



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 12, 2018

Weather Study

METEOROLOGY

WPR18FA001

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A. ACCIDENT

Location: Klamath Falls, Oregon
Date: October 1, 2017
Time: about 1043 Pacific daylight time (1743 UTC)¹
Airplane: Type: Cirrus SR22; Registration: N6083D

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in Pacific daylight time (PDT) for October 1, 2017 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Coordinates used for the accident location: 42.253611° north latitude, 122.265556° west longitude, at an elevation of about 5,675 feet.

D. WEATHER INFORMATION

1.0 Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 1100 PDT is presented in figure 1. Station models around the accident location depicted overcast skies, winds ranging from 10 knots to calm, temperatures in the high-40's degrees Fahrenheit (°F) to mid-50's °F, with dew point depressions greater than 10 °F. A trough was depicted stretching from far northwest California south toward central California.

¹ UTC – abbreviation for Coordinated Universal Time

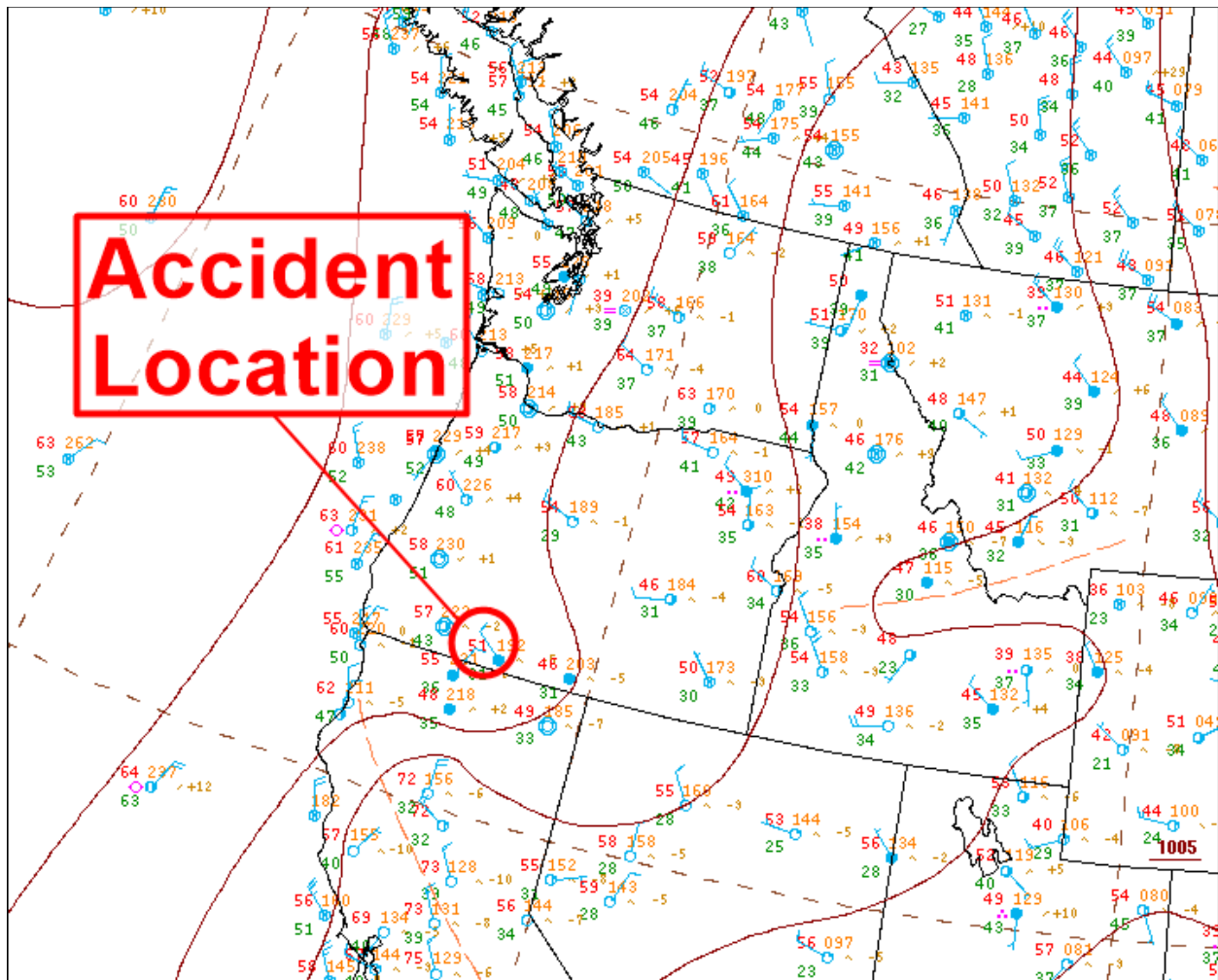


Figure 1 – Northwestern continental United States portion of the NWS Surface Analysis Chart for 1100 PDT.

2.0 Surface Observations

An Automated Surface Observing System (ASOS) was located at Crater Lake-Klamath Regional Airport (LMT)² in Klamath Falls, Oregon, and was located about 24 miles east-southeast of the accident location at an elevation of 4,095 feet. Reports from LMT during the times surrounding the accident time, which were augmented by a weather observer, are presented here:

[0853 PDT] METAR KLMT 011553Z 00000KT 10SM SCT050 07/01 A3016 RMK AO2 SLP203 T00670006 \$=
[0953 PDT] METAR KLMT 011653Z VRB03KT 10SM SCT048 09/01 A3015 RMK AO2 SLP197 T00890006 \$=
[1053 PDT] METAR KLMT 011753Z 31009G16KT 10SM OVC045 11/M01 A3014 RMK AO2 SLP192 T01061006 10106 21006 58005 \$=
[1153 PDT] METAR KLMT 011853Z 32015G22KT 10SM FEW046 12/M01 A3013 RMK AO2 SLP189 T01221006 \$=

At 1053 PDT, LMT reported a wind from 310° at 9 knots with gusts to 16 knots, prevailing visibility³ of 10 statute miles or greater, ceiling overcast at 4,500 feet above ground level (agl), temperature of 11° Celsius (C) and a dew point temperature of -1° C, altimeter setting of 30.14 inches of mercury; remarks included: station with a precipitation discriminator, maintenance needed on the system.

An ASOS was located at Rogue Valley International-Medford Airport (MFR) in Medford, Oregon, and was located about 28 miles west-northwest of the accident location at an elevation of 1,335 feet. Reports from MFR during the times surrounding the accident time, which were augmented by a weather observer, are presented here:

[0853 PDT] METAR KMFR 011553Z 27003KT 10SM OVC047 09/06 A3020 RMK AO2 SLP227 T00940061=
[0953 PDT] METAR KMFR 011653Z 00000KT 10SM SCT037 OVC050 11/06 A3020 RMK AO2 SLP226 T01110061=
[1053 PDT] METAR KMFR 011753Z 00000KT 10SM SCT034 BKN060 14/06 A3019 RMK AO2 SLP222 T01390061 10139 20072 58002=
[1153 PDT] METAR KMFR 011853Z 05006KT 10SM SCT039 OVC055 15/06 A3018 RMK AO2 SLP216 T01500056=

² The National Weather Service uses the 4-digit International Civil Aviation Organization (ICAO) format for station identifiers (as seen in the body of some formatted weather observations). This report uses the 3-digit International Air Transport Association format for station identification, which does not use the geographic designating digit (“K” for stations in the continental U.S. and “P” for U.S. stations in Alaska and the Pacific region) as found in the ICAO format.

³ Prevailing visibility - the greatest distance visible throughout at least half of the horizon, but not necessarily continuously.

At 1053 PDT, MFR reported a calm wind, visibility of 10 statute miles or greater, scattered clouds at 3,400 feet agl, ceiling broken at 6,000 feet agl, temperature of 14° C and a dew point temperature of 6° C, altimeter setting of 30.19 inches of mercury; Remark included: station with a precipitation discriminator.

3.0 Weather Radar

WSR-88D Level-II weather radar imagery from Medford, Oregon (KMAX), is presented in figure 2. KMAX was located approximately 22 miles southwest of the accident site at an elevation of about 7,480 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KMAX 0.461° tilt would have “seen” altitudes above the accident location of between about 7,800 and 10,000 feet above msl. The KMAX imagery identified widely scattered small areas of light reflectivity in the accident region, which indicated light rain may have been present in some locations.

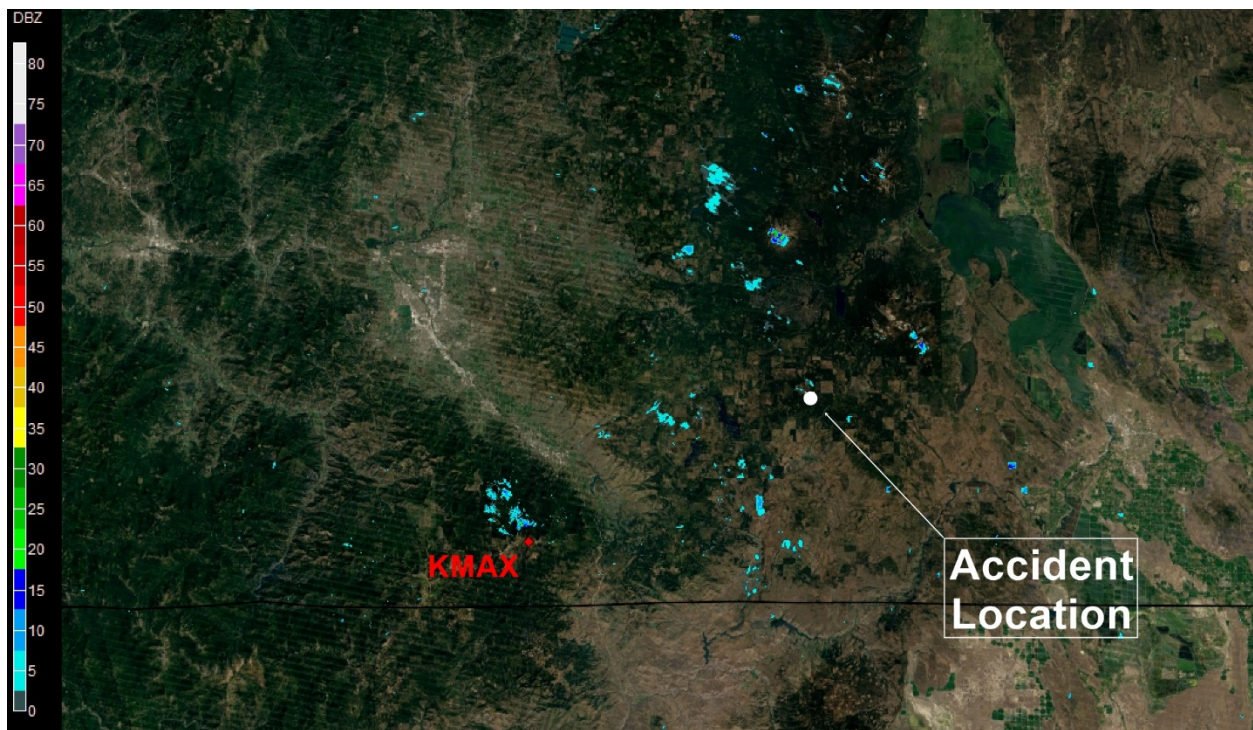


Figure 2 – KMAX 0.461° Level-II reflectivity product from a sweep initiated at 1045:39 PDT.

4.0 Pilot Reports

The following pilot reports reported conditions at or below 10,000 feet in the accident region within about 30 minutes of the accident time:

LMT UA /OV LMT /TM 1756 /FL210 /TP EVOT /SK BKN-TOP100 /TA M19 /WV
310120KT /TB OCNL LGT CHOP=

At 1056 PDT, a Lancair Evolution type aircraft located over the Klamath Falls VORTAC in Klamath Falls, Oregon, at FL210⁴ reported a broken sky with tops at 10,000 feet, air temperature of -19° C, a wind of 120 knots from 310° and occasional light chop.

MFR UA /OV OED300030/TM 1818/FL080/TP P28B/TA M05/IC LGT RIME/RM
..ZSE=

At 1118 PDT, a Piper PA-28 type aircraft located 30 miles on the 300° radial from the Rogue Valley VORTAC in Medford, Oregon, at 8,000 feet reported an air temperature of -5°C and light rime icing. The Seattle Air Route Traffic Control Center (ARTCC) filed this pilot report.

5.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR) model⁵ sounding (figure 3) valid for the accident location at 1100 PDT was retrieved from the NOAA Air Resources Laboratory. The wind near the surface was from the north-northwest at 10 knots. Above this level, the wind veered slightly with height and increased in magnitude to a north wind of about 20 knots at about 7,500 feet. Above this level the wind backed with height and increased in magnitude to a northwest wind of about 40 knots at 15,000 feet. Between 6,000 and 6,5000 feet the relative humidity was between 90 and 92 percent. The relative humidity was below 90 percent for all other levels. The freezing level was at about 6,800 feet. Calculations made by the Rawinsonde OBServation Program did not identify any layers of potential significant turbulence or structural icing.

⁴ Flight Level (FL) - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hectopascals (29.92 in Hg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

⁵ The HRRR is a National Oceanic and Atmospheric Administration (NOAA) real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.

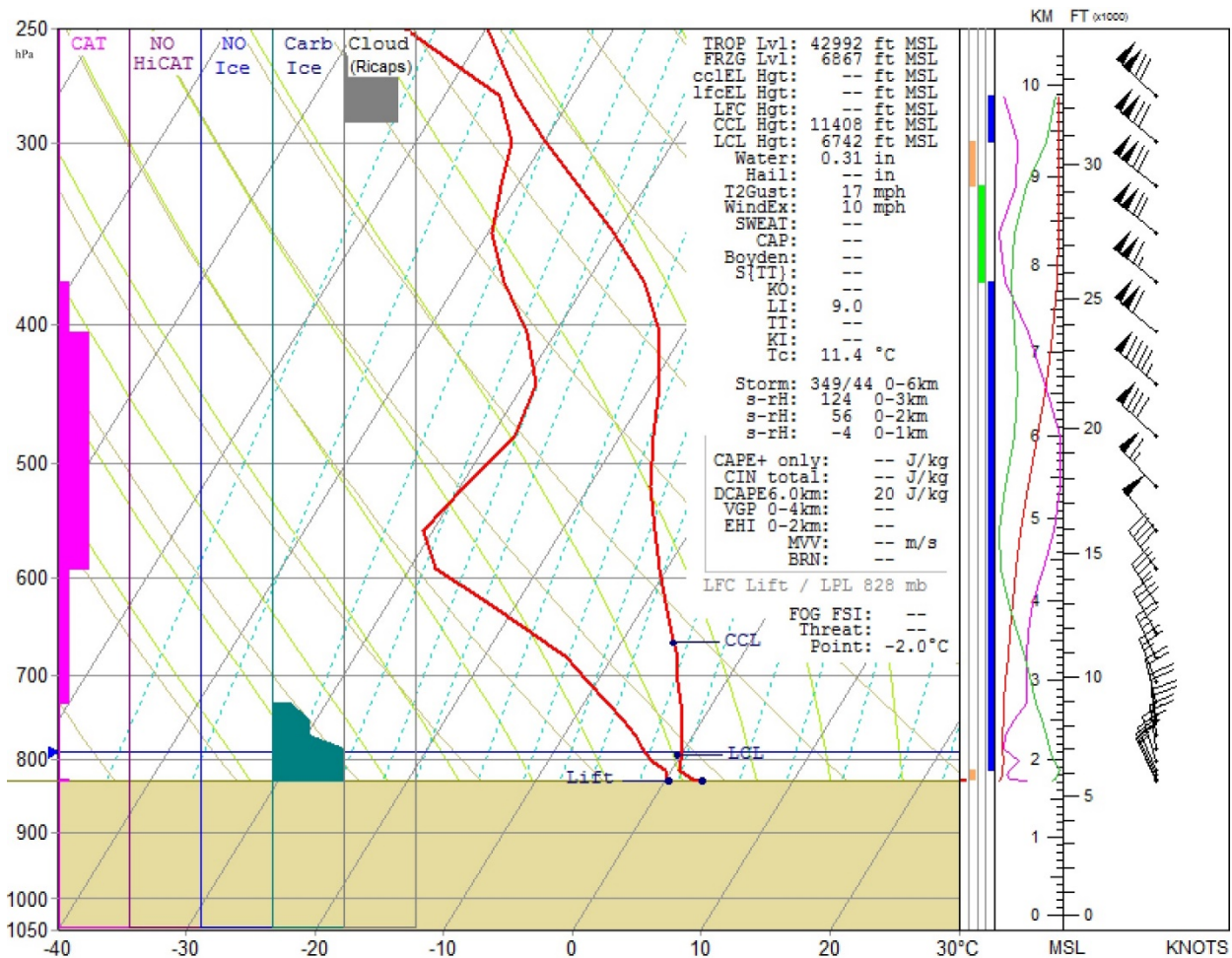


Figure 3 – HRRR model sounding data in SkewT/LogP format for 1100 PDT at the accident site, surface to 250 hectopascals.

6.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-15 “visible” (0.62 μ m) and infrared (10.7 μ m) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1045 PDT are presented in figures 4 and 5. The GOES-15 visible data revealed cloudy conditions at the accident site and over the accident region. Some of these clouds exhibiting a wave-like pattern, and terrain is visible in many parts of the region. Minimum infrared cloud-top temperatures in the area immediately surrounding the accident location were -4°C, which, according to the HRRR model sounding, corresponded to cloud top heights of about 9,000 feet. It should be noted figures 4 and 5 have not been corrected for any parallax error.

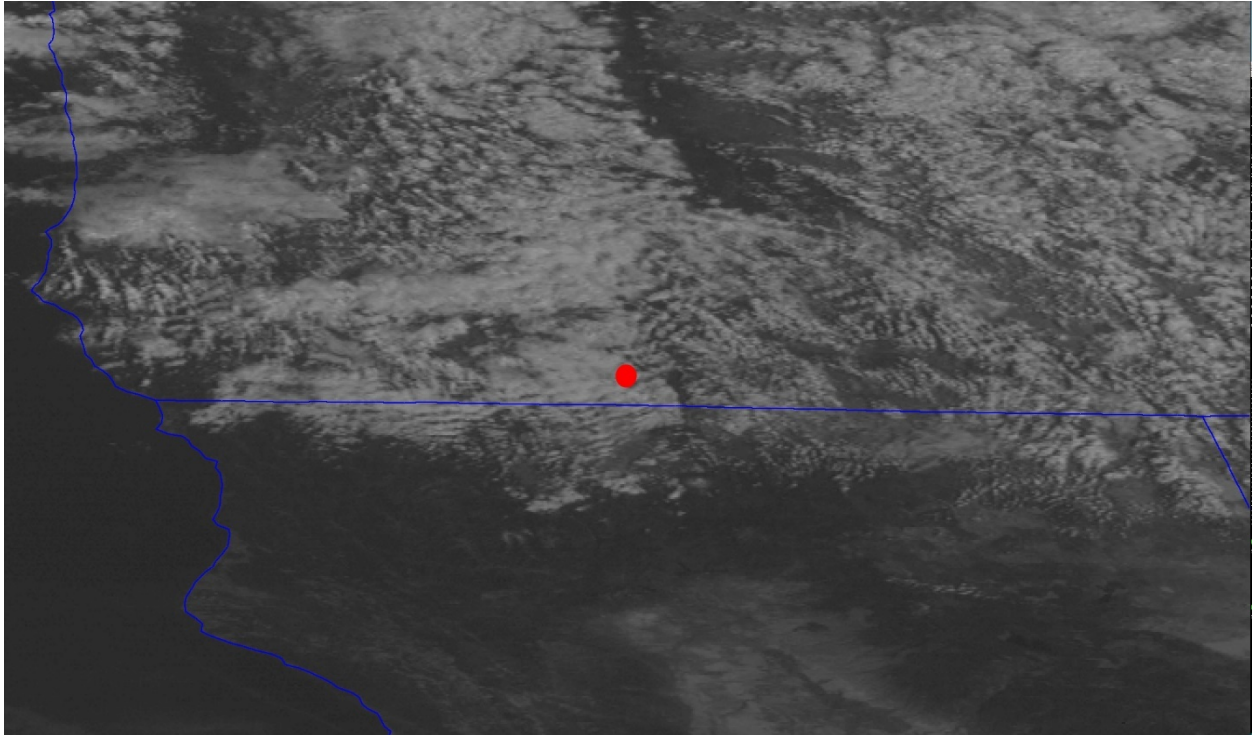


Figure 4 – GOES-15 visible imagery from 1045 PDT. Accident location denoted by red circle.

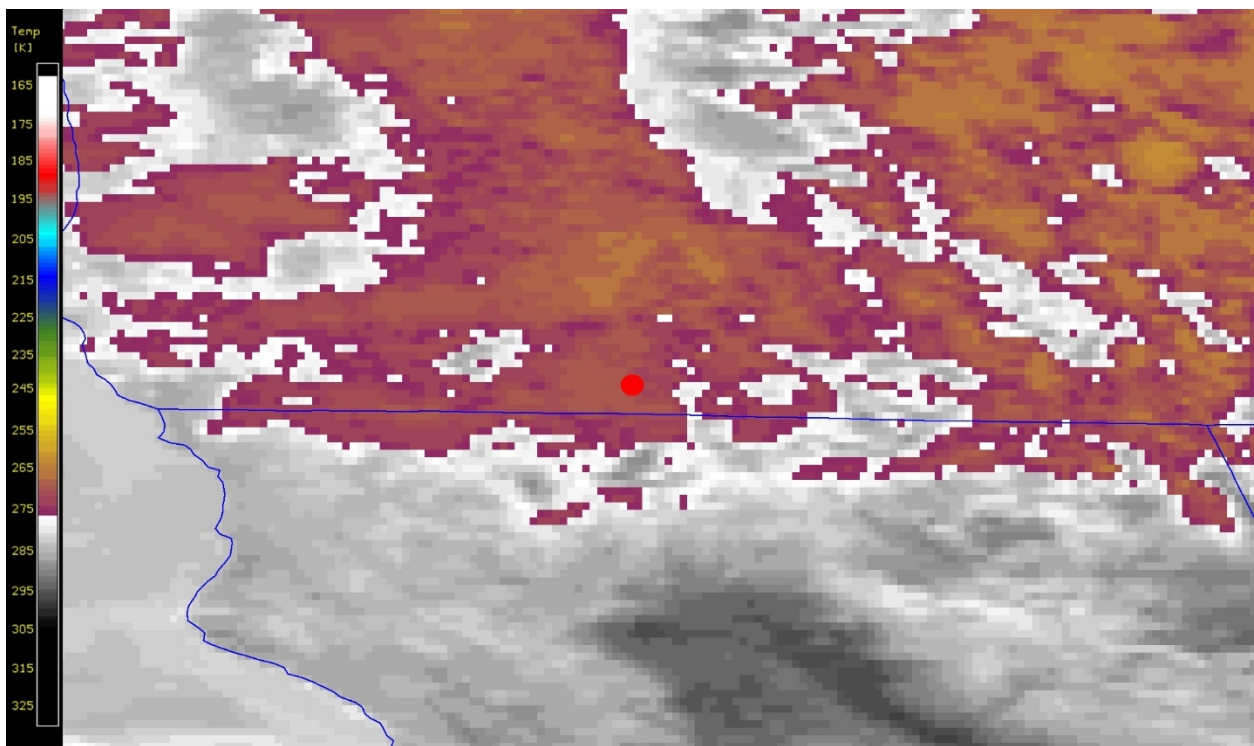


Figure 5 – GOES-15 infrared brightness temperature (degrees Kelvin) imagery from 1045 PDT. Accident location denoted by red circle.

7.0 Terminal Aerodrome Forecasts

The NWS issued Terminal Aerodrome Forecasts (TAFs)⁶ for the accident aircraft's departure (LMT) and destination (MFR) airports. The most recent LMT and MFR TAFs issued prior to the accident aircraft's departure are presented here.

[0435 PDT] KLMT 011135Z **0112/0212 31007KT P6SM SCT200**
FM011900 33015G23KT P6SM SCT050
FM020300 33008KT P6SM FEW050=

This LMT TAF forecasted for the accident time: wind from 310° at 7 knots, visibility greater than 6 statute miles, scattered clouds at 20,000 feet agl.

[0435 PDT] KMFR 011135Z **0112/0212 34005KT P6SM BKN050 BKN150**
FM012100 32013G21KT P6SM SCT070
FM020300 02005KT P6SM SCT060=

This MFR TAF forecasted for the accident time: wind from 340° at 5 knots, visibility greater than 6 statute miles, ceiling broken at 5,000 feet agl, broken clouds at 15,000 feet agl.

8.0 Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 0832 PDT by the NWS Weather Forecast Office in Medford, Oregon. The Aviation section of that AFD is presented here.

FXUS66 KMFR 011532
AFDMFR
Area Forecast Discussion
National Weather Service Medford OR
832 AM PDT Sun Oct 1 2017

AVIATION...01/12Z TAF CYCLE...Overall, VFR will prevail overnight through Sunday evening south of the Umpqua Divide and south and east of the Cascades. North of the Umpqua Divide, MVFR ceilings are expected at times through midday Sunday, especially over the mountains/foothills on westward to the coast where showers are also expected. Patchy IFR ceilings/visibility along the coast, including around KOTH this morning. Satellite imagery shows widespread IFR conditions in eastern Douglas County and northern Jackson County over the Umpqua Divide with terrain and mountains obscured through late this morning. VFR is expected by noon but IFR conditions could return to the coast again tonight. /FB

⁶ Conditions forecasted in the TAF are only official for 5 statute miles from the forecast site.

9.0 AIRMETs

There were no Airmen's Meteorological Information (AIRMET) advisories for turbulence below FL180, or AIRMETs for icing, active for the accident location at the accident time.

At 0745 PDT, an AIRMET SIERRA for mountain obscuration was issued by the NWS Aviation Weather Center (AWC) and was active for the accident location at the accident time:

WAUS46 KPCI 011445
WA6S
-SFOS WA 011445
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 012100
.
AIRMET MTN OBSCN...WA OR CA
FROM 20NW HUH TO 40SE YDC TO 20W YKM TO 50SSE YKM TO 30E GEG
TO 30W DNJ TO 60WNW REO TO 40SSE OED TO 80W OED TO 80SSW ONP TO
HQM TO 20NW TOU TO 20NW HUH
MTNS OBSC BY CLDS/PCPN. CONDS CONTG BYD 21Z ENDG 21-00Z.

At 0745 PDT, an AIRMET SIERRA for instrument flight rule (IFR) conditions was issued by the AWC for a region that was very close to the accident location (see Figure 6) and advised of ceilings below 1,000 feet, visibility below 3 statute miles, precipitation and mist.

WAUS46 KPCI 011445
WA6S
-SFOS WA 011445
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 012100
.
AIRMET IFR...WA OR AND CSTL WTRS
FROM 30WNW HUH TO 40SSE YDC TO 30NNW YKM TO 60SW YKM TO 60S
DSD TO 20ESE OED TO 90SSW ONP TO 20WNW ONP TO 30SE EUG TO 20ENE
HQM TO 30WNW HUH
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z ENDG 21-
00Z.

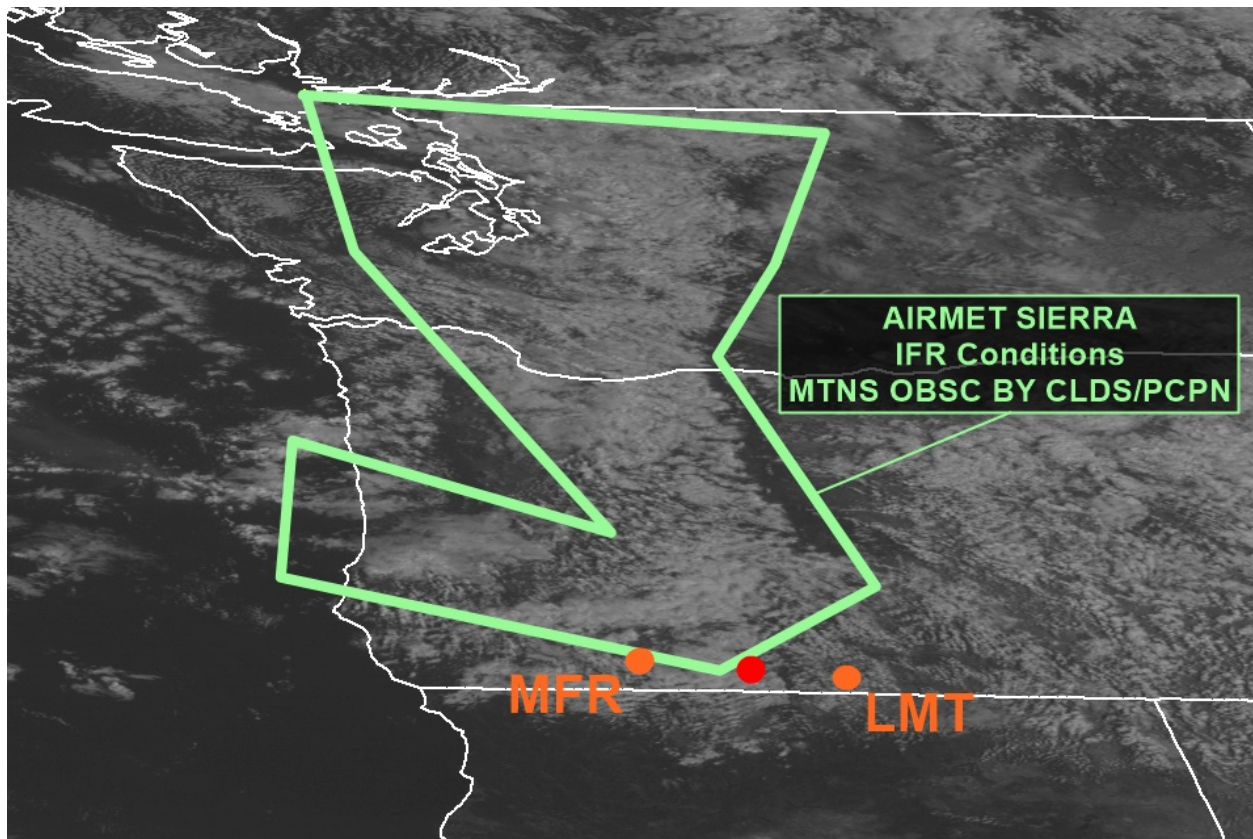


Figure 6 – AIRMET SIERRA for IFR conditions issued at 0745 PDT. Accident location denoted by red circle.

10.0 SIGMETs

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories active for the accident location at the accident time.

11.0 CWSU Products

There were no Center Weather Advisories issued by the Center Weather Service Unit (CWSU) at the Seattle ARTCC that were active for the accident site at the accident time.

12.0 Weather Depiction Charts

A Weather Depiction Chart details surface conditions as derived from METAR and other surface observations. It typically displays major fronts or areas of high and low pressure. The Weather Depiction Chart also provides a graphic display of instrument flight rule (IFR)⁷, visual flight rule

⁷ IFR conditions - Ceilings less than 1,000 feet agl and visibility less than three statute miles.

(VFR)⁸, and marginal visual flight rule (MVFR)⁹ conditions. Areas of IFR conditions are shown by a hatched area outlined by a smooth line. MVFR regions are shown by a non-hatched area outlined by a smooth line. Areas of VFR are not outlined.

Figures 7 and 8 present Weather Depiction Charts that were issued by the NOAA during the times surrounding the accident.

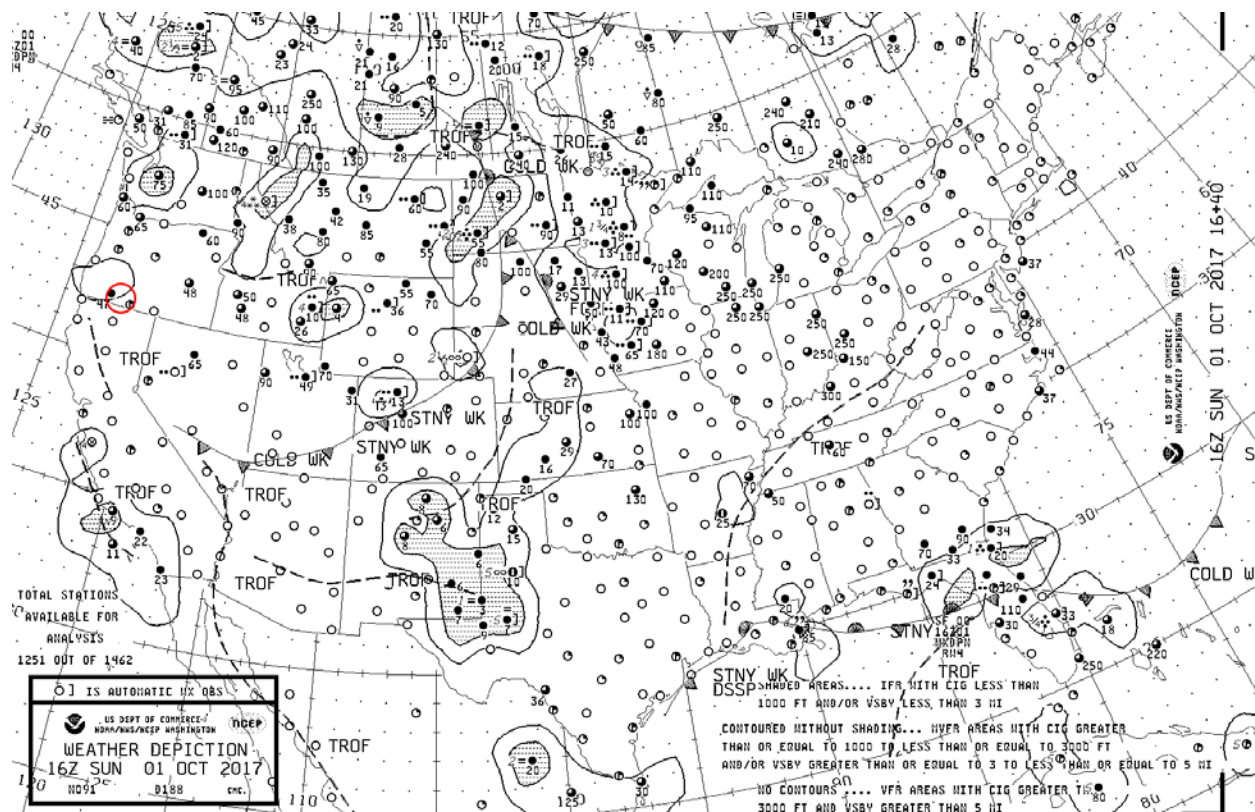


Figure 7 – Weather Depiction chart valid at 0900 PDT depicted an area of MVFR conditions very near the accident location. Accident located denoted by red circle along California-Oregon border.

⁸ VFR conditions - Ceiling greater than 3,000 feet agl (or no ceiling) and visibility greater than five statute miles.

⁹ MVFR conditions - Ceilings between 1,000 and 3,000 feet agl (inclusive) and/or visibility between three and five statute miles (inclusive)

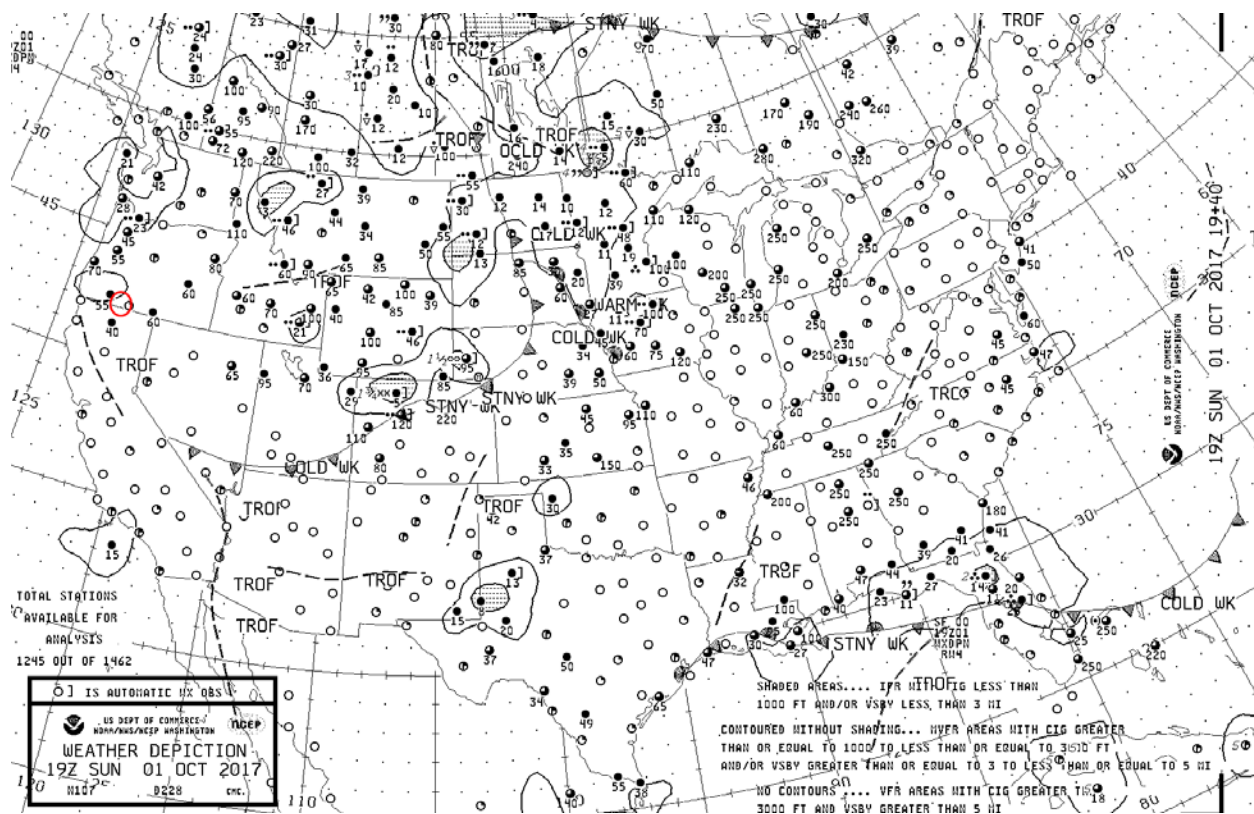


Figure 8 – Weather Depiction chart issued at 1200 PDT depicted an area of MVFR conditions very near the accident location. Accident located denoted by red circle along California-Oregon border.

13.0 Prog Charts

According to the AWC, “The low-level graphics product is a forecast of aviation weather hazards, primarily intended to be used as a guidance product for briefing the VFR pilot. The forecast domain covers the 48 contiguous states, southern Canada and the coastal waters for altitudes below 24,000 ft. Low altitude Significant Weather [“Prog”] charts are issued four times daily and are valid at fixed times: 0000, 0600, 1200, and 1800 UTC. Each chart is divided on the left and right into 12 and 24-hour forecast intervals (based on the current NAM model available). The two panels depict freezing levels, turbulence, and low cloud ceilings and/or restrictions to visibility (shown as contoured areas of MVFR and IFR conditions).”

Figures 9 and 10 present low level prog charts valid for the times surrounding the accident time.

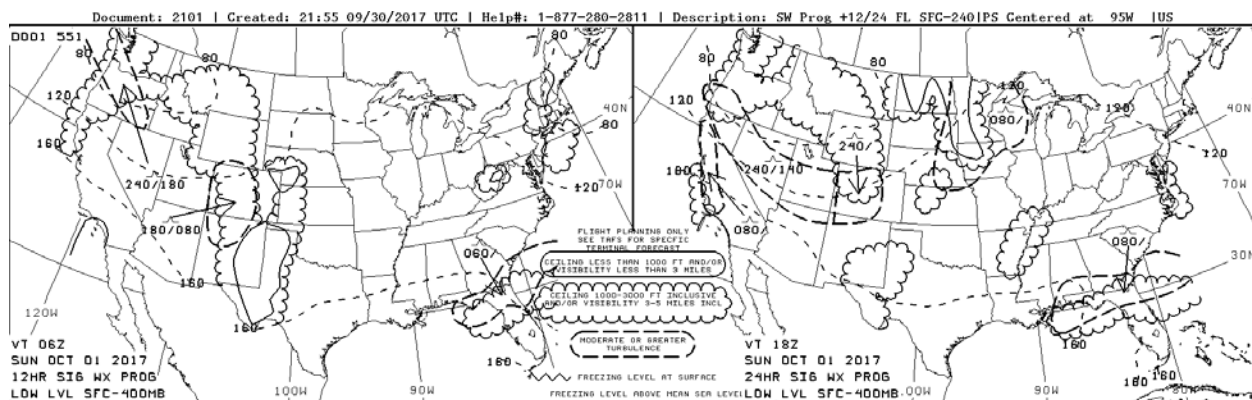


Figure 9 – Low level Prog chart created about 1500 PDT on September 30, 2017, with the right-side panel valid for 1100 PDT forecasting lower-altitude hazards of MVFR conditions.

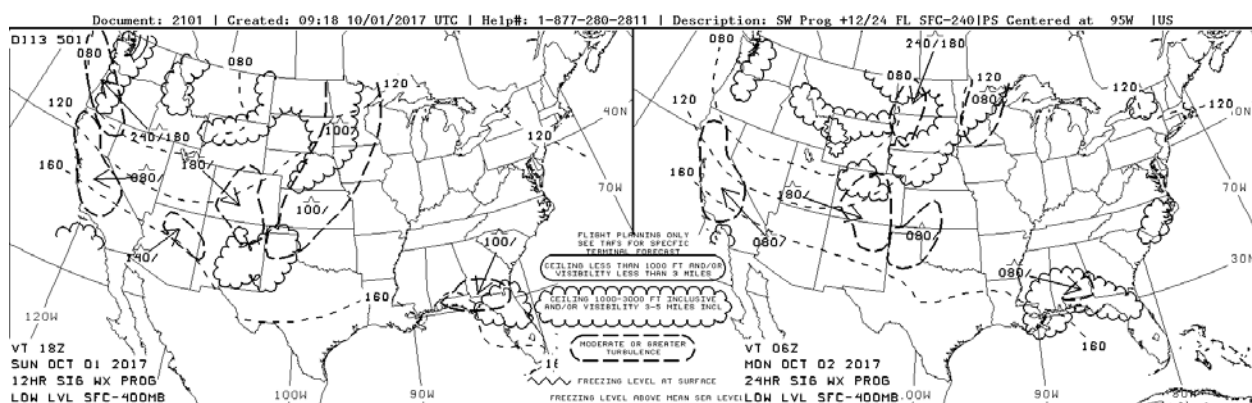


Figure 10 – Low level Prog chart created about 0200 PDT, with the left-side panel valid for 1100 PDT forecasting lower-altitude hazards of MVFR conditions.

14.0 Astronomical

The astronomical data obtained from the United States Naval Observatory for 42° 15' north latitude and 122° 16' west longitude, for the accident location, indicated the following:

SUN	
Sunrise	0707 PDT
Sunset	1850 PDT

Submitted by:

Mike Richards
Senior Meteorologist

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