



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

November 29, 2018

Weather Study

METEOROLOGY

ANC18FA012

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A. ACCIDENT

Location: Maunaloa, Hawaii
Date: December 10, 2017
Time: 1105 Hawaii standard time
2105 Universal Coordinated Time (UTC)
Airplane: Textron Aviation U206G; registration: N732DF

B. METEOROLOGIST

Don Eick
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On December 10, 2017, about 1105 Hawaiian standard time, a wheel-equipped Textron Aviation (formerly Cessna) U206G airplane, N732DF, impacted remote hills in Maunaloa, Hawaii about 4 miles southwest of the Molokai Airport, Kaunakakai, Hawaii while performing an instrument flight rules (IFR) approach. The instrument-rated private pilot and sole passenger sustained fatal injuries, and the airplane was destroyed. The airplane was registered to and operated by the pilot as a 14 *Code of Federal Regulations* Part 91 visual flight rules (VFR) personal flight that transitioned to an instrument flight rules (IFR) flight. Instrument meteorological conditions were reported at the Molokai Airport at the time of the accident and no flight plan was filed. The flight originated from the Daniel K. Inouye International Airport, Honolulu, Hawaii, about 1030.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are Hawaiian standard time (HST) based upon the 24-hour clock, local time is -10 hours from UTC, and UTC=Z. NWS airport and station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site was estimated at latitude 21.133056° North and longitude -157.149722° West at an elevation of about 1,286 ft.

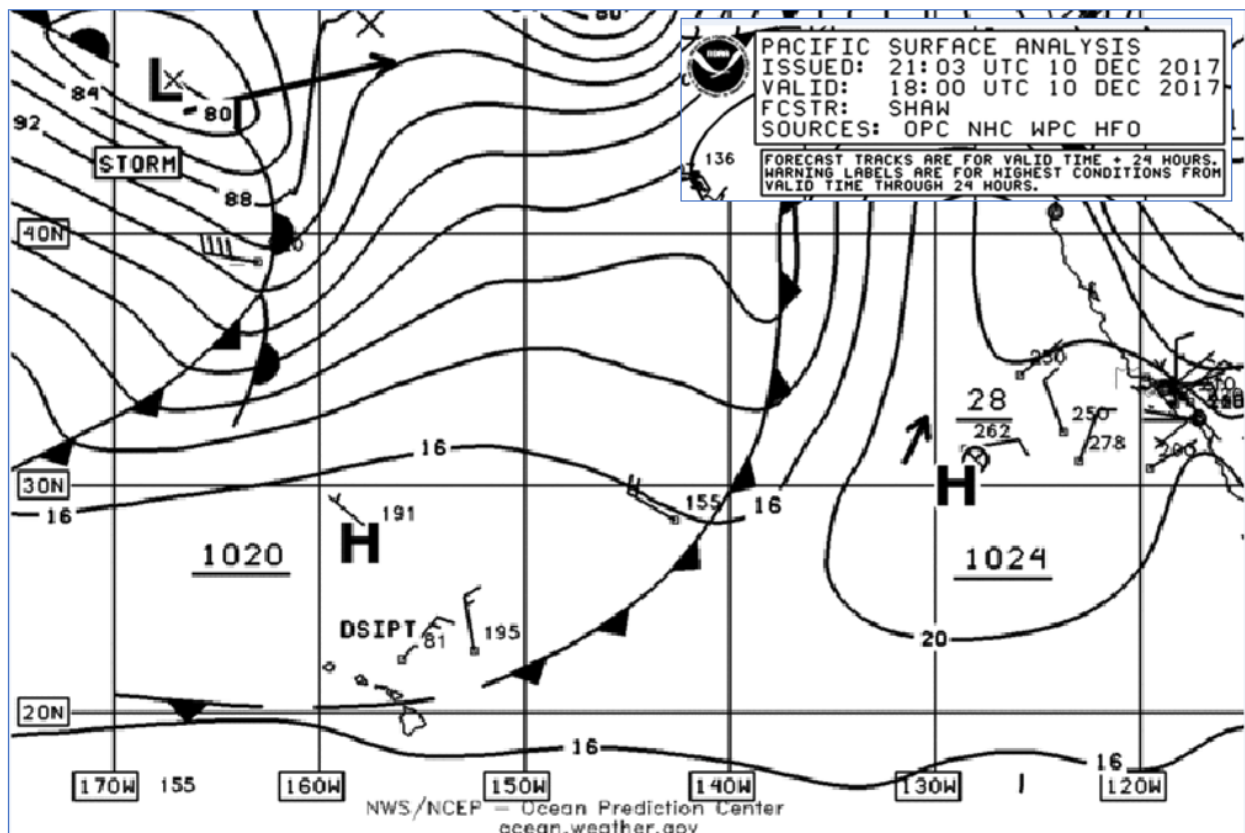
E. WEATHER INFORMATION

1.0 Synoptic Situation

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP) located in College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45H.

1.1 Surface Analysis Chart

A review of the NWS western Pacific Surface Analysis Chart for 0800 HST (1800Z) depicted a dissipating cold front over the Hawaiian Islands with a high pressure system located north of the islands at 1020-hectopascals (hPa), which resulted in a general northeasterly surface wind flow over the region.



2.0 Meteorological Aerodrome Reports

The surrounding area was documented using standard Meteorological Aerodrome Reports (METARs) and special observations (SPECI). The local magnetic variation was 10° East based on the sectional chart for the period as shown in figure 2. Wind direction is reported in degrees true and cloud heights are reported in height above ground level (agl) in the following section.

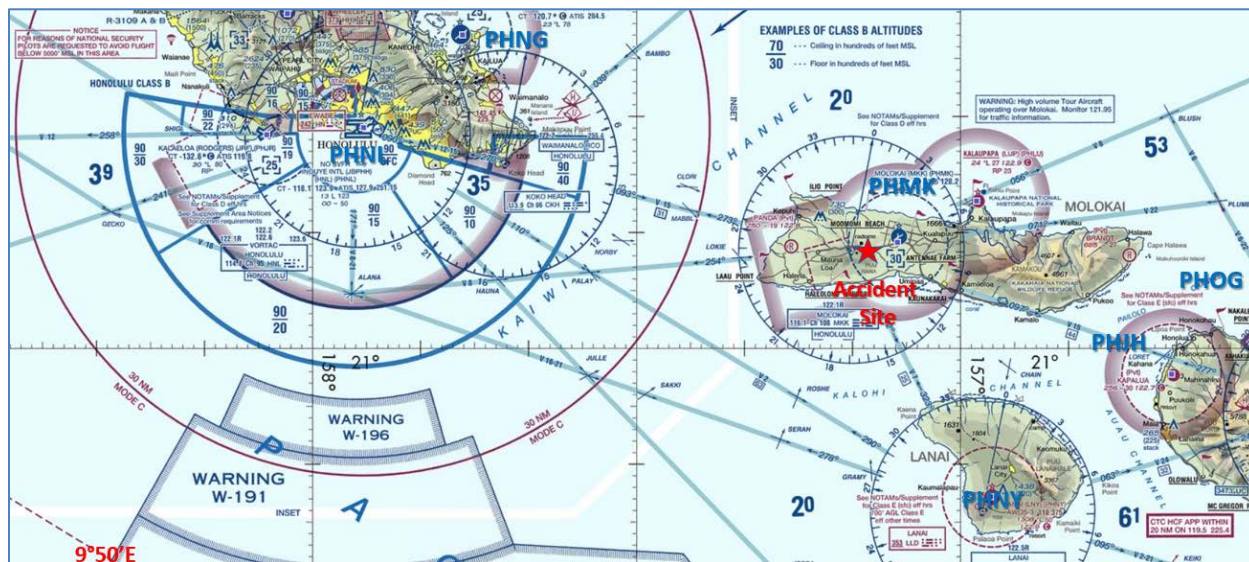


Figure 2 - Sectional chart with closest weather reporting locations and accident site

2.1 Kaunakakai

The closest weather observation site was from Molokai Airport (PHMK), Kaunakakai, HI, located 3 miles northeast of the accident site at an elevation of 443 ft, had an Automated Surface Observation System (ASOS) and was augmented by air traffic control under a Limited Aviation Weather Reporting System (LAWRS) daily from approximately 0600 through 1900 local. At the time of the accident the following conditions were being reported:

PHMK Airport special weather observation at 1103 HST, wind from 030° at 8 knots, visibility 6 miles in mist, scattered clouds at 1,200 feet agl, ceiling broken at 1,700 feet, overcast at 4,800 feet, temperature 22° Celsius (C), dew point 21° C, altimeter 30.04 inches of mercury (Hg). Remarks: automated observation system with a precipitation discriminator, rain ended at 1103 HST, hourly precipitation since 1053 HST less than 0.01 inches or a trace, temperature 21.7° C, dew point 20.6° C.

The general flight categories¹ and raw observations immediately surrounding the time of the accident were as follows:

¹ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.

MVFR METAR PHMK 101854Z 02007KT 3SM RA BR FEW008 SCT015 OVC024 21/20 A3005 RMK AO2
SLP178 P0004 T02110200

MVFR SPECI PHMK 101900Z 03006KT 3SM -RA BR FEW008 BKN012 OVC025 21/21 A3005 RMK AO2 P0000
T02110206

MVFR SPECI PHMK 101913Z 03008KT 8SM -RA SCT008 BKN018 OVC031 22/19 A3005 RMK AO2 P0000
T02170194

MVFR METAR PHMK 101954Z 03011G17KT 4SM -RA BR SCT008 BKN018 OVC031 21/19 A3005 RMK AO2
SLP179 P0002 T02110194

MVFR SPECI PHMK 102006Z 03011KT 6SM -RA BR BKN014 BKN033 OVC055 21/19 A3005 RMK AO2 P0000
T02110194

MVFR METAR PHMK 102054Z 01008G16KT 4SM -RA BR BKN014 BKN033 OVC055 22/21 A3004 RMK AO2
SLP177 P0002 60008 T02220206 50004

MVFR SPECI PHMK 102103Z 03008KT 6SM BR SCT012 BKN017 OVC048 22/21 A3004 RMK AO2 RAE03
P0000 T02170206

Accident 2105Z

VFR SPECI PHMK 102127Z 03010G17KT 9SM SCT011 BKN050 OVC065 23/21 A3003 RMK AO2 RAE03
P0000 T02280206

VFR METAR PHMK 102154Z 04010G18KT 7SM FEW010 BKN050 OVC065 22/20 A3003 RMK AO2 RAE03
SLP172 P0000 T02170200

2.1.1 5-minute Observations

The 5-minute ASOS observers were obtained from archive data from the NCEI for the period from 1030 through 1130 HST and are as follows:

5-MIN PHMK 102030Z 02007KT 4SM -RA BR BKN014 BKN033 OVC055 21/20 A3005 340 93 1200 010/07
RMK AO2 P0002 T02110200

5-MIN PHMK 102035Z 03012G17KT 4SM BR BKN014 BKN033 OVC055 22/21 A3005 340 90 1300
020/12G17 RMK AO2 RAE34 P0002 T02220206

5-MIN PHMK 102040Z 03010G17KT 4SM -RA BR BKN014 BKN033 OVC055 22/21 A3004 340 93 1200
020/10G17 RMK AO2 P0002 T02170206

5-MIN PHMK 102045Z 03011G18KT 4SM -RA BR BKN014 BKN033 OVC055 22/21 A3004 340 93 1200
020/11G18 RMK AO2 P0002 T02170206

-
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
 - Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

5-MIN PHMK 102050Z 02010G18KT 4SM -RA BR BKN014 BKN033 OVC055 22/21 A3004 340 93 1200 010/10G18 RMK AO2 SLP177 P0002 60008 T02170206 53015

5-MIN PHMK 102055Z 01010G16KT 3SM -RA BR BKN014 BKN028 OVC044 22/21 A3004 340 90 1300 010/10G16 RMK AO2 P0000 T02220206

5-MIN PHMK 102100Z 02010KT 5SM -RA BR BKN014 BKN022 OVC050 22/21 A3004 340 93 1200 010/10 RMK AO2 P0000 T02170206

5-MIN PHMK 102105Z 02009KT 7SM SCT012 BKN017 OVC048 22/21 A3004 340 93 1200 010/09 RMK AO2 RAE03 P0000 T02170206

5-MIN PHMK 102110Z 02009KT 350V050 7SM FEW011 BKN015 OVC055 22/21 A3004 350 90 1300 010/09 340V040 RMK AO2 RAE03 P0000 T02220206

5-MIN PHMK 102115Z 04008KT 6SM BR BKN013 BKN033 OVC060 22/21 A3004 350 90 1300 030/08 RMK AO2 RAE03 P0000 T02220206

5-MIN PHMK 102120Z 03008KT 7SM SCT013 BKN028 OVC065 23/21 A3004 350 90 1400 020/08 RMK AO2 RAE03 P0000 T02280211

5-MIN PHMK 102125Z 02009G15KT 9SM FEW008 BKN050 OVC065 23/21 A3003 350 87 1400 010/09G15 RMK AO2 RAE03 P0000 T02280206

5-MIN PHMK 102130Z 02011G18KT 8SM FEW010 BKN050 OVC065 23/21 A3003 350 87 1400 010/11G18 RMK AO2 RAE03 P0000 T02280206

At the time of the accident, the 5-minute observation reported the following conditions:

PHMK weather observation at 1105 HST, wind from 020° at 9 knots, visibility 7 miles, scattered clouds at 1,200 ft agl, ceiling broken at 1,700 ft, overcast at 4,800 ft, temperature 22° C, dew point 21° C, altimeter 30.04 inches of Hg. Remarks: automated observation system, rain ended at 1103 HST, hourly precipitation since 1054 HST a trace or less than 0.01 inches, temperature 21.7° C, dew point 20.6° C.

2.2 Lanai City

Lanai Airport (PHNY), Lanai City, was located approximately 24 miles south-southeast of the accident site at an elevation of 1,308 ft. The airport had an Automated Weather Observation System (AWOS) and reported the following conditions at the approximate time of the accident.

PHNY weather observation at 1056 HST, automated, wind from 170° at 5 knots, visibility 6 miles in light rain, ceiling broken at 900 ft agl, overcast at 1,700 ft, temperature 21° C, dew point 19° C, altimeter 30.07 inches of Hg. Remarks: automated observation system, rain began at 1049 HST, ceiling 600 ft variable 1,200 ft, sea level pressure 1016.7-hPa, hourly precipitation less than 0.01 inches or trace, 6-hour precipitation trace, temperature 21.1° C, dew point 19.4° C, 3-hour pressure tendency fallen 0.01-hPa.

The general flight categories and raw observations surrounding the period were as follows:

MVFR METAR PHNY 101756Z AUTO 08007KT 9SM BKN011 BKN016 OVC041 19/18 A3006 RMK AO2 SLP162 60002 T01940183 10194 20183 51010=

IFR METAR PHNY 101856Z AUTO 08009KT 4SM BR FEW005 BKN008 OVC012 19/19 A3007 RMK AO2 CIG 007V011 SLP167 T01940189=

MVFR SPECI PHNY 101917Z AUTO 09008KT 9SM SCT008 OVC016 20/19 A3008 RMK AO2=

IFR SPECI PHNY 101946Z AUTO 06004KT 3SM BR BKN008 OVC016 20/19 A3008 RMK AO2 CIG 006V012

MVFR SPECI PHNY 101950Z AUTO 09003KT 4SM BR SCT010 OVC016 20/19 A3008 RMK AO2=

MVFR SPECI PHNY 101954Z AUTO 08008KT 8SM SCT008 OVC014 20/19 A3008 RMK AO2=

MVFR METAR PHNY 101956Z AUTO 09007KT 9SM BKN010 OVC016 20/19 A3008 RMK AO2 CIG 006V013 SLP172 T02000189=

MVFR SPECI PHNY 102023Z AUTO 08009KT 10SM SCT010 OVC016 21/19 A3008 RMK AO2=

MVFR SPECI PHNY 102047Z AUTO 16006KT 9SM SCT009 OVC016 21/19 A3007 RMK AO2=

IFR METAR PHNY 102056Z AUTO 17005KT 6SM -RA BR BKN009 OVC017 21/19 A3007 RMK AO2 RAB49 CIG 006V012 SLP167 P0000 60000 T02110194 58001=

Accident 2105Z

UNK SPECI PHNY 102120Z AUTO 16005KT 9SM 21/19 A3007 RMK AO2 RAE07 P0000=

MVFR SPECI PHNY 102152Z AUTO 15007KT 10SM SCT010 OVC019 21/19 A3006 RMK AO2 RAE07B39E51 P0000=

MVFR METAR PHNY 102156Z AUTO 15009KT 10SM SCT010 BKN019 OVC024 21/19 A3006 RMK AO2 RAE07B39E51 SLP162 P0000 T02110189=

VFR METAR PHNY 102256Z AUTO 10005KT 10SM FEW019 SCT024 BKN031 22/18 A3003 RMK AO2 SLP153 T02220178=

2.3 Honolulu

Daniel K. Inouye International Airport (PHNL), Honolulu, was located 47 miles west of the accident site at an elevation 13 ft. The airport had an ASOS and was augmented by certified observers. The following conditions were reported surrounding the time of the accident airplanes departure and the accident:

PHNL weather observation at 0953 HST, wind from 040° at 8 knots, visibility 10 miles or more, a few clouds at 2,800 ft agl, scattered clouds at 4,200 ft, scattered at 5,000 ft, temperature 27° C, dew point 18° C, altimeter 30.02 inches of Hg. Remarks: automated observation system, sea level pressure 1016.6-hPa, temperature 27.2° C, dew point 17.8° C, 3-hour pressure tendency fallen 0.5-hPa.

PHNL weather observations at 1053 HST, wind from 040° at 8 knots, visibility 10 miles or more, a few clouds at 2,600 ft agl, ceiling broken at 3,500 ft, broken at 4,500 ft, temperature 27° C, dew point 17° C, altimeter 30.02 inches of Hg. Remarks: automated observation system, sea level pressure 1016.3-hPa, vicinity² showers north, northeast, and east, temperature 26.7° C, dew point 17.2° C.

The general flight categories and observation surrounding the period were as follows:

VFR METAR PHNL 101853Z 05006KT 10SM FEW023 FEW035 SCT045 24/18 A3003 RMK AO2 SLP169 VCSH NE-E T02440178=

VFR METAR PHNL 101953Z 04011G16KT 10SM FEW025 FEW039 SCT045 SCT160 26/18 A3004 RMK AO2 SLP171 VCSH NE-E T02610178=

VFR METAR PHNL 102053Z 04008KT 10SM FEW028 SCT042 SCT050 27/18 A3002 RMK AO2 SLP166 T02720178 50005=

Departure 2030Z - Accident 2105Z

VFR METAR PHNL 102153Z 04008KT 10SM FEW026 BKN035 BKN045 27/17 A3002 RMK AO2 SLP163 VCSH N-NE-E T02670172=

VFR METAR PHNL 102253Z 05009KT 10SM FEW026 BKN041 BKN070 28/18 A2998 RMK AO2 SLP153 VCSH N-NE-E T02780178=

3.0 Sounding

A Global Data Assimilation System (GDAS) numerical model data was retrieved from archive data from the NOAA Air Resource Laboratory website and plotted on a standard skew T log P diagram³ using the complete Rawinsonde Observation RAOB program software⁴ from the surface through 450-hPa (or approximately 21,000 ft) over the accident site coordinates and is included as figure 3. The GDAS provided a 1° x 1° model grid, updated every 3-hours on a global scale. The GDAS model did not have a good topographic data base and depicted an elevation of 131 ft over the accident site which produced a 1,155 ft height error over the accident site. This height error effected density altitude and cloud base estimates.

The GDAS 1100 HST sounding depicted a forecast temperature of 23.2° C (73.9° F), a dew point of 19.4° C (66.9° F), with a relative humidity of 79%, and a pressure of 1016.5-hPa. The sounding indicated a lifted condensation level (LCL)⁵ and level of free convection (LFC) at about

² Vicinity – is defined at between 5 and 10 miles of the airports reference point.

³ Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

⁴ RAOB software – The complete RAwinsonde OBservation program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data.

⁵ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry

1,770 ft, and a convective condensation level (CCL) at about 2,500 ft agl. The sounding indicated a relative humidity greater than 90% from the LCL through 5,000 ft supporting clouds. The freezing level was identified at about 15,900 ft. The sounding indicated a precipitable water content of 1.19 inches. The lapse rates indicated a conditionally stable atmosphere with a Lifted Index⁶ of +3 and a Convective Available Potential Energy (CAPE)⁷ value of 48 J/kg.

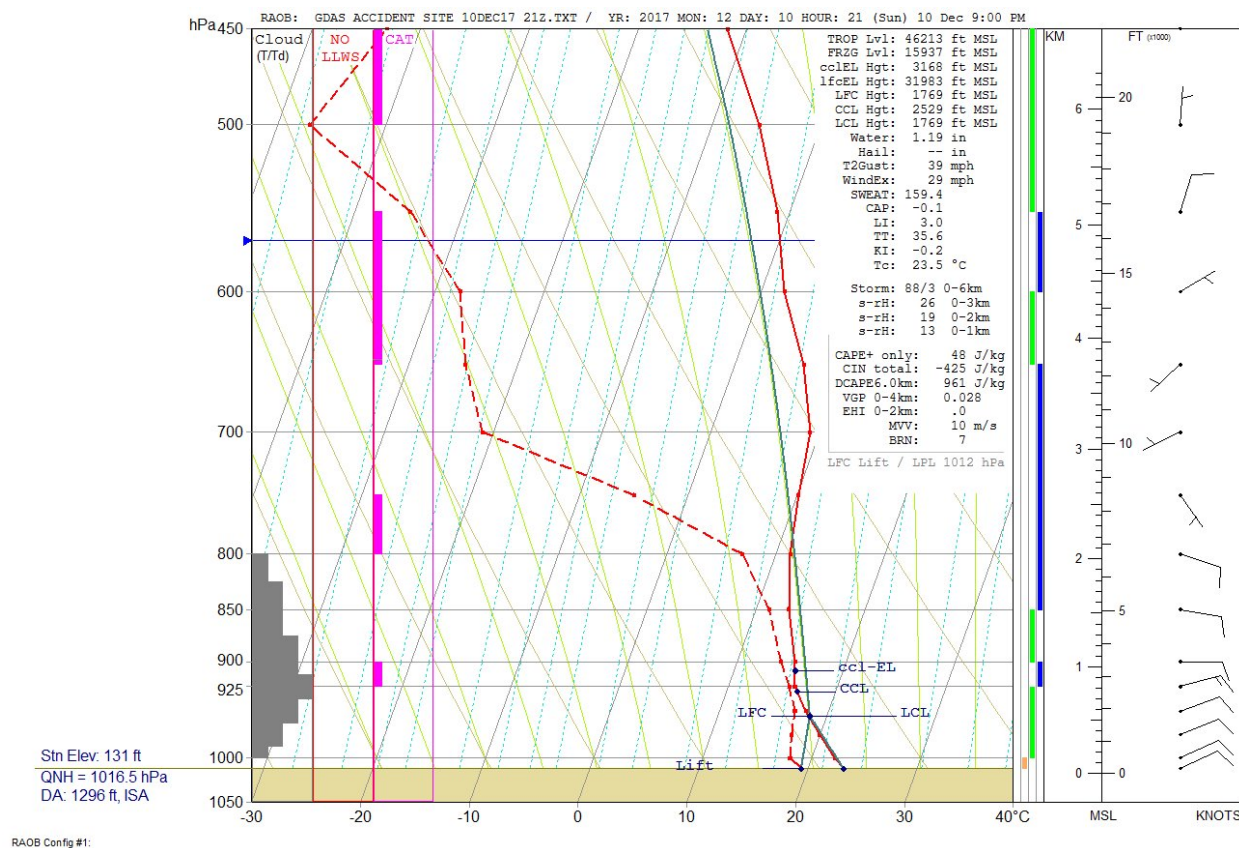


Figure 3 - GDAS sounding for 1100 HST over the accident site

The GDAS sounding indicated a surface wind from the northeast or 060° at 11 knots, with winds from the northeast to east at 15 knots or less through 7,000 ft, with winds light and variable from 7,000 through 21,000 ft. The mean 0 to 6 kilometer (approximately 18,000 ft) wind was from approximately 060° at 4 knots. The sounding did not depict any strong vertical wind shears to support any significant turbulence.

adiabatically.

⁶ Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to 500-hPa or approximately 18,000 feet and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

⁷ Convective Available Potential Energy (CAPE) - is a measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather.

The GDAS sounding parameters of height, pressure (Pres), temperature (T), dew point (Td), relative humidity (RH), wind direction and speed, and RAOB derived clear air turbulence (CAT), low-level wind shear (LLWS), icing potential were as follows:

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
131	1012	23.3	19.4	79	63 / 11			
473	1000	22.1	18.0	78	64 / 11			
1194	975	20.0	17.4	85	66 / 12			
1929	950	17.9	16.9	94	68 / 12			
2678	925	16.1	15.6	97	74 / 13	LGT		
3444	900	15.3	14.0	92	90 / 11			
5032	850	13.0	11.2	89	101 / 9			
6703	800	11.3	6.9	74	109 / 8	LGT		
8469	750	10.1	-5.0	34	147 / 3			
10346	700	9.1	-21.0	10	243 / 4			
12347	650	6.3	-24.8	9	225 / 3	LGT		
14481	600	2.1	-27.7	9	57 / 4	LGT		
16769	550	-1.2	-34.9	6	15 / 10			
19239	500	-5.7	-47.0	2	3 / 7	LGT		
21916	450	-11.8	-43.1	6	332 / 14	LGT		

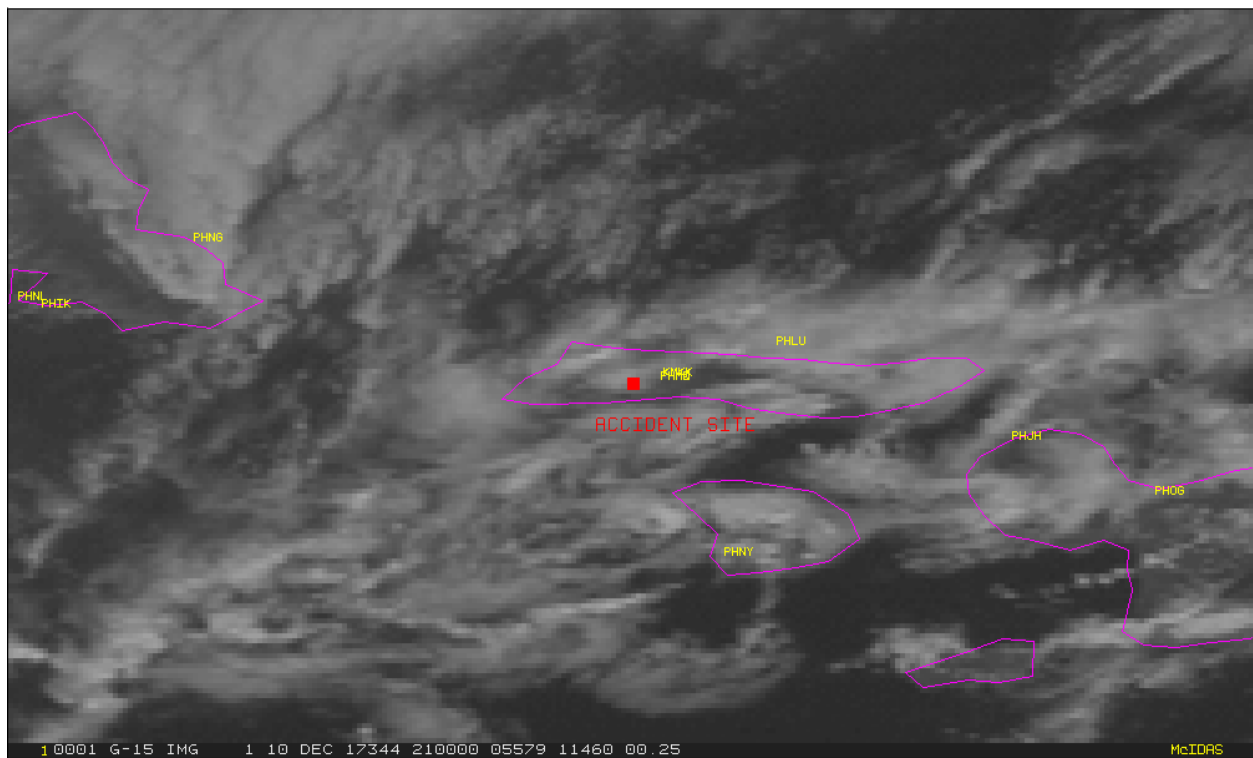
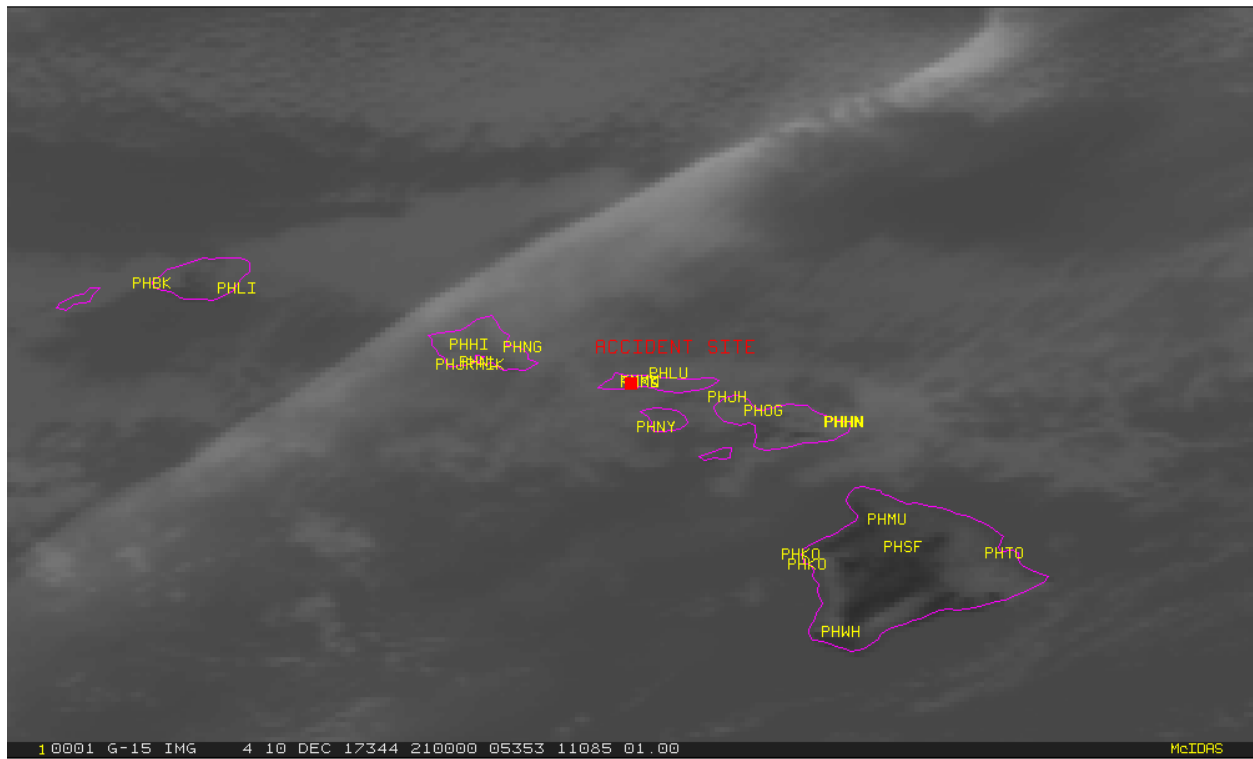
Figure 4 - GDAS Sounding parameters from surface through 22,000 ft

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 15 (GOES-15) data was obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident. The infrared long wave imagery (band 4) at a wavelength of 10.7 microns (μm) provided radiative cloud top temperatures with a nominal spatial resolution of 4 km. The visible imagery (band 1) at a wavelength of 0.65 μm provided a nominal spatial resolution of 1 km.

Figure 5 is the GOES-15 infrared image at 1100 HST at 4 X magnification with the accident site marked by a red square. The image depicted multiple layers of low to mid-level clouds over the Hawaiian Islands with a radiative cloud top temperature of 287° Kelvin or 13.84° C over the accident site, which corresponded to a cloud tops from 4,500 to 6,000 ft based on the GDAS and closest upper air soundings.

Figure 6 is the GOES-15 visible image also at 4 X magnification at 1 km resolution at 1100 HST with the accident site marked. An area of clouds obscures the accident site



5.0 Weather Surveillance Radar Imagery

The closest Weather Surveillance Radar-1988 Doppler (WSR-88D)⁸ to the accident site was from the NWS Molokai (PHMO) antenna site located 1 ½ miles west of the accident site. The level II archive data was obtained from the NCEI using the Hierarchical Data Storage System and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ⁹) and is a general measure of echo intensity. Reflectivity rates are further described in Advisory Circular AC 00-24C – “Thunderstorms”. The following table is included in that advisory circular further describing reflectivity ranges and weather echo intensities. Air traffic control (ATC) weather display systems also use radar weather processors with the ability to determine precipitation intensity, with controllers instructed to describe the intensity to pilots based on the following table. One exception is that the centers weather and radar processor system does not display light intensity echoes below 30 dBZ.

Reflectivity (dBZ) Ranges	Weather Radar Echo Intensity Terminology
< 30 dBZ	Light
30 – 40 dBZ	Moderate
>40 – 50 dBZ	Heavy
>50 dBZ	Extreme

Figure 7 is the PHMO WSR-88D 0.5° base reflectivity image at 1057 HST displaying the echoes over the Hawaiian Islands mainly east and southeast of Oahu concentrated on the north shores of Molokai and Maui, with a band south of Molokai and west of Lanai.

⁸ The WSR-88D is a S-band 10-centimeter wavelength radar with a power output of 750,000 watts, with a 28-foot parabolic antenna concentrating the energy into a 0.95° beam width. The radar produces three basic types of products reflectivity, radial velocity, and spectral width.

⁹ dBZ - 10 log Ze



Figure 7 - PHMO 0.5° base reflectivity image at 1057 HST

Figure 8 and 9 are the PHMO WSR-88D 0.5° base reflectivity images at 1102 and 1107 HST respectively zoomed into Molokai with the accident site marked. Based on a distance of 1 ½ mile from the radar antenna, which had a height of 1,444 ft, the 0.5° elevation scan assuming standard refraction of the beam, was centered at 1,525 ft with the base of the beam at 1,450 ft and the top at 1,600 ft. The images depicted an area of very light intensity echoes moving southwestward over the accident site with echoes of -5 to 15 dBZ, and maximum echoes near 30 dBZ immediately north. PHMK was temporarily in the clear with no echoes overhead at those times.

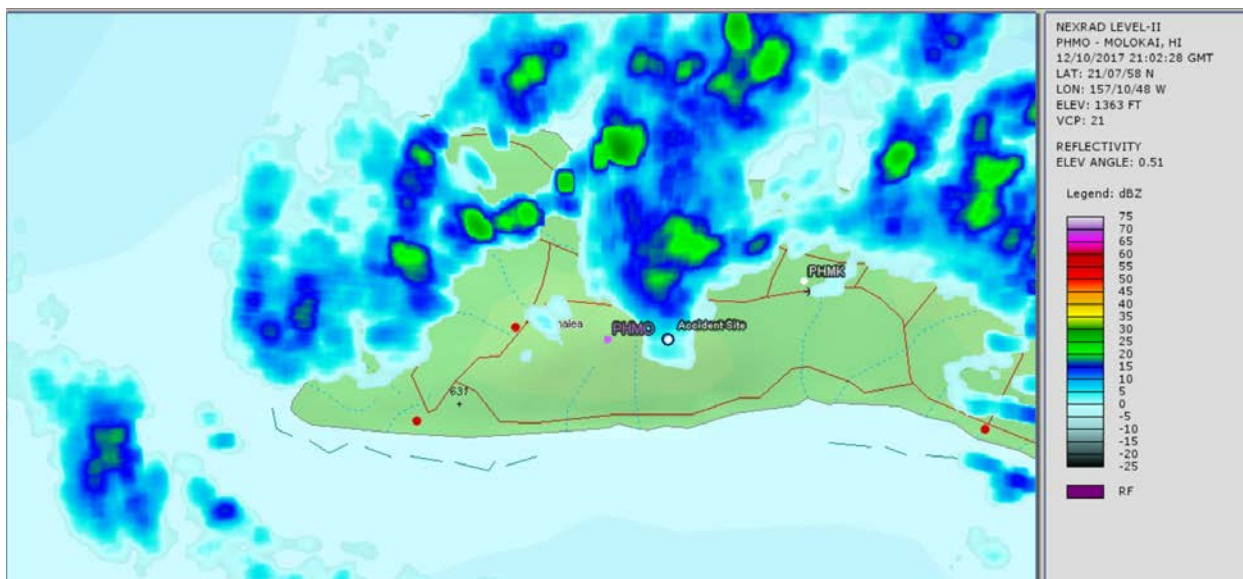


Figure 8 - PHMO WSR-88D 0.5° base reflectivity image at 1102 HST

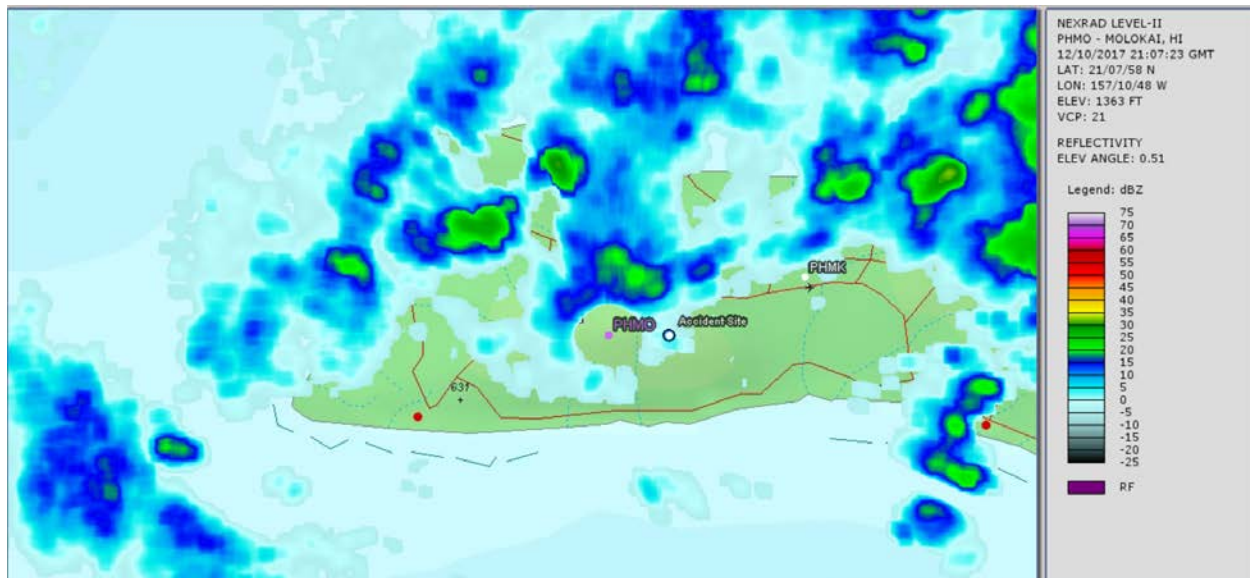


Figure 9 - PHMO WSR-88D 0.5° base reflectivity image at 1107 HST

6.0 Terminal Aerodrome Forecast

The NWS Honolulu (PHFO) Weather Forecast Office (WFO) was responsible for issuing the Terminal Aerodrome Forecast (TAF) for PHMK. During the period and available for preflight planning and evaluation. The forecasts were as follows:

TAF PHMK 101739Z 1018/1118 02008G17KT P6SM VCSH SCT009 BKN020 OVC025
TEMPO 1018/1021 5SM SHRA BR BKN010
FM102100 04011KT P6SM VCSH BKN025 BKN035
FM110000 06010KT P6SM FEW025 SCT035
FM110600 03005KT P6SM VCSH BKN020 OVC035=

AMD 1 TAF PHMK 101925Z 1019/1118 03010KT P6SM VCSH SCT009 BKN015 OVC025
TEMPO 1019/1022 5SM SHRA BR BKN010
FM102200 04011KT P6SM VCSH BKN025 BKN035
FM110000 06010KT P6SM FEW025 SCT035
FM110600 03005KT P6SM VCSH BKN020 OVC035=

AMD 2 TAF PHMK 102020Z 1020/1118 03010KT P6SM VCSH SCT009 BKN015 OVC025
TEMPO 1020/1024 4SM SHRA BR BKN010
FM110000 04011KT P6SM VCSH BKN025 BKN035
FM110600 VRB05KT P6SM VCSH BKN020 OVC035=

The initial forecast issued at about 0740 HST expected MVFR conditions during the period with rain showers in the vicinity with ceiling broken at 2,000 ft agl, with a temporary period between 0800 through 1100 HST of 5 miles in rain showers and mist, with a ceiling broken at 1,000 ft agl. The forecast was amended at 0925 HST and continued to expect MVFR conditions with rain showers and mist, with ceilings broken at 1,500 ft agl and temporary down to 1,000 ft agl. The forecast was amended at 1020 HST temporarily lowering visibility to 4 miles in rain showers and mist with a ceiling broken at 1,000 ft agl.

7.0 Area Forecast Discussion

The KHFO WFO Area Forecast Discussion issued at 1030 HST was as follows:

FXHW60 PHFO 102032 AAA
AFDHFO

Area Forecast Discussion...Corrected
National Weather Service Honolulu HI
1030 AM HST Sun Dec 10 2017

.SYNOPSIS...

Moisture associated with a dissipating front will bring clouds and showers to most windward areas today before gradually dissipating tonight. Light winds will prevail through Monday, then increase late Monday into Tuesday as a stronger front moves down the island chain. The front will bring a period of showers, followed by breezy north winds. There is the potential for unsettled weather toward the end of the week as a low pressure system develops near the islands.

&&

.DISCUSSION...

Shallow moisture associated with a stalled and gradually dissipating front is draped over most islands this morning, with the ENE-WSW oriented band of low clouds providing showery low clouds to mainly windward areas of Maui county, although a few stray showers have been drifting over SE Oahu, dampening the Honolulu Marathon. Broken low clouds over Kauai are not dropping any precipitation, and the Big Island is mostly sunny. A fast-moving and relatively weak high pressure cell is passing several hundred miles N of Kauai, supporting a weak to moderate low-level flow that is currently veering from NE to E.

Primary forecast challenge for the next day hinges on the movement and evolution of the dissipating frontal cloud band. The short-term expectation is that it will remain nearly stationary, and never make it to the Big Island. Clouds and showers will remain focused over Maui county, potentially shifting N toward Oahu later today as the high to the N continues moving rapidly E. The trailing ridge will be pushed over the islands by this time tomorrow as a more potent front approaches from the NW. Winds will weaken and veer in response, shifting to the SE by this evening, and then to the S and SW on Monday. The moisture band will drift N and gradually dissipate, with clouds and showers diminishing. Land breezes late tonight will likely allow skies to clear most areas, but lingering moisture and increasing pre-frontal convergence will keep rain chances a little higher near Kauai and Oahu.

Light S to SW winds Monday will strengthen somewhat near Kauai and Oahu as the front draws closer Monday night, with increasing pre-frontal showers. Frontal passage is depicted as occurring on Kauai Tuesday morning in latest GFS/ECMWF guidance, Oahu and Maui county Tuesday evening, and Wednesday on the Big Island. This moisture will not get too far E or S of the islands as an energetic shortwave aloft begins to dig toward the state Wednesday night. Breezy N winds will build after the front passes, potentially becoming strong on Thursday as surface pressure drops E of the islands (in response to the rapid height falls) and the local gradient tightens.

After Thursday, forecast uncertainty increases dramatically as forecast models have been exhibiting a fair amount of run-to-run variability, due to the shortwave diving SE toward the islands by mid-week. The GFS/ECMWF/CMC indicate that the shortwave will develop into a cutoff low just E of the islands on Thursday, and then drift W over the islands Friday and Saturday before gradually dissipating Sunday and Monday. If this scenario develops, island weather would become very active, with the potential for heavy rain and thunderstorms, as well as snowfall and high winds at the Big Island summits. However, if the NAVGEM is correct the cutoff would remain E of the islands, and the impacts on island weather would be significantly less. With confidence in the large scale weather

pattern so diminished, the details of the forecast are highly uncertain, and no significant changes to the longer range forecast are expected at this time.

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.AVIATION...

AIRMET SIERRA for MTN OBSC is in effect for Maui, Lanai, Molokai and Oahu. An ENE-WSW frontal cloud band nearly stationary over Maui, Lana and Molokai will produce widespread MVFR ceilings and scattered showers through the day. More stable low clouds on the fringe of the band will produce some MVFR ceilings over E sections of Oahu and Kauai through the morning, but the MTN OBSC may clear this afternoon.

The frontal band will weaken and shift north slowly tonight. Conditions will improve over Maui, Lanai and Molokai, while ceilings may lower and showers may increase tonight over Oahu and Kauai.

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.MARINE...

The current large north-northwest swell is expected to peak today, and is bringing warning level surf to the north facing shores of the smaller islands, and the west facing shores of Niihau, Kauai, Oahu and Molokai. Advisory level surf is reaching the north facing shores of the Big Island. This swell will continue to decline through Monday night.

This current swell is bringing seas in excess of 10 feet to exposed waters, and an SCA remains posted through tonight. Seas are expected to lower tonight from west to east.

The next north-northwest swell is expected to arrive Tuesday night/early Wednesday and is expected to be even larger than the current swell. This swell is expected to produce warning-level surf on north and west facing shores. This swell will also bring seas in excess of 10 feet. The current forecast brings 10 foot seas to the Kauai northwest waters as early as midday Tuesday. Winds behind this next front will likely reach SCA levels by Wednesday night.

See the latest Oahu Surf Discussion (SRDHFO) for additional details on surf and swell.

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.HFO WATCHES/WARNINGS/ADVISORIES...

High Surf Warning until 6 AM HST Monday for North and West facing shores of Niihau Kauai Oahu Molokai and Maui.

High Surf Advisory until 6 AM HST Monday for North facing shores of the Big Island.

Small Craft Advisory until 6 AM HST Monday for Kauai Northwest Waters-Kauai Windward Waters-Kauai Leeward Waters-Kauai Channel-Oahu Windward Waters-Oahu Leeward Waters-Kaiwi Channel-Maui County Windward Waters-Maui County Leeward Waters-Alenuihaha Channel-Big Island Windward Waters.

&&

DISCUSSION...Birchard
AVIATION...Donaldson
MARINE...M Ballard

8.0 Area Forecast

The PHNK Area Forecast issued for the regions was as follows:

*FAHW31 PHFO 101536
FA0HI*

*HNLC FA 101535
SYNOPSIS AND VFR CLD/WX
SYNOPSIS VALID UNTIL 111000
CLD/WX VALID UNTIL 110400...OUTLOOK VALID 110400-111000*

*.
SEE AIRMET SIERRA FOR IFR CLD AND MT OBSC.
TS IMPLY SEV OR GREATER TURB SEV ICE LOW LEVEL WS AND IFR COND.
NON MSL HGT INDICATED BY AGL OR CEILING.*

*.
SYNOPSIS...A SHALLOW COLD FRONT HAS STALLED OVER MAUI THIS MORNING.
CLOUDS ALONG THE FRONTAL BAND WILL DRIFT SLOWLY NORTHWEST THROUGH THE DAY.
A LOW LEVEL RIDGE WILL MAINTAIN STABLE AND DRY CONDITIONS ON THE
BIG ISLAND.*

*.
BIG ISLAND INTERIOR ABV 080. SKC. 22Z SCT100.
OUTLOOK...VFR.*

*.
BIG ISLAND LOWER SLOPES AND COAST.
FEW030 FEW-SCT045. 21Z FEW-SCT030 BKN045 TOPS 070 ISOL BKN030 TOPS 090 -SHRA.
OUTLOOK...VFR.*

*.
BIG ISLAND ADJ WATERS.
FEW030 FEW-SCT045 ISOL BKN040 TOPS 070 -SHRA .
OUTLOOK...VFR.*

*.
MAUI
MTN AND N TO NE FACING SECTIONS INCLUDING ADJ WATERS.
BKN025 OVC-BKN040 TOPS 100 -SHRA TEMPO BKN015 TOPS 120 VIS 3-5SM SHRA.
23Z SCT-BKN025 BKN045 TOPS 080 TEMPO -SHRA.
OUTLOOK...VFR.*

*.
REST OF MAUI INCLUDING ADJ WATERS.
SCT025 BKN045 TOPS 100 TEMPO BKN025 VIS 5SM -SHRA ISOL BKN020.
23Z FEW-SCT025 SCT-BKN045 TOPS 080 ISOL -SHRA.
OUTLOOK...VFR.*

*.
MOLOKAI AND LANAI INCLUDING ADJ WATERS.
BKN015-020 OVC030-040 TOPS 100 TEMPO -SHRA ISOL BKN010 TOPS 120 VIS 3-5SM SHRA BR.
00Z SCT015 BKN-OVC025 TOPS 100 TEMPO -SHRA ISOL BKN020 VIS 3-5SM SHRA BR.
OUTLOOK...MVFR CEILING SHRA UNTIL 0800Z.*

*.
OAHU
MTN AND N TO NE FACING SECTIONS INCLUDING ADJ WATERS.
BKN025 BKN-OVC040 TOPS 100 TEMPO -SHRA ISOL BKN020 TOPS 120 VIS 3-5SM SHRA.
18Z SCT-BKN025 BKN-OVC040 TOPS 090 TEMPO -SHRA ISOL BKN020 TOPS 100 VIS 5SM SHRA.
OUTLOOK...MVFR CEILINGS SHRA.*

*.
REST OF OAHU.
SCT025 SCT-BKN040 TOPS 080 ISOL BKN025 TOPS 100 -SHRA.*

18Z FEW-SCT025 SCT-BKN045 TOPS 080 ISOL BKN035 TOPS 100 -SHRA.
OUTLOOK...VFR.

.
KAUAI

MTN AND N TO NE FACING SECTIONS INCLUDING ADJ WATERS.

SCT-BKN025 BKN-OVC035 TOPS 080 TEMPO -SHRA ISOL BKN020 TOPS 100 VIS 3-5SM SHRA BR.

19Z SCT025 SCT-BKN035 TOPS 080 ISOL BKN025 TOPS 100 -SHRA.

OUTLOOK...VFR.

.
REST OF AREA.

FEW-SCT025 SCT-BKN045 TOPS 080 TEMPO -SHRA ISOL BKN025 TOPS 100 VIS 3-5SM SHRA BR.

OUTLOOK...VFR.

The Area Forecast for Molokai expected broken clouds at 1,500 to 2,000 ft msl and overcast clouds at 3,000 to 4,000 ft with tops to 10,000 feet, with temporary light rain showers, with isolated broken clouds at 1,000 ft with tops to 12,000 ft and 3 to 5 miles in light rain showers and mist.

9.0 Inflight Weather Advisories

The PHFO WFO issued an AIRMET Sierra for mountain obscuration at 0534 HST which was valid through 1200 HST. The advisories for the Hawaiian Islands were as follows:

WAHW31 PHFO 101534
WA0HI

HNLS WA 101600
AIRMET SIERRA UPDATE 6 FOR IFR VALID UNTIL 102200

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AIRMET MTN OBSC...KAUAI
NORTH THRU EAST SECTIONS.
TEMPO MTN OBSC ABV 025 DUE TO CLD AND SHRA. COND END BY 2200Z.

.
AIRMET MTN OBSC...OAHU
NORTH THRU EAST SECTIONS.
TEMPO MTN OBSC ABV 025 DUE TO CLD AND SHRA. COND END BY 2200Z.

.
AIRMET MTN OBSC...MOLOKAI AND LANAI
ENTIRE AREA.
TEMPO MTN OBSC ABV 015 DUE TO CLD AND SHRA. COND CONT BEYOND 2200Z.

.
AIRMET MTN OBSC...MAUI
NORTH THRU EAST SECTIONS.
TEMPO MTN OBSC ABV 020 DUE TO CLD AND SHRA. COND END BY 2200Z.

=HNLT WA 101600
AIRMET TANGO UPDATE 2 FOR TURB VALID UNTIL 102200

.
NO SIGNIFICANT TURB EXP.

=HNLZ WA 101600
AIRMET ZULU UPDATE 2 FOR ICE AND FZLVL VALID UNTIL 102200

.
NO SIGNIFICANT ICE EXP.

.

FZLVL...158 PHLI SLOPING TO 149 PHTO.

NWS had an AIRMET in effect for mountain obscuration conditions above 1,500 feet due to clouds and rain showers, with conditions expected to end after 1200 HST.

Submitted by:

Don Eick
Senior Meteorologist