National Transportation Safety Board

Office of Aviation Safety
Washington, D.C. 20594-2000
January 17, 2017

WEATHER STUDY

WPR16FA059

A. Accident

Location: Santa Rosa, California
Date: January 28, 2016
Time: about 1900 Pacific standard time (0300 UTC[1] on January 29, 2016)
Aircraft: Piper PA-24-260; N9362P

B. Meteorological Specialist

Mike Richards
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
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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 January 28, 2016 (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: 38.478889° North latitude, 122.786389° West longitude, elevation of approximately 130 feet.

[1] UTC – abbreviation for Coordinated Universal Time

Regional Conditions

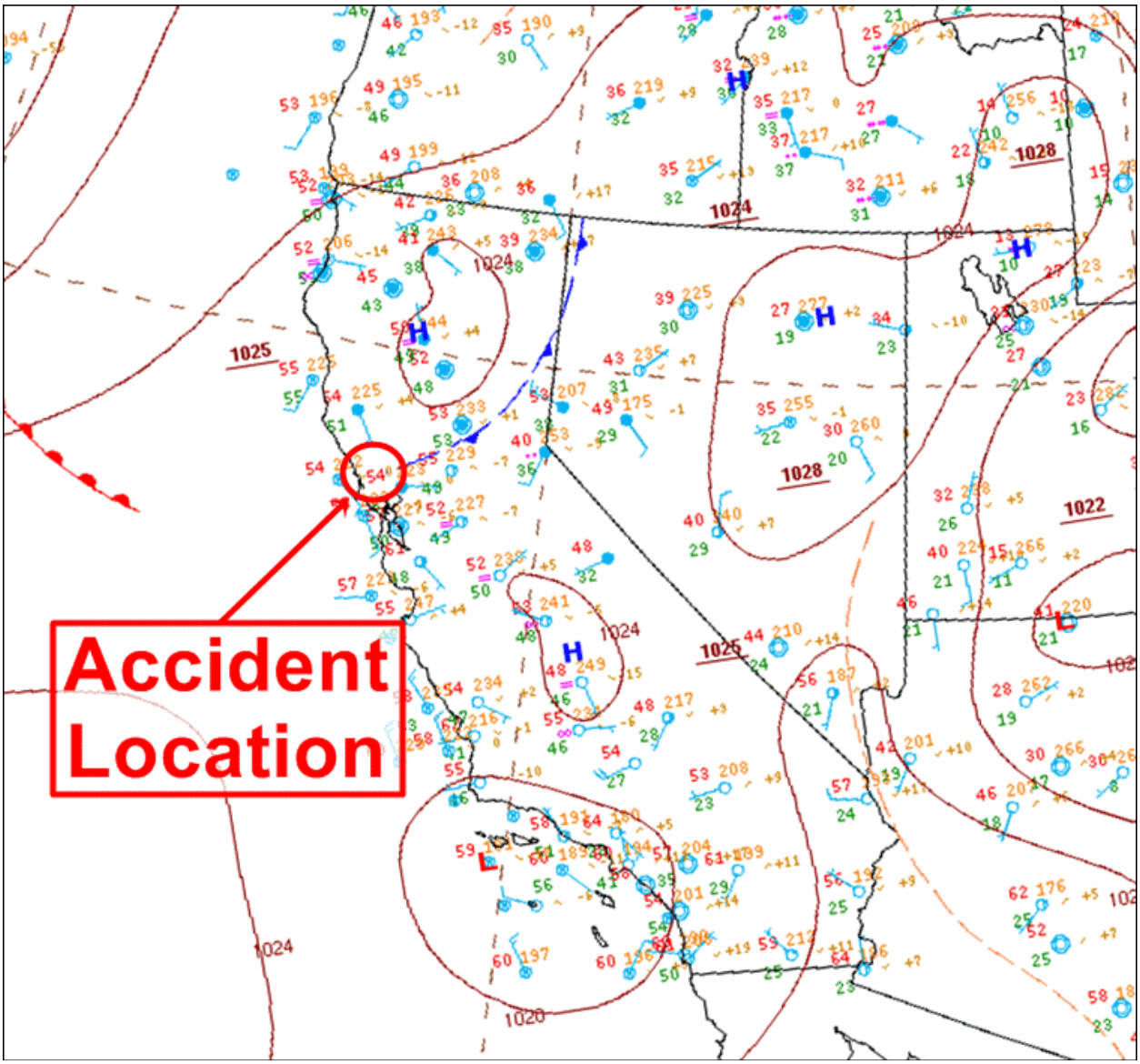

Figure 1 – NWS Surface Analysis Chart for 1900 PST.

The National Weather Service (NWS) Surface Analysis Chart for 1900 PST (figure 1) depicted a cold front stretching from the northeastern California/Nevada border southwest to the accident region. A high pressure center was identified in far northern California. A WSR-88D regional radar composite reflectivity mosaic obtained from the National Mosaic and Multi-Sensor (NMQ) Project[2] for 1900 PST (figure 2) identified light, with some moderate, values of reflectivity across northern California, with that reflectivity occurring mainly in the far northern part of the state.

[2]The NMQ project is a joint initiative between the National Severe Storms Laboratory, Federal Aviation Administration, National Weather Service/Office of Hydrologic Development, the Office of Climate, Water and Weather Services and the University of Oklahoma Cooperative Institute in Mesoscale Meteorological Studies.

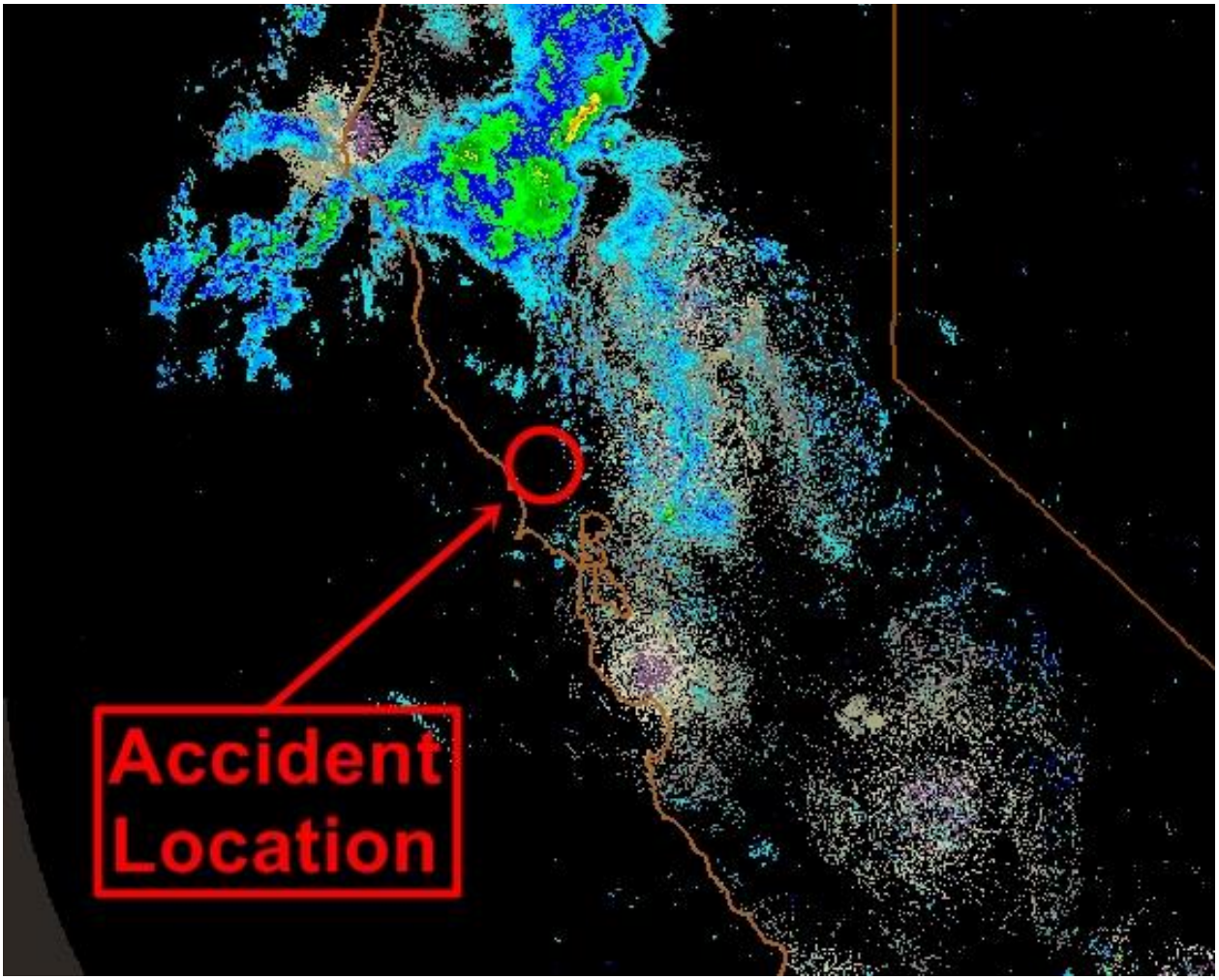

Figure 2 – NMQ NEXRAD mosaic from 1900 PST.

Surface Observations

An official surface observation station was located at Charles M. Schulz - Sonoma County Airport (STS) in Santa Rosa, California, which was located about 2 miles north-northwest of the accident location at an elevation of 129 feet. Human-augmented reports from STS during the times leading to and surrounding the accident time are presented here:

[1153 PST] METAR KSTS 281953Z 16005KT 10SM FEW050 SCT090 BKN110 12/10 A3023 RMK AO2 RAB39E53 PRESFR SLP230 P0000 T01220100=

[1253 PST] METAR KSTS 282053Z 00000KT 10SM BKN020 OVC030 13/09 A3023 RMK AO2 SLP230 60000 T01280094 55012=

[1304 PST] SPECI KSTS 282104Z 31005KT 7SM OVC020 13/10 A3024 RMK AO2 VIS 2 SW-N T01330100=

[1353 PST] METAR KSTS 282153Z 11003KT 5SM -RA BR OVC020 12/10 A3021 RMK AO2 RAB07 SLP225 VIS 2 SW-N P0001 T01220100=

[1453 PST] METAR KSTS 282253Z 16004KT 8SM BR BKN008 OVC013 12/11 A3020 RMK AO2 RAE25 CIG 007V011 SLP220 P0001 T01220111=

[1553 PST] METAR KSTS 282353Z 10004KT 3SM BR OVC007 12/11 A3020 RMK AO2 CIG 006V009 SLP221 60002 T01220111 10133 20094 55004=

[1630 PST] SPECI KSTS 290030Z 11004KT 1 3/4SM -RA BR FEW004 OVC009 12/12 A3020 RMK AO2 RAB24 P0000 T01220117=

[1640 PST] SPECI KSTS 290040Z 00000KT 2 1/2SM BR FEW004 OVC009 12/12 A3020 RMK AO2 RAB24E37 P0000 T01220117=

[1653 PST] METAR KSTS 290053Z 00000KT 2 1/2SM BR SCT004 OVC009 12/12 A3020 RMK AO2 RAB24E37 SLP221 P0000 T01220117=

[1753 PST] METAR KSTS 290153Z 12004KT 2 1/2SM BR SCT004 OVC009 12/12 A3018 RMK AO2 SLP212 T01220117=

[1853 PST] METAR KSTS 290253Z 00000KT 2 1/2SM BR SCT004 OVC009 12/12 A3020 RMK AO2 SLP219 60000 T01220122 55001=

[1900 PST] SPECI KSTS 290300Z 00000KT 2 1/2SM BR OVC004 12/12 A3020 RMK AO2 T01220122=

[1908 PST] SPECI KSTS 290308Z 00000KT 2SM BR OVC003 12/12 A3019 RMK AO2 T01220122=

[1916 PST] SPECI KSTS 290316Z 00000KT 1 3/4SM -RA BR OVC003 12/12 A3020 RMK AO2 RAB10 P0000 T01220122=

[1942 PST] SPECI KSTS 290342Z 00000KT 1 3/4SM BR OVC004 12/12 A3021 RMK AO2 RAB10E24 P0000 T01220122=

At 1900 PST, STS reported a calm wind, visibility of 2½ statute miles, mist, ceiling overcast at 400 feet above ground level, temperature of 12° Celsius (C) and a dew point temperature of 12°C, altimeter setting of 30.20 inches of mercury; remarks included: station with a precipitation discriminator.

An official surface observation station was located at Petaluma Municipal Airport (O69) in Petaluma, California, at an elevation of 90 feet. Automated reports from O69 during the times surrounding the accident time are presented here:

[1755 PST] METAR KO69 290155Z AUTO 11005KT 10SM BKN020 OVC032 12/12 A3022 RMK AO1 P0001=

[1815 PST] METAR KO69 290215Z AUTO 11006KT 10SM BKN018 OVC030 12/12 A3022 RMK AO1=

[1835 PST] METAR KO69 290235Z AUTO 10006KT 10SM BKN018 OVC028 12/12 A3023 RMK AO1=

[1855 PST] METAR KO69 290255Z AUTO 10005KT 10SM BKN018 OVC026 12/12 A3023 RMK AO1=

[1915 PST] METAR KO69 290315Z AUTO 10004KT 10SM FEW018 OVC026 13/12 A3023 RMK AO1=

[1935 PST] METAR KO69 290335Z AUTO 10005KT 10SM OVC026 13/12 A3023 RMK AO1=

An official surface observation station was located at Gnoss Field Airport (DVO) in Novato, California, at an elevation of 2 feet. Automated reports from DVO during the times surrounding the accident time are presented here:

[1755 PST] METAR KDVO 290155Z AUTO 00000KT 5SM BR OVC015 13/12 A3022 RMK AO2=

[1815 PST] METAR KDVO 290215Z AUTO 17003KT 8SM BKN010 OVC015 12/12 A3021 RMK AO2=

[1835 PST] METAR KDVO 290235Z AUTO 00000KT 10SM BKN010 OVC015 13/12 A3021 RMK AO2=

[1855 PST] METAR KDVO 290255Z AUTO 00000KT 10SM OVC015 13/12 A3022 RMK AO2=

[1915 PST] METAR KDVO 290315Z AUTO 00000KT 10SM BKN015 OVC027 13/12 A3022 RMK AO2=

[1935 PST] METAR KDVO 290335Z AUTO 00000KT 10SM BKN015 OVC027 12/12 A3022 RMK AO2=

Figure 3 – Locations of surface observing stations presented in this section. Pink line provides the last (approximately) 27 minutes of the accident aircraft's flight path.

An official surface observation station was located at Napa County Airport (APC) in Napa, California, at an elevation of 35 feet. Human-augmented reports from APC during the times surrounding the accident time are presented here:

[1732 PST] SPECI KAPC 290132Z 09005KT 4SM -RA BR FEW021 BKN030 OVC050 12/11 A3022 RMK AO2 RAB04 P0003 T01220106=

[1754 PST] METAR KAPC 290154Z 10005KT 4SM -RA BR FEW021 SCT036 OVC045 12/11 A3021 RMK AO2 RAB04 SLP221 P0003 T01220106=

[1854 PST] METAR KAPC 290254Z 08004KT 7SM OVC034 12/11 A3022 RMK AO2 RAE0155 SLP223 P0000 60003 T01220106 55000=

[1954 PST] METAR KAPC 290354Z 01003KT 6SM BR SCT019 BKN031 BKN120 12/11 A3021 RMK AO2 SLP222 T01170106=

An official surface observation station was located at Buchanan Field Airport (CCR) in Concord, California, at an elevation of 25 feet. Human-augmented reports from CCR during the times surrounding the accident time are presented here:

[1753 PST] METAR KCCR 290153Z 36006KT 9SM BKN025 BKN043 OVC050 15/10 A3021 RMK AO2 SLP215 T01500100=

[1809 PST] SPECI KCCR 290209Z 35007KT 9SM SCT025 OVC041 14/10 A3021 RMK AO2 T01440100=

[1853 PST] METAR KCCR 290253Z 01007KT 7SM SCT021 OVC040 13/10 A3020 RMK AO2 SLP213 T01330100 56005=

[1953 PST] METAR KCCR 290353Z 02007KT 6SM HZ FEW021 OVC034 13/10 A3021 RMK AO2 SLP217 T01330100=

Weather Radar

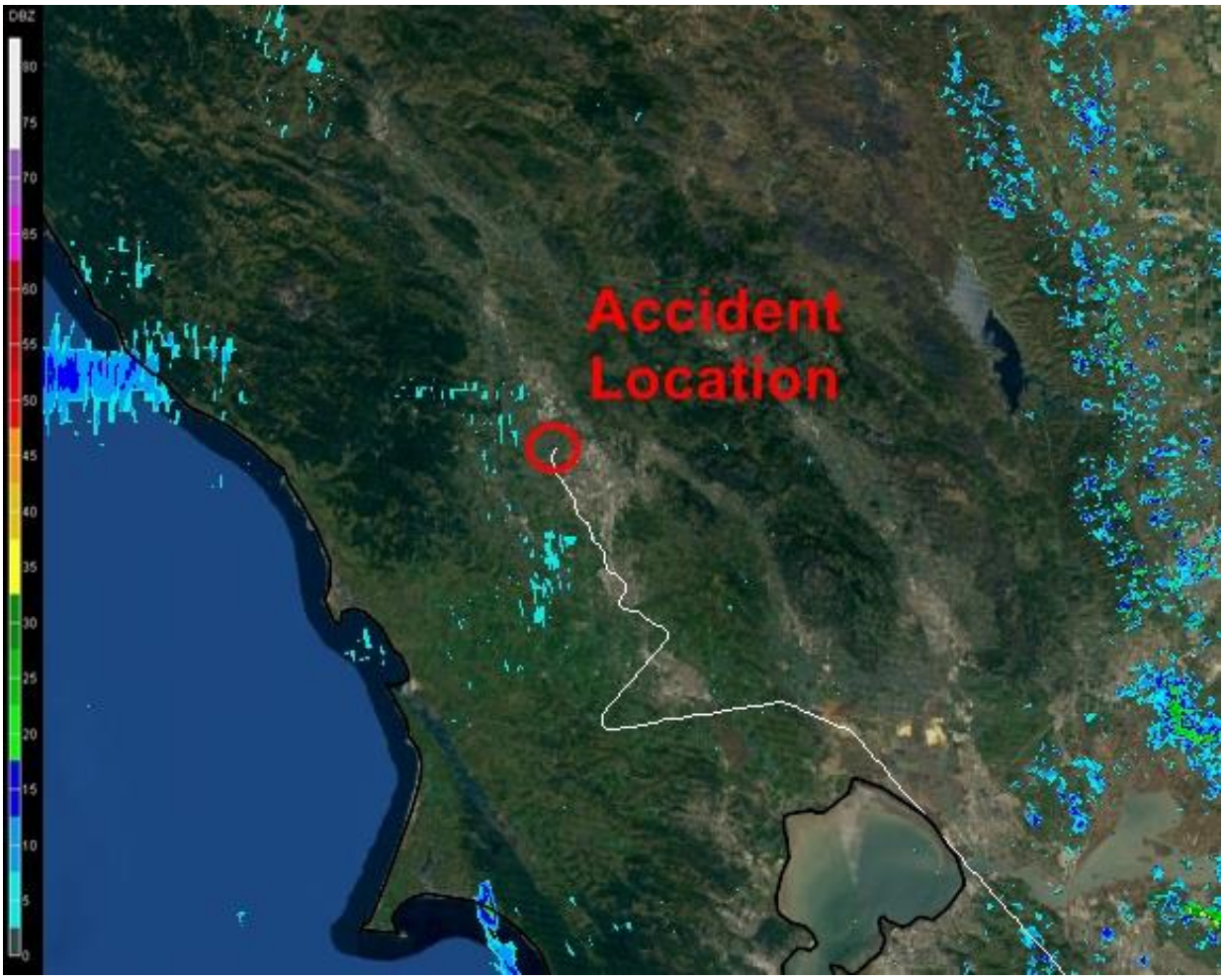

Figure 4 – KDAX 0.5° Level-II reflectivity product from 1901 PST. Accident aircraft flight path noted by white line.

WSR-88D Level-II weather radar imagery from Sacramento, California (KDAX), is presented in figure 4. KDAX was located approximately 53 miles east of the accident site at an elevation of about 30 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KLSX 0.50° tilt would have "seen" altitudes between about 2,000 and 7,400 feet above msl at the accident location.

The KDAX 0.5° imagery presents widely scattered light values of reflectivity in the accident region.

Upper Air Data

A North American Mesoscale (NAM) model sounding (figure 5) for the accident location at 1900 PST was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory. The wind was light near the surface and from the southeast, but veered with height to a westerly wind of about 15 knots at about 5,000 feet. Relative humidity was greater than 97

percent below 3,300 feet, and the Rawinsonde Observation Program (RAOB) identified a wet fog layer below 3,200 feet. The freezing level was identified as being near 10,700 feet

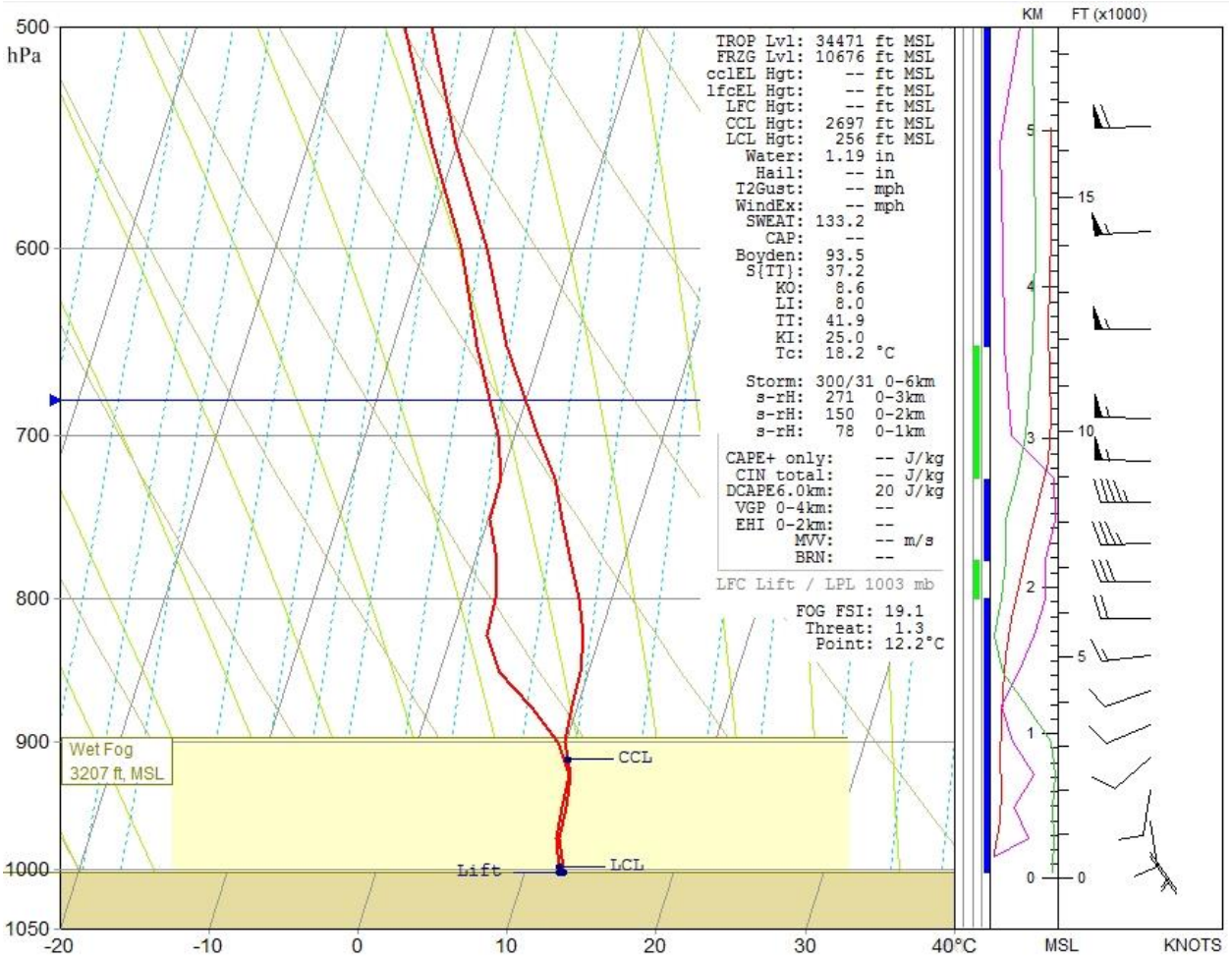

Figure 5 – NAM model sounding data in SkewT/LogP format for 1900 PST at the accident site, surface to 500 hectopascals (hPa).

Pilot Reports

There were no publicly disseminated pilot reports[3] made within two hours of the accident time at or below 10,000 feet within the accident region.

Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-15 infrared (10.7µm) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1900 PST is presented in figure 6. These data identified that infrared cloud-top temperatures in the area of the accident location varied between -53°C and -3°C. When considering the NAM model sounding, these temperatures corresponded to cloud top heights of about 34,500 feet (not depicted in figure 5) and 12,200 feet, respectively. It should be noted figure 6 has not been corrected for any parallax error.

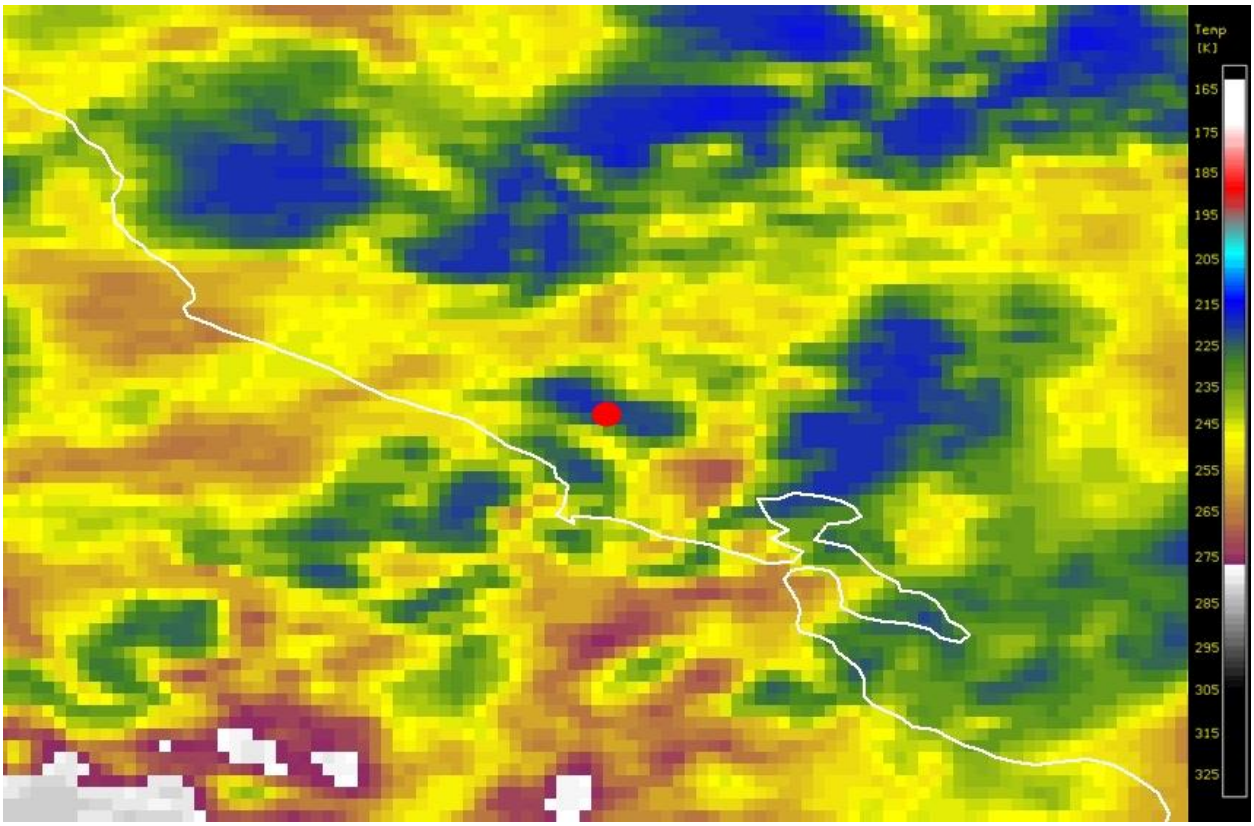

Figure 6 – GOES-15 10.7µm (infrared) color-enhanced imagery from 1900 PST. Red dot denotes accident location.

[3] Only pilot reports with the WMO header UBCA** were considered.

Terminal Aerodrome Forecasts

The NWS issued Terminal Aerodrome Forecasts (TAFs)[4] for STS. The STS TAFs issued during the times leading up to and surrounding the accident time are presented here. The TAF current at the accident aircraft's time of departure from Palm Springs International Airport (at 1535 PST) forecasted for the accident time: wind from 190° at 4 knots, visibility greater than 6 statute miles, light rain, ceiling broken at 1,500 feet agl.

[0339 PST] TAF KSTS 281139Z 2812/2912 00000KT P6SM BKN150
TEMPO 2812/2816 1/2SM FG VV002
FM281800 VRB03KT P6SM SCT100 OVC250
FM282100 21005KT P6SM BKN040 OVC100
FM282300 23004KT P6SM –RA BKN025 OVC040
FM290300 19004KT P6SM –RA OVC015=

[0645 PST] KSTS 281445Z 2815/2912 00000KT P6SM BKN150
FM281800 VRB03KT P6SM SCT100 OVC250
FM282100 21005KT P6SM BKN040 OVC100
FM282300 23004KT P6SM -RA BKN025 OVC040
FM290300 19004KT P6SM -RA OVC015=

[0821 PST] TAF AMD KSTS 281621Z 2816/2912 00000KT P6SM BKN150
FM281800 VRB03KT P6SM SCT100 OVC250
FM282100 21005KT P6SM BKN040 OVC100
FM290300 19004KT P6SM –RA OVC015=

[0928 PST] TAF KSTS 281728Z 2818/2918 VRB03KT P6SM SCT100 OVC250
FM282100 21005KT P6SM BKN040 OVC100
FM290300 19004KT P6SM -RA OVC015=

[1242 PST] TAF AMD KSTS 282042Z 2821/2918 VRB04KT P6SM VCSH BKN040 OVC100
FM290300 19004KT P6SM -RA OVC015=

[1259 PST] TAF AMD KSTS 282059Z 2821/2918 VRB04KT P6SM VCSH BKN030 OVC040
FM290300 19004KT P6SM -RA OVC015=

[1538 PST] TAF KSTS 282338Z 2900/2924 16005KT P6SM -SHRA OVC020
FM290600 VRB03KT P6SM -SHRA OVC010
FM291900 16004KT P6SM -SHRA BKN015 OVC025=

[1844 PST] TAF AMD KSTS 290244Z 2903/2924 16005KT 3SM -SHRA OVC010
FM290600 VRB03KT P6SM -SHRA OVC008
FM291900 16004KT P6SM -SHRA BKN015 OVC025=

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

Area Forecast

An Area Forecast that included the state of California was issued at 1245 PST by the Aviation Weather Center in Kansas City, Missouri. Cloud heights are above msl. The portion of the Area Forecast directed toward the northern California coastal stations forecasted for the accident time: broken clouds at 2,000 feet with cloud tops to 6,000 feet, isolated light rain showers.

FAUS46 KKCI 282045
FA6W
_SFOC FA 282045
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 291500
CLDS/WX VALID UNTIL 290900...OTLK VALID 290900-291500
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..TROF ACRS WRN WA-CNTRL OR LIFTING NWD. RIDGE ACRS CA CSTL WTRS. MOD SW FLOW ACRS PAC NW. MOD NW FLOW ELSW. 15Z WK RIDGE ACRS FCST AREA WITH MOD W-NWLY FLOW.
SFC..CDFNT FROM CNTRL WA TO WRN OR-NW CA.
.
NRN CA...STS-SAC-TVL LN NWD
CSTL SXNS...BKN020 TOP FL220. SCT -SHRA. **23Z BKN020 TOP 060. ISOL -SHRA.** OTLK...IFR CIG SHRA.
SAC VLY...OVC060 TOP FL220. SCT -SHRA. 00Z BKN025 TOP 060. ISOL -SHRA. OTLK...MVFR CIG BR.
SHASTA-SISKIYOUS-NERN CA...BKN060 TOP FL220. -RA. 03Z BKN065 TOP 100. ISOL -SHRA. OTLK...MVFR CIG SHRA.
NRN SIERNEV...BKN120 TOP FL220. 00Z BKN085. ISOL -SHRA.
OTLK...MVFR CIG SHRA.

Aviation Section of the Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 1446 PST by the NWS Monterey Weather Forecast Office. The aviation portion of the AFD is presented here:

FXUS66 KMTR 282246
AFDMTR
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE SAN FRANCISCO BAY AREA
246 PM PST THU JAN 28 2016

.AVIATION...AS OF 9:30 AM PST THURSDAY...VFR TODAY. TAFS WERE ALL ADJUSTED TO DELAY THE ONSET OF RAIN BASED OFF LATEST HRRR AND NAM MODELS. NOW LOOKS LIKE -RA GENERALLY STAYS OUT OF THE

AREA UNTIL 12Z (WHICH MAY BE OPTIMISTIC). COMBINATION OF -SHRA AND -RA FOR TOMORROW. MODERATE CONFIDENCE.
VICINITY OF KSFO...VFR IS EXPECTED TO PREVAIL TODAY WITH LIGHT VARIABLE WINDS BECOMING WESTERLY WITH THE AFTERNOON SEA BREEZE. -SHRA BY OR AFTER 12Z. HIGH CONFIDENCE THROUGH 06Z.
SFO BRIDGE APPROACH...SIMILAR TO KSFO.
MONTEREY BAY AREA TERMINALS...VFR IS EXPECTED TO PREVAIL TODAY WITH GENERALLY LIGHT WINDS BECOMING WESTERLY WITH THE AFTERNOON SEA BREEZE. -SHRA AND -RA LIKELY DELAYED TO AFTER THE FORECAST WINDOW. HIGH CONFIDENCE.

AIRMETs

An Airmen's Meteorological Information (AIRMET) advisory for mountain obscuration was active for the accident location at the accident time. AIRMETs for icing are not considered here.

AIRMET MTN OBSCN...WA OR CA ID MT NV UT
FROM 50WSW YXC TO 60ESE YXC TO 20SW LWT TO 50SW MLD TO 40SSE BAM TO 80SW BAM TO 50NE MOD TO 20SSW PYE TO 20S FOT TO 80SW EUG TO 50SSE HQM TO TOU TO 20SSW YDC TO 50WSW YXC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

The accident location was very close to the border of an active AIRMET for instrument flight rules (IFR) conditions.

AIRMET IFR...OR CA AND CSTL WTRS
FROM 50WSW LKV TO 80ENE RBL TO 60ESE RBL TO 30WNW PYE TO 30S FOT TO 60N FOT TO 50WSW LKV
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

SIGMETs

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

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 within the accident region at the accident time.

Lightning

Total lightning data from the Earth Networks Total Lightning Network did not identify the presence of any lightning in the accident area.

Astronomical Data

The astronomical data obtained from the United States Naval Observatory for 38° 29' north latitude and 122° 47' west longitude, indicated the following:

SUN	
Sunset	1728 PST
MOON	
Moonset	0948 PST
Moonset	2215 PST

Submitted by: Mike Richards
NTSB, AS-30