



**National Transportation Safety Board
Office of Aviation Safety
Washington, D.C. 20594-2000**

December 20, 1999

**METEOROLOGY FACTUAL REPORT
DCA00MA006**

A. ACCIDENT

Air Carrier: EgyptAir flight 990
Aircraft: Boeing 767-366-ER, registration: SUGAP
Location: Atlantic Ocean near Nantucket Island, Massachusetts
Date: October 31, 1999
Time: 0150 Eastern Standard Time (0650Z)

B. METEOROLOGICAL SPECIALIST

Donald Eick
Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C.

C. SUMMARY

About 0150 eastern standard time (EST), on October 31, 1999, a Boeing 767-366ER, SUGAP, operated by EgyptAir, as flight 990, crashed into the Atlantic Ocean about 60 miles south of Nantucket, MA. EgyptAir flight 990 was being operated under the provisions of Egyptian Civil Aviation Regulations Part 121 and United States Title 14 Code of Federal Regulations Part 129 as a scheduled, international flight from John F. Kennedy Airport (JFK), New York, New York to Cairo International Airport in Cairo, Egypt. The flight departed JFK about 0122 EST, with 4 flight crew members, 10 flight attendants, and 203 passengers on board. There were no survivors. The airplane was destroyed by impact forces. Floating debris from the aircraft was recovered on the morning of October 31, 1999.

D. DETAILS OF INVESTIGATION

All data and products in this report were obtained from the National Weather Service (NWS) headquarters or the National Climatic Data Center (NCDC) to reconstruct the weather conditions. All times are reported in Universal Time Coordinated (UTC) based upon the 24 hour clock. Local reference time zone in use Eastern Standard Time, UTC -5 hours and UTC=Z. Directions are referenced to true north and distances are in nautical miles. Heights are above mean sea level (MSL) unless otherwise noted. Visibility is reported in statute miles and fractions of statute miles.

1.0 Surface Observations

The surrounding area was documented by meteorological aerodrome reports or METARs for conditions likely encountered. All cloud heights in this section are reported above ground level (AGL).

1.0.1 Nantucket Memorial Airport, Nantucket Island, Massachusetts (KACK)

Nantucket Memorial Airport is located approximately 55 miles northwest of the accident site, at an elevation of 48 feet. Nantucket reported the following weather conditions surrounding at the time of the accident:

KACK weather at 0653Z, wind from 170 degrees at 9 knots, visibility 9 miles, sky clear below 12,000 feet, temperature 12.8 degrees Celsius (C), dew point temperature 11.7 degrees C, altimeter 30.39 inches of mercury (Hg). Remarks: Automated Surface Observation System (ASOS) observation, sea level pressure 1027.9 millibars (mb), thunderstorm sensor not operating.

KACK weather at 0553Z, wind from 170 degrees at 7 knots, visibility 10 miles, sky clear below 12,000 feet, temperature 12.2 degrees C, dew point temperature 11.7 degrees C, altimeter 30.41 inches of Hg. Remarks: ASOS observation sea level pressure 1028.5 mb.

1.0.2 John F. Kennedy International Airport, Jamaica, New York (KJFK)

The flight departed from John F. Kennedy International Airport, and is located 183 miles west of the accident site. The weather reported at the time of the departure to the accident period is as follows:

KJFK weather at 0651Z, wind from 250 degrees at 3 knots, tower visibility 1/2 miles in mist, temperature and dew point at 11.1 degrees C, altimeter 30.38 inches of Hg. Remarks: ASOS observation, surface visibility 1 1/4 mile, sea level pressure 1028.6 mb.

KJFK weather at 0551Z, wind from 210 degrees at 6 knots, tower visibility 1/2 mile in mist, runway 4R runway visual range greater than 6,000 feet, ceiling overcast at 300 feet, temperature and dew point 11.7 degrees C, altimeter 30.39 inches of Hg. Remarks: ASOS observation, surface visibility 1 mile, sea level pressure 1028.9 mb.

KJFK special observation at 0541Z, wind from 210 degrees at 5 knots, tower visibility 1/2 mile in mist, ceiling broken at 500 feet, temperature and dew point 12 degrees C, altimeter 30.39 inches Hg. Remarks: ASOS observation, surface visibility 1 1/2 mile.

KJFK weather at 0451Z, wind from 180 degrees at 4 knots, visibility 3 miles in mist, scattered clouds at 500 feet, temperature and dew point 11.7 degrees C, altimeter 30.40 inches of Hg. Remarks: ASOS observation, sea level pressure 1029.2 mb.

2.0 Upper Air Data

The closest upper air sounding to the accident site was from Chatham, Massachusetts located approximately 83 miles north of the accident site. The 0000Z sounding on October 31, 1999, was documented in graphic and alphanumeric format (attachment 1). The sounding provided the following temperature and wind information. The data has been rounded to the nearest thousand foot level.

| <u>Altitude (FT)</u> | <u>Temp. (°C)</u> | <u>Dew point (°C)</u> | <u>Wind Direction-Speed</u> |
|----------------------|-------------------|-----------------------|-----------------------------|
| Surface | 11.6 | 05.6 | 170° 8 KT |
| 2,000 | 10.7 | 00.6 | 190° 12 KT |
| 4,000 | 10.8 | - 00.6 | 250° 10 KT |
| 6,000 | 08.3 | 00.9 | 285° 9 KT |
| 8,000 | 05.1 | - 12.5 | 315° 12 KT |
| 10,000 | 01.6 | - 21.4 | 295° 17 KT |
| 12,000 | - 01.5 | - 16.9 | 280° 20 KT |
| 14,000 | - 06.5 | - 15.7 | 275° 23 KT |
| 16,000 | - 11.4 | - 19.3 | 270° 27 KT |
| 19,000 | - 17.3 | - 34.3 | 280° 33 KT |
| 20,000 | - 19.5 | - 35.4 | 280° 32 KT |
| 22,000 | - 23.1 | - 32.1 | 280° 37 KT |
| 24,000 | - 29.9 | - 33.4 | 275° 43 KT |
| 26,000 | - 32.7 | - 42.7 | 275° 45 KT |
| 28,000 | - 37.1 | - 50.1 | 285° 51 KT |
| 30,000 | - 40.4 | - 65.7 | 295° 53 KT |
| 31,000 | - 42.1 | - 65.7 | 300° 59 KT |
| 34,000 | - 51.7 | - 65.7 | 295° 53 KT |
| 37,000 | - 52.8 | - 68.1 | 295° 52 KT |

3.0 WSR-88D Doppler Weather Radar Data

The National Climatic Data Center National Radar Mosaic indicated no weather returns from the period 0600Z through 0730Z on October 31, 1999.

The level II radar tape of the Weather Surveillance Radar-1988 Doppler (WSR-88D) Taunton, Massachusetts (KBOX) site was obtained from the National Climatic Data Center (NCDC). The tape was then displayed on a National Transportation Safety Board Hewlett-Packard X-Station utilizing WSR-88D Algorithm Testing And Display System (WATADS) software. The period from 0647Z to 0702Z was documented, during this period the radar was being operated in the clear air mode.

The accident site was located 154 degrees and 113 miles from the KBOX radar antenna. Assuming standard refraction of the radar beam in the atmosphere, the 0.95 degree beam from the WSR-88D would be at the following heights based on the following antenna elevation angles.

| <u>Antenna Elevation</u> | <u>Beam Center</u> | <u>Beam Top</u> | <u>Beam Base</u> | <u>Beam Width</u> |
|--------------------------|--------------------|-----------------|------------------|-------------------|
| 0.5° | 14,454 FT | 20,147 FT | 8,762 FT | 11,385 FT |
| 1.5° | 26,567 FT | 32,260 FT | 20,875 FT | 11,385 FT |
| 2.5° | 38,533 FT | 44,225 FT | 32,840 FT | 11,385 FT |

The various radar elevation scans covering the period are referenced below with their respective times. The last know position of the aircraft was reported at 40.348N 69.76W by Air Traffic Control and is marked by a triangle on the radar images.

- Attachment 2 - 0647:09Z radar image at the 0.5 degree elevation scan.
- Attachment 3 - 0649:44Z radar image at the 1.5 degree elevation scan.
- Attachment 4 - 0652:19Z radar image at the 2.5 degree elevation scan.
- Attachment 5 - 0657:01Z radar image at the 0.5 degree elevation scan.
- Attachment 6 - 0659:36Z radar image at the 1.5 degree elevation scan.
- Attachment 7 - 0702:11Z radar image at the 2.5 degree elevation scan.

4.0 Pilot Reports

There were no pilot reports indicating any significant meteorological event were transmitted in the accident area between 0400Z to 1200Z on October 31, 1999.

5.0 Satellite Data

The Geostationary Operational Environmental Satellite number 8 (GOES-8) imagery was obtained from the National Climatic Data Center (NCDC) and displayed on the NTSB's Man-Computer Data Interactive Data Access System (McIDAS) workstation. Several different bands were examined for the period from 0502Z through 0702Z on October 31, 1999, at 15 minute intervals. The infrared (band 2 and 4) imagery at a wavelength of 3.9 and 10.7 microns and the moisture channel (band 3) at a wavelength of 6.8 microns provide a resolution of 4 kilometers.

Attachment 8 is the infrared band 4 image at 0645Z at 4X magnification. The infrared satellite imagery indicated a band of mid to low level clouds oriented in a northeast to southwest line located over the general location of the accident. No convective clouds were observed in the area. At a location 60 miles south of Nantucket the radiative temperatures indicated a cloud top temperature of 256.7 degrees Kelvin (-16 degrees C). The radiative temperature compared to the Chatham, Massachusetts, sounding in section 2.0 above, indicates cloud tops near 19,000 feet. At 0715Z the radiative temperature at the same location registered 284.1 degrees Kelvin (+11 degrees C) or near surface temperature.

Attachment 9 is the band 2 infrared image at 0715Z on October 31, 1999. The infrared band 2 image typically is used to identify low level cloud layers and fog, and in this case also identifies the different sea surface temperatures.

Attachments 10 and 11 are the water vapor images at 0645Z and 0715Z on October 31, 1999. No moisture channel darkening is noted in the immediate vicinity of the accident site, which is a common characteristic of vertical motion and turbulence.

6.0 In-Flight Weather Advisories

There were no in-flight weather advisories issued by the NWS current for the area of the accident. No Convective SIGMETs, SIGMETs, AIRMETs, Severe Weather Forecast Alerts, or Center Weather Advisories were issued for the accident site. In addition, there were no International SIGMETs issued by New York Center (ZNY) current for the area of the accident site.

7.0 Astronomical Data

The calculations below are based on an initial upset at an altitude of 33,000 feet and is based upon data from the U.S. Naval Observatory located in Washington, D.C..

Accident location: Latitude 40°21'N Longitude 069°46' W
Sunset: 2154Z
End of civil twilight: 2222Z

Altitude of the Sun: -45.5 degrees below the horizon
Altitude of the Moon: 41.6 degrees above the horizon
Percent illumination of Moon: 53 %
Azimuth of the Moon: 98 degrees

~~Donald E. Eick~~
Donald E. Eick
Meteorologist

Handwritten:
12-29-99