



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 15, 2017

Weather Study

METEOROLOGY

WPR17FA105

Table Of Contents

A.	ACCIDENT.....	3
B.	METEOROLOGIST	3
C.	DETAILS OF THE INVESTIGATION	3
D.	DETAILS OF THE INVESTIGATION	3
E.	WEATHER INFORMATION	4
1.0	Synoptic Conditions	4
2.0	Weather Radar.....	6
3.0	Upper Air Data.....	7
4.0	Satellite Imagery	10
5.0	Surface Observations	11
6.0	Pilot Reports	12
7.0	Terminal Aerodrome Forecasts	13
8.0	Area Forecast.....	13
9.0	Aviation Section of the Area Forecast Discussion.....	14
10.0	AIRMETs	14
11.0	SIGMETs.....	15
12.0	CWSU Products	16
13.0	Current Icing Potential.....	16
14.0	Astronomical Data.....	16
F.	Attachments.....	16

A. ACCIDENT

Location: Sierraville, California
Date: April 17, 2017
Time: about 1600 Pacific daylight time (2300 UTC¹)
Airplane: Socata TB 20 Trinidad; N28070

B. METEOROLOGIST

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

C. DETAILS OF THE INVESTIGATION

N28070, a Socata TB-20 Trinidad, departed the Truckee-Tahoe Airport (TRK), Truckee, California, on the evening of April 17, 2017, with a destination of Petaluma Municipal Airport (O69), Petaluma, California. When the airplane failed to arrive, concerned family members contacted the Federal Aviation Administration, which issued an Alert Notification (ALNOT) at 2109 Pacific daylight time (PDT). Search and rescue teams were hampered by weather conditions, primarily snow, and remote mountainous terrain. The aircraft was located on May 17, and recovered on May 25. Both occupants (the pilot and one passenger) sustained fatal injuries. The flight was being operated under the provisions of 14 *Code of Federal Regulations Part 91*.

D. 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 PDT for April 17, 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 are: 39.541111° north latitude, 120.470556° west longitude, at an elevation of 7,705 feet.

¹ UTC – abbreviation for Coordinated Universal Time

E. WEATHER INFORMATION

1.0 Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 1700 PDT is presented in figure 1. The surface analysis chart showed the majority of regional station models reporting overcast skies, with one station model near the accident site reporting light rain. A WSR-88D regional radar composite reflectivity mosaic obtained from the National Centers for Environmental Information (NCEI) for 1600 PDT (figure 2) identified light values of reflectivity in the area of the accident site at the accident time.

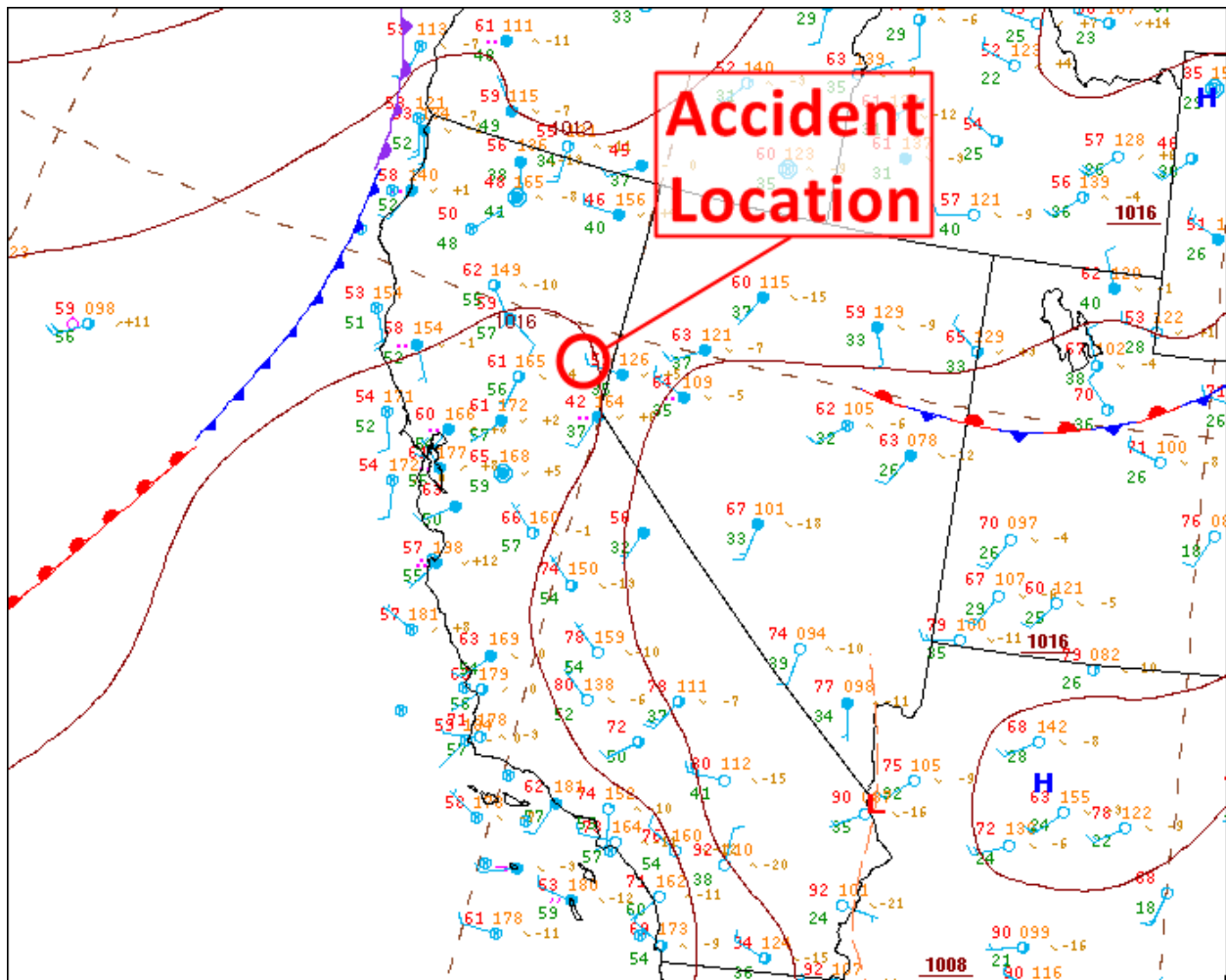


Figure 1 - NWS Surface Analysis Chart for 1700 PDT.

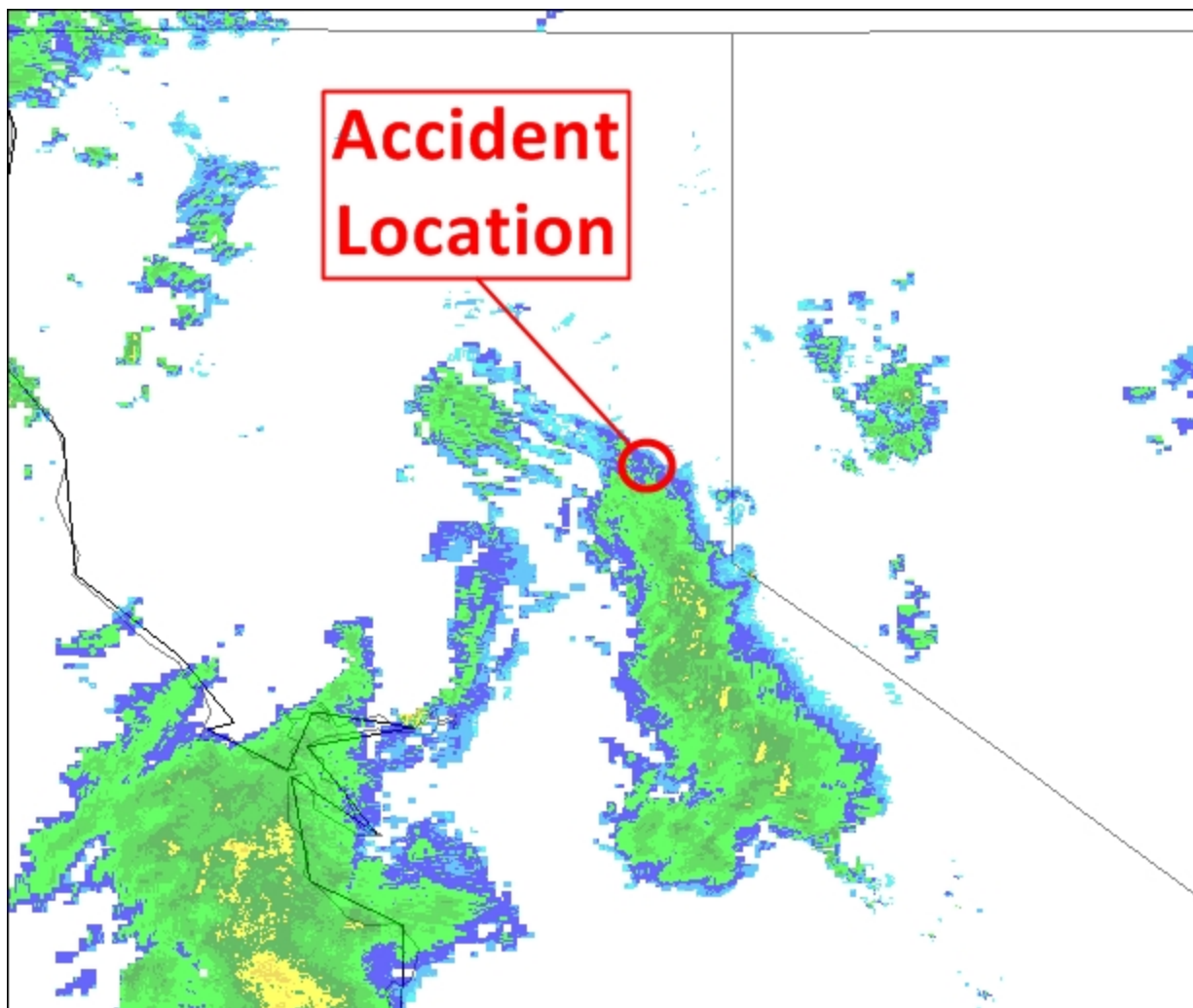


Figure 2 – NCEI WSR-88D mosaic from 1600 PDT.

2.0 Weather Radar

WSR-88D² Level-II weather radar imagery from Reno, Nevada (KGRX), is presented in figures 3 and 4. KGRX was located approximately 48 miles east-northeast of the accident location at an elevation of about 8,300 feet. Assuming standard refraction and considering the 0.95° beam width³ for the WSR-88D radar beam, the KGRX 0.432° tilt would have “seen” altitudes above the accident location of between about 9,600 and 14,400 feet above msl. Light values of reflectivity were identified in the accident region.

A vertical cross section of the KGRX radar imagery for the immediate area around the accident location (which is depicted in figure 3) is presented in figure 4. This cross section considers all tilts available from the 1600 CDT radar volume, and depicts very light values of reflectivity up to about 22,000-23,000 feet above msl above the accident location.

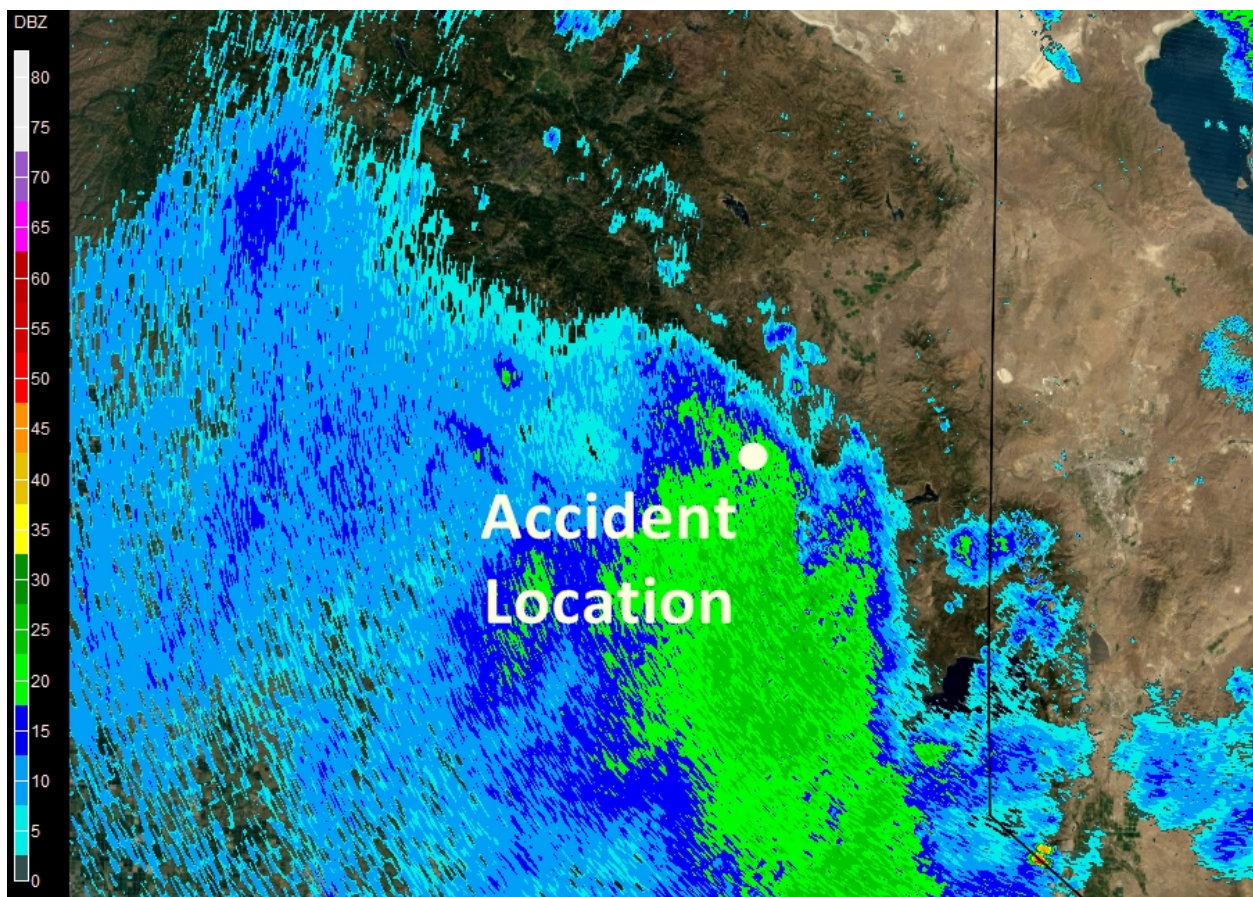


Figure 3 – KGRX 0.432° Level-II reflectivity product from a sweep initiated at 1600 PDT.

² Weather Surveillance Radar 88 Doppler (WSR-88D)

³ Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward.

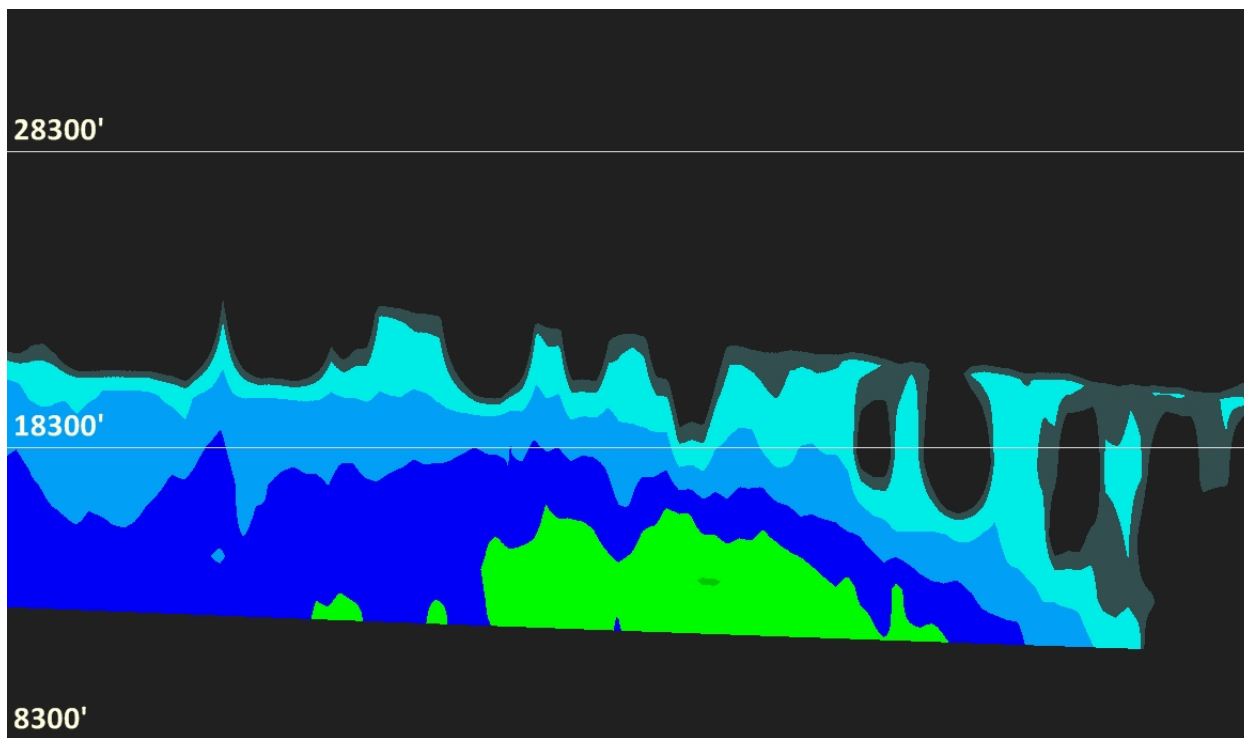


Figure 4 – KGRZ Level-II reflectivity west-to-east vertical cross section through the accident location. The accident location’s longitude runs through the center of the image. Reflectivity color scale is as depicted in figure 3.

3.0 Upper Air Data

Atmospheric data were retrieved from a 1700 PDT rawinsonde launch from Reno, Nevada (rawinsonde station: REV). These data are presented in figure 5. In addition, a High-Resolution Rapid Refresh (HRRR) model⁴ sounding (figure 6) for the accident location at 1600 PDT was retrieved from the National Oceanic and Atmospheric Administration’s (NOAA) Air Resources Laboratory.

The REV rawinsonde data identified two shallow temperature inversions near 15,000 feet. The freezing level was at approximately 9,700 feet. Relative humidity remained below 90 percent in the troposphere. The wind at 9,000 feet was from the southwest at about 15 knots. Above this level through about 20,000 feet the wind remained from the southwest to west with some variation in magnitude. At 12,000 feet the wind was about 30 knots, at 14,000 feet the wind was about 20 knots, and at 20,000 feet the wind was about 50 knots. The Universal RAWinsonde OBservation program (RAOB) identified some significant turbulence near 12,000 feet.

⁴ 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.

The HRRR sounding identified the freezing level at approximately 8,900 feet. Relative humidity was above 90 percent below 12,000 feet. Below 20,000 feet the HRRR sounding identified the wind as being generally from the southwest, with magnitudes above 12,000 feet being between 33 and 48 knots. RAOB identified areas of light rime icing between about 9,000 to 11,000 feet and between about 18,000 to 22,000 feet.

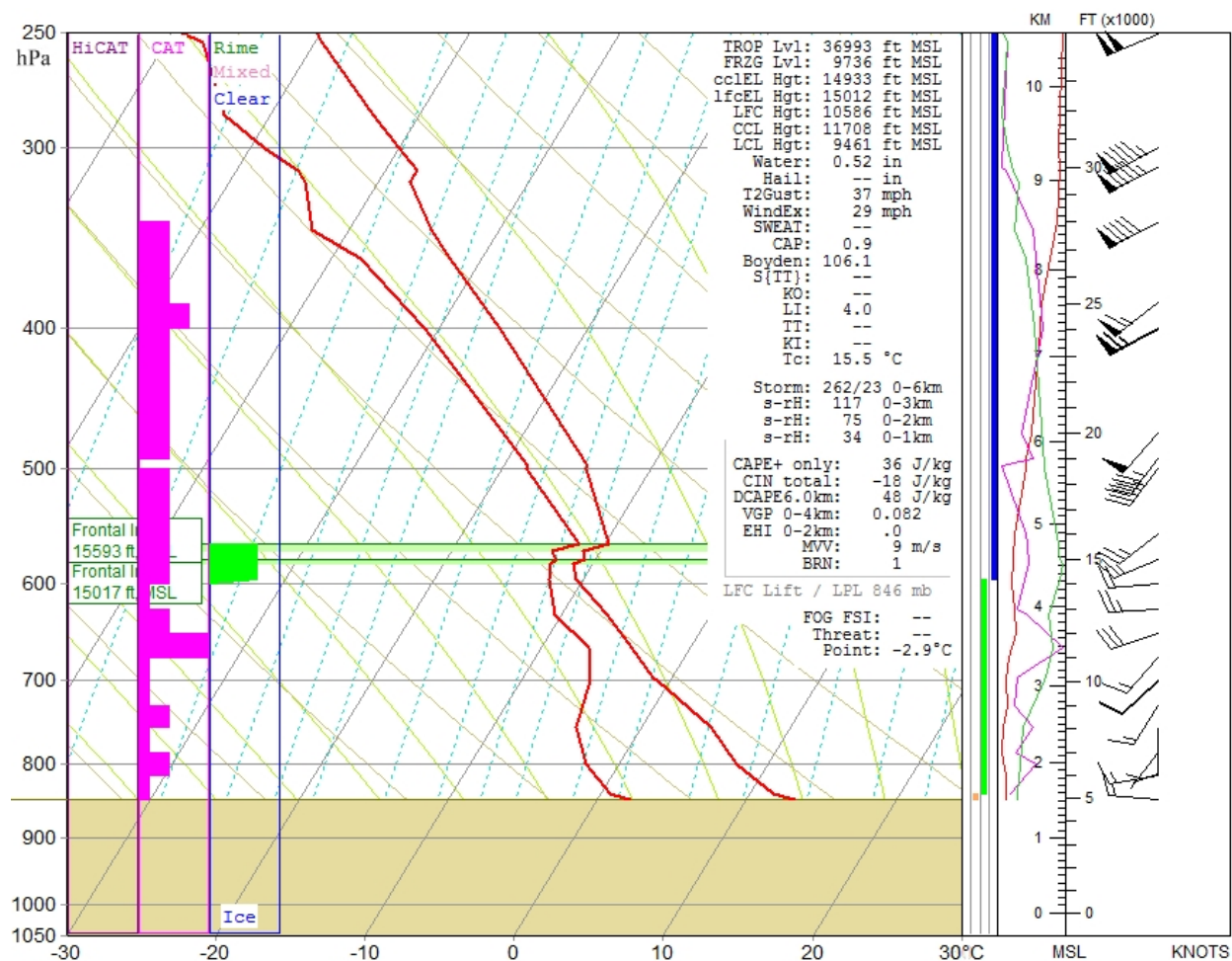


Figure 5 – Rawinsonde sounding from REV in SkewT/LogP format for 1700 PDT, surface to 250 hectopascals (hPa).

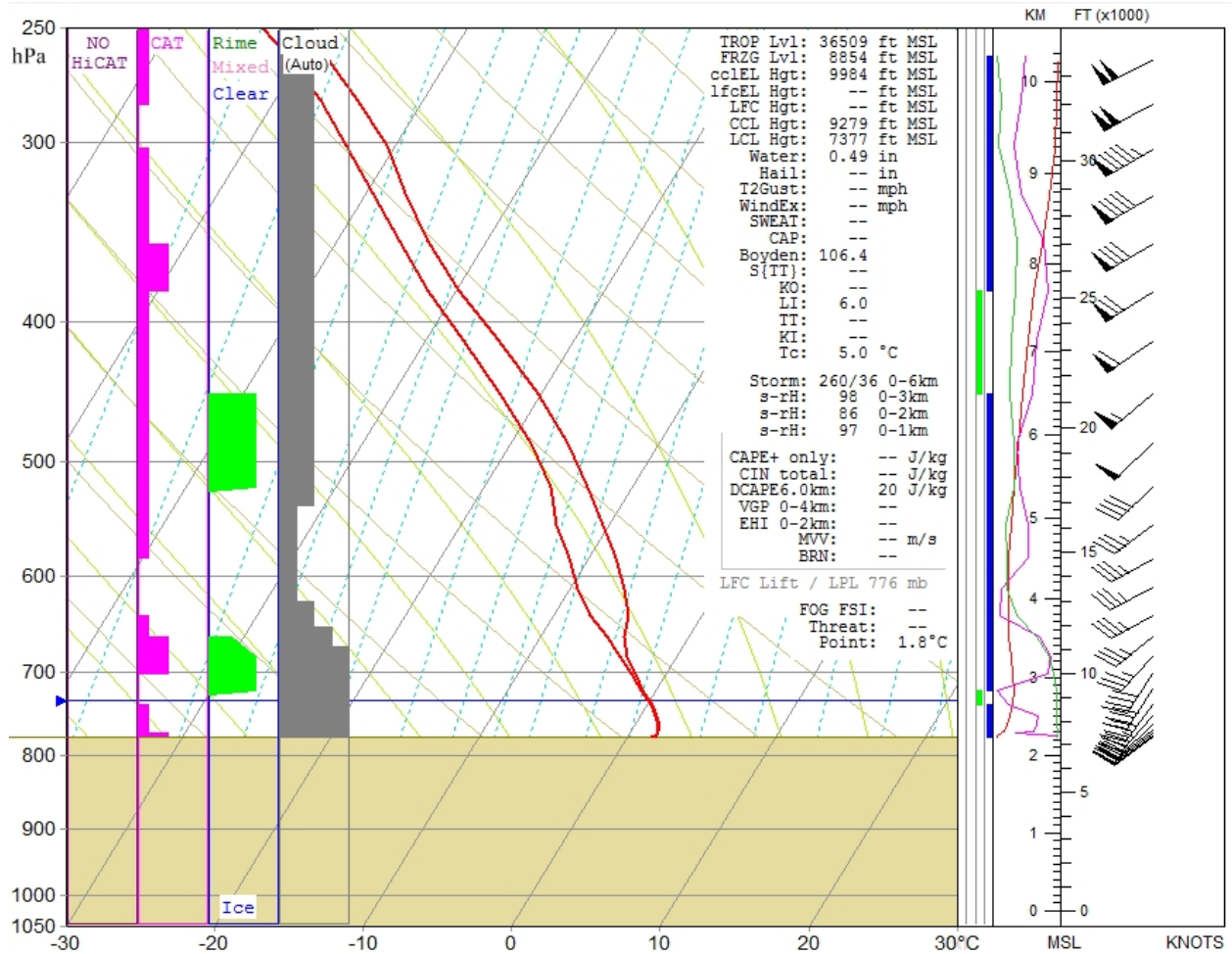


Figure 6 – HRRR model sounding data in SkewT/LogP format for 1600 PDT at the accident location, surface to 250 hPa.

4.0 Satellite Imagery

Advanced Very-High-Resolution Radiometer (AVHRR) visible ($0.63\mu\text{m}$) and infrared ($10.8\mu\text{m}$) data from the NOAA-19 platform were obtained from NOAA. Imagery from near the time of the accident are presented in figures 7 and 8. The visible AVHRR imagery depicted cloudy skies over the accident region, with the infrared data retrieving cloud top temperatures near the accident location of between about -47°C and -37°C . When considering the REV sounding, -47°C corresponded to cloud top heights of about 35,000 feet and -37°C corresponded to cloud top heights of about 28,000 feet. It should be noted these figures have not been corrected for any parallax error.

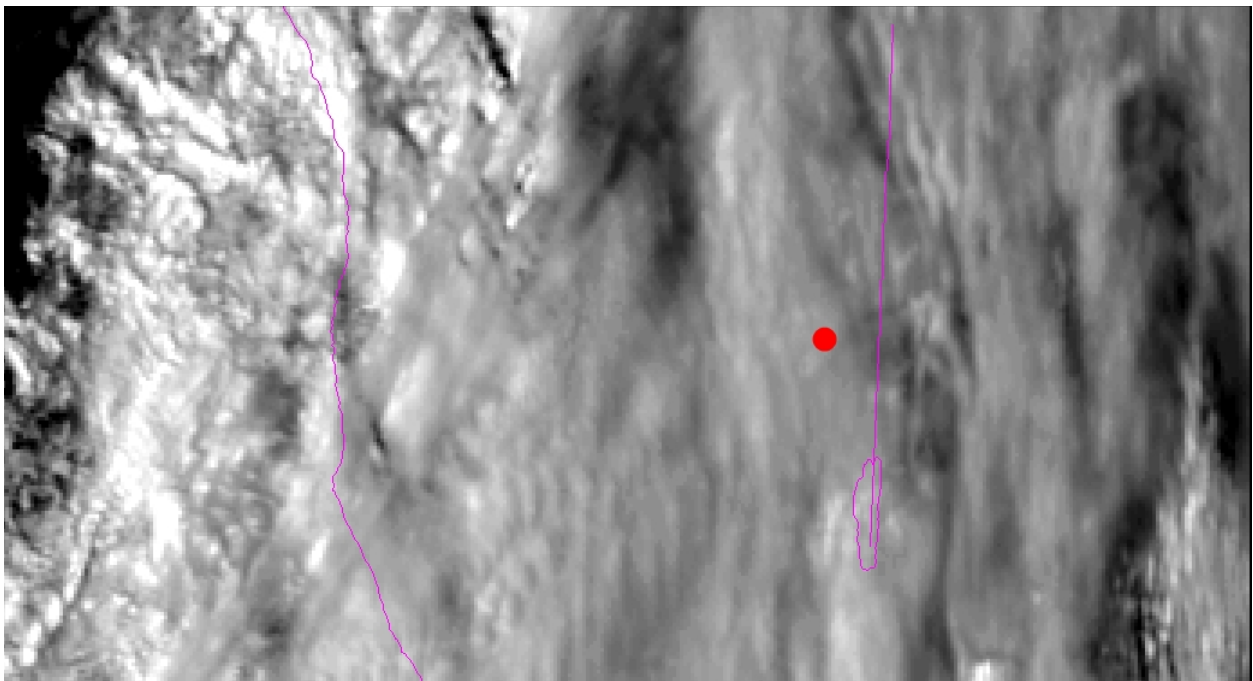


Figure 7 – AVHRR visible imagery from 1633 PDT. Accident location denoted by red dot.

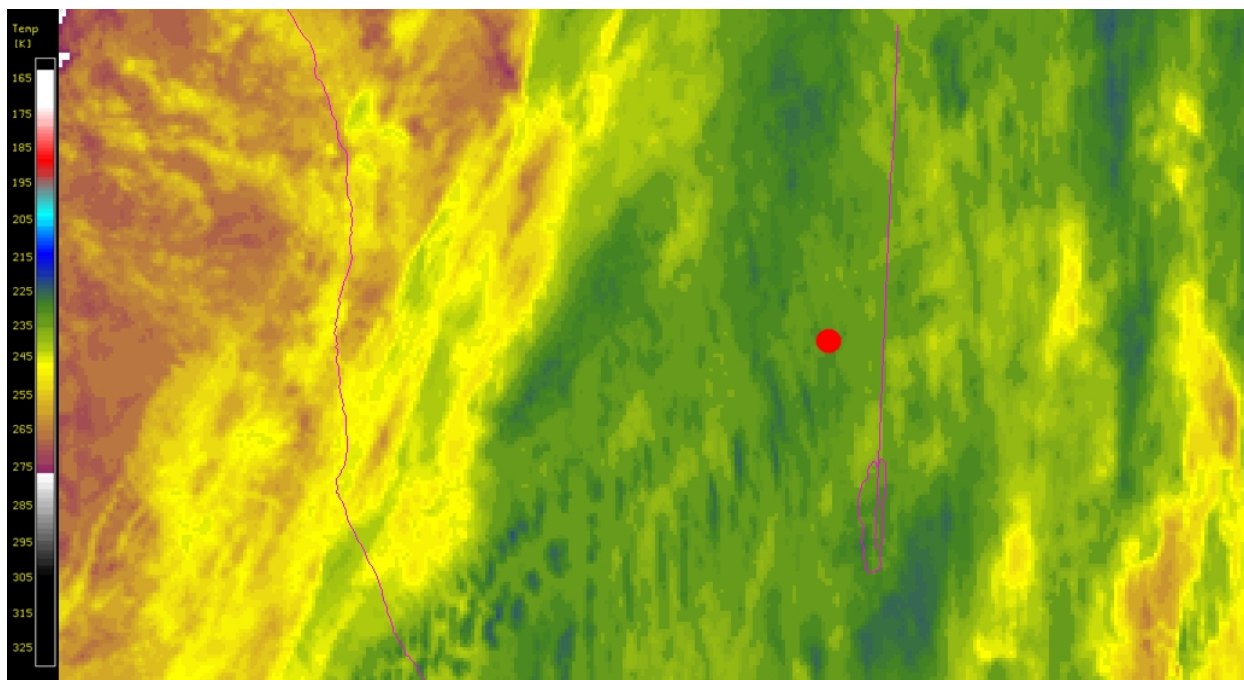


Figure 8 – AVHRR infrared imagery from 1633 PDT. Accident location denoted by red dot.

5.0 Surface Observations

An Automated Weather Observing System was located at TRK⁵, which was located about 20 miles southeast of the accident location at an elevation of 5,901 feet. Reports from TRK during the times surrounding the accident time, which were issued while an observer was logged into the augmentation system, are presented below. The observation expected around 1600 PDT was not made.

According to an email received from an Administrative Clerk at TRK:

At the time of the April 17th Metar we called in our hourly weather observation to LIDOS flight service. They would enter the Metar into the AISR website. We started entering the observations directly into the online system (www.aisr.nas.faa.gov) on Tuesday, May 2nd. The Metars are reported from 1345Z-0100Z. The Metars are to be recorded somewhere between 45 and 55 minutes after the hour. Sometimes the observer is not able to enter in a Metar during that time due to other tasks. If that is the case a Metar might be left blank, or entered in our spreadsheet with a FIBI in the remarks section, indicating it is an observation as close to the required time as possible, but it is not practical to

⁵ 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.

disseminate. Our airport does not report a SPECI. On April 17th there was a METAR at 2150Z and 2345Z. The 2255Z Metar was missed.

[1250 PDT] METAR KTRK 171950Z 21013G19KT 10SM SCT027 BKN041 OVC045 11/04
A3004 RMK NO SPECI=
[1355 PDT] METAR KTRK 172055Z 22016G23KT 10SM BKN040 OVC048 10/03 A3005
RMK NOSPECI=
[1450 PDT] **METAR KTRK 172150Z 19010G14KT 10SM BKN034 OVC042 08/04 A3006**
RMK NOSPECI=
METAR KTRK NIL=
[1645 PDT] **METAR KTRK 172345Z 19005KT 10SM BKN026 OVC039 07/04 A3007**
RMK NO=

At 1450 PDT, TRK reported a wind from 190° at 10 knots with gusts to 14 knots, prevailing visibility⁶ of 10 statute miles or greater, ceiling broken at 3,400 feet above ground level (agl), overcast cloud base at 4,200 feet agl, temperature of 8° Celsius (C) and a dew point temperature of 4°C, altimeter setting of 30.06 inches of mercury; remark: this station does not issue SPECIs.

At 1645 PDT, TRK reported a wind from 190° at 5 knots, prevailing visibility of 10 statute miles or greater, ceiling broken at 2,600 feet agl, overcast cloud base at 3,900 feet agl, temperature of 7°C and a dew point temperature of 4°C, altimeter setting of 30.07 inches of mercury; this observation included a remark of "NO."

6.0 Pilot Reports

The only publicly disseminated pilot report⁷ made within about 1 hour of the accident time came at 1636 PDT from a Boeing 737 at Reno/Tahoe International Airport who reported a gain and loss of 15 knots at 800 feet agl.

RNO UA /OV KRNO /TM 2336 /FL008 /TP B737 /TB LLWS /RM 008AGL GAIN
AND LOSS OF 15KTS...ZOA FD AWC-WEB=

About two hours before the accident time, at 1411 PDT, a Cessna 414 at 12,000 feet located 20 miles south-southwest of the Squaw Valley VOR/DME in South Lake Tahoe, California, reported moderate chop.

TRK UA /OV SWR210020 /TM 2111 /FL120 /TP C414 /TB MOD CHOP /RM ZOA
CWSU AWC-WEB=

⁶ Prevailing visibility - the greatest distance visible throughout at least half of the horizon, but not necessarily continuously.

⁷ Only pilot reports with the WMO headers UBCA** and UBNV** were considered.

7.0 Terminal Aerodrome Forecasts

A Terminal Aerodrome Forecasts (TAF)⁸ issued at 1040 PDT for TRK forecasted for the accident time: a wind from 220° at 13 knots with gusts to 24 knots, prevailing visibility greater than 6 statute miles, light rain showers, few clouds at 2,500 agl, ceiling broken at 4,000 feet agl.

TAF KTRK 171740Z 1718/1818 **22013G24KT P6SM -SHRA FEW025 BKN040**
FM180200 20005KT 4SM RA SCT014 OVC025=

8.0 Area Forecast

An Area Forecast that included the region of northern California (north of a Santa Rosa-Sacramento-South Lake Tahoe line) was issued at 1245 PDT by the Aviation Weather Center in Kansas City, Missouri. Cloud heights are above msl. The portion of the Area Forecast directed toward the northern Sierra Nevada range forecasted for the accident time: broken clouds at 9,000 feet with clouds layered to FL250⁹, scattered light rain showers.

FAUS46 KPCI 171945

FA6W

_SFOC FA 171945

SYNOPSIS AND VFR CLDS/WX

SYNOPSIS VALID UNTIL 181400

CLDS/WX VALID UNTIL 180800...OTLK VALID 180800-181400

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..RDG OVR ERN WA/OR-NWRN NV-SRN CA WTRS MOVG E OF FA BY 08Z. BY 12Z TROF WL MOV OVR WA OFFSHORE WTRS MOVG EWD. MOD-STG SWLY FLOW OVR SRN OR/NRN-CNTRL CA BY 14Z OVR CNTRL CA. SFC..TROF OVR CNTRL WA-N CNTRL OR WKNG BY 06Z. BY 00Z CDFNT WL MOV OVR SRN NV-SERN CA BECMG QSTNRY FNT BY 12Z AND DRFTG EWD.

.

NRN CA...STS-SAC-TVL LN NWD

CSTL SXNS...

CSTLN N OF FOT..BKN030 TOP 160. SCT -SHRA. ISOL -TSRA. CB TOP FL320. 07Z SCT025 BKN050 TOP 120. SCT -SHRA. OTLK...MVFR CIG SHRA BR.

⁸ Conditions forecasted in the TAF are only official for 5 statute miles from the forecast site.

⁹ 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 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.

RMNDR..BKN040 TOP 160. WDLY SCT -SHRA. 02Z CSTLN BKN020 TOP FL180.
SCT -SHRA. OTLK...IFR CIG SHRA BR.
SAC VLY...BKN020 TOP 100 BKN CI. WDLY SCT -SHRA. 22Z OVC035. WDLY
SCT -SHRA. OTLK...VFR RA 12Z MVFR CIG RA.
SHASTA-SISKIYOU-S-NERN CA...BKN070 TOP FL200. WDLY SCT -SHRA. 03Z
TOP 160. OTLK...MVFR CIG SHRA.
NRN SIERNEV...BKN090 LYRD FL250. SCT -SHRA. 02Z OVC080. OCNL VIS
3SM -RA/BR. OTLK...IFR CIG RA BR.

9.0 Aviation Section of the Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 1436 PDT by the NWS Weather Forecast Office in Reno, Nevada. The aviation portion of that AFD is presented here.

FXUS65 KREV 172136
AFDREV
Area Forecast Discussion
National Weather Service Reno NV
236 PM PDT Mon Apr 17 2017

.AVIATION...

For tonight into Tuesday, a stronger and wetter shortwave will enhance precipitation with a continuous period of terrain obscurement along the eastern Sierra and widespread MVFR conditions for KTRK/KTVL, eventually spreading south to KMMH. Snow levels will remain above Sierra terminals so snow accumulations are unlikely. Western NV airports will see periods of light to occasionally moderate rain with showers, but conditions should remain mostly VFR with higher mountain tops possibly becoming obscured. Tuesday afternoon, there is a low (10%) chance for thunderstorms over west-central Nevada (well east of KRNO). If any storms form, small hail (less than 1/2") and a few lightning strikes will be possible.

Surface winds will be fairly modest through Tuesday (gusts 20-25 kts) but Sierra ridges will continue to have gusts 60-70 kts. Some light to moderate turbulence will remain possible.

10.0 AIRMETs

Airmen's Meteorological Information (AIRMET) advisories that were active over the accident aircraft's route of flight at the accident time are presented here.

At 1345 PDT, an AIRMET SIERRA for mountain obscuration was issued:

WAUS46 KPCI 172045
WA6S
_SFOS WA 172045
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 180300

AIRMET MTN OBSCN...WA OR CA
FROM 20ENE HUH TO 40SE YDC TO 40SE LKV TO 40S FMG TO 50SW BTY TO
30SSE MOD TO 30SW EHF TO 50SSW HEC TO 60SE MZB TO 40W RZS TO
30WSW ENI TO 20WSW FOT TO 50S HQM TO 20NW TOU TO 20ENE HUH MTNS
OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

At 1345 PDT, an AIRMET ZULU for moderate icing between the freezing level¹⁰ and FL220 was issued:

WAUS46 KKCI 172045
WA6Z
_SFOZ WA 172045
AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 180300

AIRMET ICE...CA AND CSTL WTRS
FROM 40SE LKV TO 40SSW FMG TO 40WSW OAL TO 150WSW RZS TO
130WSW PYE TO 20S FOT TO 40SE LKV MOD ICE BTN FRZLVL AND FL220.
FRZLVL 070-110. CONDS CONTG BYD 03Z THRU 09Z.

At 1345 PDT, two AIRMET TANGOs were issued for moderate turbulence between FL220 and FL390 and moderate turbulence below FL180:

WAUS46 KKCI 172045
WA6T
_SFOT WA 172045
AIRMET TANGO UPDT 3 FOR TURB VALID UNTIL 180300

AIRMET TURB...WA OR CA ID MT WY NV UT CO NM AND CSTL WTRS
FROM 30SSE YXC TO 50NNW ISN TO 70SW RAP TO 40SE PUB TO 30S CIM TO
50W ILC TO 130WSW SNS TO 140WSW FOT TO 160NW FOT TO 60ESE BTG TO
30SSE YXC
MOD TURB BTN FL220 AND FL390. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET TURB...OR CA NV
FROM 50SE DSD TO 50SW REO TO 60NNW OAL TO 50NE EHF TO 20NNE MOD
TO 50ESE OED TO 50SE DSD
MOD TURB BLW FL180. CONDS CONTG BYD 03Z ENDG 03-06Z.

11.0 SIGMETs

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

¹⁰ The AIRMET identified the freezing level as being between 7,000 and 11,000 feet msl.

12.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Oakland Air Route Traffic Control Center that were active for the accident site at the accident time.

13.0 Current Icing Potential

Images presenting output from the Current Icing Potential (CIP) products for about 1600 PDT between 5,000 and 25,000 feet above msl for the accident region were provided by the National Center for Atmospheric Research (NCAR).¹¹ These images are presented in Attachment 1. The CIP identified trace to moderate severities of icing in the region between 8,500 and 23,500 feet, however the strongest severities were generally found in areas away from Lake Tahoe and the accident location.

14.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for 39° 32' north latitude and 102° 28' west longitude indicated the following:

SUN	
Sunrise	0621 PDT
Sunrise	1942 PDT
MOON	
Moonset	1050 PDT

F. Attachments

Attachment 1. Images presenting output from the CIP products for about 1600 PDT between 5,000 and 25,000 feet above msl for the accident region.

Submitted by:

Mike Richards
Senior Meteorologist

¹¹ Courtesy of Mr. Daniel Adriaansen, NCAR.

THIS PAGE INTENTIONALLY BLANK