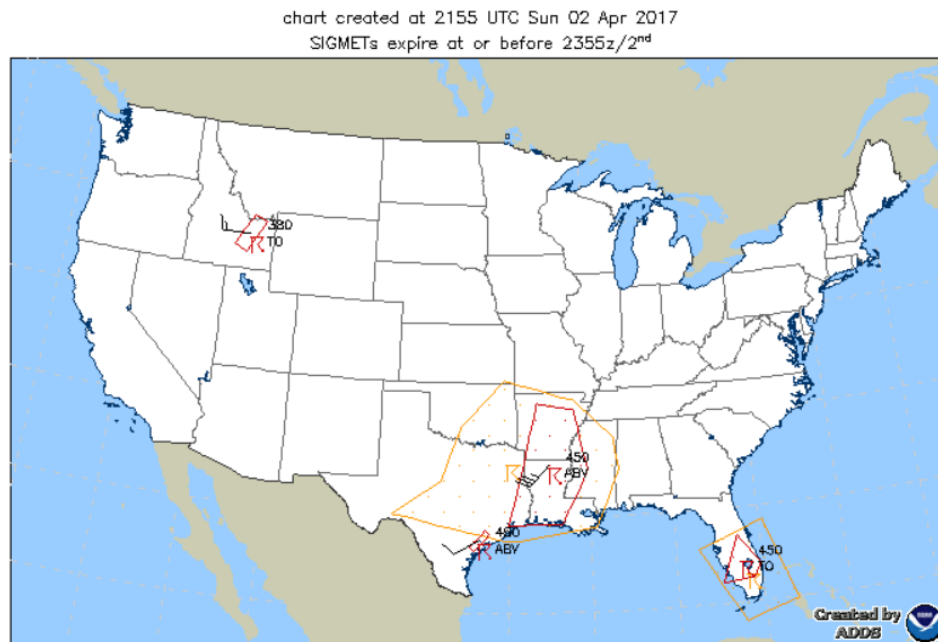


Figure 10 - Convective SIGMETs valid at 1455 PDT

AIRMETS

The NWS Aviation Weather Center (AWC) in Kansas City, Missouri, issued the following AIRMETS during the period at 1345 PDT. An AIRMET for mountain obscuration, occasional moderate turbulence below 15,000 ft, and icing conditions between 2,000 ft and 12,000 ft in clouds and precipitation were current over the region during the period and are depicted in figures 11 through 13. The advisories were as follows:

WAUS46 KPCI 022045

WA6S

-SFOS WA 022045

AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 030300

AIRMET MTN OBSCN...WA OR

FROM 20SE YDC TO 50ENE OED TO 70SW EUG TO 50S HQM TO TOU TO

20WNW HUH TO 20SE YDC

MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

....

SIERRA 2017-04-02 21:00:00

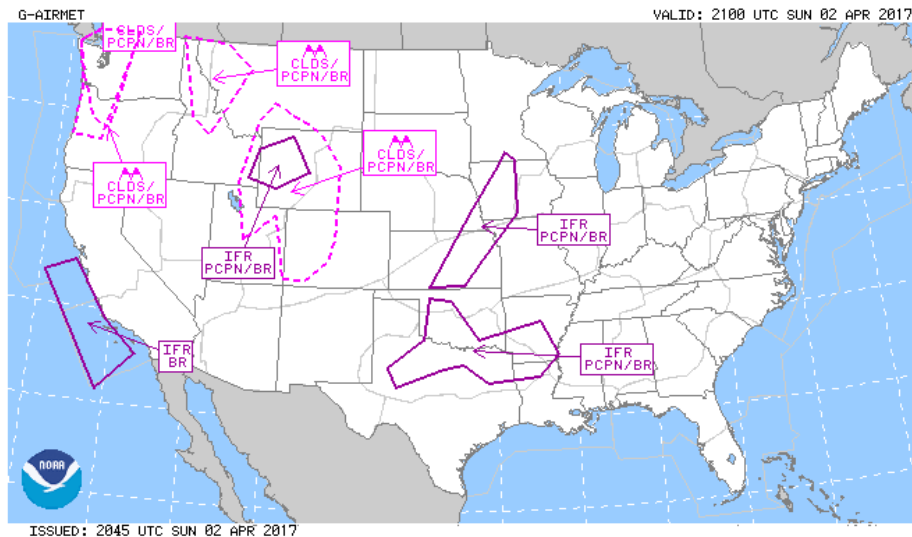


Figure 11 - AIRMET Sierra for IFR and mountain obscuration conditions

WAUS46 KKC1 022045

WA6T

-SFOT WA 022045

AIRMET TANGO UPDT 3 FOR TURB AND STG SFC WNDZ VALID UNTIL 030300

.
AIRMET TURB...WA OR CA ID MT WY NV UT CO AND CSTL WTRS
FROM 40NW HVR TO 50NNW ISN TO 50WSW DIK TO 40SSE JNC TO 70WSW
ILC TO 20WSW PYE TO 150SW FOT TO 140WSW FOT TO 140W TOU TO 30E
EUG TO 20S REO TO 70WSW DBS TO 40NW HVR
MOD TURB BTN FL220 AND FL390. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET TURB...WA OR CA ID WY UT AND CSTL WTRS
FROM 20W HUH TO 60SW YXC TO 20SSE LKT TO 20SE OCS TO LKV TO
20SSE ENI TO 20SSW FOT TO 70SW EUG TO 40S HQM TO TOU TO 20W HUH
MOD TURB BLW 150. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET STG SFC WNDZ...CA AND CSTL WTRS
FROM 80WSW OED TO 20S FOT TO 20WSW OAK TO 130SW PYE TO 140WSW
FOT TO 150WNW FOT TO 80WSW OED
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z
THRU 09Z.

.
OTLK VALID 0300-0900Z
AREA 1...TURB WA OR CA ID MT WY NV UT CO AZ NM AND CSTL WTRS
BOUNDED BY 30NNW HVR-50NNW ISN-70SW DIK-60E HBU-60SSW RSK-50WSW
LAS-20WSW PYE-150WSW ENI-140WSW FOT-140W TOU-40NNE TOU-70NE LKV-
30SW JAC-70E OCS-30NNW HVR
MOD TURB BTN FL220 AND FL390. CONDS CONTG THRU 09Z.

.
AREA 2...TURB WA OR CA ID MT WY NV UT CO AND CSTL WTRS
BOUNDED BY 70WSW YXC-40WNW DBS-20SSW BOY-50W BFF-20SSE CYS-20S
OCS-20SSW FOT-60S HQM-TOU-20W HUH-70WSW YXC
MOD TURB BLW 150. CONDS CONTG THRU 09Z.

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AIRMET Zulu for icing conditio

TANGO 2017-04-02 21:00:00

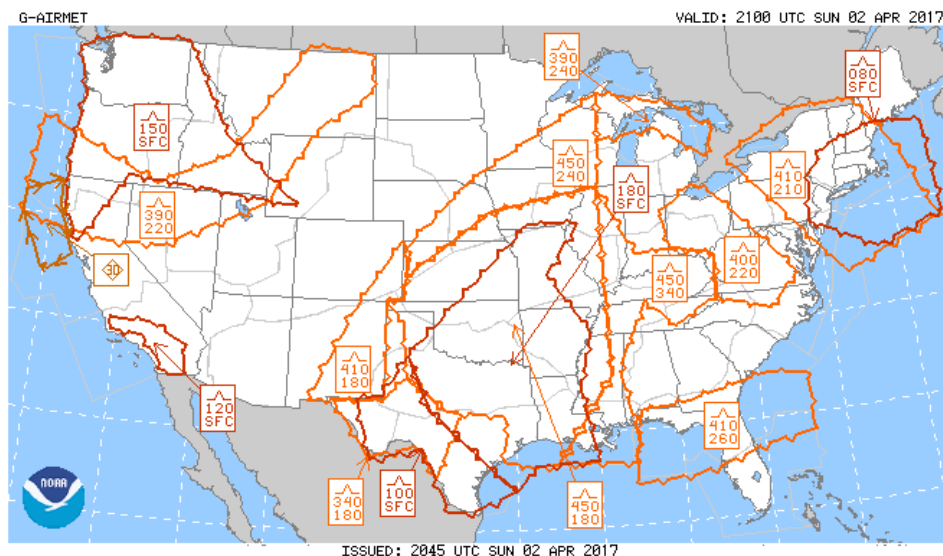


Figure 12 - AIRMET Tango current for turbulence

WAUS46 KPCI 022045

WA6Z

-SFOZ WA 022045

AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 030300

AIRMET ICE...WA AND CSTL WTRS

FROM 30S YDC TO 20NNW YKM TO 50SSE SEA TO 20E HQM TO 20W TOU TO 30W HUH TO 30S YDC

MOD ICE BTN 020 AND 120. CONDS CONTG BYD 03Z THRU 09Z.

FRZLVL...RANGING FROM SFC-140 ACRS AREA

MULT FRZLVL 070-100 BOUNDED BY 60SE EUG-60NNE RBL-60WSW OED-60SSW EUG-60SE EUG

SFC ALG 30ENE HUH-50S YDC-80SW YXC-60NNE GEG

040 ALG 150W ONP-130WSW ONP-70WSW ONP-30SE ONP-60SSW YKM-40W GEG-50NNE GEG

080 ALG 140WNW FOT-30N FOT-80SSE LKV

120 ALG 140WSW SNS-50SSW CZQ-60ENE EHF-50NW HEC-20W BZA

ZULU 2017-04-02 21:00:00

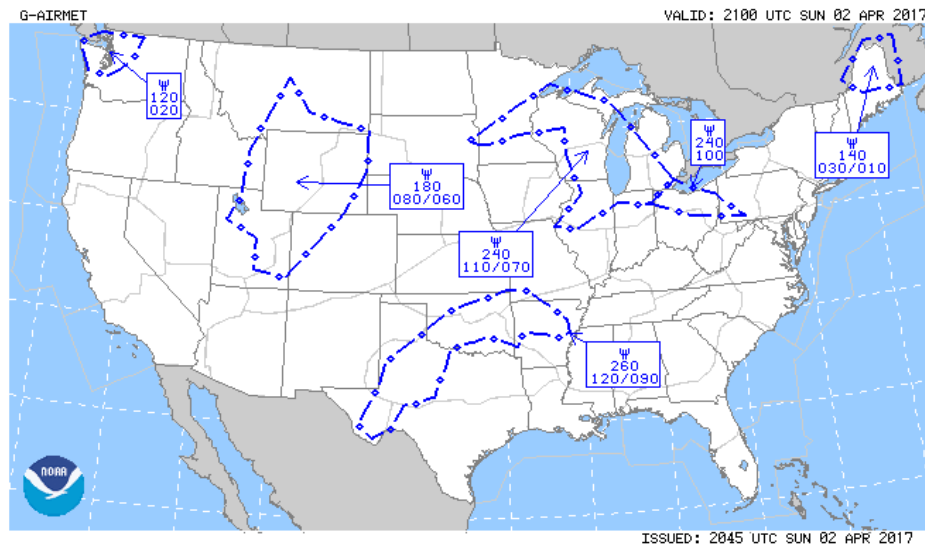


Figure 13 - AIRMET Zulu current for icing conditions

7.0 Winds and Temperatures Aloft Forecast

The NWS Winds and Temperature Aloft forecast current for the period were as follows for the region:

WINDS ALOFT FORECASTS

DATA BASED ON 021800Z

VALID 030000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

	3000	6000	9000	12000	18000	24000	30000	34000	39000
SEA	9900	2510-05	2817-11	3031-15	3039-27	3045-41	305055	294255	294050
YKM	2915	3023-04	3119-10	3125-14	3037-27	3043-40	304955	294755	284349

The forecast for Seattle (SEA) for 3,000 ft expected a light and variable winds under 5 knots, and for 6,000 ft a wind from 250° at 10 knots, with a temperature of -5° C. The forecast for Yakima (YKM) located about 120 miles southeast of the accident site, depicted a wind at 3,000 ft from 290° at 15 knots, and at 6,000 ft from 300° at 23 knots, with a temperature of -4° C. The forecast winds aloft supported the formation of mountain wave conditions to the southeast of the higher terrain above the 12,000 ft level, based on the wind direction with little variation in wind direction with height and the wind speeds over 25 knots.

8.0 Accident Site Photographs

Several images were available of the accident site, showing the snow covered area and the local topography, which is important with regards to upslope and downslope wind conditions. Figures 14 through 16 are the images of the scene with the initial photo showing the accident site within the red circle.

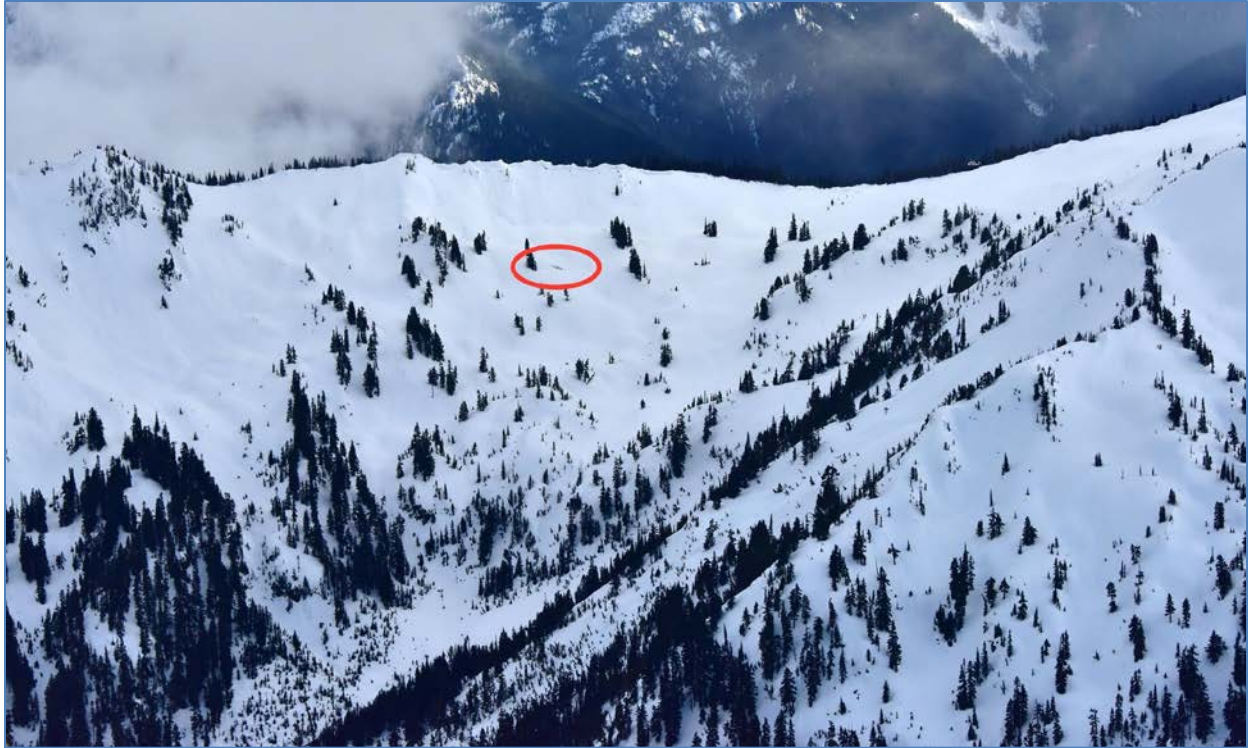


Figure 14 - Accident site below ridge crest



Figure 15 - Accident site closeup



Figure 16 - closeup of the accident airplane

F. ATTACHMENTS

Attachment 1 – Animation of the GOES-15 visible imagery from 1400 through 1600 PDT at 15-minute intervals.

Submitted by:

Don Eick
Senior Meteorologist

