

Data Requested

Synoptic Conditions - The northwest section of the National Weather Service (NWS) Surface Analysis Chart for 1600 PST is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a low-pressure system at 1019-hectopascals (hPa) over British Columbia along a stationary front that extended westward across southern Canada immediately north of the accident site. Further south over Oregon was a high pressure system at 1030-hPa. The station models depicted a general southerly wind of 5 to 10 knots, broken clouds, with temperatures in the mid 40's degrees Fahrenheit, with temperature-dew point spreads of 2° F. The one station reporting significant weather was from Ellensburg, Washington, located southwest of the accident site and in higher elevations which depicted moderate snow, sky obscured, with a temperature of 32° F, and a dew point of 30° F.

The NWS National Composite Radar Mosaic was also obtained for the period surrounding the time of the accident. Figure 2 is a regional composite over the area at 1710 PST with the departure airport (KTIW), destination airport (KAWO), and the accident site marked. The image depicted an area of moderate to heavy echoes over the departure area with scattered echoes over and near the accident site. Based on the potential of echoes the closest weather surveillance radar will be documented below.

Observations - The accident site was located approximately 9 miles from Arlington Municipal Airport (KAWO), Arlington, WA, which lists an elevation of 142 feet (ft) and a magnetic variation of 17 E. The airport had an Automated Weather Observation System (AWOS) and issued observations hourly with specials as needed.

Weather observation for KAWO at 1656 PST, automated, wind from 130° true at 9 knots, visibility 10 miles or more, a few clouds at 2,700 ft agl, ceiling overcast at 4,100 feet, temperature 8° Celsius (C), dew point temperature 5° C, altimeter 30.32 inches of mercury. Remarks; automated station with a precipitation discriminator, sea-level pressure 1027.1-hPa, temperature 7.8° C, dew point 5.0° C.

The following general flight categories (IFR, MVFR, VFR) and raw METAR and SPECI reports were reported surrounding the period.

*MVFR METAR KAWO 192256Z AUTO 14010KT 10SM BKN023 BKN028 OVC043 08/06 A3029 RMK AO2
SLP261 T00780056=*

VFR SPECI KAWO 192314Z AUTO 14009KT 10SM FEW021 SCT028 OVC045 08/06 A3029 RMK AO2=

*VFR METAR KAWO 192356Z AUTO 14011KT 10SM SCT027 BKN036 OVC045 08/05 A3030 RMK AO2
SLP266 T00780050 10083 20056 53012=*

MVFR SPECI KAWO 200011Z AUTO 15008KT 10SM BKN027 OVC036 08/05 A3031 RMK AO2=

VFR SPECI KAWO 200047Z AUTO 12008KT 10SM FEW027 OVC041 08/05 A3031 RMK AO2=

***VFR METAR KAWO 200056Z AUTO 13009KT 10SM FEW027 OVC041 08/05 A3032 RMK AO2 SLP271
T00780050=***

Accident 0109Z

*VFR METAR KAWO 200156Z AUTO 15008KT 10SM FEW029 BKN048 BKN060 07/05 A3034 RMK AO2
RAB38E54 SLP277 P0000 T00720050=*

*MVFR METAR KAWO 200256Z AUTO 12008KT 10SM BKN022 BKN028 OVC033 08/05 A3035 RMK AO2
SLP281 60000 T00780050 51010=*

Departure area - Tacoma Narrows Airport (KTIW), Tacoma, Washington

*MVFR METAR KTIW 192153Z 20012KT 10SM -RA SCT012 BKN025 OVC055 08/06 A3029 RMK AO2 RAB34 SLP258
P0001 T00780056*

*VFR SPECI KTIW 192201Z 20015G19KT 10SM -RA FEW016 SCT031 OVC043 08/05 A3030 RMK AO2 P0000
T00780050*

*VFR METAR KTIW 192253Z 20012G18KT 10SM SCT012 SCT031 OVC043 07/04 A3030 RMK AO2 RAE02 SLP264
P0000 T00720039*

VFR METAR KTIW 192353Z 19008KT 10SM SCT031 BKN035 OVC045 07/04 A3032 RMK AO2 RAB2259E40
SLP270 P0001 60019 T00720044 10078 20056 53014

VFR METAR KTIW 200053Z 22005KT 10SM -RA SCT017 OVC036 07/04 A3033 RMK AO2 RAB12 SLP275 P0003
T00670044

Departure at 0056Z

MVFR SPECI KTIW 200058Z 22004KT 10SM -RA BKN017 OVC035 07/04 A3033 RMK AO2 P0000 T00670044

IFR SPECI KTIW 200127Z VRB03KT 2SM +RA BR FEW005 BKN010 OVC015 06/05 A3035 RMK AO2 P0010
T00610050

VFR METAR KTIW 200153Z 20007KT 7SM -RA SCT008 SCT019 BKN042 06/04 A3035 RMK AO2 SLP280 P0018
T00610044

VFR METAR KTIW 200253Z 19007KT 10SM -RA SCT027 BKN034 OVC055 07/05 A3035 RMK AO2 RAE0154B51
SLP281 P0001 60022 T00670050 51011

Terminal Aerodrome Forecast (TAF) - The NWS does not issue a TAF for KAWO. The closest TAF to the accident site was issued for Snohomish County Airport - Paine Field (KPAE), Everett, Washington, located approximately 22 miles south of KAWO. While a TAF is only valid for a 5 mile radius of the airport center point, it is often reviewed for condition in the general area for planning purposes. The following TAF was current at the time the accident.

TAF KPAE 192320Z 2000/2024 19013KT P6SM VCSH OVC020
FM200300 17012KT P6SM VCSH BKN035
FM201000 17011KT P6SM -SHRA OVC025=

The forecast expected generally MVFR conditions to prevail with winds from the south or from 190° at 13 knots, visibility of 6 miles or more, with showers in the vicinity, with a ceiling overcast at 2,000 ft agl.

Sounding - A High-Resolution Rapid Refresh (HRRR) numerical model was run over the accident site for 1700 PST and plotted on a standard Skew T log P diagram from the surface to 400-hPa or approximately 24,000 ft. The HRRR sounding depicted an elevation of 1,644 ft with a near surface temperature of 4° C, a dew point of 3° C, with a relative humidity of 93%. The model sounding depicted a lifted condensation level (LCL) at 209 ft agl (1,853 ft msl), the convective condensation level (CCL) at 1,563 ft agl (3,207 ft msl), and a level of free convection (LFC) at 4,491 ft msl. The freezing level was at 3,755 ft msl and supported icing-in-clouds above this level. The sounding was saturated from the LCL through 13,000 ft and supported nimbostratus type clouds with rain shower. The moisture profile also favored carburetor type icing through 5,000 ft msl. The clouds (gray), icing potential (blue --pink-green), low-level wind shear (red), clear air turbulence or CAT (pink), and carburetor icing potential (dark green) &are displayed on the left side of the diagram.

The HRRR sounding wind profile indicated a near surface wind from 160 at 7 knots with wind veering to the southwest at 20 knots immediately above the surface and then to the west with increasing height above 5,000 ft.

Satellite Imagery - the GOES-17 infrared image at 1706 PST at 2X magnification is included as figure 4 and depicted a layer of low clouds over the region with a radiative cloud top temperature of 253 Kelvin or -20 C, which corresponded to cloud tops near 13,000 ft over the accident site.

Weather Surveillance Radar Imagery - The NWS Seattle (KATX) WSR-88D depicted echoes associated with rain showers over the Tacoma area as the accident airplane departed the KTIW and flew northward and then eastward north of KAWO before turning back to the airport, when the accident occurred.

The closeup image in Figure 6 depicted echoes of 5 to 20 dBZ along the flight track when it approaches a small area of echoes with maximum reflectivity near 45 dBZ, when the accident occurs. The KATX WSR-88D 0.53° base reflectivity image was scanning the airspace between 880 ft to 2,600 ft over the accident site.

Pilot Reports - reported over the area below 18,000 ft were as follows:

SEA UA /OV SEA110020/TM 1935/FL090/TP E175/TA M04/IC LGT RIME 090-120/RM DURC
PAE UA /OV KPAE/TM 1935/FLUNKN/TP B188/SK BKN020-TOPUNKN/RM DURD
SEA UA /OV SEA230015/TM 1952/FL100/TP E75L/SK TOP100/RM -ZSE
PAE UA /OV KPAE/TM 2024/FLUNKN/TP E75L/SK BKN027-TOP035/RM DURD

PAE UA /OV KPAE/TM 2057/FLUNKN/TP RV6/SK BKN019-TOPUNKN/RM DURD
PAE UA /OV PAE340005/TM 2120/FL022/TP PRM1/SK BKN022
BFI UA /OV KBFI/TM 2211/FL040/TP C172/RM NEG RA
PAE UA /OV KPAE/TM 2229/FL023/TP BE35/SK BKN023
BFI UA /OV BFI 3SE/TM 2250/FL024/TP C25B/SK BKN024
PAE UA /OV PAE/TM 2322/FL015/TP A109/SK BASES BKN017
PAE UA /OV PAE/TM 2359/FL017/TP PC12/SK BASES BKN020 TOPS 030/TB LIGHT CHOP
BFI UA /OV FINAL RWY 14R/TM 0016/FLFAP/TP B767/TB LGT 020/RM WIND 27027KT AT 020

Winds Aloft Forecast - current during the period for the northwest region.

WINDS ALOFT FORECASTS

DATA BASED ON 200000Z

VALID 200600Z FOR USE 0200-0900Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
SEA	2324	2420-03	2521-09	2524-17	2831-28	2935-37	294151	284456	274655
AST	2220	2417-03	2517-09	2520-16	2826-26	3032-36	283850	284257	274654
YKM	2311	2515-02	2618-09	2718-16	2727-28	2832-38	284550	284956	275251

Inflight Weather Advisories - during the period the NWS had no SIGMETs, Convective SIGMETs, or CWA's issued during the period. The NWS Aviation Weather Center did have a full series of AIRMETs current for the area for mountain obscuration, moderate turbulence below 14,000 ft, and moderate icing conditions. The advisories were as follows:

WAUS46 KKCI 192045

WA6S

_SFOS WA 192045

AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 200300

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NO SGFNT IFR EXP OUTSIDE OF CNVTV ACT.

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AIRMET MTN OBSCN...WA OR

FROM 40SE YDC TO 30SW YKM TO 50E OED TO 80W OED TO 20NNW ONP TO

HQM TO TOU TO HUH TO 40SE YDC

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

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WAUS46 KKCI 192045

WA6T

_SFOT WA 192045

AIRMET TANGO UPDT 4 FOR TURB VALID UNTIL 200300

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AIRMET TURB...WA OR ID MT WY AND CSTL WTRS

FROM 50WSW YXC TO 50NNW ISN TO 60WNW RAP TO 70E DLN TO 50WNW PIH

TO 40WSW BKE TO 40ENE EUG TO 50SSW HQM TO 40NW TOU TO 50WSW YXC

MOD TURB BLW 140. CONDS CONTG BYD 03Z THRU 09Z.

WAUS46 KKCI 192045

WA6Z

_SFOZ WA 192045

AIRMET ZULU UPDT 4 FOR ICE AND FRZLVL VALID UNTIL 200300

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AIRMET ICE...WA OR AND CSTL WTRS

FROM 60WSW YXC TO 30SE REO TO 50NNE LKV TO 20NW OED TO 30S ONP TO 90WSW ONP

TO 140W TOU TO 60WSW YXC

MOD ICE BTN FRZLVL AND 130. FRZLVL 020-070. CONDS CONTG BYD 03Z THRU 09Z.

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FRZLVL...RANGING FROM SFC-155 ACRS AREA

SFC ALG 40WSW YDC-20NNE GEG-30SE GEG-50NNE LKV-40ENE LKV-30NW REO-40ESE REO

040 ALG 160W HQM-70S HQM-20WNW BTG-40WSW EPH-60S GEG
080 ALG 130WSW PYE-80W PYE-40SSW FMG
120 ALG 140SW SNS-20S BTY

Astronomical Conditions - the astronomical conditions for Arlington, Washington, were calculated and were as follows, the time of the accident is added in italic print.

SUN

Begin civil twilight	0647 PST
Sunrise	0722 PST
Culmination	1154 PST
Sunset	1625 PST
End civil twilight	1659 PST
<i>Accident</i>	<i>1709 PST</i>

Moon

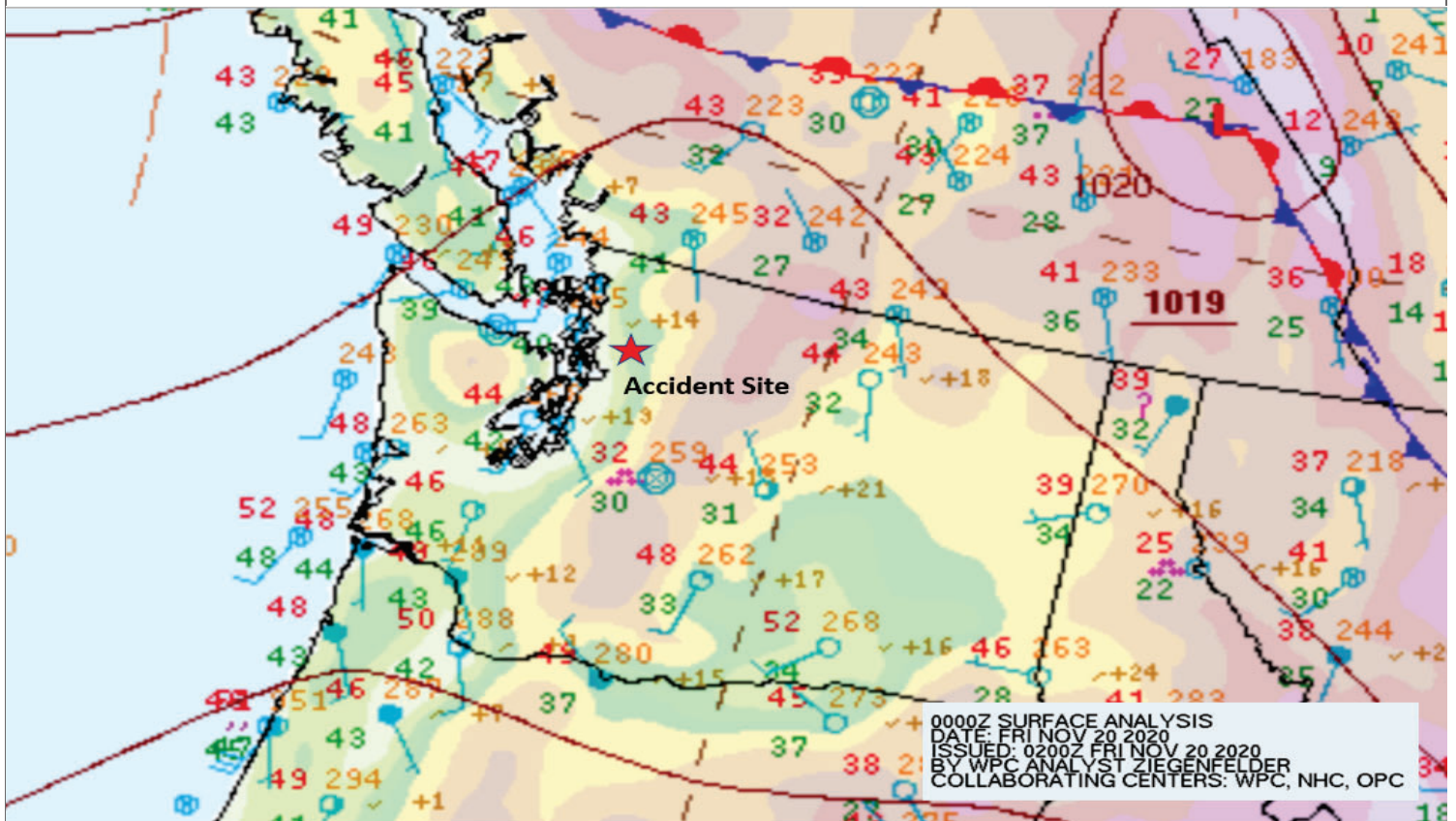
Moonrise	1219 PST
Moon Culmination	1632 PST
<i>Accident</i>	<i>1709 PST</i>
Moonset	2049 PST

At the time of the accident the Sun had set and was -7.5° below the horizon at an azimuth of 249°. The Moon was 17° above the horizon at an azimuth of 189°, and the phase was a waxing Crescent with 28% of the Moon's disk illuminated.

Preliminary Analysis

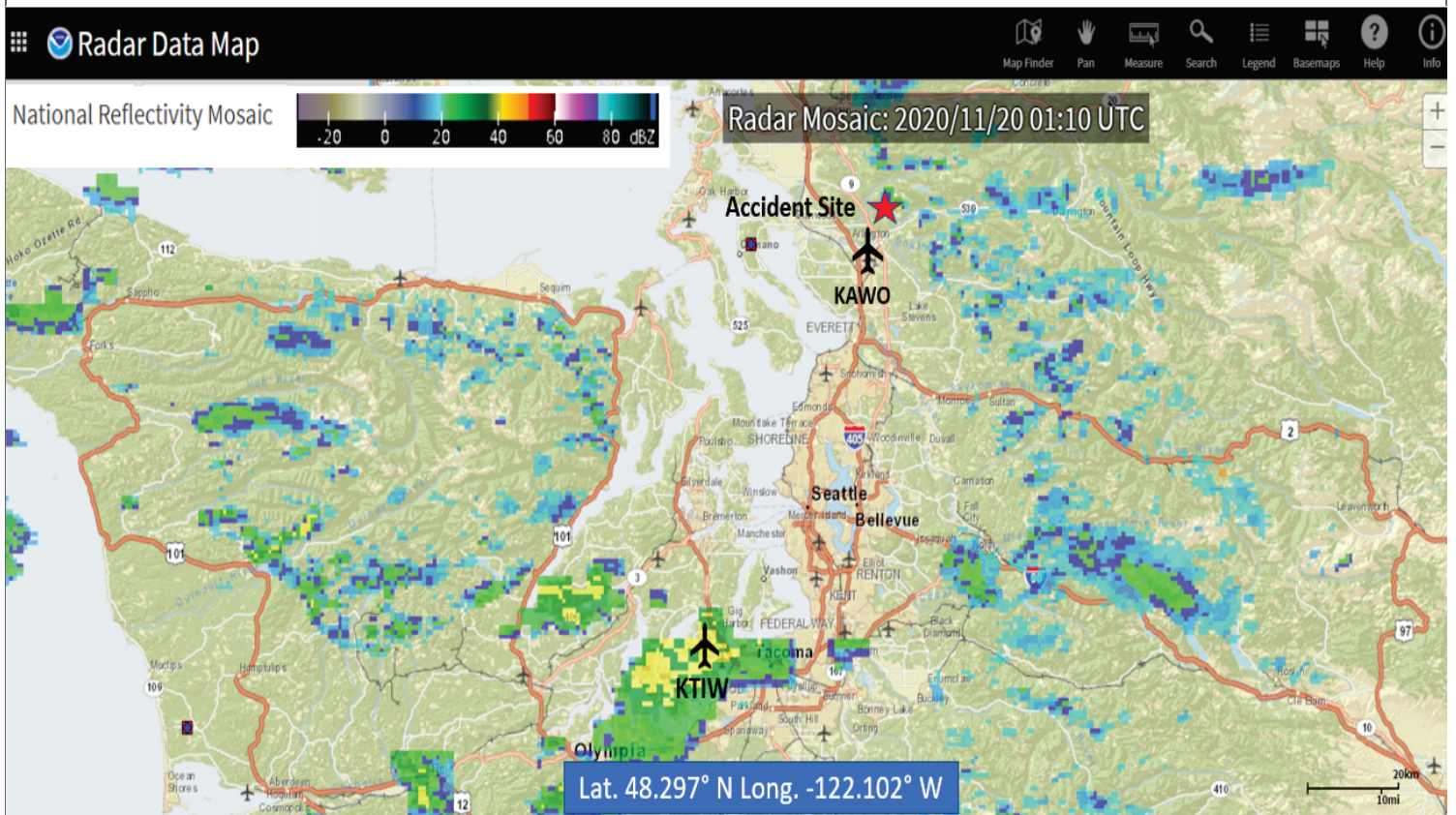
Additional Details

Figure 1



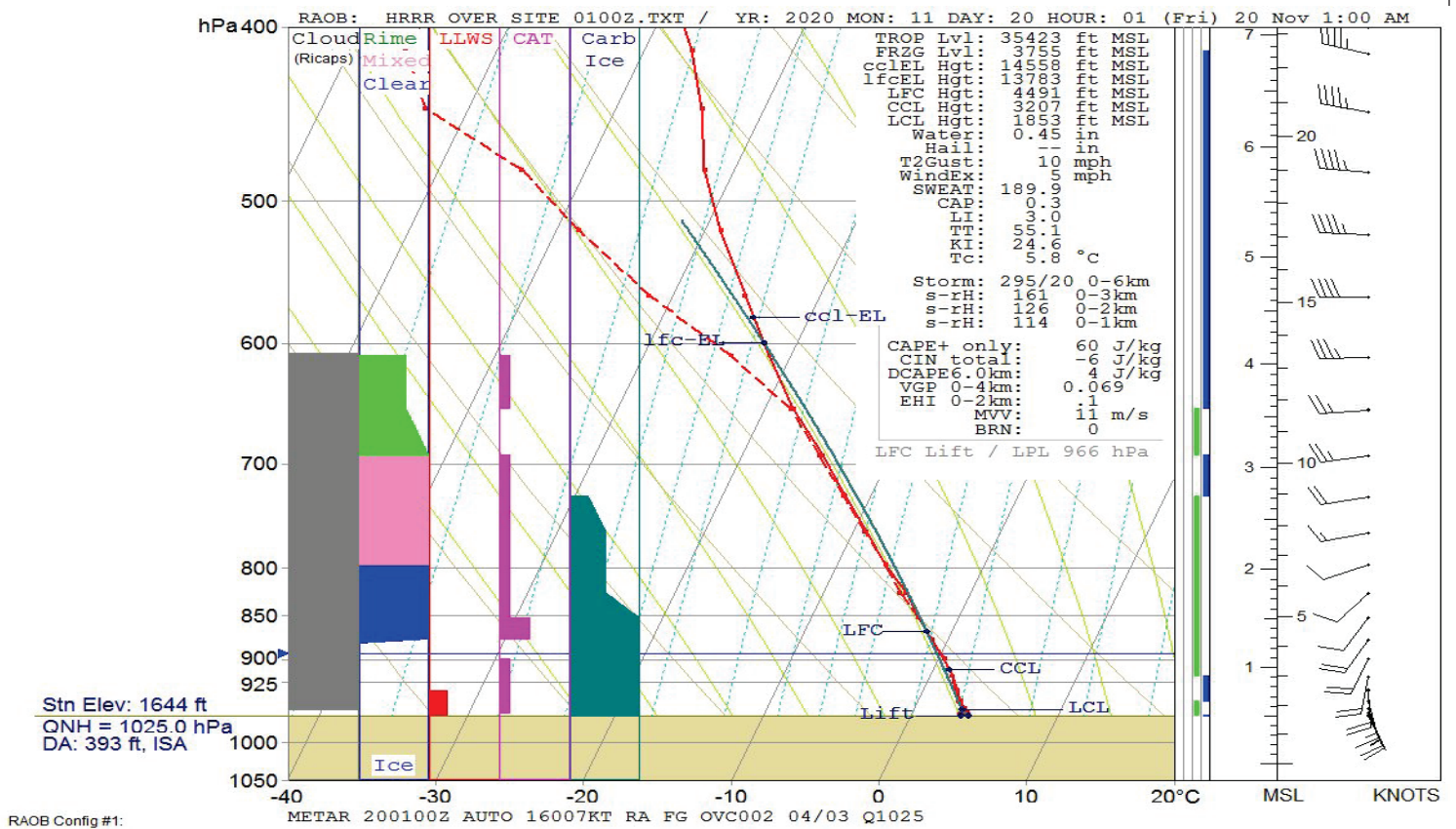
Caption Surface Analysis Chart for 1700 PST with approximate accident site marked by red star

Figure 2



Caption National Composite Radar Mosaic for 1710 PST with the accident site marked by red star and departure and destination airports

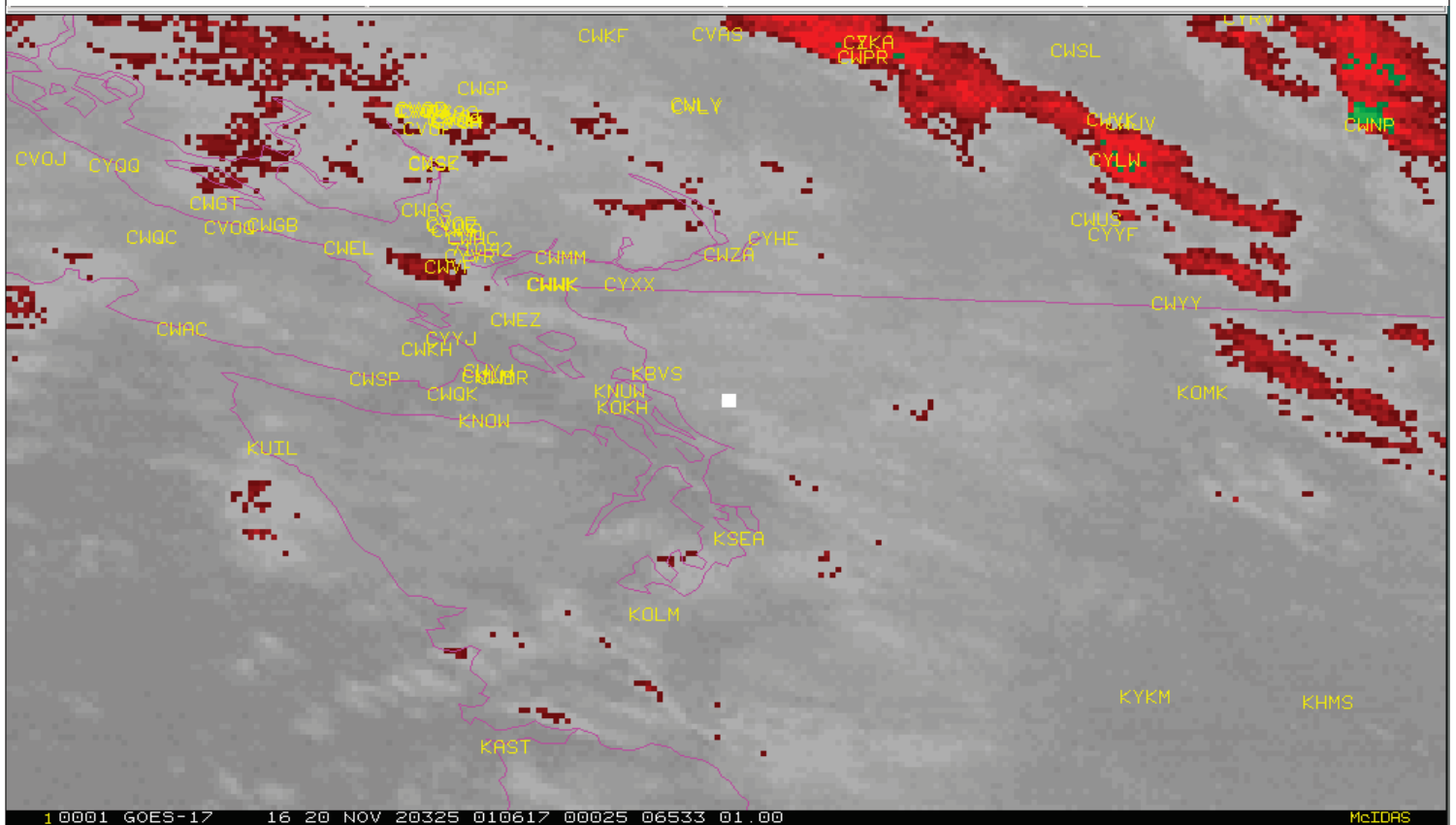
Figure 3



Caption

High-Resolution Rapid Refresh (HRRR) numerical model sounding for 1700 PST over the approximate accident site plotted on a standard Skew T log P diagram

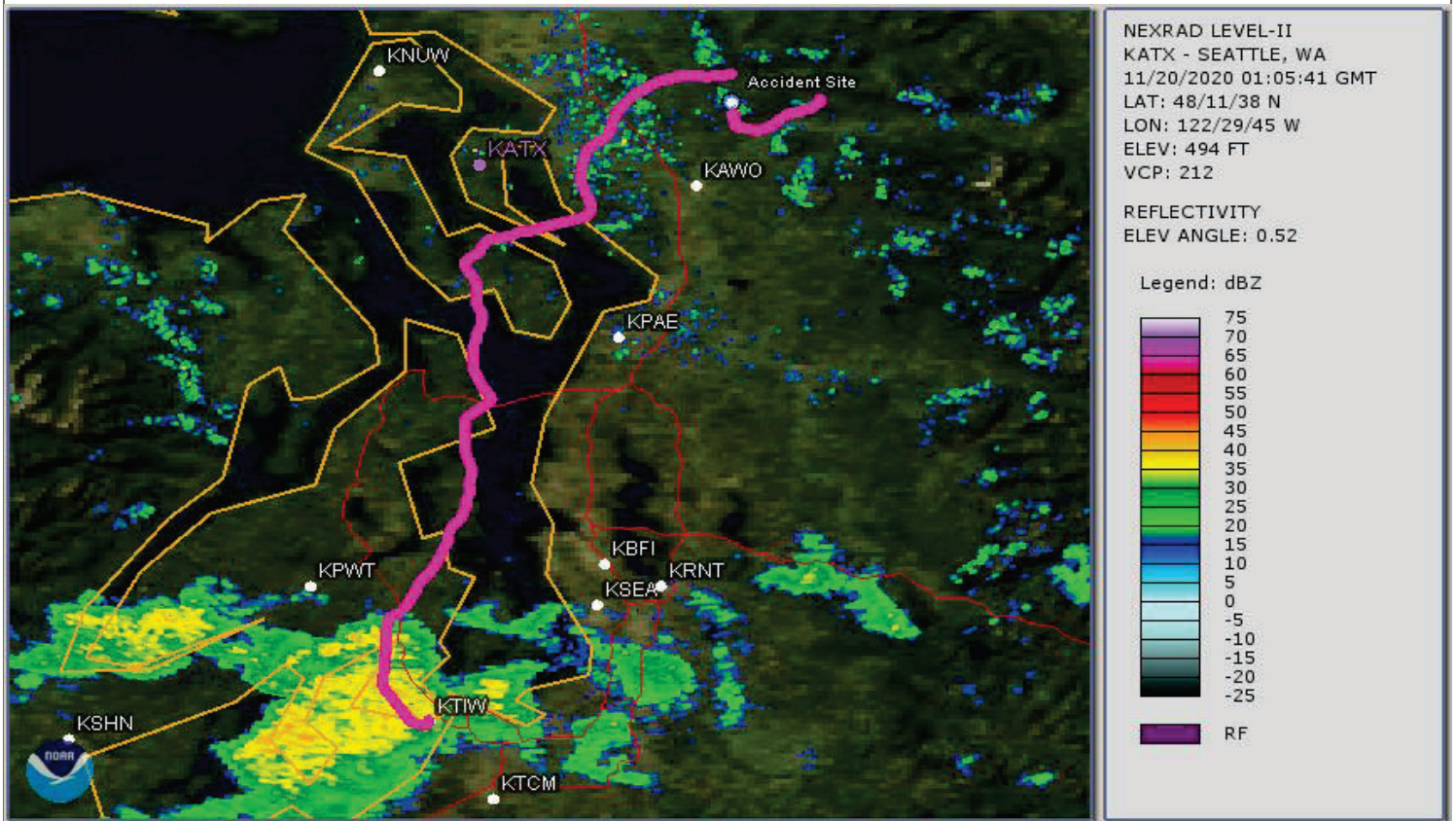
Figure 4



Caption

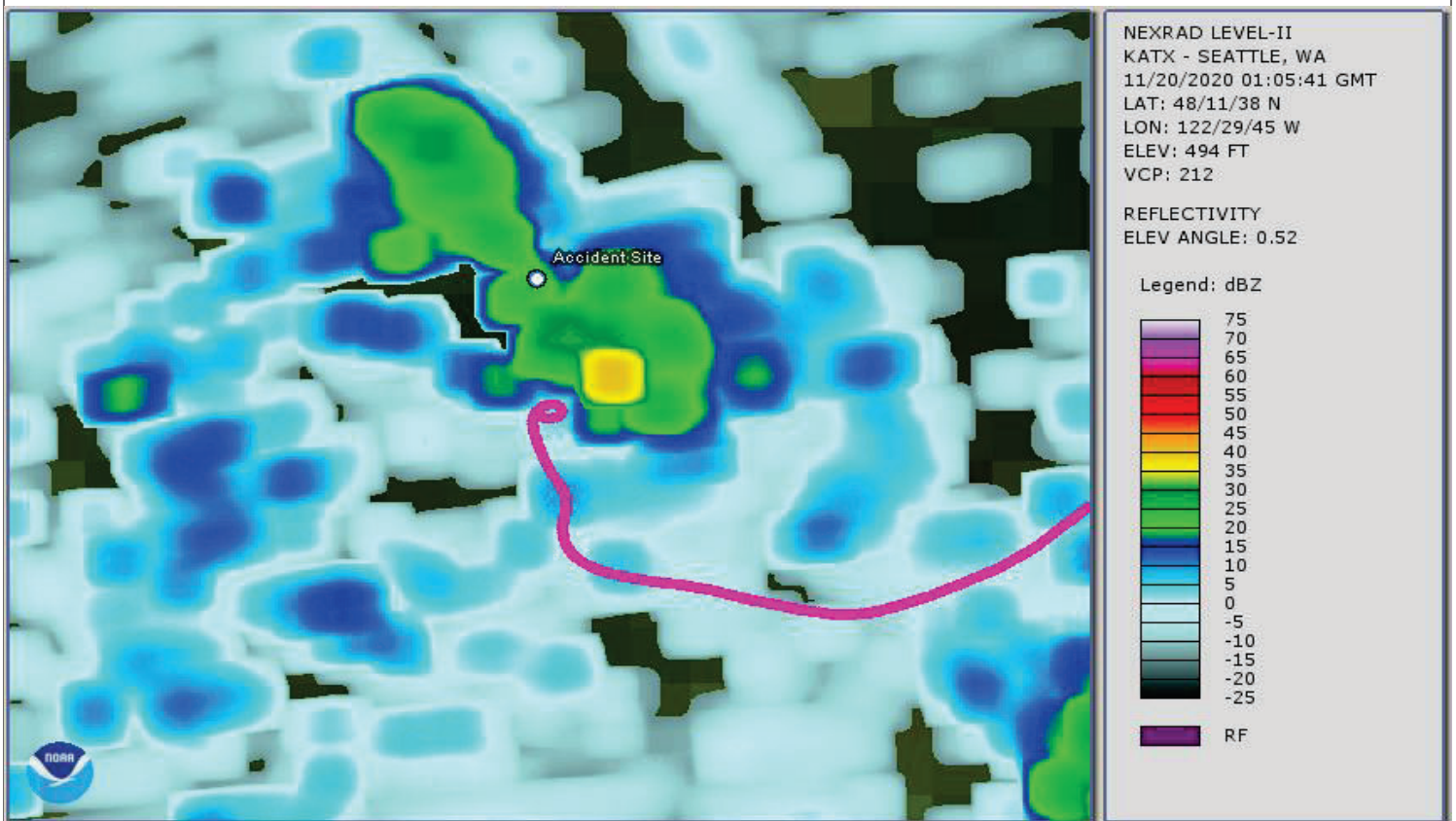
GOES-17 infrared satellite image at 1706 PST at 4X magnification depicted an extensive area of low stratiform clouds over the region

Figure 5



Caption NWS Seattle WSR-88D image for 1705 PST with the flight track overlaid and the approximate accident site marked.

Figure 6



Caption Close up of the Seattle WSR-88D 0.53 degree base reflectivity image for 1705 PST with the flight track overlaid.