



## **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety  
Washington, D.C. 20594

May 26, 2020

### **Factual Report**

# **METEOROLOGY**

DCA20MA059

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## **A. ACCIDENT**

Location: Calabasas, California  
Date: January 26, 2020  
Time: 0945 Pacific standard time (1745 UTC)<sup>1</sup>  
Aircraft: Type - Sikorsky S-76B; Registration - N72EX

## **B. METEOROLOGIST**

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## **C. SUMMARY**

On January 26, 2020, about 0945 PST, a Sikorsky S76-B helicopter, N72EX, was destroyed when it was involved in an accident near Calabasas, California. The pilot and eight passengers were fatally injured. The helicopter was operated as a Title 14 Code of Federal Regulations Part 135 charter flight.

## **D. DETAILS OF THE INVESTIGATION**

The National Transportation Safety Board's meteorological investigator traveled to California in support of this accident investigation and gathered additional weather data remotely. Unless otherwise noted, all times are in PST for January 26, 2020 (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: 34.136574° north latitude, 118.692285° west longitude, at an elevation of about 1,100 feet.

## **E. FACTUAL INFORMATION**

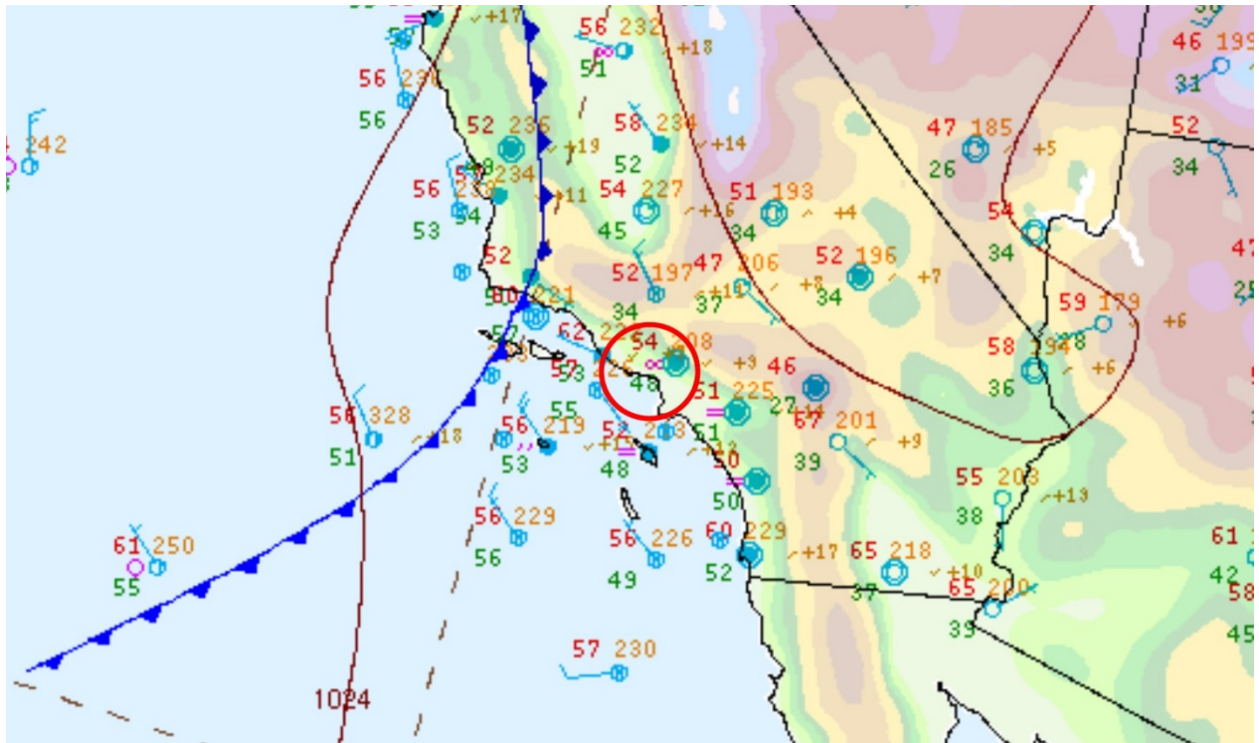
### **1.0 Synoptic Conditions**

The southwestern section of the National Weather Service (NWS) Surface Analysis Chart valid for 1000 PST is presented in Figure 1. The surface analysis chart identified a cold front stretching

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<sup>1</sup> UTC – abbreviation for Coordinated Universal Time

from central California southward then southwestward over the Pacific Ocean immediately to the west of the accident site; the cold front was advancing eastward and southeastward. Temperatures ahead of the cold front in the accident region were generally in the low- to mid-50°s Fahrenheit (F). Dew point depressions on and near the California coast in the accident region ranged from 0°F to 6°F. Haze and mist were reported in the area with wind reported as calm and light from the northwest near the accident site.



**Figure 1** – Southwest section of the NWS Surface Analysis Chart for 1000 PST. The accident site is within the red circle.

At 0943 PST, the NWS Weather Forecast Office (WFO) in Oxnard, California (LOX) issued an Area Forecast Discussion (AFD) that provided a synopsis for the region at about the accident time. The following text was taken from the “Short Term” section of that AFD. See [Section 11.0](#) of this report for further information from this AFD.

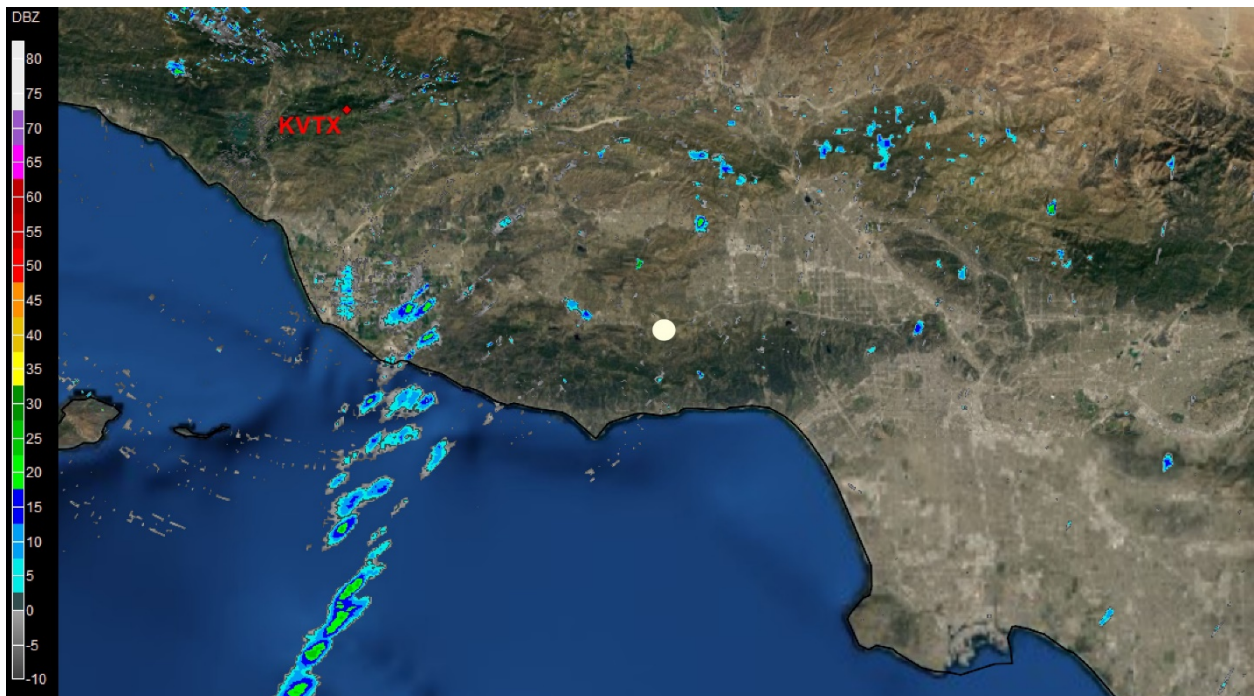
*...A weak cold front has held together as it moves across the central coast, but radar returns are mostly aloft and not reaching the ground. The only reports of measurable precipitation are related to the deep marine layer and drizzle mainly along the coast or nearby foothills. Still expect the best chance of showers to be on the north mountain slopes this afternoon and tonight, mainly under 0.20 inch and a dusting of snow above 5500 feet. Only changes to the forecast was to add more cloud cover over Los Angeles County this morning. The main impacts today will be gusty west-northwest winds in the wake of this dissipating frontal system. Current wind advisories look on-track, but will consider adding the Antelope Valley for later today into the evening hours. Also, will take a closer look at eastern Ventura Co. valleys and the Malibu coastline for later tonight into Monday when winds turn more north-northeasterly. Tough to say exactly how deep the marine layer is this morning due to the thickening higher clouds, but ACARS data and the Oat Mtn webcam support 3k feet. NAM time sections and NBM cloud cover forecasts for Monday morning keep low clouds confined mainly to the LA coast, which makes sense as pressure gradients will be trending 4-5mb offshore by then.*

## **2.0 Weather Radar**

Level-II weather radar imagery from two WSR-88D radars (KSOX and KVTX) located in the accident region are presented in figures 2 and 3. KSOX was located approximately 65 miles east-southeast of the accident site at an elevation of about 3,100 feet. Assuming standard refraction and considering the  $0.95^\circ$  beam width for the WSR-88D radar beam, the KSOX  $0.484^\circ$  tilt would have “seen” altitudes above the accident location of between about 6,000 and 12,500 feet msl. KVTX was located approximately 33 miles northwest of the accident site at an elevation of about 2,800 feet. Assuming standard refraction and considering the  $0.95^\circ$  beam width for the WSR-88D radar beam, the KVTX  $0.527^\circ$  tilt would have “seen” altitudes above the accident location of between about 3,700 and 7,000 feet msl. Imagery from both radars near the accident time depicted distinct areas of mostly light reflectivity north, northwest, west and southwest of the accident site. A loop of images from these radars around these times identified these areas of reflectivity moving to the east.



**Figure 2** – KSOX 0.484° Level-II reflectivity product from a sweep initiated at 0946:17 PST. Accident location denoted by white circle. The KSOX radar is not located within the map area.



**Figure 3** – KVTX 0.527° Level-II reflectivity product from a sweep initiated at 0946:11 PST. Accident location denoted by white circle.

### 3.0 Surface Observations

Figure 4 identifies ceiling and visibility reporting weather station locations along and nearby the accident aircraft's route of flight on the accident day. Longline-disseminated<sup>2</sup> reports from some of these stations for times surrounding the accident time are provided below. Longline-disseminated reports from all these stations for the time period of 0000 PST on 25 January 2020 through 1100 PST on 26 January 2020 can be found in Attachment 1. Five-minute data from most of these stations during this time period are also included in Attachment 1.



**Figure 4** – Ceiling and visibility reporting weather station locations along and nearby the accident aircraft's route of flight (depicted as the red line) on the accident day.

An Automated Surface Observing System (ASOS) was located at John Wayne-Orange County Airport (SNA)<sup>3</sup> in Santa Ana, California, which was located about 49 miles southeast of the accident location at an elevation of 56 feet. SNA was the departure airport on the accident flight.<sup>4</sup> Augmented reports from SNA during the times surrounding the accident flight are presented here.

<sup>2</sup> “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station's Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

<sup>3</sup> The 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.

<sup>4</sup> The accident flight departed SNA about 0906 PST.

[0753 PST] METAR KSNA 261553Z 04005KT 4SM BR OVC010 14/10 A3016 RMK  
AO2 SLP213 T01390100=  
**[0853 PST] METAR KSNA 261653Z 06005KT 4SM BR OVC010 14/10 A3018 RMK**  
**AO2 SLP220 T01440100=**  
[0949 PST] SPECI KSNA 261749Z 08006KT 4SM BR OVC015 14/10 A3019 RMK  
AO2=  
[0953 PST] METAR KSNA 261753Z 10004KT 4SM BR OVC015 15/10 A3019 RMK  
AO2 SLP224 T01500100 10150 20139 51017=

At 0853 PST, SNA reported a wind from 060° at 5 knots, visibility of four statute miles, mist, ceiling overcast at 1,000 feet above ground level (agl), temperature of 14° Celsius (C) and a dew point temperature of 10°C, altimeter setting of 30.18 inches of mercury; remarks: automated station with a precipitation discriminator, sea level pressure of 1022.0 hectopascals (hPa), hourly temperature of 14.4°C and hourly dew point temperature of 10.0°C.

A weather observing system of unknown type was located at Los Alamitos Army Airfield (SLI) in Los Alamitos, California, which was located about 40 miles southeast of the accident location at an elevation of 35 feet. Augmented reports from the SLI observing system during the times surrounding the accident flight are presented here.

[0823 PST] SPECI KSLI 261623Z 00000KT 4SM BR OVC010 13/13 A3017 RMK  
AO2A SLP220=  
**[0856 PST] METAR KSLI 261658Z 00000KT 4SM BR OVC010 13/13 A3018 RMK**  
**AO2A SLP223 T01250125=**  
[0958 PST] METAR KSLI 261758Z 12003KT 5SM BR OVC014 13/13 A3019 RMK  
AO2A SLP226 T01330131 10133 20123 51012=  
[1023 PST] SPECI KSLI 261823Z 00000KT 5SM BR OVC015 14/13 A3018 RMK  
AO2A SLP223=

At 0856 PST, SLI reported a calm wind, visibility of 4 statute miles, mist, ceiling overcast at 1,000 feet agl, temperature of 13°C and a dew point temperature of 13°C, altimeter setting of 30.18 inches of mercury; remarks: automated station with a precipitation discriminator and an observer present, sea level pressure of 1022.3 hPa, hourly temperature of 12.5°C and hourly dew point temperature of 12.5°C.

An ASOS with the station identifier KCQT<sup>5</sup> was located at the University of Southern California in Los Angeles, California, which was located about 21 miles east-southeast of the accident location at an elevation of 184 feet. Automated reports from the KCQT ASOS during the times surrounding the accident flight are presented here.

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<sup>5</sup> Because this station was not collocated with an airport, the 4-digit ICAO format for station identifiers is used.



[0823 PST] SPECI KCQT 261623Z AUTO 00000KT 2SM HZ OVC014 14/09 A3017  
RMK AO2 T01440094=

**[0852 PST] METAR KCQT 261652Z AUTO 00000KT 2SM HZ OVC015 15/09  
A3017 RMK AO2 SLP216 T01500094=**

[0952 PST] METAR KCQT 261752Z AUTO 00000KT 2 1/2SM HZ OVC015 15/10  
A3017 RMK AO2 SLP217 T01500100 10150 20144 51011=

At 0852 PST, KCQT reported a calm wind, visibility of 2 statute miles, haze, ceiling overcast at 1,500 feet agl, temperature of 15°C and a dew point temperature of 9°C, altimeter setting of 30.17 inches of mercury; remarks: automated station with a precipitation discriminator, sea level pressure of 1021.6 hPa, hourly temperature of 15.0°C and hourly dew point temperature of 9.4°C.

An ASOS was located at Bob Hope Airport (BUR) in Burbank, California, which was located about 17 miles east of the accident location at an elevation of 778 feet. Augmented reports from the BUR ASOS during the times surrounding the accident flight are presented here.

[0753 PST] METAR KBUR 261553Z 34006KT 3SM HZ OVC008 11/08 A3015 RMK  
AO2 SLP204 T01060078=

[0853 PST] METAR KBUR 261653Z 34004KT 3SM HZ OVC011 11/08 A3016 RMK  
AO2 SLP208 T01110078=

**[0916 PST] SPECI KBUR 261716Z 00000KT 2 1/2SM HZ OVC011 12/08 A3016  
RMK AO2 T01170083=**

[0953 PST] METAR KBUR 261753Z 00000KT 2 1/2SM HZ OVC011 12/09 A3016  
RMK AO2 SLP208 T01220089 10122 20100 53003=

At 0916 PST, BUR reported a calm wind, visibility of two and a half statute miles, haze, ceiling overcast at 1,100 feet agl, temperature of 12°C and a dew point temperature of 8°C, altimeter setting of 30.16 inches of mercury; remarks: automated station with a precipitation discriminator, hourly temperature of 11.7°C and hourly dew point temperature of 8.3°C.

An ASOS was located at Van Nuys Airport (VNY) in Van Nuys, California, which was located about 11 miles east-northeast of the accident location at an elevation of 802 feet. Augmented reports from the VNY ASOS during the times surrounding the accident flight are presented here.

[0821 PST] SPECI KVNY 261621Z 17003KT 2 1/2SM HZ OVC011 12/09 A3015 RMK  
AO2 T01170089=

[0851 PST] METAR KVNY 261651Z 00000KT 2 1/2SM HZ OVC011 12/09 A3016  
RMK AO2 SLP211 T01170089=

**[0951 PST] METAR KVNY 261751Z 00000KT 2 1/2SM HZ OVC013 12/09 A3016  
RMK AO2 SLP212 T01220089 10122 20111 51010=**

[1051 PST] METAR KVNY 261851Z 0000KT 2 1/2SM HZ OVC014 13/09 A3018  
RMK AO2 SLP218 T01280089=

At 0951 PST, VNY reported a calm wind, visibility of two and a half statute miles, haze, ceiling overcast at 1,300 feet agl, temperature of 12°C and a dew point temperature of 9°C, altimeter setting of 30.16 inches of mercury; remarks: automated station with a precipitation discriminator, sea level pressure 1021.2 hPa, hourly temperature of 12.2°C and hourly dew point temperature of 8.9°C, six-hour maximum temperature of 12.2°C, six-hour minimum temperature of 11.1°C, atmospheric pressure increased by 1.0 hPa over the previous three hours.

An ASOS was located at Camarillo Airport (CMA) in Camarillo, California, which was located about 20 miles west-northwest of the accident location at an elevation of 77 feet. CMA was the destination airport for the accident flight. Augmented reports from the CMA ASOS during the times surrounding the accident flight are presented here.

[0755 PST] METAR KCMA 261555Z 07003KT 4SM HZ OVC013 14/11 A3016 RMK  
AO2 SLP221 T01390106=

[0855 PST] METAR KCMA 261655Z 08008KT 4SM HZ OVC014 14/11 A3017 RMK  
AO2 SLP225 T01390106=

**[0905 PST] SPECI KCMA 261705Z 08007KT 4SM HZ OVC016 14/11 A3017 RMK  
AO2 T01390106=**

**[0955 PST] METAR KCMA 261755Z 03003KT 4SM HZ OVC017 15/11 A3019  
RMK AO2 SLP233 T01500106 10150 20117 53017=**

[1055 PST] METAR KCMA 261855Z 11005KT 5SM HZ OVC026 16/11 A3017 RMK  
AO2 SLP227 T01610106=

At 0905 PST, CMA reported a wind from 080° at 7 knots, visibility of 4 statute miles, haze, ceiling overcast at 1,600 feet agl, temperature of 14°C and a dew point temperature of 11°C, altimeter setting of 30.17 inches of mercury; remarks: automated station with a precipitation discriminator, hourly temperature of 13.9°C and hourly dew point temperature of 10.6°C.

At 0955 PST, CMA reported a wind from 030° at 3 knots, visibility of 4 statute miles, haze, ceiling overcast at 1,700 feet agl, temperature of 15°C and a dew point temperature of 11°C, altimeter setting of 30.19 inches of mercury; remarks: automated station with a precipitation discriminator, sea-level pressure of 1023.3 hPa, hourly temperature of 15.0°C and hourly dew point temperature of 10.6°C, six-hour maximum temperature of 15.0°C, six-hour minimum temperature of 11.7°C, atmospheric pressure increased by 1.7 hPa over last three hours.

Figures 5-8 present plots of near-surface relative humidity observations from the accident region during the times leading to and including the accident time and have been taken from the NWS Weather and Hazards Data Viewer.<sup>6</sup> These figures include observations from public and private

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<sup>6</sup> <https://www.wrh.noaa.gov/map/>

weather observing systems and calibration, maintenance and siting standards for many of these stations, as well as their overall quality of data, are not known. Figure 8 includes an overlay of the accident aircraft's flight track based on automatic dependent surveillance–broadcast (ADS-B) data, which is available in the docket for this investigation.

These figures present numerous stations depicting near-surface relative humidity values of 100 percent near the accident site between about 0700 and 0945 PST. During this time frame, stations to the northeast of the accident site in the San Fernando Valley and along the accident aircraft's route of flight reported near-surface relative humidity values less than, and in some locations over 10 or 15 percentage points lower than, the accident area.<sup>7</sup>

A private weather station (SE284) from Southern California Edison (SCE) of unknown type was located about 1.5 miles northeast of the accident site at an elevation of about 1,150 feet. Reporting of certain parameters<sup>8</sup> from SE284 (rounded to nearest whole numbers) during the times surrounding the accident time are presented here. Temperatures are in °F, relative humidity is in percentages, wind magnitudes are in miles-per-hour.

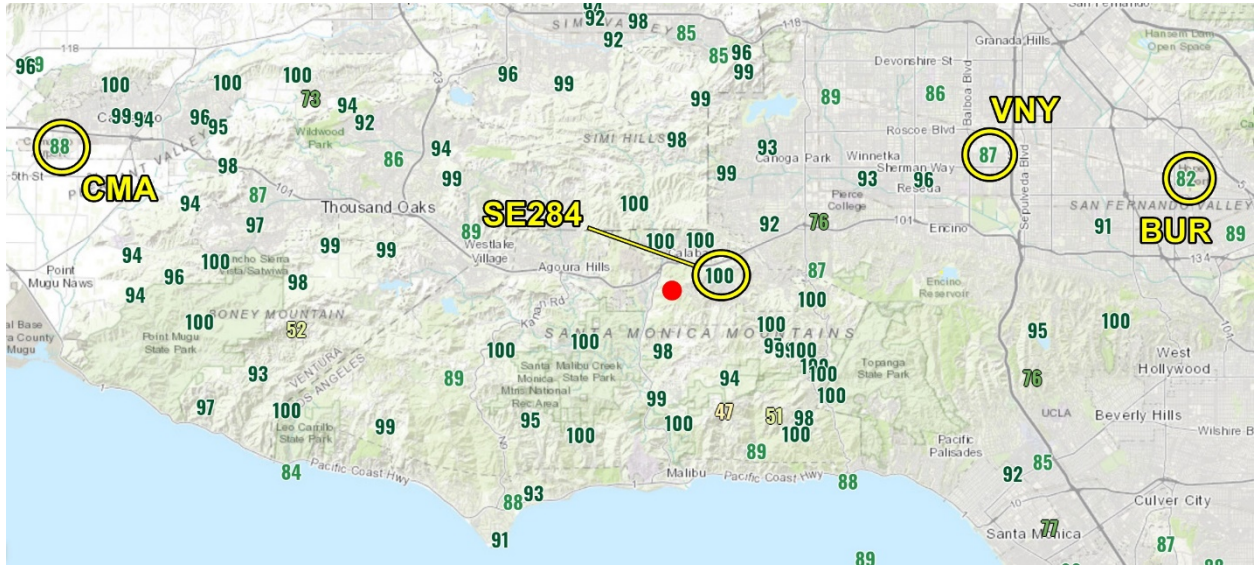
<u>Time</u>	<u>Temp</u>	<u>DTemp</u>	<u>RH</u>	<u>W Mag</u>	<u>W Dir</u>	<u>G Mag</u>
0650	48	48	100	0	303°	1
0700	47	47	100	0	---	0
0720	48	48	100	0	248°	3
0730	48	48	100	2	251°	5
0740	48	48	100	3	279°	5
0750	48	48	100	1	293°	3
0700	48	48	100	1	317°	2
0820	48	48	100	0	307°	2
0830	48	48	100	1	082°	2
0840	48	48	100	1	093°	2
0850	48	48	100	0	329°	2
0900	48	48	100	0	107°	1
0920	49	49	100	0	115°	2
0930	49	49	100	1	075°	2
0940	49	49	100	2	085°	4
0950	49	49	100	0	033°	1
1000	49	49	100	2	081°	4
1020	50	50	100	5	266°	8
1030	50	50	100	4	262°	9
1040	50	50	100	3	265°	6
1050	50	50	100	2	265°	5

<sup>7</sup> The following link can be used to assess elevations for each station (hovering over or clicking each station will display its metadata):

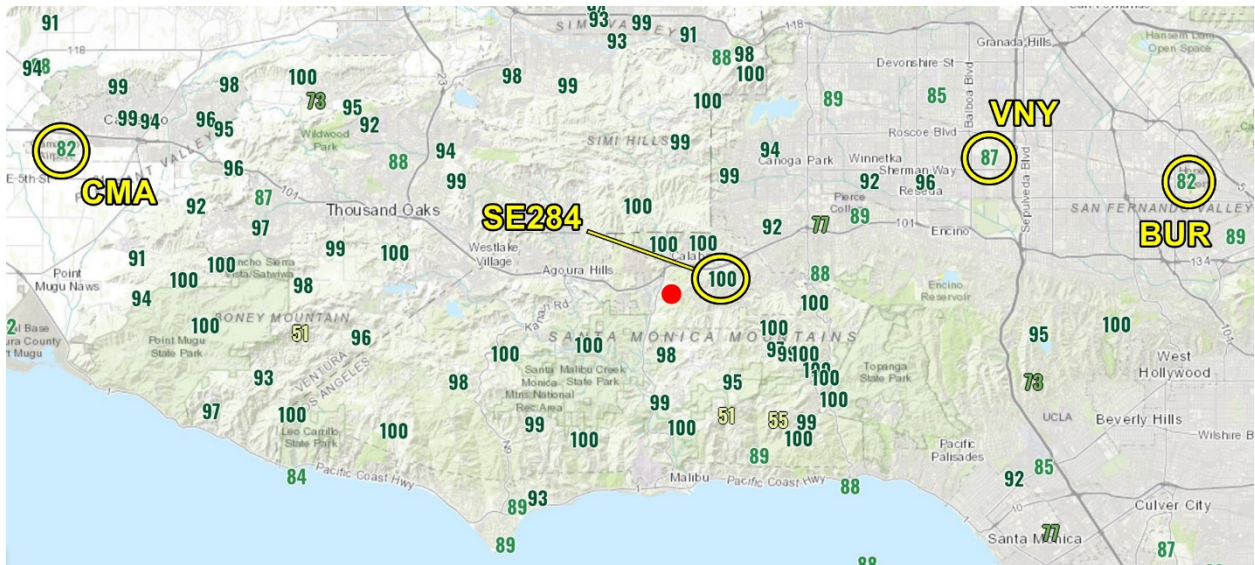
[http://www.wrh.noaa.gov/map/?&zoom=11&scroll\\_zoom=false&center=34.11834210562594,-118.49166870117189&boundaries=false,false,false,false,false,false,false,false,false&tab=observation&obs=true&obs\\_type=relative\\_humidity&obs\\_popup=true&obs\\_density=10&obs\\_provider=ALL](http://www.wrh.noaa.gov/map/?&zoom=11&scroll_zoom=false&center=34.11834210562594,-118.49166870117189&boundaries=false,false,false,false,false,false,false,false,false&tab=observation&obs=true&obs_type=relative_humidity&obs_popup=true&obs_density=10&obs_provider=ALL)

<sup>8</sup> Temp=temperature; DTemp=dewpoint temperature; RH=relative humidity; W\_Mag=average wind magnitude; W\_Dir=average wind direction; G\_Mag=gust wind magnitude

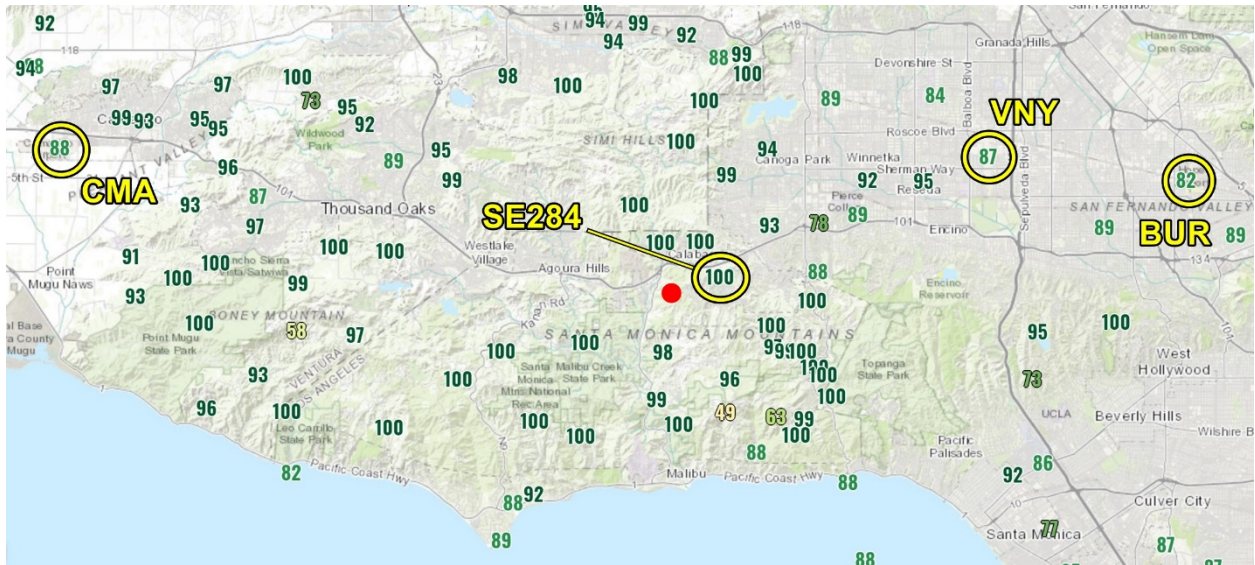
1100	51	50	100	2	259°	4
1120	52	51	96	1	256°	4



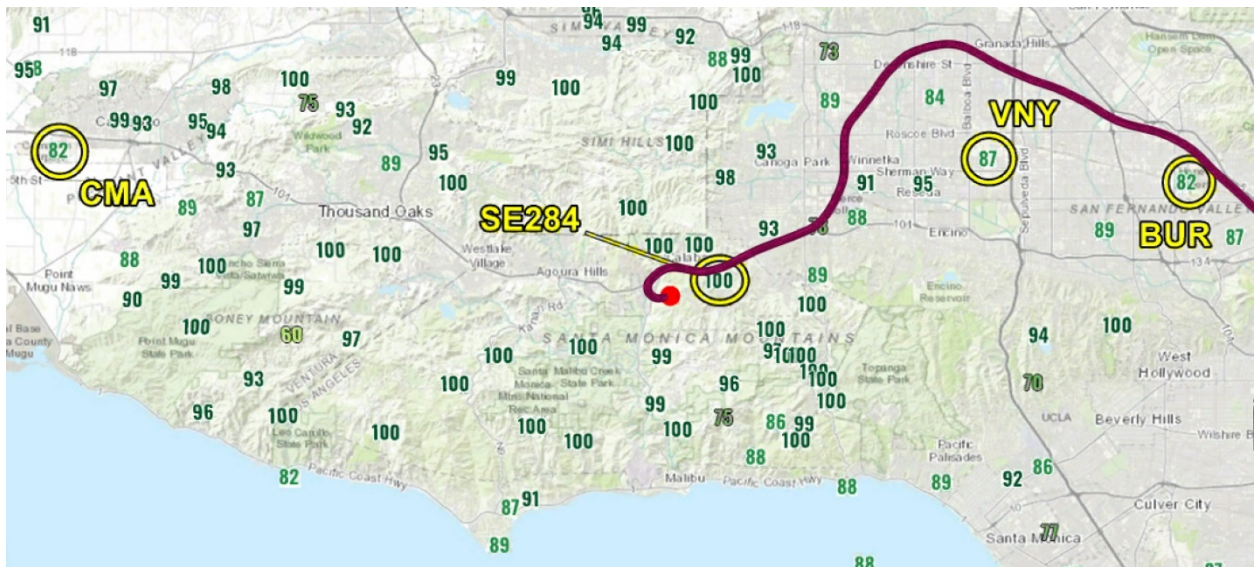
**Figure 5** – Plot of near-surface relative humidity values (in percentages) for the accident area as of 0700 PST taken from the NWS Weather and Hazards Data Viewer. The accident location is denoted by the red circle.



**Figure 6** – Plot of near-surface relative humidity values (in percentages) for the accident area as of 0800 PST taken from the NWS Weather and Hazards Data Viewer. The accident location is denoted by the red circle.



**Figure 7** – Plot of near-surface relative humidity values (in percentages) for the accident area as of 0900 PST taken from the NWS Weather and Hazards Data Viewer. The accident location is denoted by the red circle.



**Figure 8** – Plot of near-surface relative humidity values (in percentages) for the accident area as of 0945 PST taken from the NWS Weather and Hazards Data Viewer. The accident location is denoted by the red circle. The accident aircraft's ADS-B flight track is represented by the purple line.

#### 4.0 Terminal Aerodrome Forecasts

Presented here are applicable Terminal Aerodrome Forecasts (TAFs) issued by the NWS for SNA, BUR, VNY and CMA. According to NWS Instruction 10-813, TAFs are valid for an area within 5 statute miles of the center of an airport's runway complex.<sup>9</sup>

At 0340 PST, a TAF was issued for SNA that forecasted for the accident aircraft's departure time: wind variable at 4 knots, visibility of 6 statute miles, haze, ceiling broken at 1,000 feet agl.

TAF KSNA 261140Z 2612/2712 VRB04KT 5SM HZ OVC009  
**FM261500 VRB04KT 6SM HZ BKN010**  
FM261730 22006KT P6SM SCT250  
FM270400 VRB04KT P6SM OVC010=

At 0746 PST, a TAF was issued for BUR that forecasted for the period between 0900 and 1100 PST: wind variable at 3 knots, visibility of 5 statute miles, haze, ceiling broken at 1,300 feet agl.

KBUR 261546Z 2616/2712 VRB05KT 2SM BR OVC007  
**FM261700 VRB03KT 5SM HZ BKN013**  
FM261900 17009KT P6SM FEW018  
FM270200 34008KT P6SM SKC  
FM270600 VRB03KT P6SM SKC=

At 0856 PST, a TAF was issued for BUR that forecasted for the period between 0900 and 1100 PST: wind variable at 5 knots, visibility of 3 statute miles, mist, ceiling overcast at 1,100 feet agl.

KBUR 261656Z **2617/2712 VRB05KT 3SM BR OVC011**  
FM261900 17009KT P6SM FEW018  
FM270200 34008KT P6SM SKC  
FM270600 VRB03KT P6SM SKC=

At 0746 PST, a TAF was issued for VNY that forecasted for the period between 0900 and 1100 PST: wind variable at 3 knots, visibility of 4 statute miles, haze, ceiling broken at 1,200 feet agl.

KVNY 261546Z 2616/2712 VRB05KT 2SM BR OVC008  
**FM261700 VRB03KT 4SM HZ BKN012**  
FM261900 14008KT P6SM FEW017  
FM270100 35015G23KT P6SM SKC  
FM270800 35012KT P6SM SKC=

At 0858 PST, a TAF was issued for VNY that forecasted for the period between 0900 and 0930 PST: wind variable at 5 knots, visibility of 2 statute miles, mist, ceiling overcast at 1,000 feet agl.

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<sup>9</sup> <https://www.nws.noaa.gov/directives/sym/pd01008013curr.pdf>

The TAF forecasted for the period between 0930 and 1100 PST: wind variable at 5 knots, visibility of 4 statute miles, haze, ceiling broken at 1,200 feet agl.

**KVNY 261658Z 2617/2712 VRB05KT 2SM BR OVC010**  
**FM261730 VRB05KT 4SM HZ BKN012**  
FM261900 14008KT P6SM FEW017  
FM270100 35015G23KT P6SM SKC  
FM270800 35012KT P6SM SKC=

At 0403 PST a TAF was issued for CMA that forecasted for the period between 0400 and 1000 PST: wind variable at 3 knots, visibility of 4 statute miles, mist, scattered clouds at 800 feet agl, ceiling overcast at 1,700 feet agl; temporary conditions<sup>10</sup> between 0600 and 0800 PST: visibility of 3 statute miles, light drizzle, mist, ceiling overcast at 1,700 feet agl. The TAF forecasted for the period between 1000 and 1300 PST: wind from 240° at 8 knots, visibility greater than 6 statute miles, ceiling broken at 1,800 feet agl.

**TAF KCMA 261203Z 2612/2712 VRB03KT 4SM BR SCT008 OVC017**  
**TEMPO 2614/2616 3SM -DZ BR OVC008**  
**FM261800 24008KT P6SM BKN018**  
FM262100 25010KT P6SM SCT023  
FM270300 27005KT P6SM SKC  
FM270700 06006KT P6SM SKC=

At 0853 PST a TAF was issued for CMA that forecasted for the period between 0900 and 1000 PST: wind variable at 5 knots, visibility of 4 statute miles, mist, scattered clouds at 800 feet agl, ceiling overcast at 1,500 feet agl. The TAF forecasted for the period between 1000 and 1300 PST: wind from 240° at 8 knots, visibility greater than 6 statute miles, ceiling broken at 1,800 feet agl.

**KCMA 261658Z 2617/2712 VRB05KT 4SM BR SCT008 OVC015**  
**FM261800 24008KT P6SM BKN018**  
FM262100 25010KT P6SM SCT023  
FM270300 27005KT P6SM SKC  
FM270700 06006KT P6SM SKC=

## **5.0 Witness Information**

Witness information (written correspondence) pertinent to the meteorological investigation is provided in Attachment 2. This includes information from eyewitnesses to the meteorological conditions near the accident site, an email submission from a Captain with the Los Angeles Fire Department and an email submission of videos from a “dash cam” in a car that drove the 101 Freeway near the accident site near the accident time. The dash cam videos may be found in the docket for this investigation.

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<sup>10</sup> 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.

## 6.0 Regional Cameras

Written correspondence related to regional camera data considered during the meteorological investigation can be found in Attachment 3.

Imagery from ALERTWildfire cameras located in the accident region for times surrounding the accident time were provided by SCE by way of the University of Nevada Reno (UNR).<sup>11</sup> These imagery were taken from the following cameras, whose locations are presented in Figure 9: Castro 2, Gold 1, Gold 2, Helibase 69B, Helibase 69B West, Rasnow 1, Rasnow 2, Saddle 1, Saddle 2, Sage Peak 2, Topanga Canyon 1 and Topanga Canyon 2. Video loops of the camera images may be found in the docket for this investigation. Several images are reproduced below.



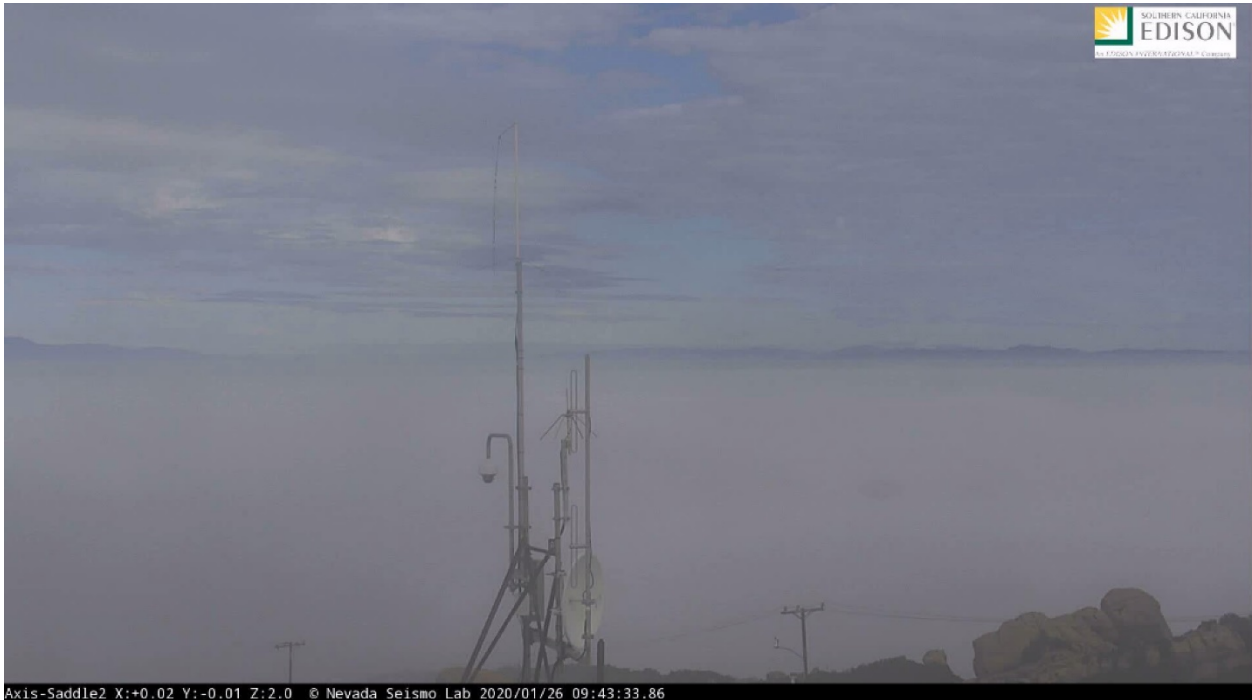
**Figure 9** – ALERTWildfire camera locations. Camera elevations provided by UNR. Yellow text identifies approximate distance from camera to accident location. Accident location denoted by the red circle.

<sup>11</sup> Further information on ALERTWildfire can be found here: <http://www.alertwildfire.org/about.html>





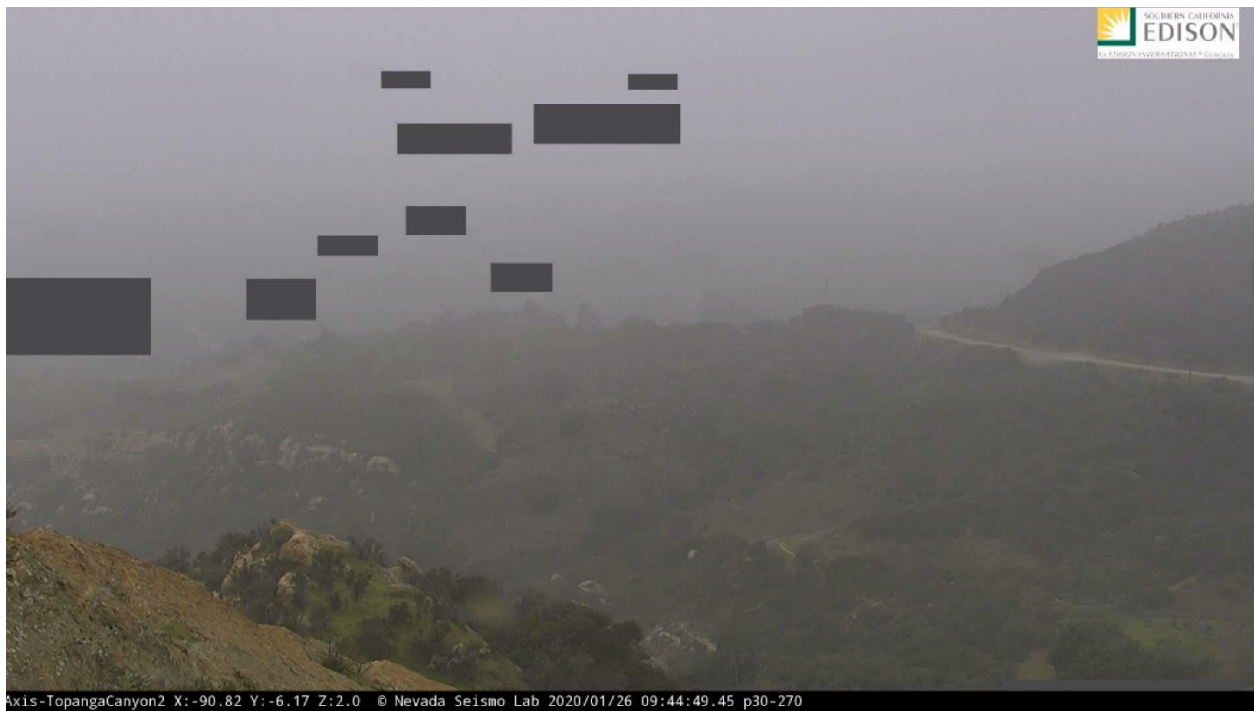
**Figure 10** – ALERTWildfire Castro 2 camera image from 0943:23 PST, facing east-northeast.



**Figure 11** – ALERTWildfire Saddle 2 camera image from 0943:33 PST, facing north.



**Figure 12** – ALERTWildfire Helibase 69B West camera image from 0944:57 PST, facing west.



**Figure 13** – ALERTWildfire Topanga Canyon 2 camera image from 0944:49 PST, facing west.



**Figure 14** – ALERTWildfire Sage Peak 2 camera image from 0943:38 PST, facing south.

A west-facing video camera connected to the Bloomsy network<sup>12</sup> was located almost two miles east of the accident location (see Figure 15) at an elevation of about 1,320 feet and captured images on the accident day. Footage from this camera can be found in the docket for this investigation. An image from this camera is presented in Figure 16.



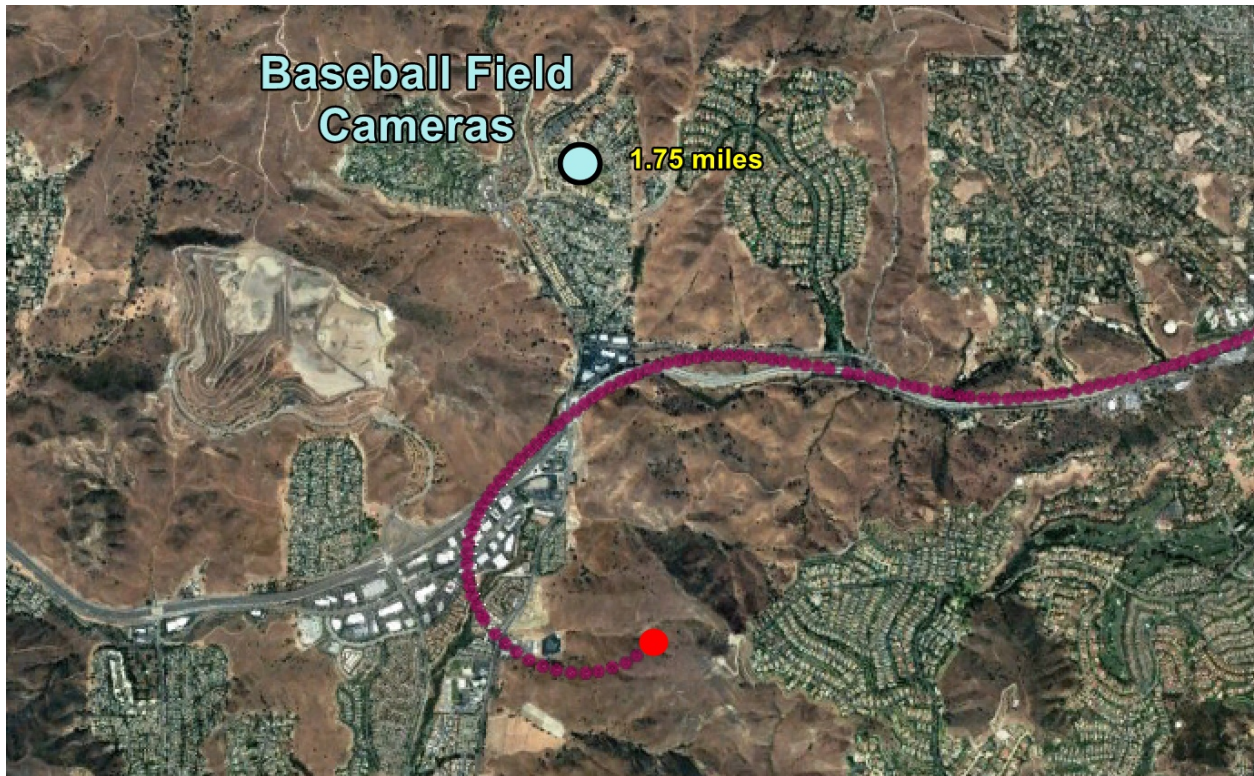
**Figure 15** – Bloomsy network west-facing camera location. Yellow text identifies approximate distance from camera to accident location. Accident location denoted by the red circle.

<sup>12</sup> For more information see: <https://www.bloomsy.com/>



**Figure 16** – West-facing Bloomsy network camera image from 0947 PST.

Several south-facing cameras located at baseball fields north of the accident site (see Figure 17) recorded conditions at the time of the accident. Footage recorded from these cameras during the accident time can be found in the docket for this investigation. A visibility analysis titled *Video-Based Visibility Analysis* was performed using these cameras' footage and can also be found in the docket for this investigation. The time stamps in these videos did not reflect real-time. The *Video-Based Visibility Analysis* documents the clocks' errors. An image from these cameras is presented in Figure 18.



**Figure 17** – Baseball field camera locations. Yellow text identifies approximate distance from cameras to accident location. Accident location denoted by the red circle. The accident aircraft's ADS-B flight track is plotted by the purple circles/line.



**Figure 18** – Still image from one of the south-facing baseball field cameras about the accident time. See the *Video-Based Visibility Analysis* in the docket for this investigation for further information.

Footage from a west-facing camera located under the accident aircraft's flight path (see Figure 19) operated by the City of Calabasas can be found in the docket for this investigation. Figures 20 and 21 present still images from this footage (note: the time stamp in the video was 59 minutes and 37 seconds behind real time).



**Figure 19** – City of Calabasas west-facing camera location. Yellow text identifies approximate distance from cameras to accident location. Accident location denoted by the red circle. The accident aircraft's ADS-B flight track is plotted by the purple circles/line with aircraft positions matching timestamps in Figures 20 and 21 identified.



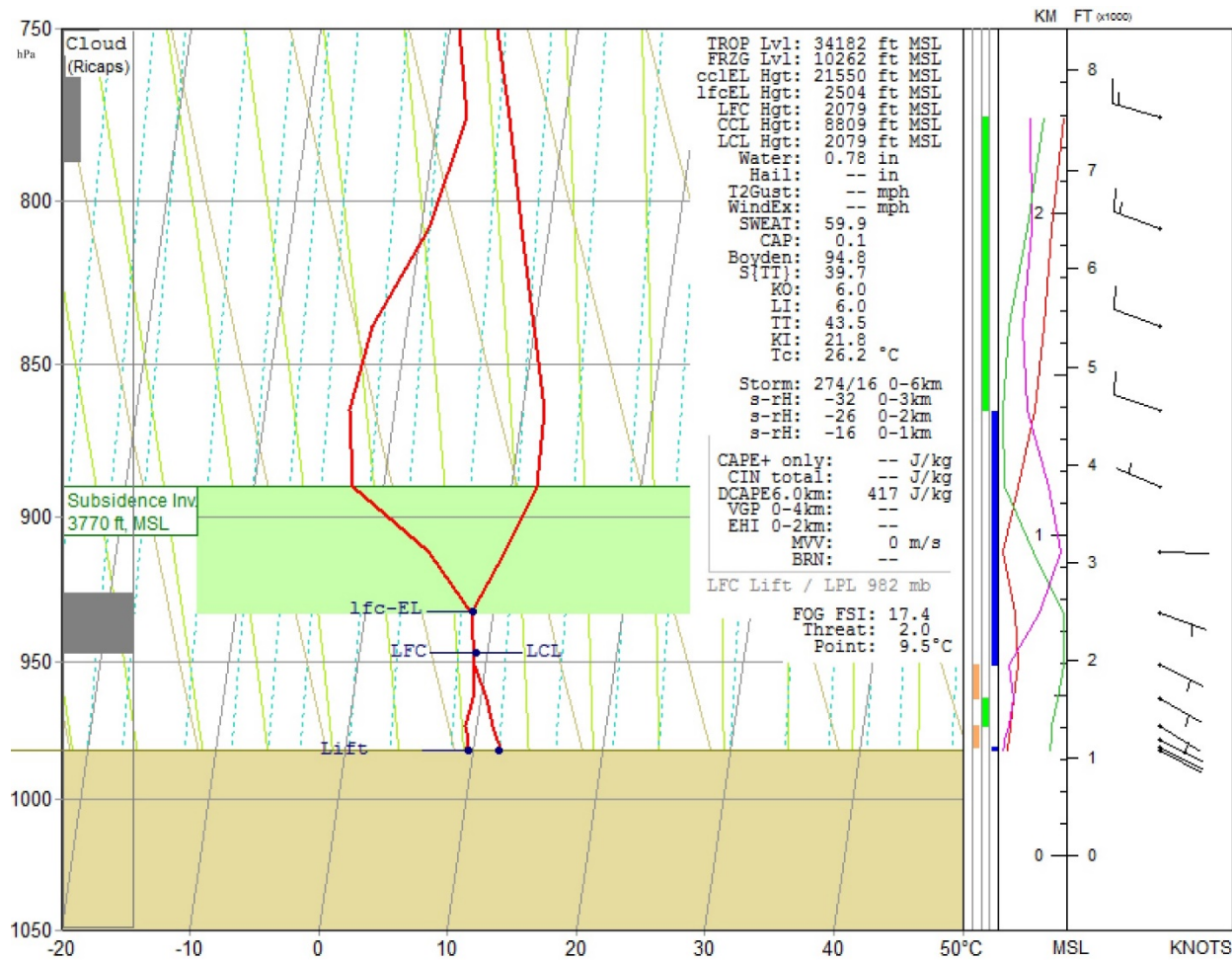
**Figure 20** – City of Calabasas west-facing camera image from 0944:20 PST. Accident aircraft circled in red moving away from the camera.



**Figure 21** – City of Calabasas west-facing camera image from 0944:23 PST. Accident aircraft is not pictured in the video.

## 7.0 Model Sounding

A High-Resolution Rapid Refresh (HRRR) model<sup>13</sup> sounding (figure 22) for the accident location at 1000 PST was retrieved from the National Oceanic and Atmospheric Administration’s (NOAA) Air Resources Laboratory.<sup>14</sup> Below 2,500 feet the wind was from the east-southeast at less than 5 knots. Above this level the wind veered very slightly with height to a 1 knot easterly wind at about 3,100 feet. Above this level the wind was from the west-northwest at magnitudes of about 10 knots or less below 5,500 feet. The Rawinsonde OBServation Program identified overcast stratus cloud conditions between about 2,000 and 2,600 feet. A temperature inversion was noted between about 2,400 and 3,700 feet.



**Figure 22** – HRRR model sounding data in SkewT/LogP format for 1000 PST at the accident site, surface to 750 hPa.

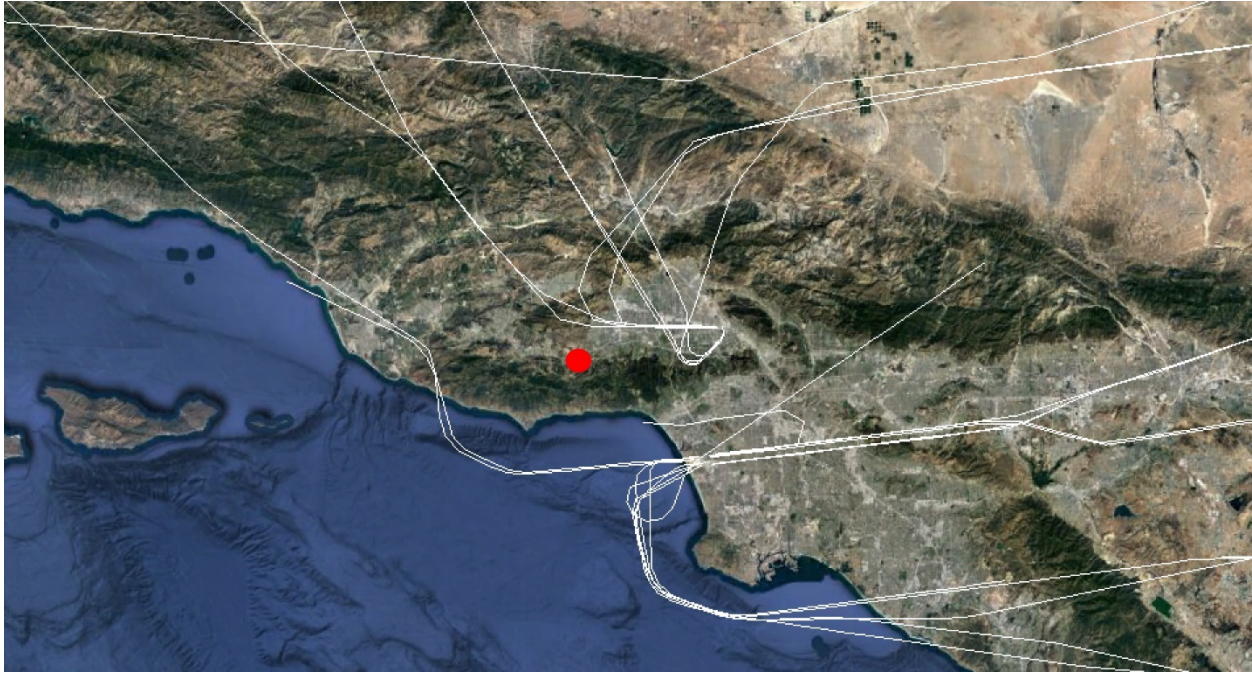
<sup>13</sup> The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data are assimilated in the HRRR every 15 minutes over a one-hour period.

<sup>14</sup> For levels where the model dew point temperature exceeded the model air temperature, the dew point temperature was reduced to the air temperature.



## 8.0 AMDAR

Aircraft Meteorological Data Relay (AMDAR) data<sup>15</sup> from aircraft in the accident region between 0900 and 1000 PST were obtained from NOAA and are available in Attachment 4. Figure 23 presents plots of the flight tracks of these aircraft.



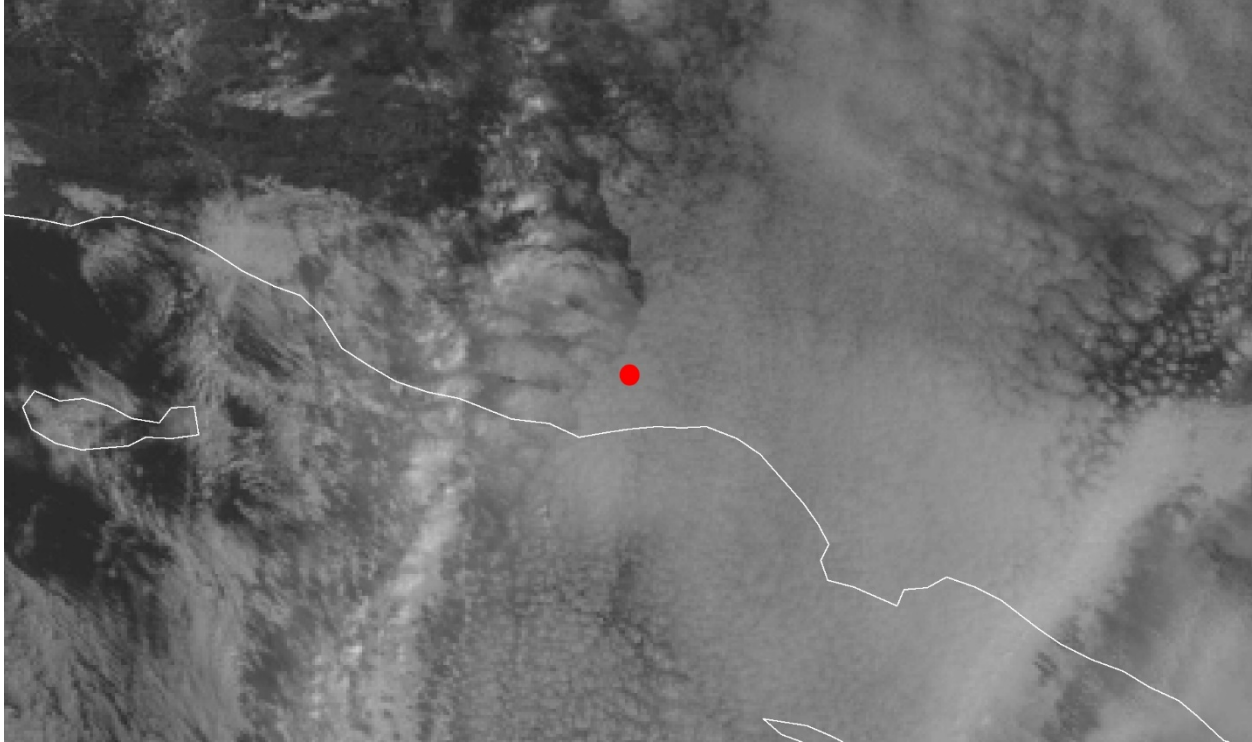
**Figure 23** – Flight tracks (white lines) for aircraft whose AMDAR data are provided in Attachment 4. The accident location is denoted by the red circle.

## 9.0 Satellite Imagery

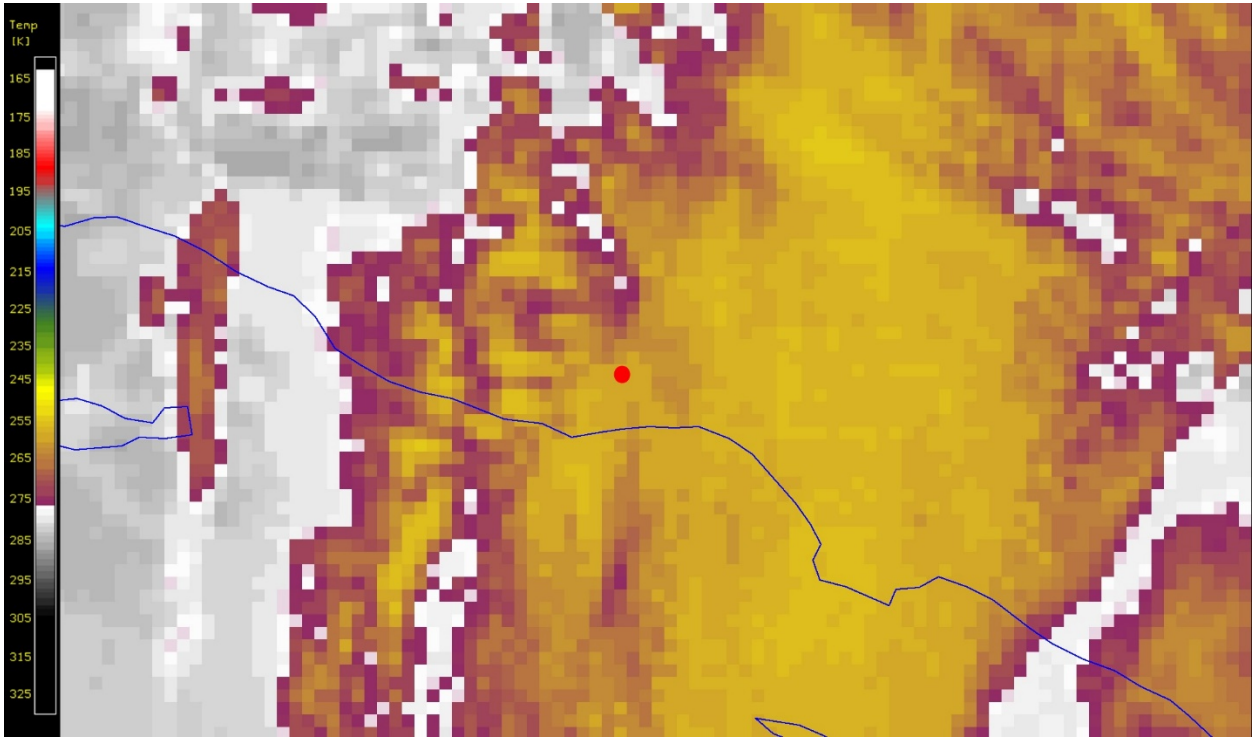
Geostationary Operational Environmental Satellite (GOES)-13 visible ( $0.63\mu\text{m}$ ) and infrared ( $10.7\mu\text{m}$ ) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 0914 PST is presented in Figures 24-26. The GOES-17 visible imagery identified clouds over the accident region. The infrared brightness temperature imagery identified cloud-top temperatures over the accident location of  $-13^{\circ}\text{C}$ . When considering the HRRR model sounding,  $-13^{\circ}\text{C}$  corresponded to cloud top heights of about 16,400 feet (not depicted in Figure 22). It should be noted that these satellite images have not been corrected for any parallax error.

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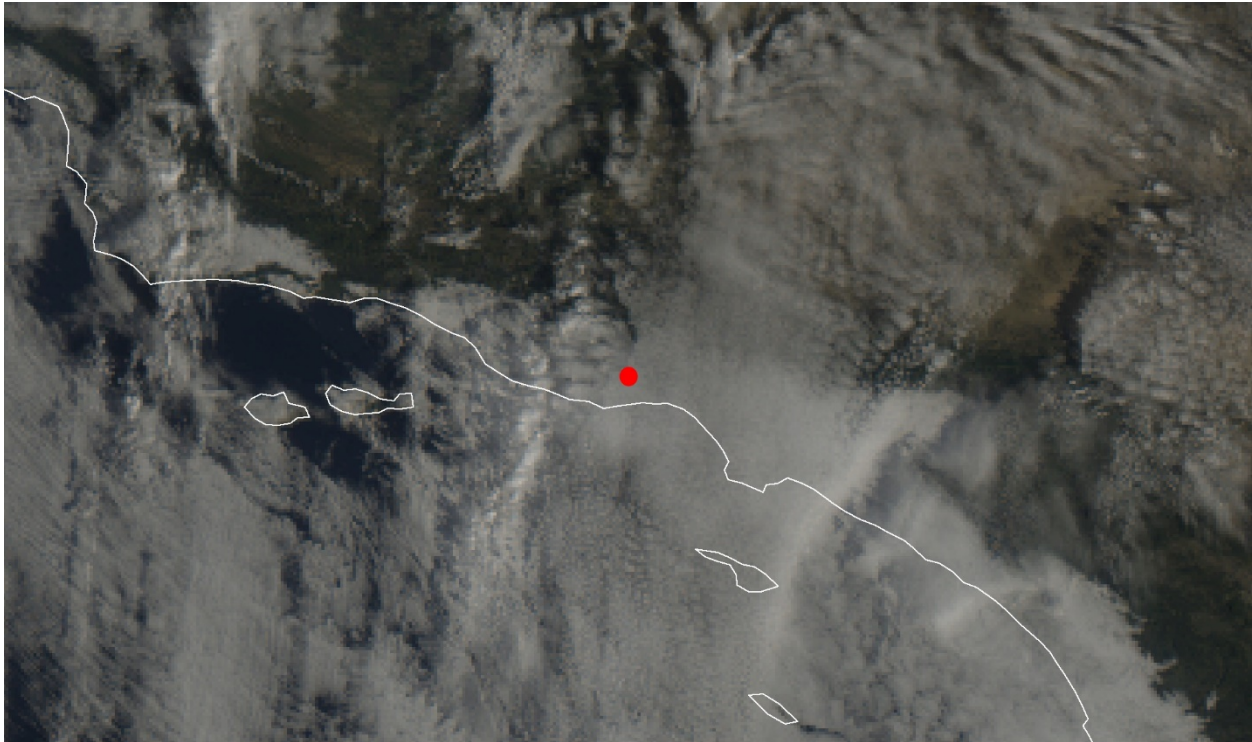
<sup>15</sup> For further information see: <https://amdar.noaa.gov/>



**Figure 24** – GOES-17 visible imagery from 0941 PST. Accident location denoted by red dot.



**Figure 25** – GOES-17 brightness temperature imagery from 0941 PST. Accident location denoted by red dot.



**Figure 26** – GOES-17 true-color imagery from 0941 PST. Accident location denoted by red dot.

## 10.0 Pilot Reports

There were eight publicly disseminated<sup>16</sup> pilot reports (PIREPs) made within 50 miles and two hours of the accident time.

At 0800 PST, a Boeing 737 aircraft at 800 feet over BUR reported seeing runway 08 in sight while on a three-mile final at 800 feet agl.

*BUR UA /OV BUR/TM 1600/FL008/TP B737/RM RY8 IN SIGHT ON A 3MI FINAL  
800AGL*

At 0820 PST, a Van's RV-8 aircraft at 1,200 feet two miles away on the 080° radial from CMA reported cloud bases at 1,300 feet with cloud tops at 2,600 feet.

*CMA UA /OV 08002/TM 1620/FL012/TP RV8/SK BASES AT 013 TOPS AT 026*

At 0853 PST, a CRJ-200 aircraft at 800 feet over BUR reported runway 08 in sight at 600 feet agl while on a two-mile final for runway 08.

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<sup>16</sup> These do not include pilot reports only broadcast via radio. For PIREPs broadcast via radio and captured on air traffic control frequencies, please see the Air Traffic Control Factual Report in the docket for this accident investigation.

*BUR UA /OV BUR/TM 1653/FL008/TP CRJ2/RM RY8 IN SIGHT 600AGL 2MI FINAL  
RY8*

At 0924 PST, a ERJ-135 aircraft at 800 feet over BUR reported runway 08 in sight at 700 feet agl while on a two-mile final for runway 08.

*BUR UA /OV BUR/TM 1724/FL008/TP E135/RM RY8 IN SIGHT 700 AGL 2MI FINAL  
RY8*

At 0948 PST, a Diamond DA42 Twin Star aircraft at 2,200 feet five miles away on the 200° radial from Long Beach Airport (LGB) in Long Beach, California, reported overcast clouds at 1,200 feet with cloud tops to 2,200 feet.

*LGB UA /OV LGB200005/TM 1748/FL022/TP DA42/SK OVC012-TOP022*

At 1105 PST, a Cessna 525B Citation CJ3 aircraft at 800 feet over BUR reported runway 08 in sight while on a two-mile final at 700 feet agl.

*BUR UA /OV BUR/TM 1905/FL008/TP C25B/RM RY8 IN SIGHT ON A 2MI FINAL  
700FT AGL*

At 1130 PST, a Boeing 737 aircraft at 800 feet over BUR reported runway 08 in sight while on a two and a half-mile final at 1,500 feet agl.

*BUR UA /OV BUR/TM 1930/FL008/TP B737/RM RY8 IN SIGHT IN A 2.5MI FINAL  
1500AGL*

At 1130 PST, a Boeing 737 aircraft at 2,600 feet over Los Angeles International Airport (LAX) in Los Angeles, California, reported cloud tops at 2,600 feet and cloud bases at 1,200 feet.

*LAX UA /OV LAX/TM 1930/FL026/TP 737/RM TOPS 026 BAS 012*

## **11.0 Aviation Section of the Area Forecast Discussions**

Presented here are the “Aviation” sections of AFDs issued by LOX as well as the NWS WFO in San Diego, California (SGX). Figure 27 depicts the County Warning Areas (areas of responsibility) of each of the WFOs that establish the geographic applicability of each product.

At 0452 PST, LOX issued the following Aviation section in an AFD. This Aviation section was originally developed at 0314 PST and first released with an AFD issued at 0409 PST. The same Aviation section was included with the next LOX AFD, which was issued at 0943 PST.

*FXUS66 KLOX 261252  
AFDLOX  
Area Forecast Discussion  
National Weather Service Los Angeles/Oxnard CA  
452 AM PST Sun Jan 26 2020*

*.AVIATION...26/1114Z.*

*At 0741Z, the marine layer depth was around 1700 feet deep at KLAX. The top of the inversion was near 2500 feet with a temperature of 16 degrees Celsius.*

*Low-to-moderate confidence in the current forecast. LIFR to IFR conditions should improve to the IFR to MVFR category by 17Z. IFR to MVFR conditions will likely linger at coastal terminals until as late as 22Z. There is a chance that coastal terminals may stay cloudy throughout the day.*

*KLAX...IFR to MVFR conditions will likely linger through at least 22Z. There is a 50 percent chance that MVFR conditions will continue into this evening, then lower to the IFR categories between 00Z and 03Z. Any east winds should remain less than 7 knots.*

*KBUR...IFR conditions will likely improve to MVFR between 14Z and 16Z, then linger through at least 18Z. There is a 30 percent chance of MVFR conditions lingering until as late as 22Z.*

At 0230 PST, SGX issued the following Aviation section in an AFD. This Aviation section was developed at 0200 PST.

*FXUS66 KSGX 261030*

*AFDSGX*

*Area Forecast Discussion*

*National Weather Service San Diego CA*

*230 AM PST Sun Jan 26 2020*

*.AVIATION...*

*261000Z...Coast/Valleys...BKN/OVC stratus/fog affecting areas up to 25 mi inland through around 17Z. Forecast is of moderate to high confidence with exception of KONT which will likely remain on the fringe of the low clouds, with about a 50% chance of low CIGS reducing VIS below 1SM.*

*Bases will be 500-1000 ft MSL with tops to 1200 ft MSL and areas of terrain obscured. Vis will generally be 3-5 miles, but local vis below 1 mile will occur over higher coastal terrain, including the San Diego County mesas and some of the coastal valleys. Only minor VIS restrictions anticipated at KSAN and KSNA. Clouds clearing toward coast 17Z through 19Z, with lingering stratus possible into Sun afternoon at the beaches. More stratus, with bases a little higher than tonight, will spread inland Sun evening after 02Z.*

At 0827 PST, SGX issued the following Aviation section in an AFD. This Aviation section was developed at 0715 PST.

*FXUS66 KSGX 261627*

*AFDSGX*

*Area Forecast Discussion*

National Weather Service San Diego CA  
827 AM PST Sun Jan 26 2020

*.AVIATION...*

*261515Z...Coast/Valleys...BKN/OVC stratus/fog affecting areas up to 25 mi inland through mid morning with patchy DZ in the coastal valleys. Improving VIS at the coast with bases around 1500 ft MSL. The Inland Empire will continue cigs <500 ft MSL and areas of VIS below 1sm with gradual improvements by late morning. Clouds clearing toward coast mid morning, with lingering stratus possible into Sun afternoon at the beaches. More low clouds (generally 1000 ft MSL and above will spread inland Sun evening after 02Z.*

*Mountains/Deserts...SCT/BKN high clouds at/above 20000 ft MSL and unrestricted vis will continue through Sun night.*



**Figure 27** – Depiction of LOX and SGX County Warning Areas. Accident location denoted by red dot.

## 12.0 AIRMETs SIERRA

At 0645 PST, the NWS Aviation Weather Center issued Airmen's Meteorological Information (AIRMET) SIERRA advisories for instrument flight rule (IFR)<sup>17</sup> conditions in mist and fog and for mountain obscuration for areas that included the accident location (see Figure 28). These AIRMETs were valid at the accident time.

*WAUS46 KKCI 261445*

*WA6S*

*-SFOS WA 261445*

*AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 262100*

*AIRMET IFR...CA AND CSTL WTRS*

*FROM 20SW SNS TO 40WNW RZS TO 40N LAX TO 50SW HEC TO 40ESE MZB*

*TO 120SW MZB TO 110SW LAX TO 140SW SNS TO 20SW SNS*

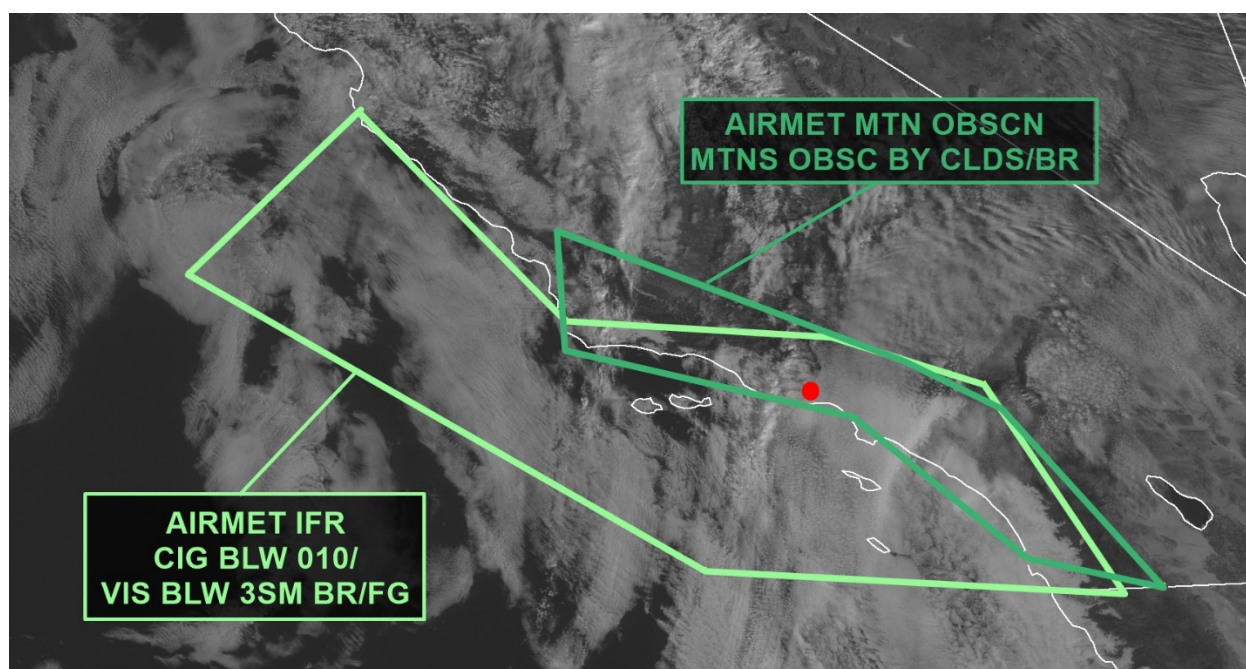
*CIG BLW 010/VIS BLW 3SM BR/FG. CONDS CONTG BYD 21Z THRU 03Z.*

*AIRMET MTN OBSCN...CA*

*FROM 70W EHF TO 40NE LAX TO 50WNW TRM TO 60S TRM TO MZB TO LAX*

*TO 40W RZS TO 70W EHF*

*MTNS OBSC BY CLDS/BR. CONDS CONTG BYD 21Z THRU 03Z.*



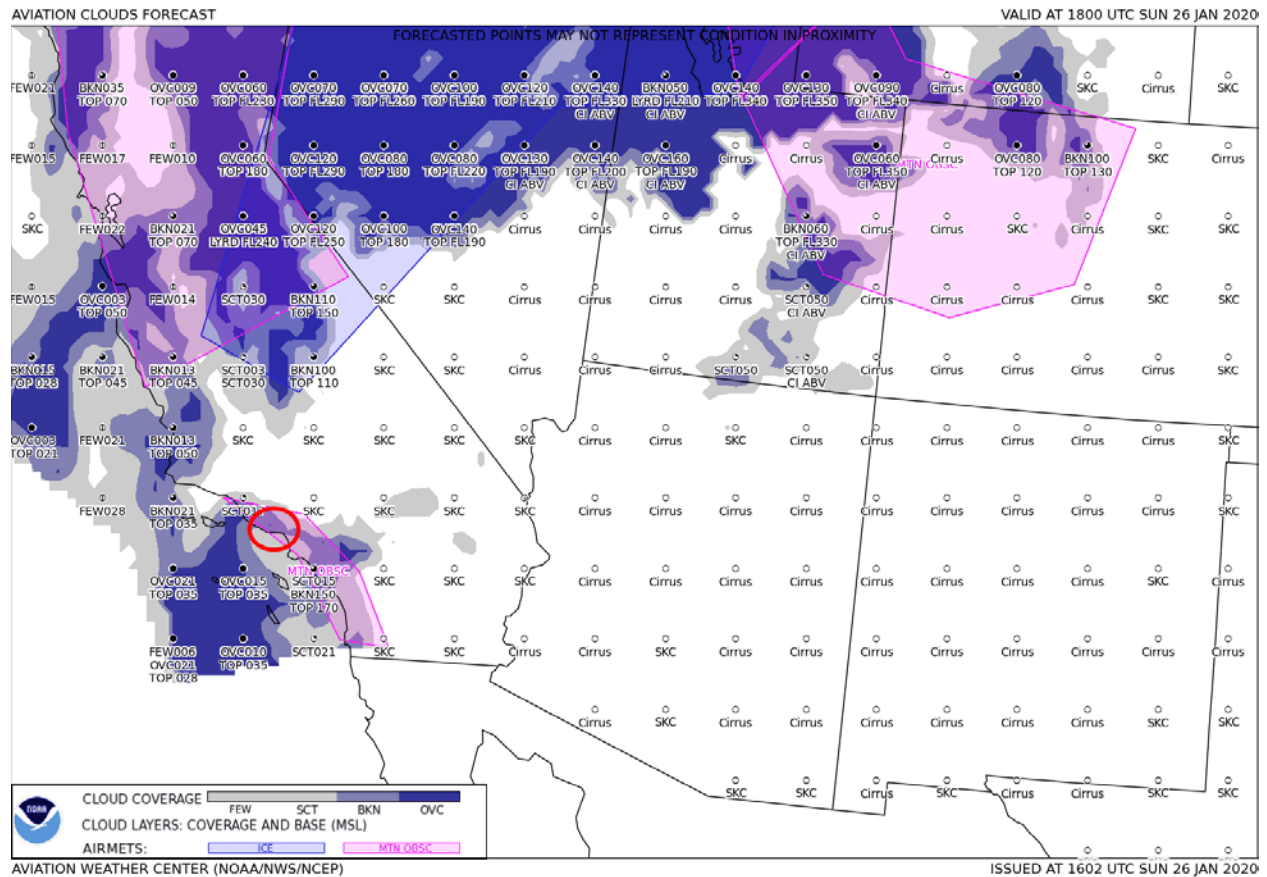
**Figure 28** – AIRMETs for IFR conditions and mountain obscuration active for the accident location at the accident time. Accident location denoted by the red dot.

<sup>17</sup> IFR conditions - Ceilings less than 1,000 feet agl and/or visibility less than three statute miles.

### 13.0 Graphical Forecasts for Aviation

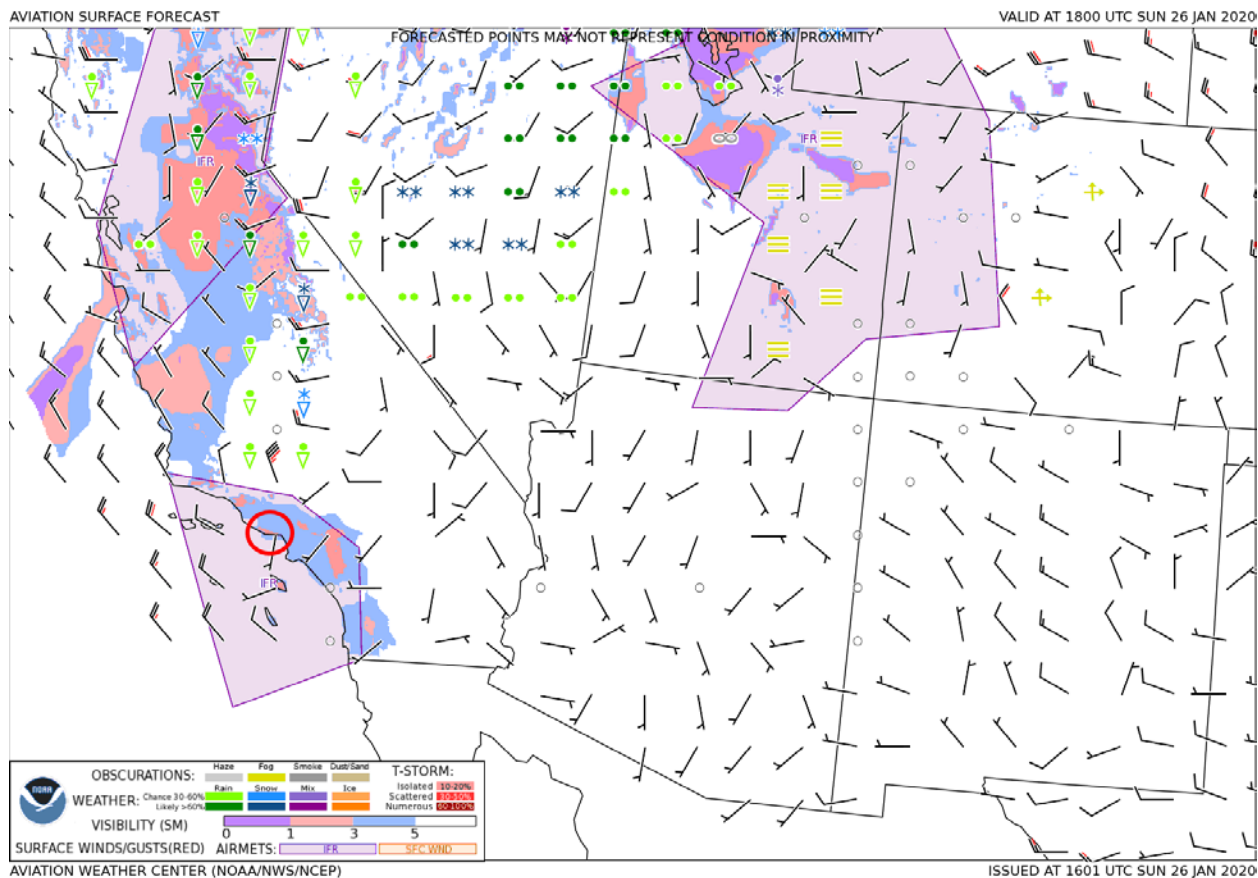
The Graphical Forecasts for Aviation (GFA) are intended to provide the necessary aviation weather information to give users a complete picture of the weather that might impact flight in the continental United States. Hourly model data and forecasts, including information on clouds, flight category, precipitation,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

The following images (Figures 29 and 30) depict GFA forecast information on sky condition, icing, mountain obscuration, IFR condition and surface wind Graphical-AIRMET (G-AIRMET) advisories, surface visibility, surface wind, precipitation, and other obscurations and hazards, valid for a time near the accident time.



**Figure 29** – GFA forecast imagery depicting sky condition and icing and mountain obscuration G-AIRMETs. Issued about 0800 PST and valid for 1000 PST. This GFA forecast imagery depicted broken sky conditions over the accident site with a point to the northwest of the accident site identifying scattered clouds at 1,700 feet above msl. A G-AIRMET for mountain obscuration was active for the accident location. The accident location is located within the red circle.





**Figure 30** – GFA forecast imagery depicting IFR conditions and surface wind G-AIRMETS, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 0800 PST and valid for 1000 PST. This GFA forecast imagery depicted surface visibilities as being between both 1 to 3 statute miles and 3 to 5 statute miles at or near the accident location. A southerly surface wind of 5 knots was depicted near the accident location along the coast. A G-AIRMET for IFR conditions was active over the accident region. The accident location is located within the red circle.

#### 14.0 SIGMETs

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

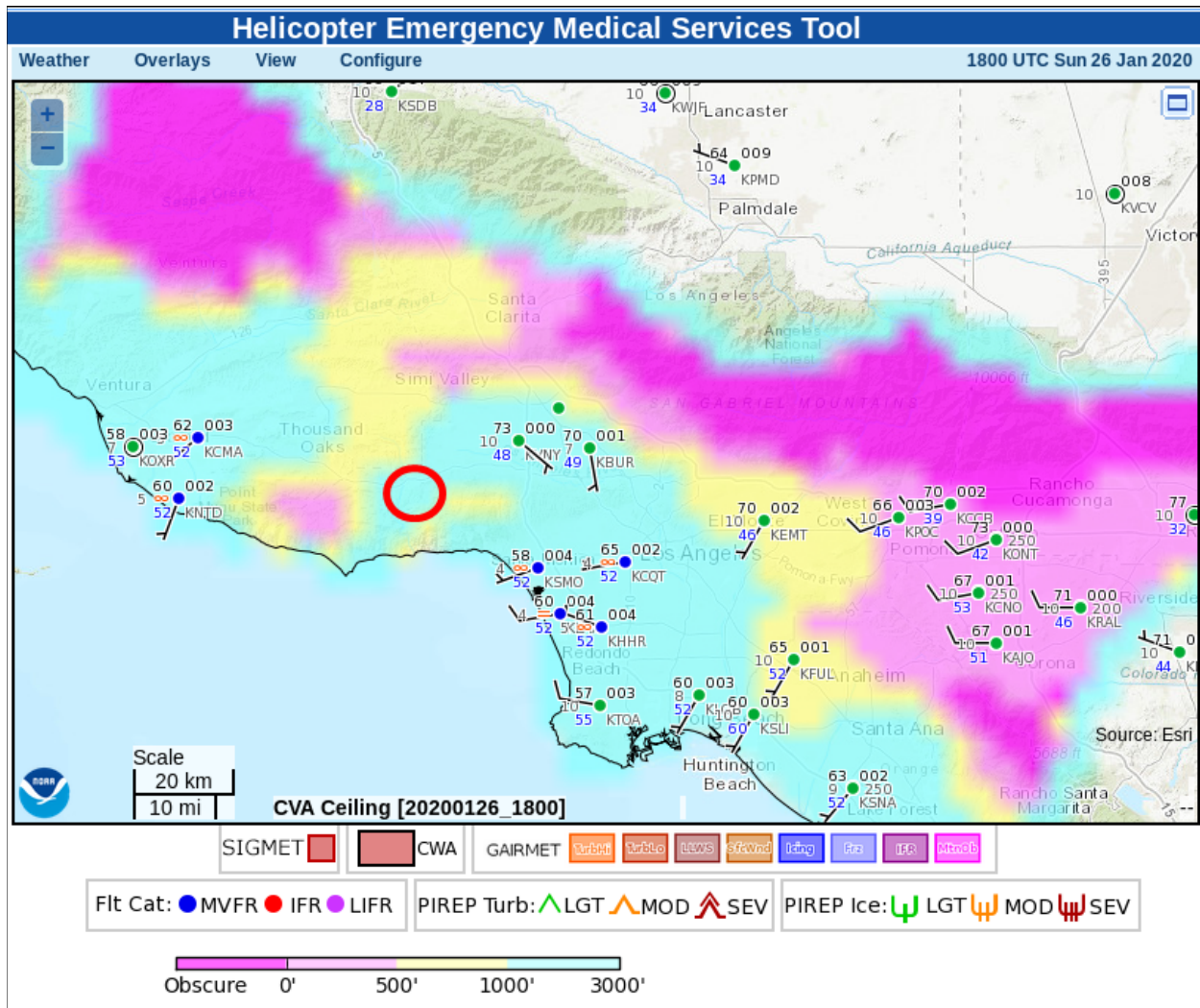
#### 15.0 Center Weather Service Unit Products

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

## 16.0 HEMS Tool

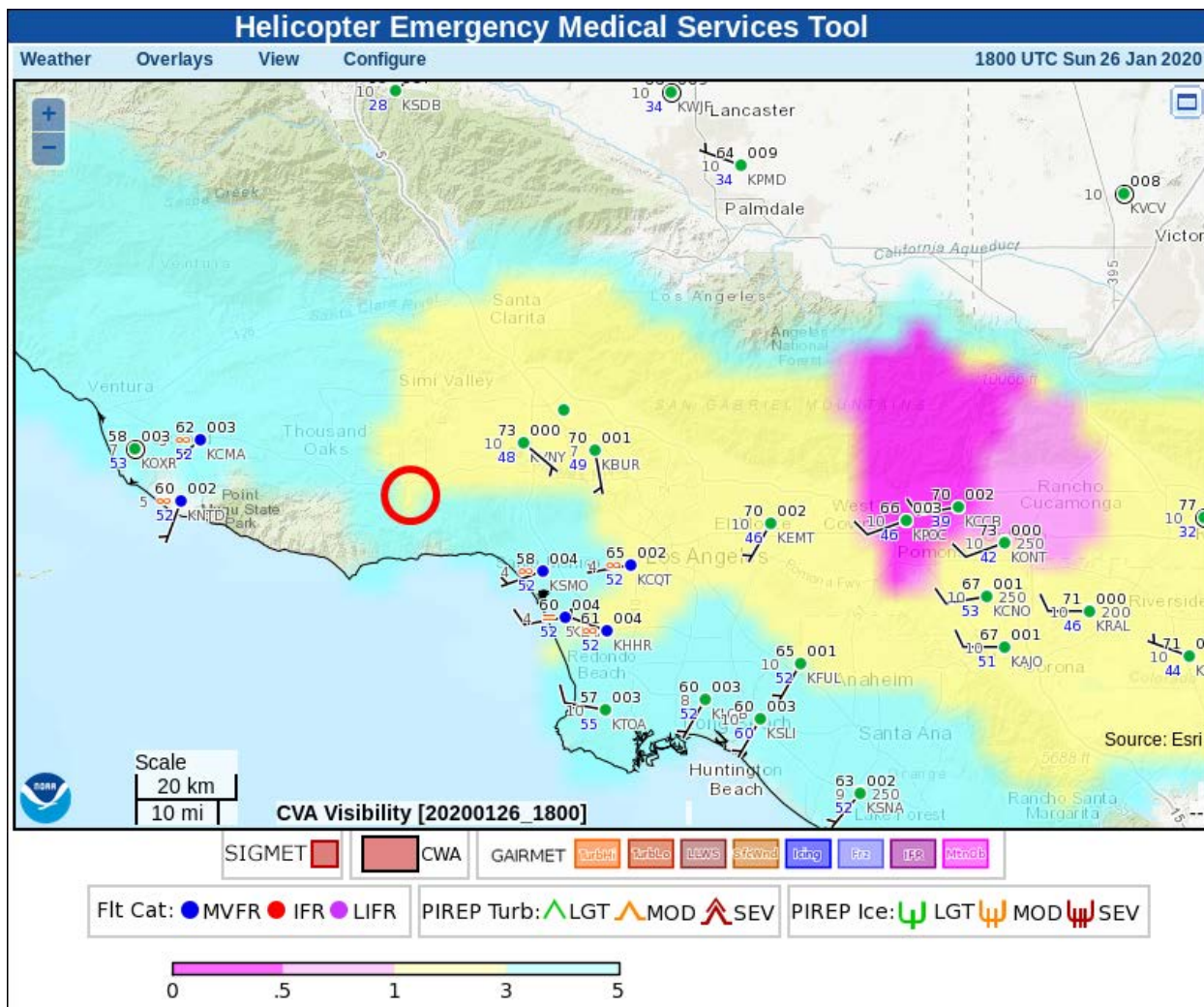
The helicopter emergency medical services (HEMS) tool (hereafter referred to as the “HEMS tool”) was specifically designed to show weather conditions for short-distance and low-altitude flights that are common for the HEMS community (but the tool is available for use by anyone). HEMS tool images present high-resolution output of critical weather parameters, particularly cloud ceiling and surface visibility. These images can be accessed through the interactive HEMS tool available on the NWS Aviation Weather Center’s website.<sup>18</sup>

Figures 31-33 are HEMS tool images presenting analyses of ceiling, surface visibility and flight rule conditions valid for and available to the public at about 1000 PST. Attachment 5 provides additional HEMS tool imagery, as well as imagery from an experimental version of the tool not available to the public.

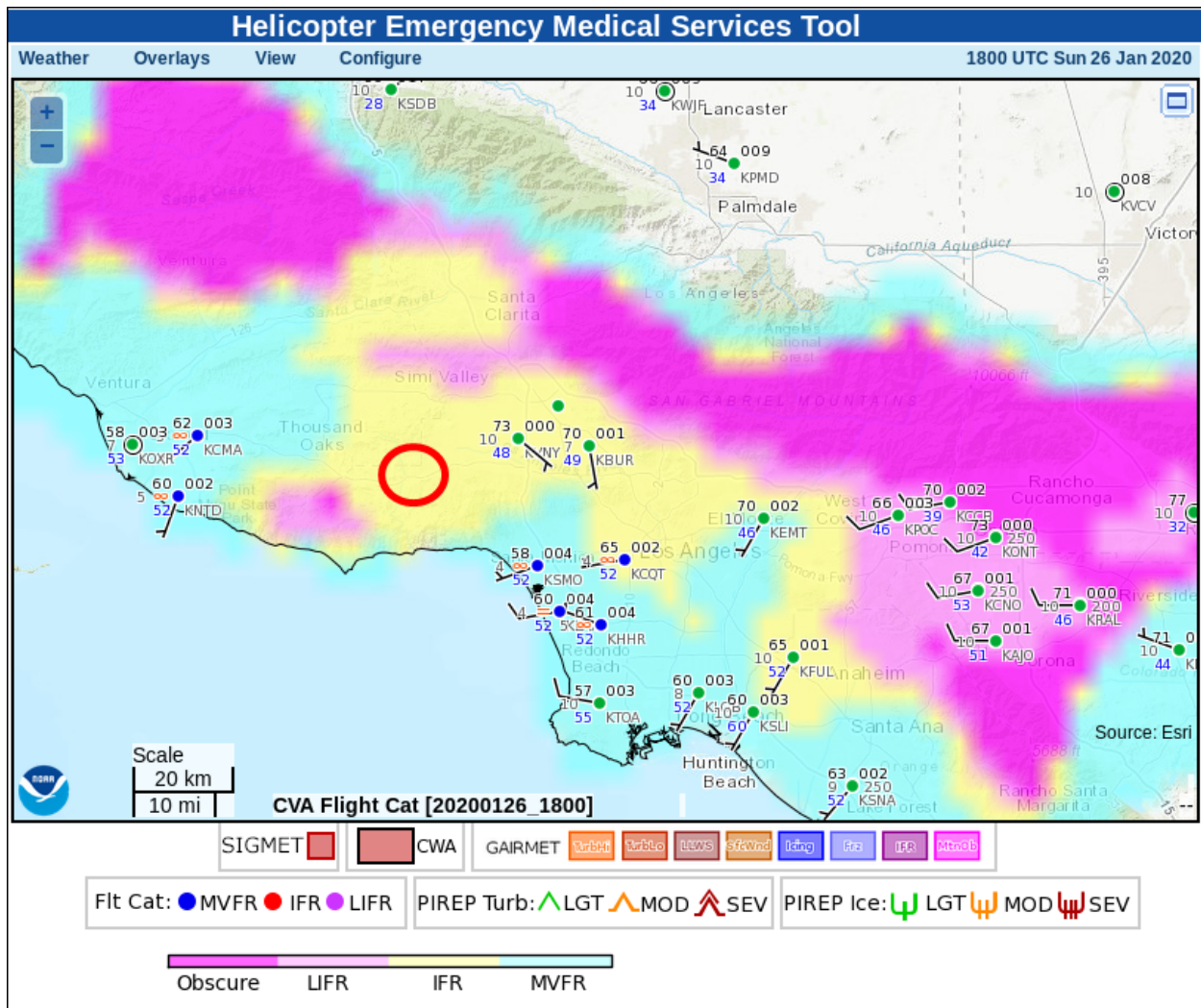


**Figure 31** – Ceiling analysis for the accident region valid at and available through the HEMS tool at about 1000 PST. Accident location is within the red circle.

<sup>18</sup> For more information see: <https://www.aviationweather.gov/hemst>



**Figure 32** – Surface visibility analysis for the accident region valid at and available through the HEMS tool at about 1000 PST. Accident location is within the red circle.



**Figure 33** – Flight rule category analysis for the accident region valid at and available through the HEMS tool at about 1000 PST. Accident location is within the red circle.

## 17.0 Pre-Flight Weather Briefing

According to Leidos (see Attachment 6), Leidos Flight Services (LFS) and its third-party vendors utilizing the LFS system had no contact with the accident aircraft on the day of the accident or the day before the accident.

According to data provided by ForeFlight (see Attachment 6), an “iPad mini 5 (Wi-Fi+LTE)” associated with the accident pilot was last seen by their server(s) at 0731:12 PST on the day of the accident, and an “iPhone 11 Pro” associated with the accident pilot was last seen by their server(s) at 0802:12 PST on the day of the accident. Additional data available from ForeFlight did not include any information that could address whether the accident pilot utilized a ForeFlight application on the day of the accident to avail himself of weather information. The data did indicate that there was only one airport viewed from the accident pilot’s account in the ForeFlight

application during the 10 days prior to the accident day, and that that airport appeared to have been located in Idaho. According to the Co-Founder and CTO of ForeFlight, this information "...tells me [the accident pilot] really did not use our app extensively." There was also no evidence of any "formal" weather briefings ever being created for the account.

There was no information available to address whether the accident pilot availed himself of weather information from other sources prior to the accident flight.

## **18.0 Additional Information**

Several days after the accident the Meteorologist In Charge of LOX provided a weather summary of the accident day. This summary may be found in Attachment 7.

An interview was conducted with employees of LOX and a summary of that interview can also be found in Attachment 7.

## **F. LIST OF ATTACHMENTS**

Attachment 1 – Surface observations

Attachment 2 – Witness information pertinent to the meteorological investigation

Attachment 3 – Information related to the regional cameras

Attachment 4 – AMDAR data from aircraft in the accident region between 0900 and 1000 PST

Attachment 5 – HEMS tool imagery

Attachment 6 – Information from Leidos and ForeFlight

Attachment 7 – Summaries of the accident day weather provided by LOX and of an interview with LOX employees

Submitted by:

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Mike Richards  
Senior Meteorologist

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