NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington D. C. 20594

Meteorological Factual Report
DCA97MA017

A. ACCIDENT

Date: January 9, 1997.
Location: Monroe, Michigan.
Time: About 2054 UTC.
Aircraft: EMB-120 RT, N265CA, COMAIR Flight 3272.

B. METEOROLOGICAL GROUP

Chairman:

Gregory D. Salottolo, National Transportation Safety Board, Washington D.C.

Members:

Herb White, National Weather Service, Silver Spring, Maryland.
James Johnson, Air Line Pilots Association, Glenview, Illinois.
Steve Rayborn, COMAIR, Inc., Cincinnati, Ohio.

Herb White joined the investigation on January 11, 1997.
James Johnson and Steve Rayborn joined the investigation on January 12, 1997.

C. SUMMARY

On January 9, 1997, at 2054 Coordinated Universal Time (UTC), COMAIR flight 3272, an Embraer EMB-120RT, N265CA, crashed while being vectored for an approach to runway 3R at Detroit Metro Wayne County airport (KDTW). The flight was operated under 14 Code of Federal Regulations (CFR) Part 135 and carried 26 passengers and 3 crew members. The airplane was destroyed by impact and a post crash fire. There were no survivors. Instrument meteorological conditions prevailed at the time of the accident.

D. DETAILS OF INVESTIGATION

Note: in the report all times are Coordinated Universal Time (UTC) based on the 24 hour clock unless noted. All directions with reference to true north unless noted. All heights above mean sea level (MSL) unless noted. Heights in terminal forecast and surface weather observations above ground level. Z = UTC. Eastern Standard Time (EST) = UTC - 5 hours.

Synoptic Situation

The 1800Z National Weather Service [NWS] surface analysis showed a low pressure center [992 millibars] in East-Central Indiana with a surface trough extending to the northeast of the low pressure center. The 2100Z NWS surface analysis showed the low pressure center [988 millibars] near Northern Ohio with a surface trough extending to the northeast.

See Attachments_A 1 and 2.

Surface Weather Observations

Monroe Custer Airport, Monroe Michigan (D92)

D92 is located about 6 nautical miles east-southeast of the accident site.

2041Z .. Sky partially obscured; 700 feet scattered, 1,300 feet overcast; visibility 1 ¼ miles; temperature 28 degrees F; dew point 27 degrees F; winds 170 degree at 5 knots; altimeter setting 29.20 inches of Hg.

2101Z .. 700 feet scattered, 1,700 feet broken; 5,000 feet broken; visibility 3 ½ miles; temperature 28 degrees F; dew point 27 degrees F; winds 180 degrees at 6 knots; altimeter setting 29.18 inches of Hg.

See Attachments_A 3, 4, and 5.

METAR .. Aviation Routine Weather Report.
SPEC / SPECI .. Special Report.

Detroit, Michigan (KDTW)

DTW is located about 19 nautical miles north-northeast of the accident site.

2041Z .. SPEC .. Winds 060 degrees at 6 knots; visibility 1 ½ miles; light snow, mist; ceiling 600 feet broken, 1,100 feet broken, 1,900 feet overcast; temperature -3 degrees C;

dew point -3 degrees C; altimeter setting 29.19 inches of Hg; .00 inch of precipitation from 1954Z.

2054Z .. METAR ..Winds 070 degrees at 5 knots; visibility ¾ mile; light snow, mist; ceiling 600 feet broken, 1,200 feet broken, 1,700 feet overcast; temperature -2 degrees C; dew point -3 degrees C; altimeter setting 29.19 inches of Hg., ceiling 400 feet variable 900 feet; .00 inch of precipitation from 1954Z.

2103Z .. SPEC .. Winds 080 degrees at 3 knots; visibility 1 mile; light snow, mist; 600 feet scattered, 900 feet scattered, ceiling 1,400 feet overcast; temperature -2 degrees C; dew point -3 degrees C; altimeter setting 29.18 inches of Hg.; .00 inch of precipitation from 2054Z.

A trace of precipitation was recorded between 1954Z and 2054Z.
A trace of precipitation was recorded between 2054Z and 2154Z.
Light snow [-SN] began at 2005Z and ended at 2150Z.
Mist [BR] began at 2035Z and ended at 2050Z.
Mist [BR] began at 2100Z and ended at 2255Z.

See Attachments_A 6, 7, and 8.

Ann Arbor, Michigan (KARB)

ARB is located about 17 nautical miles north-northwest of the accident site.

2053Z .. METAR .. Winds 090 degrees at 8 knots; visibility 4 miles; light snow; mist; few clouds at 600 feet, ceiling 2,000 feet overcast; altimeter setting 29.20 inches of Hg.

2121Z .. SPECI .. winds 100 degrees at 8 knots; visibility 2 ½ miles; light snow, mist; ceiling 1,600 feet broken; 2,100 feet overcast; altimeter setting 29.18 inches of Hg.

See Attachments_A 9 and 10.

Toledo, Ohio (KTOL)

TOL is located about 25 nautical miles south-southwest of the accident site.

1951Z .. METAR .. Winds 160 degrees at 4 knots; visibility 1 ¾ miles; light snow, mist; ceiling 1,400 feet overcast; temperature -3 degrees C; dew point -4 degrees C; altimeter setting 29.22 inches of Hg.; .01 inch of precipitation from 1851Z.

2033Z .. SPEC .. Winds 160 degrees at 4 knots; visibility 1 ¼ miles; light snow, mist; 1,400 feet scattered, 1,900 feet broken, 2,400 feet overcast; temperature -3 degrees C; dew point -3 degrees C; altimeter setting 29.19 inches of Hg.; .01 inch of precipitation from 1951Z.

2051Z .. METAR .. Winds 190 degrees at 5 knots; visibility 1 ¾ miles; light snow, mist; few clouds at 600 feet, ceiling 2,200 feet broken, 4,500 feet overcast; temperature -3 degrees C; dew point -3 degrees C; altimeter setting 29.18 inches of Hg., .02 inch of precipitation from 1951Z.

2105Z .. SPEC .. Winds 200 degrees at 7 knots; visibility 2 ½ miles; light snow, mist; ceiling 800 feet broken, 3,000 feet broken, 4,500 feet overcast; temperature -2 degrees C; dew point -3 degrees C; altimeter setting 29.18 inches of Hg.; .00 inch of precipitation from 2051Z.

2131Z .. SPEC .. Winds 220 degrees at 11 knots gusts to 17 knots; visibility 2 ½ miles; light snow, mist; 800 feet scattered, 1,400 feet scattered, ceiling 3,900 feet overcast; temperature -2 degrees C; dew point -3 degrees C; altimeter setting 29.17 inches of Hg., precipitation .00 inch from 2051Z.

Light snow [-SN] began at 1835Z and ended at 2125Z.
Mist [BR] began at 1835Z and ended at 2145Z.

See **Attachments_A** 11, 12, and 13.

Findlay, Ohio (FDY)

FDY is located about 58 nautical miles south of the accident site.

1950Z .. METAR .. Winds 220 degrees at 7 knots gusts to 15 knots; visibility 3 miles; mist, light rain; ceiling 800 feet overcast; temperature 0 degree C; dew point -1 degree C; altimeter setting 29.22 inches of Hg.; snow ended 1932Z, rain began 1933Z.

2032Z .. SPECI .. Winds 220 degrees at 13 knots; visibility 5 miles; mist, light rain; ceiling 1,100 feet broken, 2,100 feet overcast; temperature 1 degree C; dew point -2 degrees C; altimeter setting 29.20 inches of Hg.

2052Z .. METAR .. Winds 230 degrees at 15 knots gusts to 22 knots; visibility 5 miles; mist, ice pellets; ceiling 1,100 feet broken, 2,000 feet overcast; temperature 0 degree C; dew point -2 degree C; altimeter setting 29.19 inches of Hg.; rain ended 2045Z, ice pellets began 2046Z.

See **Attachments_A** 14.

Cincinnati, Ohio (KCVG)

1854Z .. METAR .. Winds 230 degrees at 11 knots gusts to 18 knots; visibility 5 miles; light snow, mist; 700 feet scattered, ceiling 1,300 feet broken, 1,900 feet overcast; temperature 1 degree C; dew point -1 degree C; altimeter setting 29.34 inches of Hg.; intermittent light snow grains; .00 inch precipitation from 1754Z.

1909Z .. SPEC .. Winds 230 degrees at 11 knots gusts to 23 knots; visibility 2 ½ miles; light snow, mist; 900 feet scattered, ceiling 1,600 feet overcast; temperature 1 degree C; dew point -1 degree C; altimeter setting 29.33 inches of Hg.; .00 inch of precipitation from 1854Z.

1954Z .. METAR .. Winds 240 degrees at 16 knots gusts to 28 knots; visibility 8 miles; ceiling 1,800 feet broken, 2,500 feet overcast; temperature 1 degree C; dew point -3 degrees C; altimeter setting 29.32 inches of Hg.; .00 inch of precipitation from 1854Z.

2013Z .. SPEC .. Winds 250 degrees at 12 knots gusts to 23 knots; visibility 6 miles; light snow, mist; ceiling 1,400 feet overcast; temperature 0 degree C; dew point -2 degrees C; altimeter setting 29.33 inches of Hg.; snow began 2003Z; .00 inch precipitation from 1954Z.

Light snow [-SN] began 1735Z and ended 1925Z.
Light snow [-SN] began 2005Z and ended 2100Z.
Mist [BR] began 1740Z and ended 1900Z.
Mist [BR] began 1905Z and ended 1925Z.
Mist [BR] began 2015Z and ended 2030Z.

See *Attachments_A* 15, 16, and 17.

Information from Detroit Edison Company

Maybee, Michigan, Meteorological Monitoring Site 1/9/97 ....
The site is located about 3 nautical miles north-northeast of the accident site...

2000Z .. Peak wind speed 12.3 mph; average wind speed 6.9 mph; average wind direction 57 degrees; average wind standard deviation 11.4 degrees; temperature 27.2 degrees F.
2100Z .. Peak wind speed 7.8 mph; average wind speed 3.1 mph; average wind direction 87 degrees; average wind standard deviation 27.2 degrees; temperature 28.2 degrees F.

Enrico Fermi Atomic Power Plant Unit 2 ...
2000:18Z .. 10 meters wind speed 8.9 mph; 10 meters wind direction 103.4; temperature at 10 meters -1.4 degrees C; 60 meters wind speed 13.8 mph; 60 meters wind direction 108.4.
2100:18Z .. 10 meters wind speed 7.1 mph; 10 meters wind direction 158.5; temperature at 10 meters -0.9 degree C; 60 meters wind speed 10.6 mph; 60 meters wind direction 167.5.

See Attachments_A 18 and 19.

According to officials at Detroit Edison, contacted by phone on February 24 and 25, 1997, the Enrico Fermi Atomic Power Plant was running at about 20% of capacity on January 9, 1997. This would not have resulted in any significant moisture plume being emitted from the cooling towers. The plant is located about 92 degrees at 13 nautical miles from the accident site. The cooling towers are at 400 feet above ground level.

The Monroe Power Plant (coal fired), which is located about 119 degrees at 10 nautical miles from the accident site, was operating at full capacity. The Monroe Power Plant has 2 stacks, each at a height of 800 feet above ground level.

See Attachments_A 20.

Upper Air Data

White Lake, Michigan 1/10/0000Z

White Lake, Michigan is located about 44 nautical miles north of the accident site.

Upper air data obtained on McIDAS.

Height .. Meters MSL.
Temp .. Temperature Degrees C.
Dew Pt .. Dew Point Temperature Degrees C.
Dir .. Wind Direction Degrees True.
Spd .. Wind Speed Meters Per Second.

Height	Temp	Dew Pt	Dir	Spd
329.0	-5.7	-6.7	230.0	2.0
362.2	-4.7	-7.6	224.8	2.3
522.4	-4.7	-5.1	200.0	3.6
609.0	-5.2	-5.6	185.0	4.1
914.0	-7.1	-7.4	155.0	6.1
1,183.6	-8.7	-9.0	150.0	7.7
1,219.0	-8.8	-9.1	150.0	8.2
1,829.0	-10.5	-10.9	160.0	10.2
2,678.0	-12.9	-13.5	176.2	15.5
3,252.1	-15.9	-18.0	187.2	19.1
3,658.0	-19.0	-26.7	195.0	21.6

Upper air data from White Lake, Michigan and Wilmington, Ohio for January 10, 1997 at 0000Z are contained as Attachments_A 21 and 22 .

WSR-88D Doppler Weather Radar Data

Doppler Weather Radar data were obtained from the National Weather Service White Lake, Michigan radar site (KDTX). Base reflectivity images for 2043Z, 2049Z, 2055Z, and 2100Z showed weak weather echoes (weather radar reflectivities less than or equal to 15 dBZ) in the area of the accident. Base velocity images for the above times showed a southerly wind component of about 20 knots for the area of the accident. The radar elevation angle was set to .5 degrees. The beam height over the accident site was about 5,000 feet. The accident site is located about 45 nautical miles south of KDTX.

See Attachments_B 1, 2, 3, 4, 5, 6, 7, and 8. The cross on the images = the approximate accident location.

The following winds were estimated from the VAD Wind Profile within a 30 kilometer radius of KDTX for 2055Z:

Height (feet)	Wind Direction (degrees true)	Wind Speed (knots)
2,000	106	20
3,000	142	20
4,000	170	25
5,000	202	25
6,000	201	25
7,000	188	30
8,000	204	40
9,000	209	45
10,000	219	45

See Attachments_B 9.

An Airbus 320 [Cactus 50] reported winds at 4,600 feet of 237 degrees at 32 knots. The time of the report was 2053:14Z. The altitude of 4,600 feet was obtained from the radar track plot. The time of 2053:14Z was obtained from the Air Traffic Control Transcript.

Cactus 50 reported seeing a Brazilia at 11,000 feet. Cactus 50 was at 12,000 feet. The time was 2045:22Z. Information was from the Air Traffic Control Transcript.

Attachments_B 10 and 11 .. WSR-88D Doppler Weather Radar Composite Reflectivity Images from Cleveland, Ohio (KCLE); times 2038Z and 2055Z.

Attachments_B 12, 13, and 14 .. WSR-88D Doppler Weather Radar Composite Reflectivity Images from Wilmington, Ohio (KILN); times 2030Z, 2047Z, and 2105Z.

Attachments_B 15 .. Range-Radar Beam Altitude Nomogram (Federal Meteorological Handbook No. 11).

Satellite Data

Geostationary Operational Environmental Satellite (GOES) 9 data were reviewed on the Safety Board's McIDAS Workstation. GOES 9 visible images for 2000Z, 2030Z, and 2100Z showed an extensive lower cloud cover over Ohio and Southeastern Michigan. The cloud cover was moving to the northeast. A small area of higher clouds can be seen moving from West Central Ohio to the northeast. The visible images are at a 2 kilometer [blowdown] resolution and are contrast stretched and remapped (Lambert Conformal Projection). The GOES 9 visible images are contained in **Attachments_C** 1, 2, and 3. The cross box on the images = the accident location.

GOES 9 infrared images [Band = 4] for 2000Z, 2030Z, and 2100Z showed warming radiative temperatures in the area of the accident. Radiative temperatures at the accident site increased from 249 degrees K at 2000Z to 256 degrees K at 2100Z. Radiative temperatures were about 256 degrees K in Northern Ohio and Southeastern Michigan at 2030Z and 2100Z. Using upper air data from White Lake, Michigan and Wilmington, Ohio for 1/10/97 at 0000Z indicates cloud tops of about 11,000 feet given a temperature of 256 degrees K. See **Attachments_C** 4, for a plot of upper air data from White Lake and Wilmington.

The GOES 9 infrared image for 2000Z showed radiative temperatures in the CVG area of about 260 degrees K. This would correspond to a cloud top of about 9,000 feet (using White Lake and Wilmington upper air data). The 2000Z image also showed predominant radiative temperatures along the route from CVG to the Michigan border of about 260 to 256 degrees K (cloud tops 9,000 feet to 11,000 feet). A small area of minimum temperatures of about 245 degrees K (cloud tops about 17,000 feet) were located in West Central Ohio. At 2030Z the predominate radiative temperatures along the route from CVG to the Michigan border remained about 260 to 256 degrees K. The area of minimum temperatures seen at 2000Z moved northeast. The minimum temperatures had warmed to about 250 degrees K (cloud tops of about 14,000 feet). GOES 9 infrared images are contained in **Attachments_C** 5, 6, and 7. The infrared images are at a 1 kilometer [blow up] resolution with radiative temperature contours in degrees K plotted. The images are remapped (Lambert Conformal Projection) and color enhanced. The cross box = the location of the accident.

Icing research* has shown that GOES 9 multispectral imager data can be used to sense possible aircraft icing regions. The following values from the GOES 9 imager for the accident location and a time of 2100Z were noted:

Band 1 Brightness .. 96 counts
Band 2 Temperature .. 278 degrees K [4.8 degrees C].
Band 4 Temperature .. 256 degrees K [-17.2 degrees C].
Band 5 Temperature .. 257 degrees K [-16.2 degrees C].

Band 2 - Band 4 = 22 degrees K
Band 4 - Band 5 = -1.0 degrees K

The research has shown that these values are indicative of possible icing conditions (Band 4 temperature rounded to -17 degrees C).

*Remote Sensing of Aircraft Icing Regions Using Multispectral Imager Data; Gary P. Ellrod and James P. Nelson; 15th Conference on Weather Analysis and Forecasting. See **Attachments_C 8, 9, 10, and 11.**

Pilot Weather Reports

310 degrees at 15 nautical miles from DTW / time 2155Z / Flight Level 9,000 feet / type aircraft C414 / temperature -8 degrees C / icing negative during descent 9,000 feet to 4,000 feet.

230 degrees at 25 nautical miles from DTW / time 2110Z / Flight Level 5,000 feet / type aircraft DC-3 / icing moderate mixed.

045 degrees at 15 nautical miles from DXO / time 2040Z / Flight Level 10,000 feet / type aircraft B-757 / skies 3,500 feet overcast tops 4,500 feet, 7,000 feet overcast / temperature -13 degrees C / icing trace 3,500 feet to 4,500 feet.

Over CRL / time 2031Z / Flight Level 16,000 feet / type aircraft Lear 24 / icing moderate rime.

180 degrees at 18 nautical miles from CMH / time 2119Z / Flight Level 4,000 feet / type aircraft MU-2 / icing light mixed.

Over CMH / time 2030Z / Flight Level unknown / type aircraft PA-20 / skies overcast to 6,600 feet. / icing trace rime.

135 degrees at 40 nautical miles from FDY / time 2024Z / during climb / type aircraft BA31 / skies overcast to 10,000 feet / icing moderate rime 8,000 to 10,000 feet.

Over CVG / time 2003Z / Flight Level 8,000 feet / type aircraft E120 / skies 2,300 feet overcast tops 8,000 feet / icing trace to light mixed.

220 degrees at 6 nautical miles from CVG / time 2009Z / Flight Level unknown / type aircraft CL65 / skies overcast 8,000 feet / icing light to moderate rime 3,500 to 7,500 feet / during climb.

180 degrees at 10 nautical miles from DAY / time 2008Z / Flight Level 3,000 feet / type aircraft DC-8 / icing moderate rime.

Over AOH / time 2002Z / Flight Level 9,000 feet / type aircraft C310 / icing severe rime / reported as heavy.

CVG ..Cincinnati, Ohio.
DAY .. Dayton, Ohio.
FDY .. Findlay, Ohio.
AOH .. Lima, Ohio.
CRL .. Carleton, Michigan.
DXO .. Detroit, Michigan

Attachments_D 1 - 16 .. Pilot Reports (PIREPS).
Attachments_D 17 .. Plot of PIREPs.
Attachments_D 18 and 19 .. PIREP Classification as Urgent (UUA).

Area Forecast (FA)

Information contained in the National Weather Service Area Forecast (CHIC FA 091945) issued January 9 at 1945Z and valid until January 10 at 0800Z is as follows:

Wisconsin, Lake Superior, Lake Huron, Lake Michigan, **Michigan** ..
Ceilings broken 1,000 to 2,000 feet, broken at 4,000 feet, overcast at 7,000 feet, tops Flight Level 30,000 feet. Visibility 3 to 5 miles in moderate snow.

Information contained in the National Weather Service Area Forecast (BOSC FA 091845) issued January 9 at 1845Z and valid until January 10 at 0700Z is as follows:

Ohio, Lake Erie ..
Northern Half .. Clouds 1,500 to 2,500 feet overcast, tops to Flight Level 25,000 feet. Visibility 3 to 5 miles in light snow and mist. Occasional light ice pellets and light freezing rain until 0000Z.

The FA was issued by the Aviation Weather Center in Kansas City, Missouri.

See Attachments_E 1, 2, 2a, and 2b.

An Area Forecast (FA) is a forecast of Visual Flight Rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra bulletin for the same area in order to get a complete picture of the weather. The Area Forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports that do not have terminal forecasts.

The Area Forecast consists of a:

a) Synopsis section which is a brief summary of the location and movement of fronts, pressure systems, and circulation patterns for an 18 hour period.

b) VFR clouds and weather section which is a 12 hour forecast, in broad terms, of clouds and weather significant to flight operations plus a 6 hour categorical outlook.

Reference: Aviation Weather Center, Kansas City, Missouri.

In-Flight Weather Advisories

AIRMET Tango Update 3 [BOST WA 091445] for turbulence and low level wind shear issued 1445Z and valid until 2100Z ..

Moderate turbulence below 12,000 feet due to moderate/strong southerly low level winds. Isolated severe turbulence possible Eastern Ohio.

The route from CVG to the Michigan border was contained in the area outlined by this advisory. See Attachments_E 3.

Occasional moderate turbulence between 12,000 feet and Flight Level 33,000 feet western half of area and between Flight Level 18,000 feet and Flight Level 38,000 feet eastern half.

The route from CVG to the Michigan border was contained in the area outlined by this advisory. [Although DTW was a point on the line defining the area encompassed by the AIRMET, the AIRMET was valid for Ohio (OH). Therefore, the defining area line ends at the Michigan / Ohio border.] See Attachments_E 4.

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AIRMET Tango Update 3 [CHIT WA 091445] for turbulence issued 1445Z and valid until 2100Z ..

See SIGMET Quebec Series for Severe Turbulence ..

Occasional moderate turbulence between 15,000 feet and Flight Level 35,000 feet associated with strong jetstream and upper level trough.

DTW was included in the area outlined by this advisory. See **Attachments_E** 5.

Occasional light to moderate turbulence below 15,000 feet associated with moderate southwesterly/southerly winds.

DTW was included in the area outlined by this advisory. See **Attachments_E** 6.

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AIRMET Zulu Update 2 [BOSZ WA 091445] for Ice and Freezing Level issued 1445Z and valid until 2100Z ..

Occasional moderate rime / mixed icing in cloud and in precipitation below Flight Level 25,000 feet. Isolated severe ice possible below 15,000 feet over Ohio ..

Freezing level at the surface.

The route from CVG to the Michigan border was contained in the area outlined by this AIRMET. See **Attachments_E** 7.

AIRMET Zulu Update 3 [CHIZ WA 091445] for Ice and Freezing Level issued 1445Z and valid until 2100Z ..

Occasional light to moderate rime icing in clouds below 18,000 feet.

Freezing level at or near the surface.

DTW was included in the area outlined by this advisory. See **Attachments_E** 8.

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AIRMET Sierra Update 3 [BOSS WA 091445] for IFR issued 1445Z and valid until 2100Z ..

Ceiling below 1,000 feet / visibility below 3 miles precipitation / fog / mist.

The route from CVG to the Michigan border was contained in the area outlined by this AIRMET. See **Attachments_E** 9.

AIRMET Sierra Update 3 [CHIS WA 091445] for IFR issued 1445Z and valid until 2100Z ..

Ceiling below 1,000 feet / visibility below 3 miles precipitation / mist.

DTW was included in the area outlined by this advisory. See **Attachments_E** 10.

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SIGMET Quebec 4 [BOSQ UWS 091600 & CHIQ WS 091600] issued 1600Z and valid until 2000Z ...

Moderate occasional severe turbulence between 13,000 feet and Flight Level 30,000 feet. Conditions ending Michigan portion area 2000Z ..

The route from CVG to DTW was included in the area outlined by this advisory. See **Attachments_E** 11.

SIGMET Quebec 4 was canceled at 2000Z .. Conditions mostly moderate over the Chicago Forecast Area .. See BOSQ WS for latest issuance of SIGMET Quebec 5.

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SIGMET Quebec 5 [BOSQ WS 092000] issued 2000Z and valid until 1/10/0000Z ...

Moderate to severe turbulence between 11,000 feet and Flight Level 28,000 feet.

The route from CVG to just south of DTW was included in the area outlined by this advisory. See **Attachments_E** 12.

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The following Urgent Center Weather Advisory (ZOB1 UCWA 091735) was issued at 1735Z by the Meteorologist at the Cleveland Air Route Traffic Control Center Weather Service Unit (ZOB CWSU). The Urgent Center Weather Advisory was valid until 1935Z..

Occasional moderate - severe rime / mixed / clear icing in cloud and in precipitation at or below 16,000 feet. Severe rime / mixed icing in cloud and in precipitation reported vicinity KDTW and 40 nautical miles southwest of KCLE at 12,000 to 14,000 feet. The area covered by the CWA included Northern Ohio and Eastern Michigan. See **Attachments_E** 13.

There were no Center Weather Advisories in effect issued by the ZOB CWSU for the time and location of the accident.

The following Center Weather Advisory (ZID1 CWA 092045) was issued at 2045Z by the Meteorologist at the Indianapolis Air Route Traffic Control Center Weather Service Unit (ZID CWSU). The Center Weather Advisory was valid until 2245Z..

Frequent occasional severe ice in clouds / precipitation 3,000 feet to 10,000 feet. The area covered by the CWA included West Central through Southwestern Ohio. See Attachments_E 14.

Attachments_E 15, 16, 17, and 18 .. AIRMET Icing, Turbulence, and IFR texts.
Attachments_E 19 and 20 .. SIGMET Quebec texts and cancellation.
Attachments_E 21, 22, and 23 .. Center Weather Advisory texts from Cleveland and Indianapolis Center.

An AIRMET (AIRman's METeorological Information) advises of weather that maybe hazardous other than convective activity, to single engine, other light aircraft, and Visual Flight Rule (VFR) pilots. However, operators of large aircraft may also be concerned with these phenomena. The items covered are:

In the AIRMET Sierra bulletin:
a) Ceilings less than 1,000 feet and/or visibility less than 3 miles affecting over 50% of the area at one time.
b) Extensive mountain obscuration.

In the AIRMET Tango bulletin:
a) Moderate turbulence.
b) Sustained surface winds of 30 knots or more at the surface.

In the AIRMET Zulu bulletin:
a) Moderate icing.
b) Freezing levels.

AIRMETs are routinely issued for 6 hour periods beginning at 0145Z during Central Daylight Time and at 0245Z during Central Standard Time.

References: Weather Service Operations Manual Chapter D-22; Aviation Weather Center, Kansas City, Missouri.

A SIGMET (SIGnificant METeorological Information) advises of weather potentially hazardous to all aircraft other than convective activity. In the conterminous U.S., items covered are:

a) Severe Icing.
b) Severe or extreme turbulence or clear air turbulence not associated with thunderstorms.
c) Widespread dust storms, sandstorms, or volcanic ash lowering surface and/or in-flight visibility to less than 3 miles.
d) Volcanic eruption.

References: Weather Service Operations Manual Chapter D-22; Aviation Weather Center, Kansas City, Missouri.

A Center Weather Advisory (CWA) is an aviation weather warning for conditions meeting or approaching national In-Flight Advisory (AIRMET, SIGMET, or Convective SIGMET) criteria. The CWA is primarily for use by air crews to anticipate and avoid adverse weather conditions in the en route and terminal environments. The CWA should reflect conditions at the time of issuance and/or be a short range forecast. CWA's are issued by Center Weather Service Unit Meteorologists at the Air Route Traffic Control Centers.

Reference: Weather Service Operations Manual Chapter D-25, 10/25/96.

Meteorological Impact Statements (MIS)

The following MIS (ZOB MIS 01 valid 091220-092100) was issued by the Cleveland Air Route Traffic Control Center Weather Service Unit on January 9 at 1220Z valid until January 9 at 2100Z:

...For ATC Planning Purposes Only.
Over the entire Cleveland Center area, occasional moderate/isolated severe turbulence 12,000 to Flight Level 35,000 feet.
Over the Cleveland Center area southwest of a 60 nautical miles northwest of KERI to 40 nautical miles south of KJST line, occasional ceiling 300 to 600 feet and/or visibility ½ to 2 miles in moderate snow / freezing rain / ice pellets.
Conditions north and west of a KFDY to 40 nautical miles north of KCLE to 30 nautical miles west of KELM remaining all snow. Conditions south and east of a KFDY to 40 nautical miles north of KCLE to 30 nautical miles west of KELM line in moderate snow until 1400Z. Becoming moderate snow / freezing rain / ice pellets southern Cleveland Center area and spreading north to line by 2000Z.
Over the Cleveland Center area west of a 60 nautical miles northwest of KERI to 40 nautical miles south of KJST line moderate turbulence at or below 8,000 feet with low level wind shear at or below 2,000 feet.
Over the Cleveland Center area northwest of a 30 nautical miles west of KELM to KERI to 20 nautical miles north of KPKB line moderate / isolated severe rime / mixed / clear icing in cloud and in precipitation at or below 16,000 feet.
Over the Cleveland Center area southeast of a 30 nautical miles west of KELM to KERI to 20 nautical miles north of KPKB line moderate / isolated severe rime / mixed / clear icing in cloud and in precipitation at or below 22,000 feet.

The following MIS (ZOB MIS 02 valid 092050-100500) was issued by the Cleveland Center Weather Service Unit on January 9 at 2050Z valid until January 10 at 0500Z:

...For ATC Planning Purposes Only.
Over the entire Cleveland Center area ... Occasional moderate isolated severe turbulence 14,000 feet to Flight Level 28,000 feet.
Over the Cleveland Center area west of a 60 nautical miles northwest of KERI to 25 nautical miles northwest of KEKN line .. Moderate isolated severe rime /mixed / clear icing in cloud and in precipitation at or below 16,000 feet.
Over the entire Cleveland Center area ... occasional ceiling 300 to 900 feet and/or visibility ½ to 2 ½ miles in freezing rain / ice pellets / moderate snow / mist.
Over the Cleveland Center area east of a 55 nautical miles northeast of KDTW to 75 nautical miles west of KDTW line .. Occasional moderate turbulence at or below 8,000 feet.

KERI .. Erie, Pennsylvania
KEKN .. Elkins, West Virginia
KCLE .. Cleveland, Ohio
KJST .. Johnstown, Pennsylvania
KELM .. Elmira, New York
KFDY .. Findlay, Ohio
KPKB .. Pakersburg, West Virginia

The accident site is in Cleveland Air Route Traffic Control Center's area.

Attachments_E 24, 25, and 26 .. Meteorological Impact Statement texts from Cleveland and Indianapolis Center.
Attachments_E 27 and 28 .. ZOB Center Weather Service Unit Weather Briefing.
Attachments_E 29 and 30 .. Daily Record of Facility Operations.

A Meteorological Impact Statement (MIS) is an unscheduled flow control and flight-operations-planning forecast. It details weather conditions that are expected to adversely impact the flow of air traffic in the Center Weather Service Unit (CWSU) area of responsibility. The MIS is a forecast and briefing product intended for those personnel at Air Route Traffic Control Centers, Air Traffic Control System Command Center, and large terminal air traffic control facilities responsible for making flow control and flow control-related decisions. MISs are issued by National Weather Service Meteorologists at CWSUs in the Air Route Traffic Control Centers.

Reference: National Weather Service Operations Manual, Chapter D-25.

Terminal Aerodrome Forecast (TAF)

The TAF for KDTW is, in part, as follows:
Issued 1730Z by the National Weather Service Forecast Office in White Lake, Michigan.

1800Z to 2100Z .. Winds 100 degrees at 14 knots gusts to 20 knots, visibility 1 ½ miles, light snow, mist; ceiling 1,500 feet overcast.
Tempo 1800Z to 2100Z .. Visibility ½ mile, moderate snow, ceiling 500 feet overcast.

See Attachments_F 1.
Attachments_F 2, 3, 4, 5, 6, 7, and 8 .. Terminal Forecasts for locations in Ohio and Michigan.

Pre-Departure Weather

The following weather information was provided to the flight crew of Flight 3272 prior to departure from CVG:

Departure Weather ..

The 1822Z KCVG surface weather observation and the 1/9/97 1800Z to 1/10/97 1800Z KCVG TAF.

KCVG .. Cincinnati, Ohio.

Destination Weather ..

The 1754Z surface weather observation for KDTW:
Winds 070 degrees at 11 knots gusts to 17 knots; visibility ¾ mile; light snow, mist; 500 feet scattered, ceiling 1,100 feet broken, 1,400 feet overcast; temperature -4 degrees C; dew point -5 degrees C; Altimeter setting 29.35 inches of Hg.; peak wind 070 degrees at 26 knots at 1659Z; pressure falling rapidly.

The KDTW TAF issued at 1730Z.

A Pilot Report (PIREP) .. Over Windsor, Ontario [CYQG] / time 1818Z / During descent / type aircraft DA-20/ icing 14,000 to 4,000 feet light to moderate rime.

Enroute Weather ..

The 1751Z KDAY and the 1819Z KTOL surface weather observations.

KDAY .. 1751Z .. Winds 200 degrees at 13 knots gusts to 21 knots; visibility 5 miles; mist; ceiling 500 feet overcast; temperature 1 degree C; dew point 0 degrees C; altimeter setting 29.29 inches of Hg.

KTOL .. 1819Z .. Special .. Winds 090 degrees at 8 knots; visibility ¼ mile; snow, freezing fog; vertical visibility 500 feet; temperature -3 degrees C; dew point -4 degrees C; altimeter setting 29.26 inches of Hg.; pressure falling rapidly.
KDAY .. Dayton, Ohio.
KTOL .. Toledo, Ohio

AIRMETs / SIGMETs ..

AIRMET Zulu Update 3 for Icing and AIRMET Tango Update 3 for Turbulence. DTW included in these areas.

AIRMET Zulu Update 2 for Icing and AIRMET Tango Update 3 for Turbulence. Route from CVG to the Michigan boarder included in these areas.

SIGMET Quebec 4 for moderate occasional severe turbulence between 13,000 feet and Flight Level 30,000 feet.

See **Attachments_F** 9 - 17.

Interviews

Interviews with the first people on the accident scene were conducted in person by the Weather Group on January 12, 1997. The following are interview summaries:

INTERVIEW WITH ED WERTEMBERGER

Fire Chief, Monroe Fire Department

January 12, 1997

The Chief of the Monroe Fire Department was interviewed. His best recollection was that there was light snow falling at the time. He estimated that there was approximately 3 1/2" of snowcover on the ground. He described the snowflakes falling as small and wet. He defined wet snow as to whether or not it would pack into a snowball. This snow was packable. He estimated the winds to be blowing from the southwest in reference to a nearby smoke stack he glanced at. He believed the surface winds to be less than 10 knots.

INTERVIEW WITH ASSISTANT FIRE CHIEF

1-12-97

The Assistant Chief of the Monroe Fire Department was interviewed. He recalled the snow to be a wetter snow; snow on the wetter side of the spectrum He felt it was wet snow because it would stick to his pant legs while he was walking. The falling snow packed on his pants up to about 1/2". He couldn't recall any significant wind. He did remember that there was no blowing snow. He had that thought while he was driving stakes into the ground around the accident site. The stakes went right in and none of the snow covered them up or filled in any holes when some of the stakes were removed and re-positioned. He felt that the temperature near the time of the accident was around 28 degrees or so. He said it got cold later that evening. He said that the visibility was good vertically but didn't recall being able to see the sun or its presence through the cloud layer.

INTERVIEW WITH BRETT ORTOLANO

Monroe Sheriff's Department

1-12-97

He was the 5th person to arrive on the accident scene. He thought it was about 10 minutes after the accident occurred. It was snowing a decent amount. He estimated the flakes to be dime sized snowflakes. He said it was a wet, good packing snow. He felt it was kind of windy and estimated the speed to be about 15 mph. He could not recall the direction it was blowing from. He mentioned it was really cloudy with the overcast at 1400-1500 feet at most.

MONROE COUNTY FIREMAN

1-12-97

He was the first fireman to arrive on the accident scene. He was at Lake Erie earlier and said there were snow pellets bouncing off his hood shortly before arriving at accident site (estimated 1 hour before). As he approached the site turning off route 50 he could smell the fuel. The snow at the time he arrived was sticking snow and it was snowing lightly. He described the smoke from the accident as going straight up to tree top level where the wind then pushed the smoke toward the northwest.

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The Captain of a DC-3 that departed YIP at 2055Z was interviewed by phone on January 13, 1997. The following is a summary of the interview:

He departed YIP for Middletown, Ohio. After takeoff he climbed to 4,000 to 5,000 feet. He encountered moderate to less than moderate rime ice. According to the Captain the icing was definitely not severe. The icing he encountered was " no problem " for the DC-3 boot system. He did not have to use the boots. There was a little bit of " impact snow " on the leading edges. There was no buildup on the windshield. There was not much ice on the props. In the clouds there was mostly snow and he did not notice rain or drizzle size drops. The temperatures were well below freezing. There was minimal turbulence. He was on top at 8,000 to 9,000 feet. He did not stay in the icing environment. There was nothing extraordinary about the weather conditions. He has flown Twin Beech aircraft for 6 winters in the Michigan area and has at times encountered severe icing. He has about 1,000 hours in the DC-3.

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The Captain of a DC-9 that landed at DTW at 2016Z was interviewed by phone on January 16, 1997. The following is a summary of that interview:

He landed on DTW runway 03R. During the initial approach to the runway he encountered a trace to light rime as noted on the windshield wiper blades. Inside the marker no ice was noted. The airplane was in the clouds during the vectoring phase of the approach. He did not encounter any turbulence or significant winds.

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The Captain of a B-727 [Northwest Flight 243] was interviewed by phone on January 22, 1997. The following is a summary of the interview:

Flight 243 was enroute from Fort Lauderdale, Florida to DTW. The aircraft was landing on runway 03R. During the descent moderate rime icing was encountered. The icing was not "at a level to be concerned about." The ice accreted on the windshield wiper bolts; maybe 1/8 to 1/4 inch. It was a slow, gradual buildup. The ice did not "suddenly appear." It is not uncommon to have ice buildup on the wiper bolts. The Captain does not remember any visible moisture. It was a smooth descent and there was no convection in the area. There was blue sky above the lower stratus cloud deck. He was not sure at what altitude he entered the lower cloud deck. He did not remember any icing reports on frequency. He did not notice any ice on the airplane at the gate.

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The Cleveland Center Weather Service Unit Meteorologist who worked the afternoon shift was interviewed by phone on January 16, 1997. The following is a summary of that interview:

The afternoon shift runs from January 9 / 1830Z to January 10 / 0230Z. He was the only one on shift. He has been at the Cleveland Center Weather Service Unit since May of 1996. He issued a Center Weather Advisory (CWA) for icing at 1935Z [ZOB1 CWA 091935] (The CWA covered an area which included northeast Ohio). There were no severe icing PIREPS in Northwest Ohio or over Michigan. Freezing rain that was occurring at KDTW / KTOL / KCLE (Cleveland, Ohio) / and KFDY now changed to all snow. Everything shifted east. There was a severe icing report from KCAK (Akron, Ohio which is in Eastern Ohio). At 1945Z he talked with the Aviation Weather Center Forecaster (Boston Area Forecast area) about turbulence and the severe icing noted in the CWA. The Aviation Weather Forecaster noted that a SIGMET would not be issued because of the size of the severe icing area. The meteorologist was aware of a PIREP for severe icing over Lima, Ohio at 2002Z [FDY UUA / OV AOH /TM 2002 / FL090 / TP C310 / IC SEV RIME /RM RPTD AS HVY]. He did not see this PIREP as soon as it came out. He saw it later. He did not issue a CWA to include that area since everything was snow and there was no freezing rain in the area to the west. The severe icing PIREP came out after he issued the 1935Z CWA. He was also preparing his weather briefing at the time. At 1955Z he verbally briefed an individual at the DTW Approach Control about weather conditions in the area that included information about occasional moderate isolated severe rime / mixed / clear icing at or below 16,000 feet, and moderate turbulence below 8,000 feet. He described the workload as "pretty hectic."

The following are summarized excerpts from a written statement from the Meteorologist dated February 3, 1997:

The Detroit Metro Airport was not included in the 1935Z Center Weather Advisory because at the time of issuance there had not been any reports of severe icing over Michigan or Western Ohio for over 2 hours. In addition, by 1800Z all reporting stations west of Cleveland were reporting snow not freezing or frozen precipitation. At approximately 1945Z, the east forecaster from the Aviation Weather Center in Kansas City, Missouri called to discuss the current SIGMET for severe turbulence. Afterwards the forecaster was informed of the Center Weather Advisory for severe icing. The Aviation Weather Center forecaster stated that he was aware of the situation but felt that the severe icing was a localized phenomena which did not cover a large enough area for him to issue a SIGMET. At approximately 1955Z the FAA tower supervisor was briefed on a forecast for the Detroit Metro Airport. The briefing included "moderate isolated severe rime /mixed / clear icing in cloud and in precipitation at or below 16,000 feet."

See Attachments_G 1 and 2 for Meteorologist's written statement.

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The Cleveland Center Weather Service Unit Meteorologist who worked the morning shift was interviewed by phone on January 16, 1997. The following is a summary of that interview:

The morning shift runs from 1030Z to 1830Z. She issued the Urgent CWA for moderate - severe / mixed / clear icing at or below 16,000 feet at 1735Z (the advisory covered an area which included Northern Ohio and Eastern Michigan). The advisory was issued due to freezing rain over the area and pilot reports indicating moderate to severe icing. The CWA was not coordinated with the Aviation Weather Center. However, all CWAs are automatically displayed at the Aviation Weather Center. She briefed the DTW approach control at about 1200Z to 1230Z. The briefing included information regarding moderate, isolated severe rime / mixed / clear icing below 16,000 feet.

Attachments_G 3 and 4 .. Written statement of Meteorologist.

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Meteorologists at the Indianapolis Air Route Traffic Control Center Weather Service Unit (ZID CWSU) were interviewed by phone on January 24, 1997. The following is a summary of that interview:

The workload during the afternoon was heavy. A Center Weather Advisory (CWA) for frequent moderate occasional severe ice in clouds and precipitation 3,000 feet to 10,000 feet was issued at 2045Z [ZID1 CWA 092045]. The CWA was issued in part because several moderate icing reports for Eastern Indiana were received as well as a few reports of severe icing. In addition, cold air aloft from 3,000 to 10,000 feet was moving into the area from the west. The CWA was not coordinated with the Aviation Weather Center in Kansas City, Missouri or with the Meteorologist at the Cleveland CWSU. Supervisors at the Center were advised of the CWA by the CWSU Meteorologist. Icing was also emphasized at the stand up briefing to Center personnel.

Attachments_G 5, 6, 7, and 8 .. Meteorologists' written statements.

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An Aviation Meteorologist at the Aviation Weather Center in Kansas City, Missouri was interviewed by phone on January 28, 1997. The following is a summary of that interview:

The Meteorologist worked the 1300Z to 2100Z shift the day of the accident. He is responsible for issuing Area Forecasts, AIRMETs, and non-convective SIGMETS for the Boston and Miami Area Forecast Areas. Ohio is included in his area of responsibility. He issued AIRMET Zulu Update 2 for occasional moderate rime / mixed icing in cloud and in precipitation below Flight Level 25,000 feet with possible isolated severe icing below 15,000 feet over other areas that included Ohio. The AIRMET was valid for 1500Z to 2100Z and the area covered included most of Ohio. The AIRMET was issued due to the fact that there was a strong weather system in Ohio with abundant moisture. The guidance products he reviewed also indicated icing of at least moderate intensity with the possibility of isolated severe icing. He was using primarily the

"neural net" icing product for the icing forecast. He had no recollection as to whether he saw the Center Weather Advisory for icing issued by the Cleveland Center Weather Service Meteorologist at 1735Z [ZOB1 UCWA 091735]. He did talk to the Cleveland Center Weather Service Meteorologist regarding the Center Weather Advisory for icing issued at 1935Z [ZOB1 CWA 091935]. He did not issue a SIGMET for severe icing because the notation in the AIRMET calling for isolated severe icing "pretty much covered it." He noted that Center Weather Advisories are available for call up but are not automatically displayed at the Aviation Weather Center. He noted that the Meteorologists at the Center Weather Service Units do not always call to coordinate Center Weather Advisories. He did not recall seeing the Indianapolis Center Weather Advisory for icing issued at 2045Z [ZID1 CWA 092045]. He did not see a plot or the text of the Center Weather Advisories for icing issued by the Cleveland Center Weather Service Meteorologists. However, he stated that even if he had the Center Weather Advisories he still would have gone with isolated severe icing. He is not sure if he would have done anything different. He noted that Center Weather Advisories might be helpful if they were more readily available. If Supercooled Large Drops [SLD] or freezing rain / freezing drizzle are forecast aloft a notation indicating freezing rain / freezing drizzle aloft is put in the AIRMET or SIGMET. The "stovepipe" product can be used to forecast SLD or freezing rain /freezing drizzle. He does not remember what that product was showing during his shift. During the afternoon of the accident he does not remember any reports of freezing rain or freezing drizzle aloft. He described the workload as a "busy shift."

> The "stovepipe" icing algorithm is based on the combination of surface weather observations and 3-D computer model output. The "stovepipe" algorithm is based upon the well known physics of freezing precipitation processes, combined with statistical relationships drawn between the occurrence of icing conditions and observed precipitation/cloud cover. The algorithm uses surface observations of precipitation type and cloud cover to indicate locations where supercooled large drops and general icing are most likely to exist. The "stovepipe" algorithm is an essential part of the production of freezing drizzle AIRMETs by the Aviation Weather Center. The algorithm was developed at the National Center for Atmospheric Research [NCAR].
>
> Reference: The Stovepipe Algorithm: Identifying Locations Where Supercooled Large Droplets Are Likely to Exist; Ben C. Bernstein; Research Applications Program; National Center for Atmospheric Research ; Boulder, Colorado.
>
> The "neural net" icing products are experimental products produced by the Experimental Forecast Facility at the Aviation Weather Center. The products graphically indicate icing location and intensity (light, moderate, severe).
>
> Reference: Internet site ..www.awc.noaa.gov/awc/Neural_Net_Icing.html [Aviation Weather Center Web Site].

In a written statement dated February 6, 1997 the Meteorologist noted, "During the course of the shift, and upon reviewing all available PIREPs after the fact, it was and is my opinion that the 1445Z AIRMET Zulu forecast for icing accurately reflected icing conditions that actually

occurred over Ohio (as well as the remainder of my area of responsibility) during the period 1445Z through 2100Z on January 9, 1997."

Attachments_G 9, 10, and 11 .. Meteorologist's written statement.

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An Aviation Meteorologist at the Aviation Weather Center in Kansas City, Missouri was interviewed by phone on January 28, 1997. The following is a summary of that interview:

The Meteorologist had to replace the day shift Meteorologist working the Chicago and Dallas/Fort Worth area at 1900Z due to the day shift Meteorologist suddenly becoming ill. He worked until 2100Z. He was responsible for issuing Area Forecasts, AIRMETs, and non-convective SIGMETs for the Chicago and Dallas/Fort Worth Area Forecast Areas. Michigan is included in his area of responsibility. He was not aware of the Indianapolis Center Weather Service Unit Center Weather Advisory for icing issued at 2045Z. He could not remember specific weather conditions for the Michigan area but he does remember focusing on the Indiana, Kentucky, and Michigan area. When he took over the shift he looked at what was going on across the area. He did not see anything severe at the time. He could not remember specifics. He did review Pilot Reports and satellite data. He was not overly rushed just a little uncomfortable at having to take over the shift on such short notice. He said he would not have issued anything different. He could not recall receiving a call from a Center Weather Service Unit regarding icing that day.

The following are summarized excerpts from a written statement from the Meteorologist dated February 7, 1997:

He received a briefing, from the Meteorologist who became sick, concerning potential problem areas across the central United States. He was informed of the icing conditions over the Great Lakes region as described in the 1445Z AIRMET Zulu. He was also informed that the meteorological conditions that led the Meteorologist to mention the possibility of enhanced icing over the region was moving east of Indiana into the Eastern United States Forecaster's area of responsibility.

Upon relieving the Meteorologist who became sick he reviewed the valid forecasts of icing, turbulence, and IFR conditions and compared them with current surface weather observations and recent pilot reports. He does not remember seeing anything in the data which would have prompted him to amend the valid Chicago AIRMET Zulu or to issue a SIGMET for severe icing conditions. During the 2 hours he covered the forecast desk he received no telephone calls from the Indianapolis or Cleveland Center Weather Service Units concerning information they might have had concerning the possibility of severe icing conditions over Indiana, Michigan, or Kentucky.

Attachments_G 12 and 13 .. Meteorologist's written statement.

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An Aviation Meteorologist at the Aviation Weather Center in Kansas City, Missouri was interviewed by phone on January 28, 1997. The following is a summary of that interview:

The meteorologist worked the day shift [1300Z to 2100Z]. However, he became sick at about 1900Z and had to leave. He was replaced by another Aviation Meteorologist at 1900Z. During the time he was on shift he issued AIRMET Zulu Update 3 [CHIZ WA 091445] for icing. The AIRMET was issued at 1445Z. The AIRMET called for occasional light to moderate rime icing in cloud below Flight Level 18,000 feet. The area covered by the AIRMET included Michigan. He noted that it was an "extremely active weather day " with icing and turbulence and widespread IFR conditions. Numerical guidance that he was using showed a large area of icing below 18,000 feet. The " stovepipe" model showed a fair amount of SLD for Kentucky, Indiana, and a small portion of Illinois. He did not see the Urgent Center Weather Advisory for icing issued by the Cleveland Center Weather Service Unit Meteorologist at 1735Z [ZOB1 UCWA 091735]. However, he did talk with the Center Weather Service Unit Meteorologist about moderate to severe icing contained in the advisory. He noted that the Center Weather Advisory "looked awfully good" and he would not push it up to a SIGMET unless additional information warranted it. Although at one time, Center Weather Advisories were displayed automatically at the Aviation Weather Center they currently are not. Center Weather Advisories need to be called up. The "stovepipe" model was showing the northern boundary of SLD near a Fort Wayne, Indiana to Cleveland, Ohio line. The "stovepipe" model is "not great" in locating areas of SLD but it is "better than guessing." He noted that it allows the meteorologist to focus on certain areas.

Attachments_G 14 and 15 .. Meteorologist's written statement.

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The Captain of an America West Airbus 320 [Cactus 50] in the area of the accident about the time of the accident was interviewed by phone on January 31, 1997. The following is a summary of that interview.

During descent from 21,000 feet the airplane entered a lower cloud deck. He was not sure of the altitude of the lower cloud deck. The lower cloud deck was solid with no breaks. He thought he entered the clouds higher than 5,000 feet. He did pick up moderate rime icing in the clouds. The ice had a white cloudy appearance. The ice accumulated slowly at first than more rapidly and than tapered off to light icing down lower. There is an ice probe on the airplane. It is located between the two windshields. In the icing conditions about 1/8 to 3/16 of an inch of ice accumulated on the probe. He noted that the whole approach was in the weather. He said that there was light turbulence down the approach. There was "no serious turbulence or dramatic change in the wind. " If there was a sudden wind shear he would have remembered it and reported it to ATC. He could not recall seeing any precipitation in the clouds. The airplane was enroute from Phoenix to DTW.

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The Captain of a DeHavilland Dash 8 (Masaba 3176) was interviewed by phone on January 1, 1997. The following is a summary of that interview:

The Captain had 10,000 hours of total flight time with 3,200 hours in the DeHavilland Dash 8. He departed Pellston, Michigan (PLN) about 1330 local. He flew the Polar 1 arrival at 11,000 feet into DTW. For a brief time he was on top of the clouds but went IMC in the descent. There was moderate icing from 16,000 feet to 11,000 feet. It was mixed icing. Perhaps more rime than clear. The icing tapered off near the airport to almost nothing. They were vectored for a left downwind for runway 3R - basically a square pattern. He was stepped down to 7,000 feet then to 6,000 feet and to 4,000 feet on base leg. No more than trace to light icing on base leg. Moderate icing was around 11,000 to 13,000 feet. The base leg was not farther out or closer in to the airport than normal. It was not remarkable.

There was no turbulence although at the higher altitudes, 13,000 to 11,000 feet, it was occasional moderate turbulence. Again it decreased to occasional light chop on downwind and base leg. He used the boots at altitude and not again until near the outer marker. There was not much accumulation. He used the boots more out of habit to clear any residual ice on the aircraft. There was 1/8 inch or less.

Nothing stood out relating to changing winds. The conditions that day were not unusual to contribute to an accident. Nothing more serious than light icing. He did not recall cloud layers during the descent. He said the clouds were fairly solid below 11,000 feet and it smoothed out. The Dash 8 is a high winged airplane and he could easily see the leading edges and the propeller spinner.

Astronomical Data

Location: Approximate accident location .. Time 2054Z .. Date 1/9/97
Sunset .. 2221Z
Altitude of Sun .. 12.1 degrees.
True Bearing to Sun .. 224.9.
Altitude of Moon .. 20.5 degrees.
True Bearing to Moon .. 221.1 degrees.
Percent Illumination of Moon .. 1 %

Terminal Doppler Weather Radar (TDWR) Data

A meeting was held at the TDWR Program Support Facility at the Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma on February 15, 1997. The following is a summary of the meeting:

Review of the TDWR product data (base data was not available) from DTW for the approximate time period 1936Z to 2100Z was made on a SUN Workstation. The data showed weather echoes moving to the northeast. Weather echo intensities in the area of the accident were diminishing during this period. There were no weather echoes in the area of the accident (weather echo intensities 18 dBZ or greater) at 2052:51Z and 2057:51Z. There were no Microburst Alerts noted. A Gust Front was displayed at 2037:49Z and was located about 5 nautical miles north of the accident site and at 2056:41Z and was located about 8 nautical miles north of the accident site. The minimum value of the Gust Front algorithm is a convergence of 5 meters per second (10 knots). Images from the DTW TDWR product data are contained as Attachments_H 1-7. On the images range rings = 5 nautical miles. The diamond = the location of the TDWR antenna. The cross = the location of the last radar hit of the accident airplane. Colors (PRECIP) correspond to weather echo intensities.

Level 1 = 18 to <30 dBZ
Level 2 = 30 to <41 dBZ
Level 3 = 41 to <46 dBZ

See Attachments_H 8.

Icing Questionnaire Information

A NTSB developed icing questionnaire was provided to a number of pilots,operating in the DTW area on January 9, 1997. The following summarizes their responses.

DeHavilland Dash 8-100, Masaba Flight 3176

Location (Icing)
Most of the icing that occurred greater than light in nature was north of the Polar Arrival at 11,000 to 13,000 feet.
Time or Time Period
Approximately 2040Z to 2050Z.
Type Aircraft
Dehavilland Dash-8-100.
Flight Number / Tail Number
Masaba Flight 3176 / N828MA.
Ice Protection Systems Installed
Standard anti and deice systems.
Type Systems
Pneumatic boots and prop heat and intake doors plus heat.
Cloud Bases
IMC throughout the flight. Multiple layers during descent into DTW.

Cloud Tops
Tops above Flight Level 19,000 feet well north of DTW.
Precipitation
Mostly snow in clouds light in intensity.
Visible Moisture
Yes - mostly dry snow in clouds and between layers.
Size of Drops (Drizzle, Rain, Cloud, Mist)
N/A Snow.
Drops Splattering on Windshield
N/A Snow.
Ice Crystal / Snow
Yes.
Intensity of Icing
During icing conditions, north of DTW at 16,000 feet to 11,000 feet occasional moderate ice. Mostly light mixed and rime.
How Determined
Windshield post on wiper.
Rate of Ice Accumulation (Inches per Minute)
N/A.
Type of Ice
Light to moderate mixed at 16,000 to 11,000 feet.
Icing Aft of Boots / Protected Surfaces
None.
Top and / or Underside of Wing
N/A.
Side Window Icing
None.
Icing on Prop Spinner
Normal amount.
How Far Aft on Prop Spinner
2 inches aft.
Shape of Ice
Conformed to spinner.
Amount of Ice on Airframe
Less than 1/8 inch.
IAS in Icing Environment
Between 210 and 190 knots.
Time in Icing Environment
Approximately 10 to 15 minutes on arrival into Metro Airport.
Icing in Clouds or Clear
In clouds.
Icing Altitudes
Most icing occurred in descent from north of Flint (FNT) until below 11,000 feet on Polar Arrival into DTW.
Climbing, Descending, Level Flight

Level plus descent.
Outside Air Temperature (Icing Environment)
-10 degrees SAT or warmer.
Total Air Temperature
N/A.
Turbulence in Icing Environment
Light associated with cloud layers in descent.
Inflight Visibility
0 in IMC.
Winds
Aloft were out of the southwest on approach. Approach 30 to 40 knot tailwind at 4,000 to 5,000 feet.
How Determined
On board computer.
Wind Shear in Icing Environment / Intensity of Wind Shear
Not detected. Directional changes were minimal in icing environment.
Aware of Icing Forecast
Yes, can't recall precise forecast.
Intensity of Icing Forecast
Don't recall.
How Became Aware of Forecast
On board weather.
Did You Provide Pilot Report
Negative.
Character of Clouds - Cumulus / Stratus
Stratus.
Echoes on Weather Radar
None.
Control Problems
None.
Any Ice Observed on Airplane on Ground
Just traces of what remained on aircraft.
Additional Comments
The only thing that I can add is that the weather on this day was fairly consistent when a "wound up" low moves through this area at this time of year. Icing was only of concern at the high altitudes on the arrival. During approach sequencing icing was no more than a trace at times. The winds aloft at 4,000 to 5,000 feet were approximately 220 degrees at 30 to 40 knots. This made the approach a bit more difficult than usual. However, the winds shifted to easterly at 10 to 15 knots upon landing on 3R. On the approach no ice was detected, light turbulence or "chop." Airspeed variations were not excessive - plus or minus 5 to 7 knots.

Airbus 320, Flight 2050, Cactus 50

Location (Icing)
Descent and approach to Detroit International Airport..
Time or Time Period
About 2100Z.
Type Aircraft
Airbus A320.
Flight Number / Tail Number
Flight 2050 / N641AW.
Cloud Bases
Low. I think less than 500 feet (we did not see the runway until near ¾ mile).
Cloud Tops
Can not recall.
Precipitation
Can not recall.
Visible Moisture
Definitely - we were IMC for most of the approach (ILS 3R).
Size of Drops (Drizzle, Rain, Cloud, Mist)
Small I believe. Clouds possibly freezing drizzle or snow.
Drops Splattering on Windshield
No.
Ice Crystal / Snow
Probably. Can not recall exactly.
Intensity of Icing
I would say moderate. It varied at different altitudes.
How Determined
Watching ice accumulation on ice probe between pilot's windshields.
Rate of Ice Accumulation (Inches per Minute)
Approximately ¼ inch during 5 to 8 minute approach, varying during approach at different times and altitudes.
How Determined
By occasionally looking at ice probe and subjectively estimating rate and thickness.
Type of Ice
Rime ice. White and frosty in appearance.
Icing Aft of Boots / Protected Surfaces
Do not recall seeing any.
Top and / or Underside of Wing
Do not recall seeing any.
Side Window Icing
None.
Shape of Ice
None.
Amount of Ice on Airframe
About ¼ inch on ice probe. This is indicative of ice on the airframe where ice is accumulating - i.e. on the leading edge of the wing.

Time in Icing Environment
About 5 to 10 minutes.
Icing in Clouds or Clear
In clouds.
Icing Altitudes
Ground level up to considerably higher. I do not recall cloud layers. I think there were multiple layers and thick lowest layer (ground to >5,000 feet above ground level).
Climbing, Descending, Level Flight
Descending.
Outside Air Temperature (Icing Environment)
Can not recall exactly but below 10 degrees C TAT.
Total Air Temperature
Below 10 degrees C.
Turbulence in Icing Environment
Can not recall exactly but nothing worse than light, occasional moderate.
Inflight Visibility
Low in clouds (less than 1 mile).
Winds
Can not recall.
Wind Shear in Icing Environment / Intensity of Wind Shear
No severe wind shears.
Aware of Icing Forecast
Yes.
Intensity of Icing Forecast
Can not recall.
How Became Aware of Forecast
America West weather reports, ATIS, and Tower reports.
Did You Provide Pilot Report
No. Low visibility approach, icy runway and taxi ways, and low visibility on the ground kept us busy until we were in the gate.
Character of Clouds - Cumulus / Stratus
Stratus.
Echoes on Weather Radar
Can not recall.
Control Problems
Nothing major.
Time Landed / Location
Flight 2050 landed DTW at about 2100Z.
Any Ice Observed on Airplane on Ground
Can not recall.
Additional Comments
The pilot workload was pretty busy due to the icing, low visibility, concern for runway conditions, and the fair possibility of having to go missed approach - fuel, alternate, return for another try, etc.

B-727-200, Northwest Flight 243

Type Aircraft
B-727-200.
Flight Number / Tail Number
Flight 243, ship number 2201.
Cloud Bases
Low to the ground, do not remember exactly.
Cloud Tops
Can not remember, but guessing between 5,000 and 9,000 feet. Blue sky above.
Precipitation
On ground yes, inflight no precipitation, only cloud.
Size of Drops (Drizzle, Rain, Cloud, Mist)
Cloud.
Drops Splattering on Windshield
No.
Ice Crystal / Snow
No.
Intensity of Icing
Light to moderate.
How Determined
Viewing ice on bolts, washers of windshield wipers.
Rate of Ice Accumulation (Inches per Minute)
Guessing we picked up approximately ½ inch in 15 to 20 minutes.
How Determined
Viewing windshield wipers.
Type of Ice
Rime.
Side Window Icing
No.
IAS in Icing Environment
About 250 knots.
Time in Icing Environment
Do not know precisely, but guessing approximately 20 minutes.
Icing in Clouds or Clear
Icing in clouds.
Icing Altitudes
Starting picking ice up as we entered tops of the overcast.
Climbing, Descending, Level Flight
Descending and level flight.
Total Air Temperature
TAT was less than 10 degrees C; can not remember exactly.
Turbulence in Icing Environment
Smooth.
Inflight Visibility

In clouds.
Wind Shear in Icing Environment / Intensity of Wind Shear
No.
Aware of Icing Forecast
Aware of potential icing simply by observing outside temperature and knowing clouds were below us.
Did You Provide Pilot Report
I did not make a PIREP as I did not consider existing conditions a hazard. First Officer was working the radios that leg, and I think he made some sort of reference that we were picking up some ice. This was not a PIREP. This was his very first trip as F/O, and he made an off the cuff remark. As Captain, I did not think an icing PIREP was necessary as icing was expected and rate of accumulation was not a hazard for any plane certified for flight in icing condition.
Character of Clouds - Cumulus / Stratus
Stratus.
Echoes on Weather Radar
Weather radar not on.
Time Landed / Location
Landed at 2036Z at DTW.
Additional Comments
Since this was a routine, nothing out of the ordinary arrival, I was not focused on the details, the particulars of cloud tops, OAT, speeds, etc. It was a typical winter time descent into DTW. We anticipated icing by putting engine and wing heat on prior to descending into stratus clouds below.

Airbus 320, Northwest Flight 208

Location (Icing)
DTW arrival.
Time or Time Period
About 2045Z
Type Aircraft
A-320.
Flight Number / Tail Number
Flight 208.
Cloud Bases
400 to 500 feet.
Cloud Tops
11,000 feet.
Precipitation
Light snow.
Drops Splattering on Windshield
No.
Ice Crystal / Snow
Yes.

Intensity of Icing
Light rime.
How Determined
Windshield probe.
Rate of Ice Accumulation (Inches per Minute)
Unknown. ½ inch or less on probe during descent from 11,000 feet.
Type of Ice
Rime.
Side Window Icing
No.
Amount of Ice on Airframe
½ inch or less.
IAS in Icing Environment
250 knots or less.
Time in Icing Environment
Approximately 15 minutes.
Icing in Clouds or Clear
Clouds.
Icing Altitudes
11,000 feet and below.
Climbing, Descending, Level Flight
Descending.
Turbulence in Icing Environment
No.
Inflight Visibility
Poor.
Wind Shear in Icing Environment / Intensity of Wind Shear
No.
Did You Provide Pilot Report
No.
Character of Clouds - Cumulus / Stratus
Stratus.
Echoes on Weather Radar
No.
Control Problems
No.
Time Landed / Location
Detroit.

Northwest Flight Landed at 2105Z at DTW

Cloud Tops
At 12,000 feet.
Precipitation
None.

Visible Moisture
Clouds.
Size of Drops (Drizzle, Rain, Cloud, Mist)
Clouds.
Drops Splattering on Windshield
No.
Ice Crystal / Snow
No.
Intensity of Icing
Trace to light.
How Determined
Rate of accumulation on wipers.
Type of Ice
Trace rime.
Icing Aft of Boots / Protected Surfaces
No.
Side Window Icing
No.
Shape of Ice
Rough.
Amount of Ice on Airframe
Trace.
IAS in Icing Environment
250 knots.
Time in Icing Environment
5 to 8 minutes.
Icing in Clouds or Clear
In clouds between 12,000 feet and 8,000 feet.
Icing Altitudes
8,000 to 12,000 feet.
Climbing, Descending, Level Flight
Level and descending.
Turbulence in Icing Environment
Smooth.
Wind Shear in Icing Environment / Intensity of Wind Shear
No.
Aware of Icing Forecast
Yes on DTW ATIS.
Intensity of Icing Forecast
Light to moderate.
How Became Aware of Forecast
DTW ATIS.
Did You Provide Pilot Report
Yes.
Character of Clouds - Cumulus / Stratus

Stratus.
Echoes on Weather Radar
No.
Control Problems
None.
Time Landed / Location
2105Z at DTW.

DC-9 - 30, Northwest Flight 272

Time or Time Period
2100Z.
Type Aircraft
DC-9-30.
Flight Number / Tail Number
Flight 272.
Cloud Bases
500 feet above ground level.
Cloud Tops
4,000 to 5,000 feet.
Precipitation
Clear above clouds / turning to moderate snow at ground level.
Visible Moisture
Did not seem to be any until 2,000 feet than snow.
Drops Splattering on Windshield
Ice formed immediately upon entering clouds at 4,000 to 5,000 feet.
Intensity of Icing
Moderate to severe, heaviest I have seen this season.
How Determined
Amount forming on windshield wiper.
Rate of Ice Accumulation (Inches per Minute)
½ inch per minute.
How Determined
Visually watching.
Type of Ice
Rime.
Icing Aft of Boots / Protected Surfaces
Not able to observe.
Side Window Icing
Some splash back, does not happen to often on DC-9 only heavy ice will do this.
IAS in Icing Environment
210 knots.
Time in Icing Environment
4 minutes - asked to climb back to clear when instructed to hold.

Icing in Clouds or Clear
Heavy in clouds.
Icing Altitudes
Approximately 4,000 to 5,000 feet down to 1,800 feet above ground level.
Climbing, Descending, Level Flight
Level and descending.
Outside Air Temperature (Icing Environment)
Approximately 0 degrees RAT.
Turbulence in Icing Environment
None.
Inflight Visibility
Zero in cloud.
Wind Shear in Icing Environment / Intensity of Wind Shear
None.
Aware of Icing Forecast
Yes from our Dispatch and ATIS.
Intensity of Icing Forecast
Moderate to severe.
How Became Aware of Forecast
Notice on release from Dispatcher.
Did You Provide Pilot Report
Did not experience any other than what was forecast and told by ATC.
Character of Clouds - Cumulus / Stratus
Solid overcast.
Echoes on Weather Radar
No.
Describe Echoes on Weather Radar
Very few if any returns.
Control Problems
No.
Time Landed / Location
2120Z.
Additional Comments
I would say the icing at cloud entry (4,000 to 5,000 feet) until breaking out at 500 feet above ground level was extremely heavy to severe, based on operations I have flown, into DTW area and around lake Erie in a DC-9 for 18 years with Northwest Airlines.

B-757, Northwest Flight 483

Type Aircraft
B-757.
Flight Number / Tail Number
NWA 483. Ship 5502.
Cloud Bases

700 to 800 feet above ground level.
Precipitation
Light snow.
Visible Moisture
None, except light snow.
Size of Drops (Drizzle, Rain, Cloud, Mist)
Small flakes.
Drops Splattering on Windshield
None.
Ice Crystal / Snow
Light.
Intensity of Icing
None observed.
IAS in Icing Environment
210 knots to 130 KIAS.
Time in Icing Environment
Less than 5 minutes.
Icing in Clouds or Clear
None.
Inflight Visibility
Less than 1 mile.
Did You Provide Pilot Report
No.
Echoes on Weather Radar
None.
Control Problems
None.
Time Landed / Location
Approximately 2045Z.
Additional Comments
Conditions looked like we should have expected icing problems, but none were actually observed.

B-757, Northwest Flight 440

Location (Icing)
On MIZAR Arrival into DTW.
Time or Time Period
About 2040Z.
Type Aircraft
B-757.
Flight Number / Tail Number
Northwest Flight 440 / 5509.
Cloud Bases

About 3,000 feet.
Cloud Tops
About Flight Level 25,000 feet.
Precipitation
Snowing.
Visible Moisture
Snow.
Ice Crystal / Snow
Rime icing / snow.
Intensity of Icing
Moderate.
How Determined
Front windscreen.
Type of Ice
Rime.
Side Window Icing
None.
IAS in Icing Environment
295 to 250 knots.
Time in Icing Environment
About 1 minute.
Icing in Clouds or Clear
In clouds.
Climbing, Descending, Level Flight
Descending.
Outside Air Temperature (Icing Environment)
About -10 degrees C.
Turbulence in Icing Environment
None.
Inflight Visibility
½ mile.
How Became Aware of Forecast
I heard from other PIREPs over the radio.
Did You Provide Pilot Report
No.
Character of Clouds - Cumulus / Stratus
Stratus. (Solid deck from FL 250 to 3,000 feet).
Echoes on Weather Radar
None.
Control Problems
None.
Time Landed / Location
2050Z at DTW.

DC-10-40, Northwest Flight 68

Location (Icing)
Detroit Metro Airport.
Time or Time Period
About 2045Z.
Type Aircraft
DC-10-40.
Flight Number / Tail Number
NWA Flight 68, Ship 1143.
Cloud Bases
Near the ground, 200 to 400 feet above ground level.
Cloud Tops
Intermediate - about 7,000 to 8,000 feet.
Precipitation
Snow.
Intensity of Icing
No significant icing noted.
Amount of Ice on Airframe
None noted.
IAS in Icing Environment
210 knots to 150 knots.
Time in Icing Environment
15 minutes.
Icing Altitudes
Below 7,000 feet.
Climbing, Descending, Level Flight
Descending.
Outside Air Temperature (Icing Environment)
Do not recall.
Turbulence in Icing Environment
No significant turbulence.
Wind Shear in Icing Environment / Intensity of Wind Shear
None noted.
Aware of Icing Forecast
Yes.
Intensity of Icing Forecast
Moderate (I think).
How Became Aware of Forecast
Approach control.
Did You Provide Pilot Report
No.
Character of Clouds - Cumulus / Stratus
Stratus.
Control Problems

No !
Time Landed / Location
At gate 2100Z; approximately 2050Z touchdown.

DC-10, Northwest Flight 9451

Location (Icing)
CETUS II Arrival.
Time or Time Period
2030Z to landing.
Type Aircraft
DC-10.
Flight Number / Tail Number
Number 9451 / 1149.
Cloud Bases
200 feet.
Cloud Tops
Unknown.
Precipitation
Sleet depends on altitude.
Visible Moisture
Yes.
Size of Drops (Drizzle, Rain, Cloud, Mist)
Cloud.
Drops Splattering on Windshield
No.
Ice Crystal / Snow
Yes.
Intensity of Icing
Moderate.
How Determined
Windshield iced over above 10,000 feet descending.
Rate of Ice Accumulation (Inches per Minute)
Maybe ½ inch per minute.
How Determined
Looking at wipers.
Type of Ice
Rime.
Side Window Icing
No.
Amount of Ice on Airframe
Moderate.
IAS in Icing Environment

330 to 160 knots.
Time in Icing Environment
Approximately 20 to 30 minutes.
Icing in Clouds or Clear
In clouds.
Icing Altitudes
Approximately 24,000 feet to the ground.
Climbing, Descending, Level Flight
Descending.
Total Air Temperature
Below 8 degrees TAT.
Turbulence in Icing Environment
Light.
Inflight Visibility
IMC.
Wind Shear in Icing Environment / Intensity of Wind Shear
None.
Aware of Icing Forecast
Yes. TP with severe ice warning. Most unusual.
Intensity of Icing Forecast
Severe.
How Became Aware of Forecast
TP ACARS.
Did You Provide Pilot Report
Reported runway very poor braking missed turn off.
Echoes on Weather Radar
precipitation - moderate snow.
Control Problems
None.
Time Landed / Location
Block in at 2102Z. Landed about 2050Z.
Additional Comments
Very heavy ice above 10,000 feet on approach. Both windshields iced over with maximum heat.

Northwest Flight Time Period 2050Z to 2100Z

Location (Icing)
Downwind runways 21 at KDTW.
Time or Time Period
2050Z to 2100Z.
Type Aircraft
Airbus 320.

Cloud Bases
Ragged approximately 4,000 feet msl.
Cloud Tops
Layers to 20,000 feet.
Precipitation
None.
Visible Moisture
Clouds.
Size of Drops (Drizzle, Rain, Cloud, Mist)
Clouds.
Drops Splattering on Windshield
None.
Intensity of Icing
Light to moderate rime.
How Determined
Visual.
Type of Ice
Rime.
Side Window Icing
None.
Amount of Ice on Airframe
None.
IAS in Icing Environment
250 to 170 knots.
Time in Icing Environment
15 minutes.
Icing in Clouds or Clear
Clouds.
Icing Altitudes
10,000 to 4,000 feet.
Climbing, Descending, Level Flight
Descending and level flight.
Turbulence in Icing Environment
Light occasional.
Inflight Visibility
In and out of clouds.
Wind Shear in Icing Environment / Intensity of Wind Shear
None.
Aware of Icing Forecast
Not to my recollection.
Intensity of Icing Forecast
These were very typical conditions for the time of year.
How Became Aware of Forecast
Had expected.
Did You Provide Pilot Report

Character of Clouds - Cumulus / Stratus
Cumulus / Stratus.
Control Problems
No.

Attachments_I 1 - 35 .. Weather questionnaires.

Summary of Questionnaire Responses

Time Period ... Approximately 2030Z to 2105Z on approach to DTW.

Visible Moisture .. Four pilots reported snow, 2 pilots reported clouds, and 2 pilots reported yes.

Size of Drops .. Two pilots reported snow and 5 pilots reported clouds - the pilot of Cactus 50 [Airbus 320] reported clouds and possible freezing drizzle.

Intensity of Icing .. Two pilots reported none or no significant icing, 1 pilot reported trace to light, 1 pilot reported light, 3 pilots reported light to moderate, 2 pilots reported moderate, 1 pilot [DC-9 Flight 272] reported moderate to severe.

Type of Ice .. Eight pilots reported rime and 1 pilot reported rime and mixed [Masaba 3176. The Masaba pilot also reported light to moderate mixed icing at 16,000 feet to 11,000 feet north of DTW].

Rate of Ice Accumulation .. One pilot reported ¼ inch in 5 to 8 minutes, 1 pilot reported ½ inch in 15 to 20 minutes, 1 pilot reported ½ inch during descent from 11,000 feet, 2 pilots reported ½ inch per minute - DC-9 Flight 272 and DC-10 Flight 9451.

Precipitation .. Six pilots reported snow, 1 pilot reported sleet (depending on altitude) [DC-10 Flight 9451], and 4 pilots reported none.

Cloud Tops .. One pilot reported above Flight Level 19,000 feet well north of DTW; 1 pilot reported 5,000 to 9,000 feet with blue sky above, 1 pilot reported 11,000 feet, 1 pilot reported 12,000 feet; 1 pilot reported 4,000 to 5,000 feet, 1 pilot reported Flight Level 25,000 feet, 1 pilot reported 7,000 to 8,000 feet, and 1 pilot reported layers to 20,000 feet.

Time in Icing Environment .. One pilot reported 20 to 30 minutes, 1 pilot reported 20 minutes, 3 pilots reported 15 minutes, 1 pilot reported 10 to 15 minutes, 1 pilot reported 5 to 10 minutes, 1 pilot reported 5 to 8 minutes, 1 pilot reported less than 5 minutes, 1 pilot reported 4 minutes, and 1 pilot reported 1 minute.

Icing Altitudes .. One pilot reported that most icing occurred in descent from north of Flint (FNT) until below 11,000 feet on Polar Arrival into DTW, 1 pilot reported ground to greater than 5,000 feet, 1 pilot reported tops of the overcast, 1 pilot reported 11,000 feet and below, 1 pilot reported 8,000 feet to 12,000 feet, 1 pilot reported 4,000 to 5,000 feet to 1,800 feet above ground level, 1 pilot reported below 7,000 feet, 1 pilot reported 24,000 feet to the ground, and 1 pilot reported 10,000 feet to 4,000 feet.

Turbulence in Icing Environment .. Six pilots reported none or smooth or no significant turbulence, 3 pilots reported light, and 1 pilot reported light occasional moderate.

Did You Provide Pilot Report .. Nine pilots answered no .. one of the pilots who answered no noted that ATC was involved with COMAIR 3272 at the time; 1 pilot reported very poor braking action; and 1 pilot answered yes.

Meeting at the National Center for Atmospheric Research (NCAR) on March 25, 1997

Meeting Summary

Meeting with NCAR Scientists Dr.Marcia Politovich, Mr. Gregory Thompson and Mr. Ben Bernstein. Weather group members present were Mr.Greg Salottolo(NTSB), Mr. Herb White (NOAA), Captain Jim Johnson (ALPA), and Captain Steve Rayborn (Comair). Jim Skeen of the NTSB was also present.

Discussions began with available satellite data. It was noted that GOES 8 data was not available that day. GOES 9 data was available.

NASA Lewis is running a freezing drizzle research project. They were flying that day. These data are in the process of being retrieved and reviewed.

Scientist Ben Bernstein was driving just west of Toledo approximately 1530Z in moderate freezing drizzle on the day of the accident.

Upper air charts were analyzed. Ben Bernstein briefed the synoptic situation on the 500 millibar chart for January 10, 1997 for 0000Z. A cold, dry air intrusion up to Michigan depressed the formation of snow crystals. Dry air from 10,000 feet upward and fairly warm cloud tops were noted. The 700 and 850 millibar charts were also discussed.

The surface analysis chart was discussed. The 2100Z chart showed a surface low pressure system centered just west of Detroit with fairly good circulation. Throughout most of Ohio, no precipitation was occurring at the surface. To the north and the west of the low pressure, snow was being reported at the surface. Detroit had snow occurring at the time. All of Ohio had overcast skies. Surface temperatures in Ohio and Southern Michigan were in the mid to high 20's. Some surface observations in Western Ohio reported snow grains, ice pellets, and drizzle for this time period. Anecdotal evidence suggests that when drizzle and snow occur aloft, snow grains and/or ice pellets can occur beneath them. The snow grains and/or ice pellets may or may not extend to the surface. Further research in this area is needed.

Pilot reports (PIREPs) were discussed next. There were numerous pilot reports in Ohio and Michigan. At 2000Z, the further north the pilot report was made, the higher the altitude of the aircraft making the report. Just north of Detroit, PIREPS of icing diminished when looking at plots of pilot reports versus radar reflectivities.

Greg Thompson discussed various satellite products. He presented satellite images from the Naval Research Laboratory for the 1830Z and 2130Z infrared GOES 9 scan. He showed the 11 micron wavelength (longwave infrared) cloud top temperatures. The 1830Z image had cold cloud tops in the DTW area of about -20° C. At 2130Z cloud tops had warmed up to around -16° C. Satellite icing products were discussed. Initial analysis of the data suggests small supercooled cloud drops were present at cloud top levels in the Detroit area.

Mr. Bernstein then presented various products using the Stovepipe Algorithm. Overlays of satellite imagery were also discussed. These products indicated the possibility of large supercooled droplets throughout Western Ohio up to the Michigan border. Altitudes for these drops ranged from 1,000 feet up to approximately 10,000 feet. There was a close correlation to pilot reports of icing locations and altitudes received during the same time period. These products do not show conclusive evidence of the actual conditions but may indicate the possibility of icing conditions.

A discussion followed regarding further support that is needed by the Weather Group from NCAR. To support their investigation NCAR needs the following additional information:

- Air traffic Control radar track data for Comair 3272 and other pertinent aircraft.

- Precipitation data with greater than hourly resolution.

- Official weather observation forms for the Western Ohio region.

- Wilmington Ohio WSR-88D level 2 data tapes.

NCAR said they can provide the investigation with:

- Airplane profile of Comair 3272 and America West flying through the reflectivity environment and estimated liquid water content areas.

- They can estimate exposure time in precipitation conditions and project drop size distributions as well as water distribution by percentage of ice and water.

- They will look at the Twin Otter raw data from the NASA Lewis Icing Research project and determine its relevance to this accident.

- Examine the RUC Atmospheric Model for snow, ice, and water data fields.

The group spent the afternoon in the Aviation Weather Development Laboratory. Various icing products and numerical models were run, examined and discussed.

Attachments_J 1 - 4 .. Data from Stovepipe Algorithm for 2100Z.
Attachments_J 5 and 6 .. GOES 9 Icing Product image for 1830Z and 2130Z.
Attachments_J 7 - 11 .. Radar Data Plots for 2000Z and 2100Z.
Attachments_J 11 - 14 .. Pilot Reports (PIREPs) of Icing.
Attachments_J 15 and 16 .. Experimental FSL Aircraft Weather Data.
Attachments_J 17 - 20 .. Surface and upper air data.

Hazardous Inflight Weather Advisory Service (HIWAS)

HIWAS .. continuous recorded hazardous inflight weather forecasts broadcasted to airborne pilots over selected VOR outlets. The HIWAS broadcast consists of a summary of weather products including AIRMETs, SIGMETs, Center Weather Advisories, and Urgent Pilot Reports (UUA).

An audio tape of the HIWAS broadcasts over the Cleveland Center HIWAS outlets for the time period 1900Z to 2100Z, on January 9, 1997, was provided by the FAA. Review of the tape indicated that the HIWAS broadcast was for a time of 1600Z (last recorded at 1600Z). The HIWAS outlets are the Carelton (CRL), Peck (ECK), and Saginaw (MBS) VORs. The broadcasts are for a 150 nautical mile radius of these VORs. Icing was noted in the broadcast - "light to occasional moderate rime or mixed icing in clouds below Flight Level 180 for the entire broadcast area."

According to the FAA "our investigation of HIWAS broadcasts and analysis of event reconstruction (EVR) data on January 9, 1997, between 1545Z and 2145Z indicate there were occurrences when weather elements were issued that should have been incorporated into the HIWAS broadcast. We did not comply with agency requirements

to update the HIWAS broadcasts in any of these instances." The FAA is addressing this as a performance issue with the individuals assigned HIWAS duties during this period. The FAA has also initiated facility wide measures to ensure all operational employees are complying with the requirements of FAA Order 7110.10L, Chapter 2, Section 6. The FAA notes that mandatory reviews of requirements has been completed and documented in training records. The Lansing, Michigan, Automated Flight Service Station (AFSS) is responsible for generating these HIWAS broadcasts.

See Attachments_K 1 and 2 .. FAA Memorandum.

CRL is located about 6 nautical miles northeast of the accident site.
ECK is located about 86 nautical miles north-northeast of the accident site.
MBS is located about 97 nautical miles north-northwest of the accident site.

****

[redacted]

Gregory D. Salottolo
National Resource Specialist
Meteorology
April 16, 1997

AS-30
4-30-97