



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 21, 2018

Weather Study

METEOROLOGY

WPR19FA025

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A. ACCIDENT

Location: Redding, California
Date: November 15, 2018
Time: about 1827 Pacific standard time (0227 UTC¹ on November 16, 2018)
Airplane: Cessna 182K; N2629R

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 standard time (PST) for November 15, 2018 (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: 40.526944° north latitude, 122.283611° west longitude, at an elevation of about 485 feet.

D. WEATHER INFORMATION

1.0 Surface Observations

An Automated Surface Observing System was located at Redding Municipal Airport (RDD)² in Redding, California, which was located within one mile of the accident location at an elevation of about 505 feet. Human-augmented reports from RDD during the times surrounding the accident time are presented here.

[1653 PST] METAR KRDD 160053Z 00000KT 2 1/2SM HZ FU BKN031 16/M04 A3007
RMK AO2 SLP182 T01611039=

¹ UTC – abbreviation for Coordinated Universal Time

² The National Weather Service (NWS) 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.

[1738 PST] SPECI KRDD 160138Z 00000KT 2 1/2SM HZ FU OVC029 14/M04 A3007
RMK AO2 T01391039=

[1753 PST] METAR KRDD 160153Z 00000KT 2 1/2SM HZ FU SCT028 13/M04
A3008 RMK AO2 SLP185 T01281044=

[1837 PST] SPECI KRDD 160237Z 00000KT 2 1/2SM HZ FU BKN027 11/M04 A3008
RMK AO2 T01111044=

[1853 PST] METAR KRDD 160253Z 00000KT 2 1/2SM HZ FU OVC023 10/M05 A3009
RMK AO2 SLP189 T01001050 53008=

At 1753 PST, RDD reported a calm wind, prevailing visibility of two and one-half statute miles, haze, smoke, scattered clouds at 2,800 feet above ground level (agl), temperature of 13° Celsius (C) and a dew point temperature of -4°C, altimeter setting of 30.08 inches of mercury; remarks: station with a precipitation discriminator, sea level pressure of 1018.5 hectopascals (hPa), temperature of 12.8°C and dew point temperature of -4.4°C.

At 1837 PST, RDD reported a calm wind, prevailing visibility of two and one-half statute miles, haze, smoke, ceiling broken at 2,700 feet agl, temperature of 11°C and a dew point temperature of -4°C, altimeter setting of 30.08 inches of mercury; remarks: station with a precipitation discriminator, temperature of 11.1°C and dew point temperature of -4.4°C.

2.0 Pilot Reports

There was only one publicly disseminated pilot report³ made below FL350⁴ between 1600 and 2100 PST within 100 statute miles of the accident location. At 1901 PST a Swearingen SA-227 Merlin 4 aircraft over Chico Municipal Airport, which was located about 50 miles south-southeast of the accident location in Chico, California, reported instrument meteorological conditions and smoke from the surface through 6,000 feet.

OVE UA /OV CIC/TM 0301/FL060/TP SW4/SK IMC VV001-TOP060/WX IMC
FU000-TOP060/RM ZOA CWSU AWC-WEB/

3.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR) model⁵ sounding (figure 1) for the accident site at 1800 PST was retrieved from the National Oceanic and Atmospheric Administration's (NOAA) Air

³ These do not include pilot reports only broadcast via radio.

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 hPa (29.92 inches of mercury), 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 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.

Resources Laboratory. Between the about 800 and 2,000 feet the wind was generally from the south at magnitudes less than 5 knots. Between 2,000 and 7,000 feet the wind was generally from the east at 5 knots or less. The relative humidity was below 35 percent for the entire atmosphere below 500 hPa. The freezing level was at about 12,000 feet.

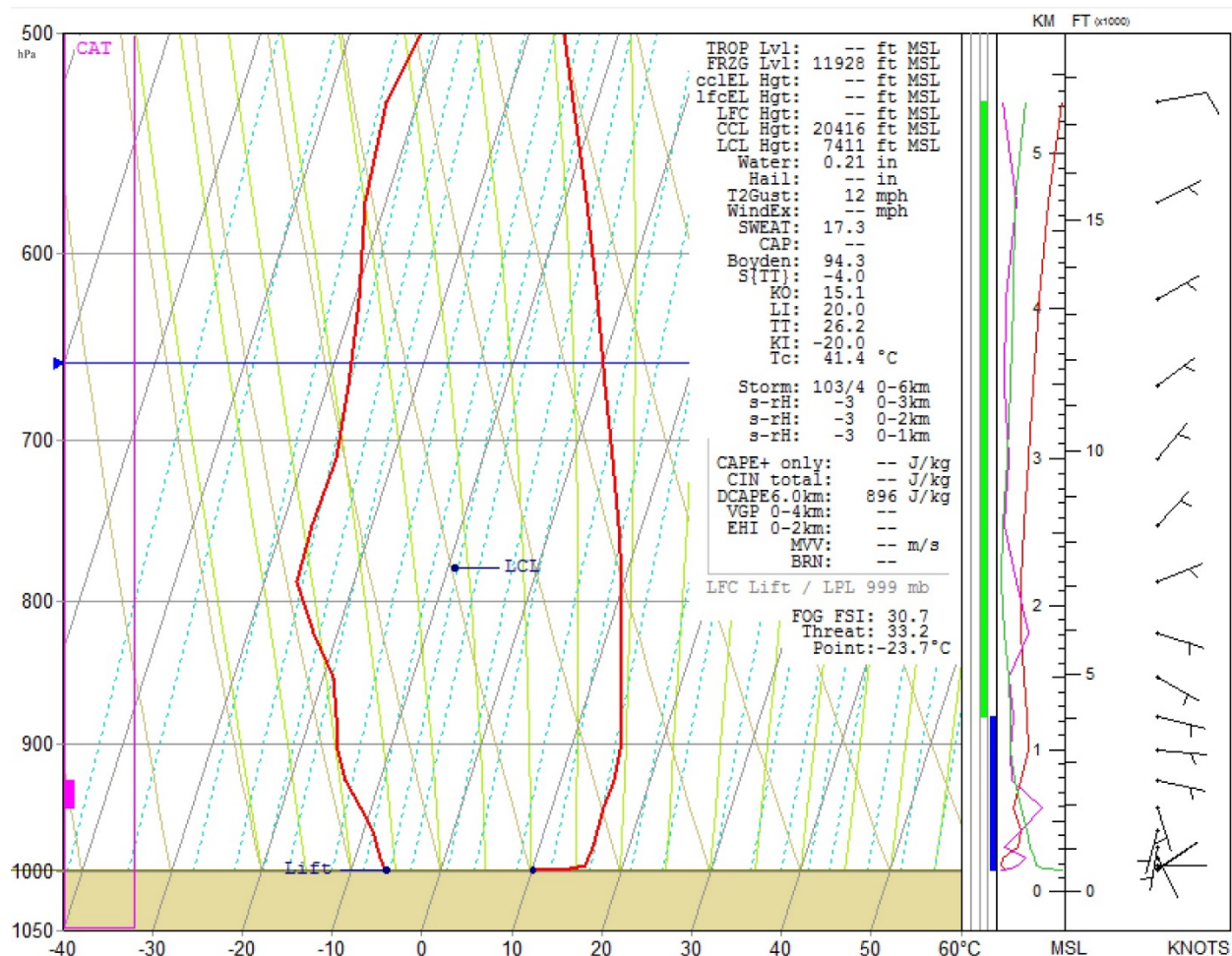


Figure 1 – HRRR model sounding data in SkewT/LogP format for 1800 PST at the accident site, surface to 500 hPa.

4.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-16 data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Simulated “true color” imagery from 1701 PST (86 minutes prior to the accident time) is presented in figure 2. The simulated true color imagery depicts a smoke/aerosol cloud over central Northern California with the northern-most portion of the cloud over the accident location.



Figure 2 – GOES-16 simulated “true color” imagery from 1701 PST. Accident location is denoted by the red dot. This image has not been corrected for parallax error.

5.0 Weather Radar

Review of WSR-88D weather radar imagery did not reveal any pertinent returns applicable to the accident location.

6.0 Terminal Aerodrome Forecasts

The Terminal Aerodrome Forecast (TAF) issued at 1553 PST for RDD forecasted from the time of the accident: a variable wind of 4 knots, visibility of 3 statute miles, smoke, haze, sky clear; temporary conditions⁶: visibility of 2 statute miles, smoke, haze, ceiling overcast at 1,500 feet.

TAF KRDD 152333Z 1600/1624 VRB04KT 3SM FU HZ SKC
TEMPO 1601/1604 2SM FU HZ OVC015
FM161800 35006KT 5SM FU HZ SKC=

7.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) are intended to provide the necessary aviation weather information to give users a complete picture of the weather that might impact flight in the continental United States. Hourly model data and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and other output from the NWS are available, however only certain imagery are archived by the NWS.

The following images (figures 3-8) depict GFA forecast information on sky condition, icing, mountain obscuration, instrument flight rule (IFR)⁷ condition and surface wind Airmen's Meteorological Information (AIRMET) advisories, surface visibility, surface wind, precipitation, and other obscurations and hazards, valid for the times surrounding the accident.

⁶ Temporary conditions - fluctuations to forecast conditions which are expected to last less than one hour in each instance and, in the aggregate, to cover less than half of the indicated period.

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

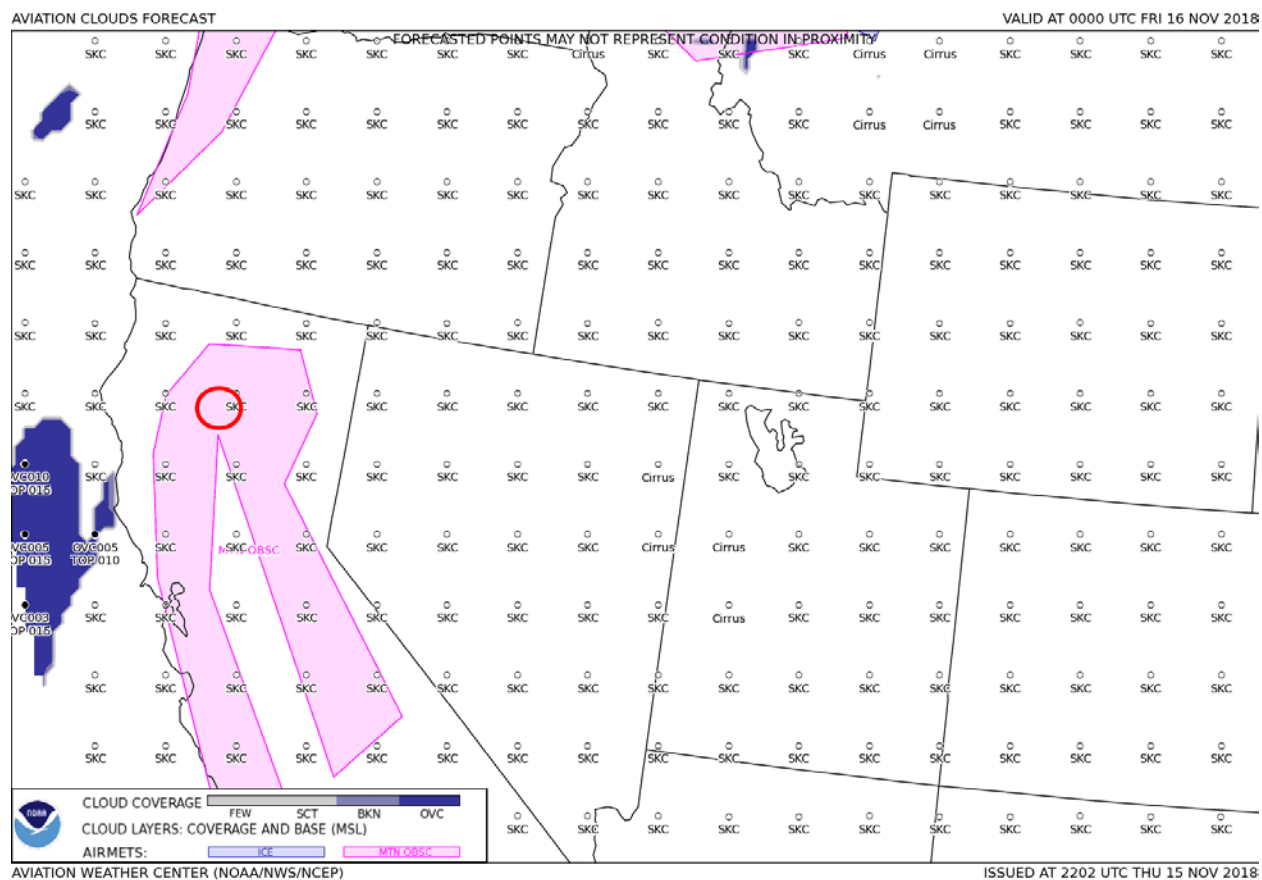


Figure 3 – GFA forecast imagery depicting sky condition and icing and mountain obscuration AIRMETs. Issued about 1400 PST and valid for 1600 PST. This GFA forecast imagery depicted clear sky conditions over the accident region. An AIRMET for mountain obscuration was active over the accident site. The accident location is within the red circle.

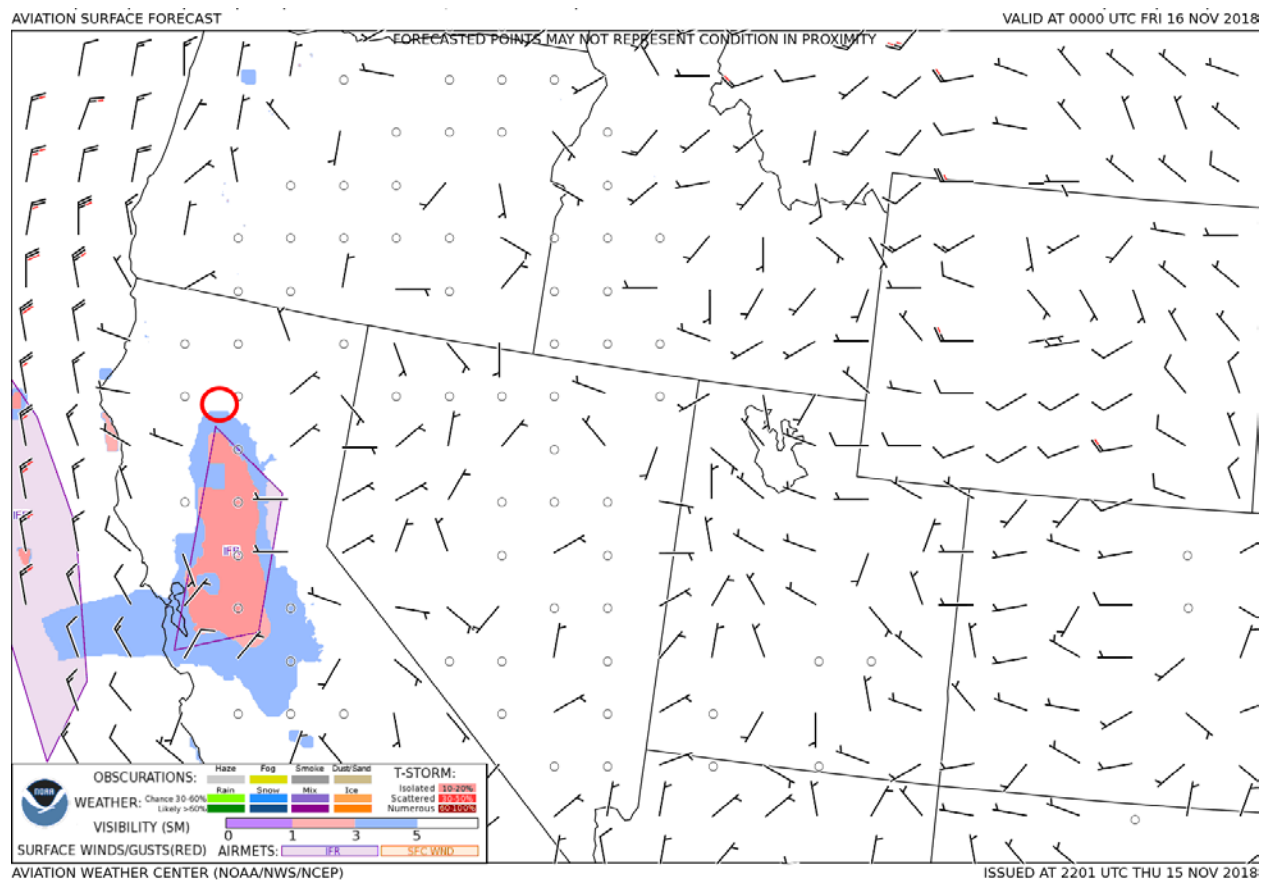


Figure 4 – GFA forecast imagery depicting IFR conditions and surface wind AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 1400 PST and valid for 1600 PST. This GFA forecast imagery depicted a calm surface wind near the accident location, and a surface visibility of greater than 5 statute miles at the accident location, with lower visibility and an AIRMET for IFR conditions immediately to the south. The accident location is within the red circle.

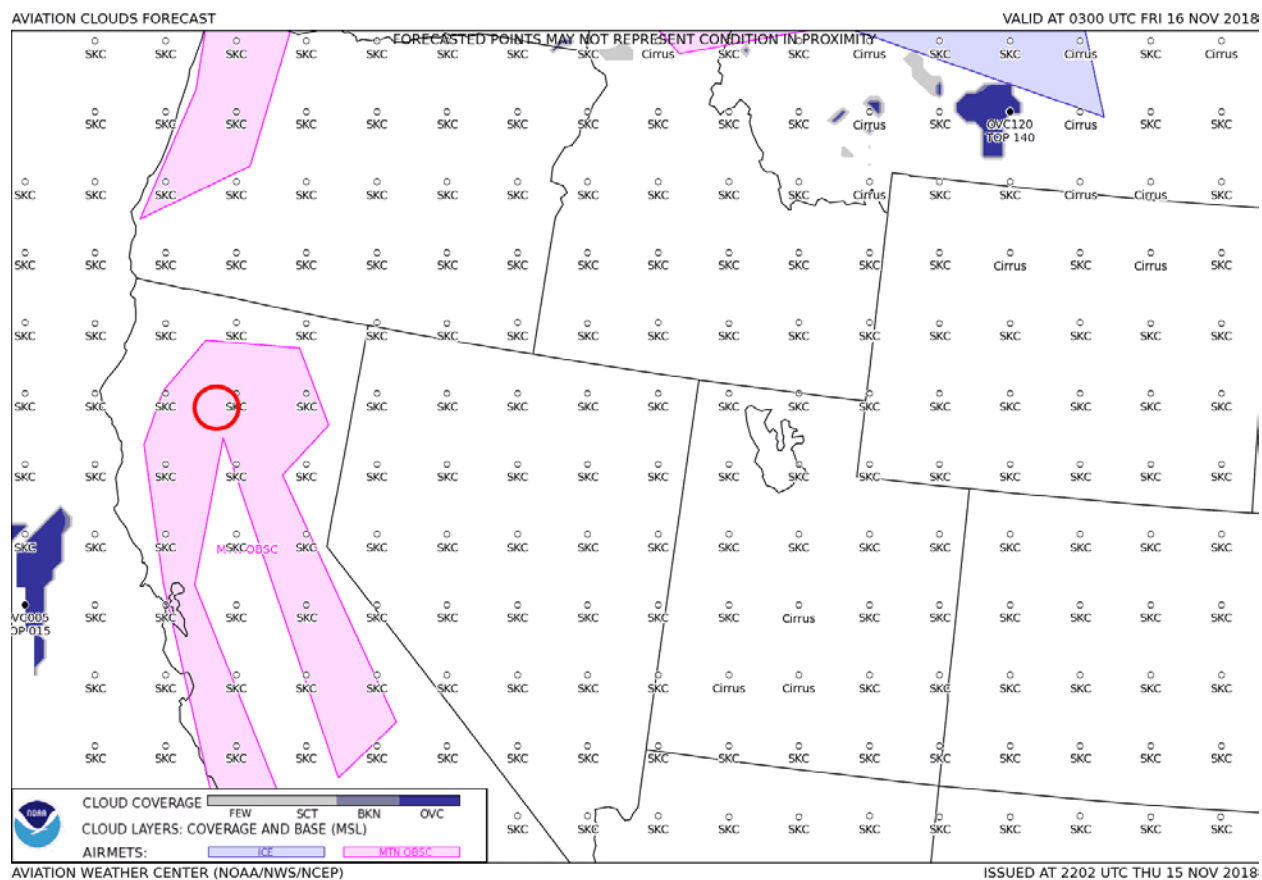


Figure 5 – GFA forecast imagery depicting sky condition and icing and mountain obscuration AIRMETs. Issued about 1400 PST and valid for 1900 PST. This GFA forecast imagery depicted clear sky conditions over the accident region. An AIRMET for mountain obscuration was active over the accident site. The accident location is within the red circle.

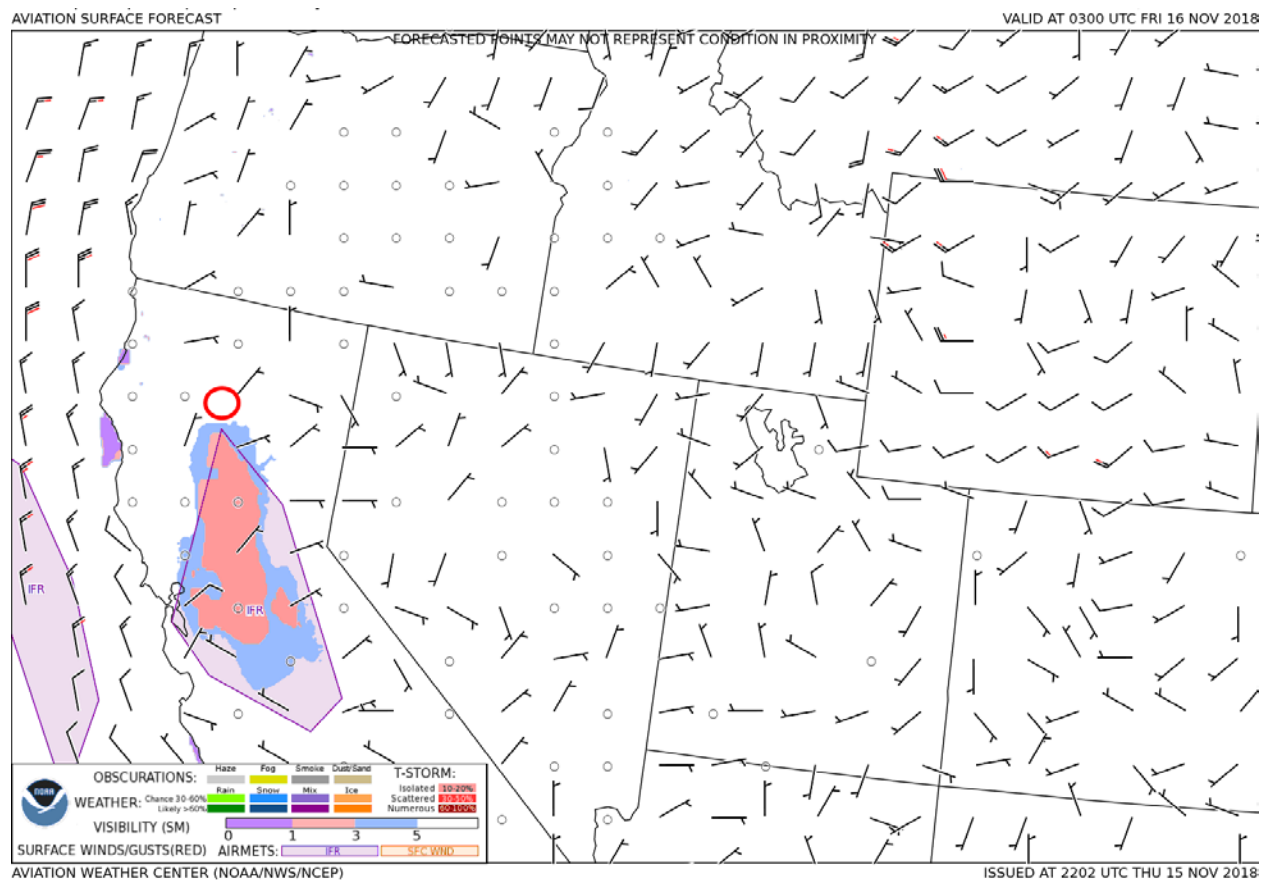


Figure 6 – GFA forecast imagery depicting IFR conditions and surface wind AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 1400 PST and valid for 1900 PST. This GFA forecast imagery depicted a northeast surface wind of five knots near the accident location and a surface visibility of greater than 5 statute miles at the accident location, with lower visibility and an AIRMET for IFR conditions immediately to the south. The accident location is within the red circle.

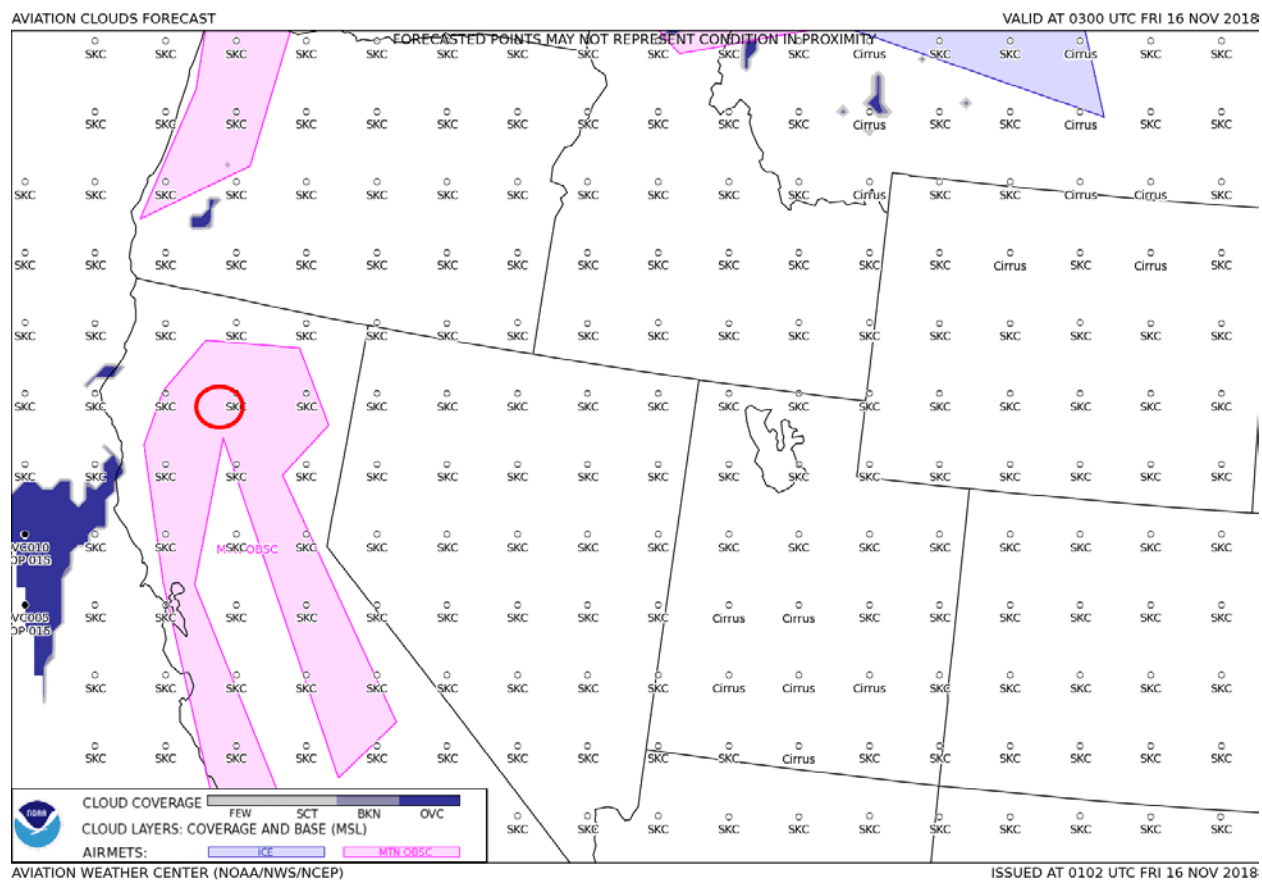


Figure 7 – GFA forecast imagery depicting sky condition and icing and mountain obscuration AIRMETs. Issued about 1700 PST and valid for 1900 PST. This GFA forecast imagery depicted clear sky conditions over the accident region. An AIRMET for mountain obscuration was active over the accident site. The accident location is within the red circle.

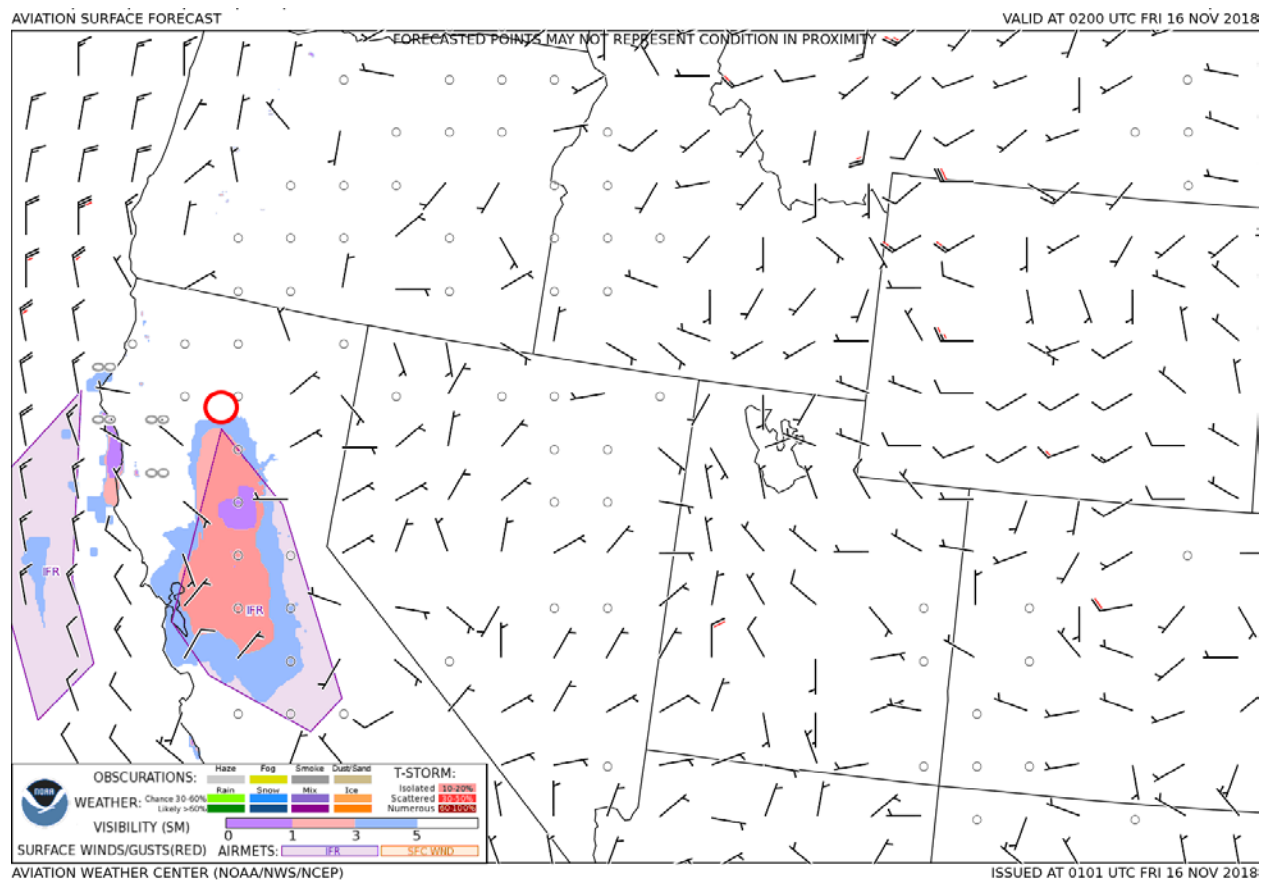


Figure 8 – GFA forecast imagery depicting IFR conditions and surface wind AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 1700 PST and valid for 1800 PST. This GFA forecast imagery depicted a calm surface wind near the accident location, and a surface visibility of greater than 5 statute miles at the accident location, with lower visibility and an AIRMET for IFR conditions immediately to the south. Haze was depicted to the west and southwest. The accident location is within the red circle.

8.0 Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 1533 PST by the NWS Weather Forecast Office (WFO) in Sacramento, California. Presented here is the “Aviation” section of that AFD, which discussed IFR and marginal visual flight rule (MVFR)⁸ conditions across the region.

FXUS66 KSTO 152333

AFDSTO

Area Forecast Discussion

National Weather Service Sacramento CA

⁸ MVFR conditions – A subset of visual flight rule conditions. Ceilings between 1,000 and 3,00 feet agl (inclusive) and/or visibility between 3 and 5 statute miles (inclusive).

333 PM PST Thu Nov 15 2018

.AVIATION...

Winds have remained fairly stagnant through the early afternoon hours and with smoke billowing from the Camp Fire, conditions have been bouncing between MVFR and LIFR conditions. Look for these conditions to continue into tomorrow morning.

An AFD was issued at 2245 PST by the NWS WFO in Sacramento, California. Presented here is the "Aviation" section of that AFD, which discussed the impact of smoke on the region.

FXUS66 KSTO 160646

AFDSTO

Area Forecast Discussion

National Weather Service Sacramento CA

1045 PM PST Thu Nov 15 2018

.AVIATION...

Winds continue to remain fairly calm with smoke continuing to impact the entire Sacramento Valley. Visibilities will range from MVFR to LIFR with little improvement through the period. Mid-afternoon PIREP over KSMF had top of the smoke layer at 5kft.

9.0 AIRMET SIERRAs

An AIRMET SIERRA advisory for mountain obscuration in smoke and haze was issued by the NWS' Aviation Weather Center (AWC) at 1421 PST and was active for the accident site at the accident time. At the same time the AWC also issued an AIRMET SIERRA for IFR conditions for an area immediately south of the accident location that was active at the accident time (see figure 9).

WAUS46 KPCI 152221 AAA

WA6S

-SFOS WA 152221 AMD

AIRMET SIERRA UPDT 5 FOR IFR AND MTN OBSCN VALID UNTIL 160300

AIRMET IFR...CA AND CSTL WTRS...UPDT

FROM 60WNW FOT TO FOT TO 80SSW PYE TO 130WSW SNS TO 150SW FOT
TO 60WNW FOT

CIG BLW 010/VIS BLW 3SM BR. CONDS CONTG BYD 03Z ENDG 03-06Z.

AIRMET MTN OBSCN...CA

FROM 60SSW LKV TO 70NNW FMG TO 60ESE RBL TO 60W BTY TO 20N EHF
TO 40W EHF TO 70NW RZS TO PYE TO 50SE FOT TO 70S OED TO 60SSW LKV
MTNS OBSC BY FU/HZ. CONDS CONTG BYD 03Z THRU 09Z.

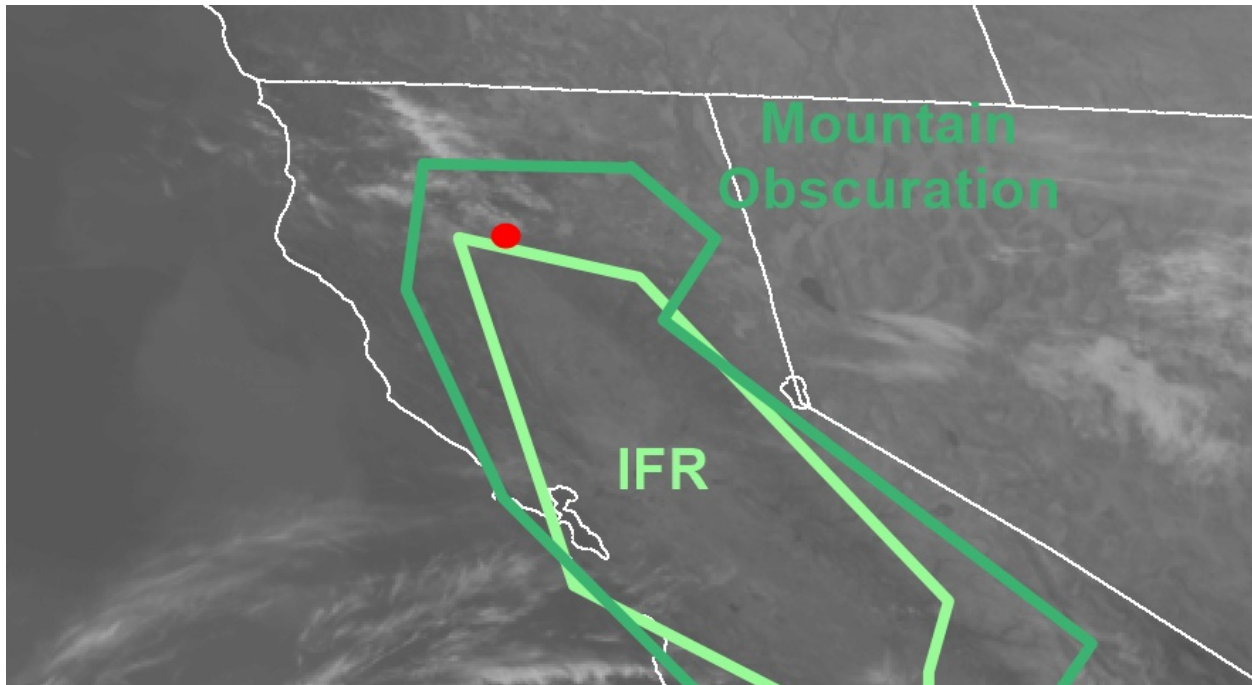


Figure 9 – AIRMET SIERRAs issued at 1421 PST applicable to the accident location. The accident location is denoted by the red circle.

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

At 1709 PST, the Center Weather Service Unit (CWSU) at the Oakland Air Route Traffic Control Center (ZOA) issued the following Center Weather Advisory (CWA) for LIFR conditions⁹, visibility 1/2 to 1 miles in haze and smoke, widespread dense smoke and areas of low visibility that was active at the accident time for an area south of the accident location (see Figure 10).

FAUS21 KZOA 160109
 ZOA1 CWA 160110
 ZOA CWA 101 VALID UNTIL 160310
 FROM 10SW RBL-45ESE RBL-15NNW MOD-10SSW OAK-10SW RBL
**AREA LIFR CONDS. VIS 1/2SM TO 1SM IN HZ FU. WIDESPREAD DENSE
 SMOKE AREAS WITH LOW VIS. ZOA CWSU**

⁹ Low Instrument Flight Rule (LIFR) conditions – A subcategory of IFR conditions that refer to ceilings less than 500 feet agl and/or visibility less than one statute mile.

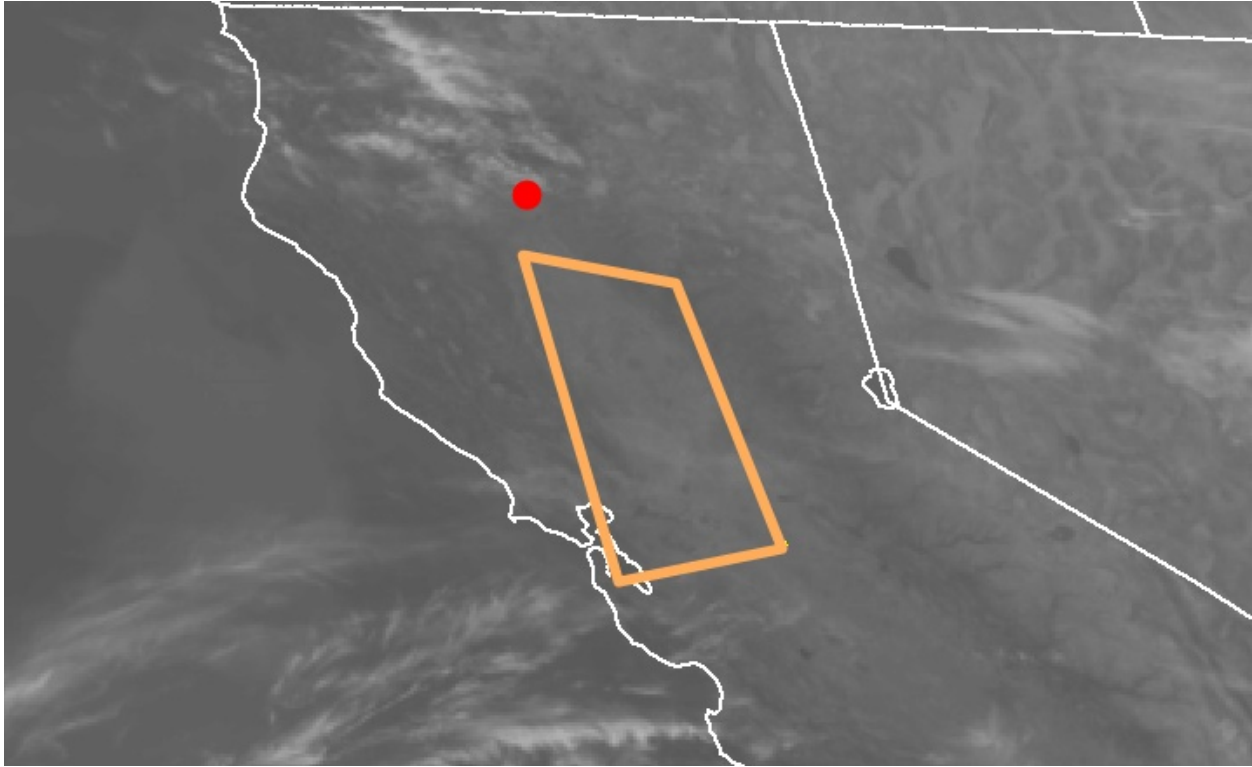


Figure 10 – CWA issued by the ZOA CWSU at 1709 PST. The accident location is denoted by the red circle.

12.0 Astronomical Data

According to NOAA, apparent sunset¹⁰ occurred at 1651 PST at the accident location.

Submitted by:

Mike Richards
Senior Meteorologist

¹⁰ Apparent sunset occurs slightly after actual sunset due to light from the sun being bent, or refracted, as it enters earth's atmosphere.

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