



MEMORANDUM FOR RECORD

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Air Carrier and Space Investigations

March 8, 2023

Subject: NTSB investigation DCA23LA172, N212UA, Boeing B777-222, Kahului, Hawaii, December 18, 2022. Weather Reports and Records.

The NTSB Operational Factors Division provided the following information via email on February 16 and March 7, 2023:

Synoptic Conditions - The area was being impacted by an approaching Kona storm with heavy rain and winds.

Observations - The conditions for Kahului Airport (HOG/PHOG), Kahului, Hawaii, elevation of 54 ft, and has an Automated Surface Observation System (ASOS) and contract weather observers to augment the observations. The conditions recorded at the time of the event were as follows based on the 5-minute observations.

PHOG weather observation at 1450 HST, wind from 140° at 10 knots, visibility 3 miles in heavy rain and mist, ceiling broken at 900 ft agl, overcast at 2,000 ft, temperature 19° C, dew point temperature 18° C, altimeter 29.78 inches of mercury (inHg), pressure altitude 190 ft, relative humidity 93%, density altitude 800 ft, magnetic winds 130° at 10 knots. Remarks: automated station with a precipitation discriminator, sea-level pressure 1008.8-hPa, hourly precipitation 0.18", temperature 19.4° C, dew point 18.3° C.

PHOG weather observation at 1455 HST, winds from 150° at 8 knots, visibility 2 1/2 miles in heavy rain and mist, a few clouds at 6,000 ft agl, ceiling broken at 7,000 ft overcast at 9,000 ft, temperature 19° C, dew point temperature 18° C, altimeter 29.77 inHg, pressure altitude 200 ft, relative humidity 93%, density altitude 800 ft, magnetic wind from 140° at 8 knots. Remarks: automated station with a precipitation discriminator, hourly precipitation since 1450 HST 0.01", temperature 19.4° C, dew point 18.3° C.

The general flight conditions and the raw observations issued surrounding the period were as follows (date/time in Coordinated Universal Time).

[IFR] SPECI PHOG 182156Z 23004G14KT 2SM +TSRA BKN009 BKN030 OVC060 20/19 A2979 RMK A02 TSB56 PRESFR TOWER VIS VARIABLE 1V3 P0014 T02000189 \$=

[IFR] SPECI PHOG 182222Z 05009KT 3SM TSRA BKN009 BKN030 OVC060 21/19 A2979 RMK AO2 TSB2156 TOWER VIS 1V3SM TS OHD MOV NE P0058 T02110194 \$=

[MVFR] SPECI PHOG 182251Z 33007G15KT 5SM -RA BR BKN011 BKN020 OVC100 21/19 A2977 RMK AO2 TSB2156E50 TS OHD MOV NE P0060=

[IFR] METAR PHOG 182254Z 34010KT 4SM RA BR BKN009 BKN020 OVC100 21/19 A2977 RMK AO2 TSB2156E50 SLP085 TS OHD MOV NE P0061 T02110194=

[IFR] METAR PHOG 182354Z 32010KT 3SM +RA BR BKN009 OVC020 20/18 A2976 RMK AO2 SLP081 TS OHD MOV NE P0027 60140 T02000183 10233 20200 56022=

[EVENT 0051Z]

[IFR] METAR PHOG 190054Z 14009KT 3SM +RA BR BKN009 OVC020 19/18 A2977 RMK AO2 SLP085 P0020 T01940183=

[IFR] METAR PHOG 190121Z COR 17016G22KT 5SM RA BR BKN009 OVC020 19/18 A2977 RMK AO2 SLP085 P0020 T01940183=

[IFR] METAR PHOG 190154Z 18021KT 8SM RA BKN009 OVC020 19/18 A2976 RMK AO2 PK WND 18028/0135 SLP083 P0020 T01940178=

[MVFR] SPECI PHOG 190158Z 18019G26KT 8SM -RA SCT009 BKN030 OVC060 20/18 A2976 RMK AO2 P0000 T02000183=

5-minute ASOS Data - The 5-minute observations for PHOG were as follows surrounding the period from 1430 through 1515 HST.

[14:30:31] 5-MIN PHOG 190030Z 14009KT 3SM RA BR BKN009 OVC020 20/18 A2977 190 90 900 130/09 RMK AO2 P0010 T02000183

[14:35:31] 5-MIN PHOG 190035Z 14007KT 3SM +RA BR BKN009 OVC020 20/18 A2977 190 90 900 130/07 RMK AO2 P0012 T02000183

[14:40:31] 5-MIN PHOG 190040Z 13012KT 3SM +RA BR BKN009 OVC020 20/19 A2978 180 93 900 120/12 RMK AO2 P0014 T02000189

[14:45:31] 5-MIN PHOG 190045Z 14009KT 3SM +RA BR BKN009 OVC020 19/18 A2978 190 93 800 130/09 RMK AO2 P0016 T01940183

[14:50:31] 5-MIN PHOG 190050Z 14010KT 3SM +RA BR BKN009 OVC020 19/18 A2978 190 93 800 130/10 RMK AO2 SLP088 P0018 T01940183

[EVENT 0051Z]

[14:55:31] 5-MIN PHOG 190055Z 15008KT 2 1/2SM +RA BR FEW060 BKN070 OVC090 19/18
A2977 200 93 800 140/08 RMK AO2 P0001 T01940183

[15:00:31] 5-MIN PHOG 190100Z 16011KT 3SM +RA BR BKN009 OVC020 20/18 A2977 200 90
900 150/11 RMK AO2 P0003 T02000183

[15:05:31] 5-MIN PHOG 190105Z 16011KT 3SM +RA BR BKN009 OVC020 20/18 A2976 200 90
900 150/11 RMK AO2 P0006 T02000183

[15:10:31] 5-MIN PHOG 190110Z 17010KT 3SM +RA BR BKN009 OVC020 20/18 A2976 210 87
900 160/10 RMK AO2 P0008 T02000178

[15:15:31] 5-MIN PHOG 190115Z 17015G22KT 3SM RA BR BKN009 OVC020 20/18 A2975 210 87
900 160/15G22 RMK AO2 P0011 T02000178

The Terminal Aerodrome Forecast (TAF) issued for PHOG surrounding the period were as follows:

TAF PHOG 182341Z 1900/1924 23012KT 5SM SHRA BR BKN010 OVC030
TEMPO 1900/1903 2SM SHRA BR
FM190500 20019G30KT 5SM SHRA BR BKN025 BKN035
FM191800 23027G36KT 6SM -SHRA BR BKN025=

[Sounding Data](#) - A Global Data Assimilation System (GDAS) numerical model data was obtained over the grid point closest to PHOG for 1400 HST on December 18, 2022 and plotted on a standard Skew T log P diagram and is included as figure 1. The sounding depicted an elevation of 112 ft over the grid point, a near surface temperature of 22.6° C (72.7° F), a dew point temperature of 19.1° C (66.4°F), with a relative humidity of 81%, which provided a density altitude of 1,515 ft. The lifted condensation level was identified at 1,472 ft agl, the level of free convection at 2,927 ft, and convective condensation level at 3,819 ft, with a precipitable water content of 1.72". The freezing level was identified at about 11,400 ft. The RAOB analysis program support multiple layers of clouds with bases near 2,000 ft agl and convective cloud tops (LFC-EL) to 30,000 ft. The atmosphere was characterized as conditionally unstable with the Lifted Index of -1.8, and a Convective Available Potential Energy (CAPE) of 552 Joules/kilogram. The GDAS wind profile for 1400 HST depicted a near surface wind from 290° at 5 knots, with wind backing to the southwest with height with increasing wind speeds with height. The mean 0 to 6 kilometer or 18,000 ft wind was from 240° at 29 knots. At altitude the maximum wind was identified at about 40,000 ft with winds from 260° at 92 knots. At 2,000 ft the wind was identified from 235° at 7 knots. No significant low-level wind shear (LLWS) was identified based on the sounding outside of any convective activity.

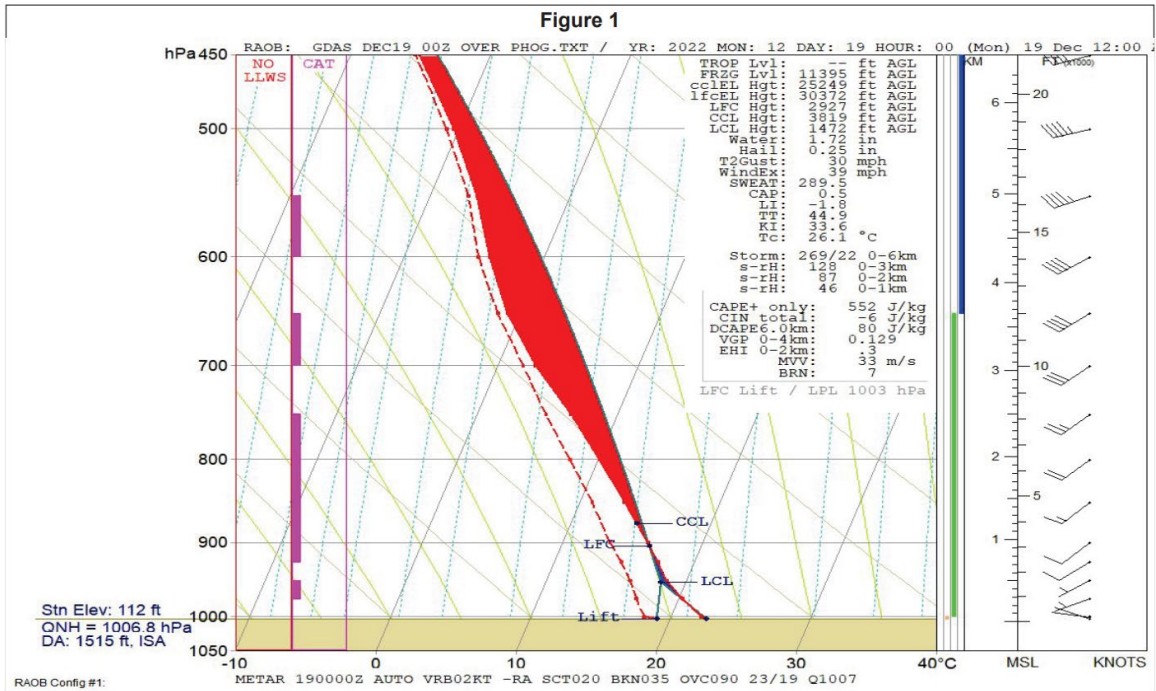


Figure 1 Skew T log P Diagram

Radar Imagery - The NWS Molokai (PHMO) Weather Surveillance Radar 1988 Doppler (WSR-88D) located about 45 miles west-northwest of the incident location was reviewed and the relevant images documented. Figure 2 is the PHMO WSR-88D 0.5 base reflectivity image for 1451 HST and depicted a large area of moderate intensity echoes over the north shore of Maui with echoes of 44.5 dBZ over PHOG and the departure path, with echo tops near 17,400 ft (Figure 3 is an enlarged view).

A review of the radial velocity data did not detect any strong outflows or divergent couplets typically associated with any strong outflow or microbursts at the time of the incident.

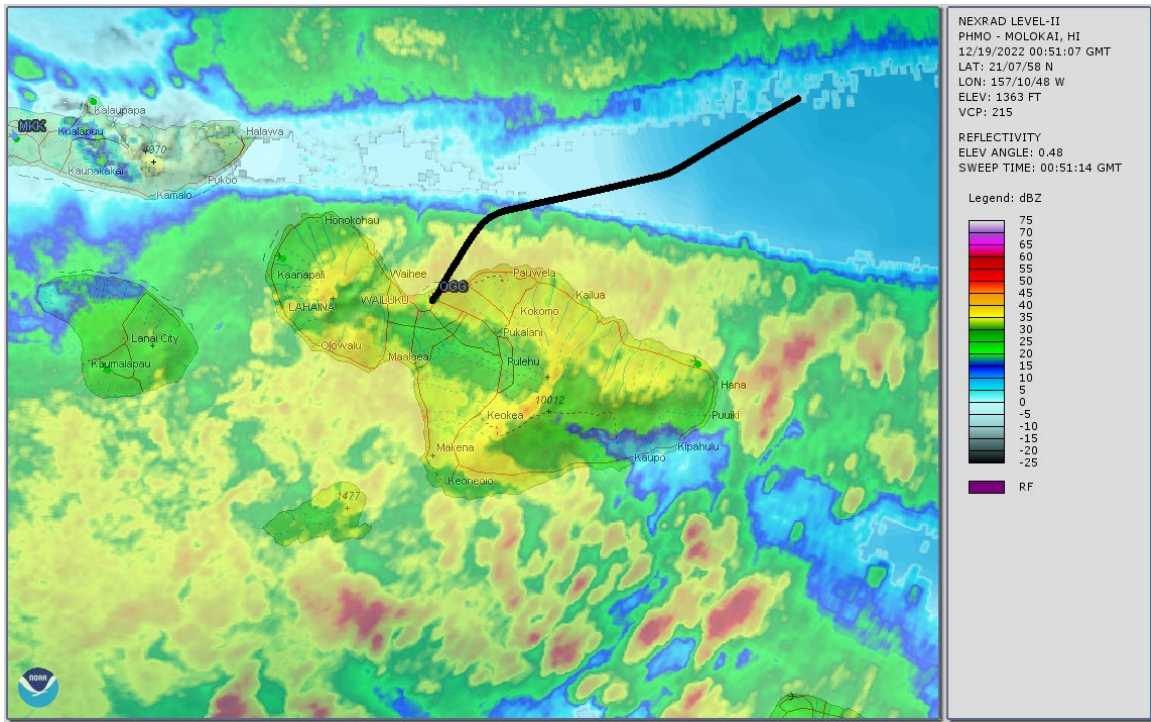


Figure 2 WSR-88D 0.5 base reflectivity with airplane ground track

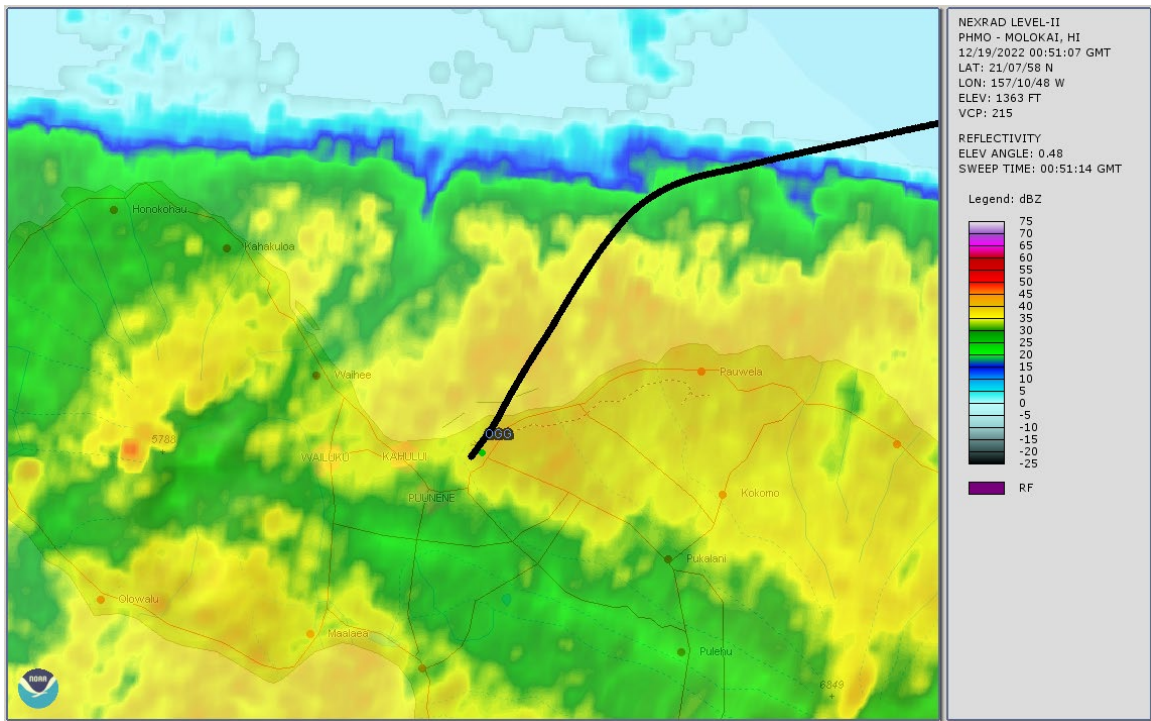


Figure 3 WSR-88D 0.5 base reflectivity with airplane ground track (enlarged)

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