NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

September 3, 2013

Group Chairman's Factual Report

METEOROLOGY

CEN12LA095

Table Of Contents

A. ACCIDENT

Location:	Midland, Texas
Date:	December 2, 2011
Time:	About 0810 central standard time (1410 UTC[1])
Airplane:	Beechcraft King Air F-90; registration N90QL

B. METEOROLOGY GROUP

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Washington, D.C. 20594-2000

C. SUMMARY

On December 2, 2011, about 0810 central standard time, a Beech F90, N90QL, collided with terrain while on an instrument approach to the Midland Airpark (KMDD), Midland, Texas. The commercial pilot, the sole occupant, sustained serious injuries. The airplane was registered to and operated by Quality Lease Air Services LLC., under the provisions of 14 Code of Federal Regulations Part 91 as a positioning flight. Instrument meteorological conditions prevailed and an instrument flight rules (IFR) flight plan had been filed for the cross-country flight. The flight had originated from the Wharton Regional Airport (KARM), Wharton, Texas, at 0626 and was approaching KMDD.

According to the pilot, while on approach to KMDD, the airplane was experiencing an accumulation of moderate to severe mixed ice. At the time, his right windscreen was covered with ice and the left windscreen was partially covered with ice. Air Traffic Control (ATC) informed the pilot, that according to radar, that he was not going to make the Final Approach Fix (FAF), for the instrument approach. Subsequently, the pilot elected to execute a missed approach. As the pilot added power, the airplane entered a 90 degree bank to the left. The pilot disconnected the autopilot and attempted to level the wings; however, the airplane then entered a 90 degree bank to the right. The pilot reported hearing the stall warning horn and said the airplane was out of control as it descended from 3,300 feet.

The airplane impacted into a residential house, approximately 1 mile from the approach end of runway 25, and a post crash fire ensued. The pilot was able to exit the airplane and there were no reported ground injuries.

[1] UTC – is an abbreviation for Coordinated Universal Time.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are central standard time (CST) based upon the 24 hour clock, local time is +6 hours to UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport Association (IATA) 3-letter identifiers which deletes the initial country code designator "K" for U.S. airports. Both codes are both used intermittently in this report.

The accident site was estimated to be located at latitude 32.0431° N and longitude 102.0811° W at an elevation of 2,792 feet.

E. FACTUAL INFORMATION

1.0 Synoptic Situation

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

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 0600 CST on December 2, 2011 (1200Z) is included as figure 1 with the approximate accident site within the red circle and the general route of flight indicated by the red dash line. The chart depicted a low pressure system over eastern Texas at 1026-hectopascals (hPa) with a cold front extending southwestward and turning into a stationary front to the south of the accident site over Mexico. To the northeast a cold-core high pressure system was located over Nebraska at 1033-hPa with a ridge of high pressure extending southwestward over the Texas panhandle and into western Texas.

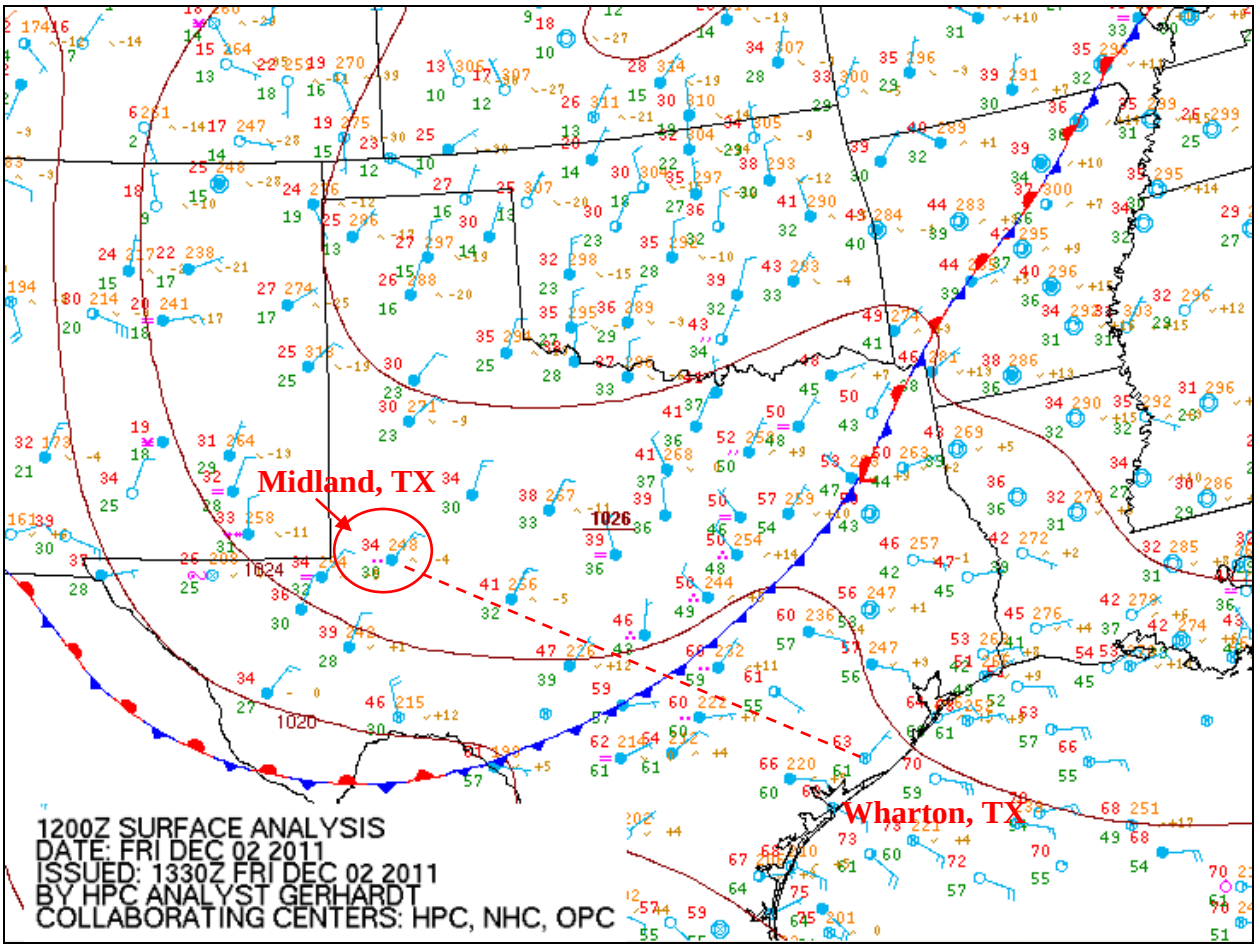

Figure 1 - NWS Surface Analysis Chart for 0600 CST

The station model for Midland, Texas, indicated a wind from the northeast at approximately 15 knots, light continuous rain, overcast clouds, a temperature 34° Fahrenheit (F), the dew point temperature of 30° F, and sea level pressure of 1024.8-hPa. Station models west and north of the accident site over Texas and New Mexico reported below freezing temperatures with fog, snow, and one station freezing rain at the time.

1.2 Weather Radar Mosaic

The NWS regional radar mosaic for 0810 CST on December 2, 2011 is included as figure 2 and depicted an area of light intensity echoes over the Midland area in the range of 10 to 30 dBZ associated with precipitation. Based on the potential for some interaction with some radar echoes the closest NWS weather radar and flight track will be analyzed in section 5.0 of this report.

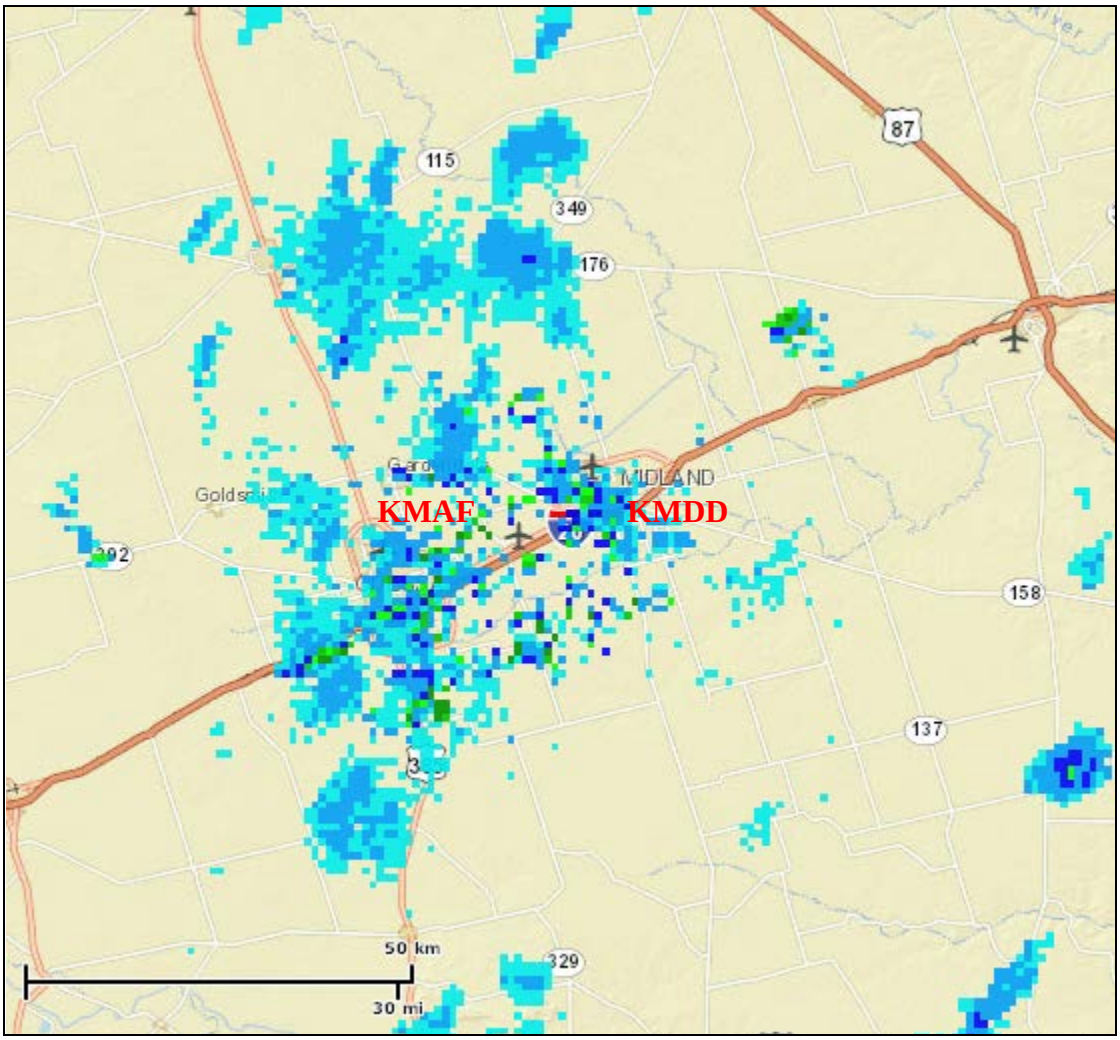

Figure 2 - NWS regional radar mosaic for 0810 CST

1.3 Upper Air Charts

The NWS southwest section of the Constant Pressure Charts for 850- and 700-hPa for 0600 CST (1200Z) on December 2, 2011 are included as figures 3 and 4, and represented the conditions at approximately 5,000 and 10,000 feet respectively. The charts depicted a cut off upper level low pressure system over California and Arizona, with a trough of low pressure extending southward, with the 850-hPa chart also showed a small cold core high pressure system over the New Mexico and the Texas panhandle at low-levels. Both charts depicted below freezing conditions over the Midland area with saturated conditions on the 850-hPa chart suggested potential icing conditions. The charts also indicated an abrupt change in wind conditions between the layers with a northwesterly wind near 10 knots at 5,000 feet and wind from the south at 40 knots at 10,000 feet.

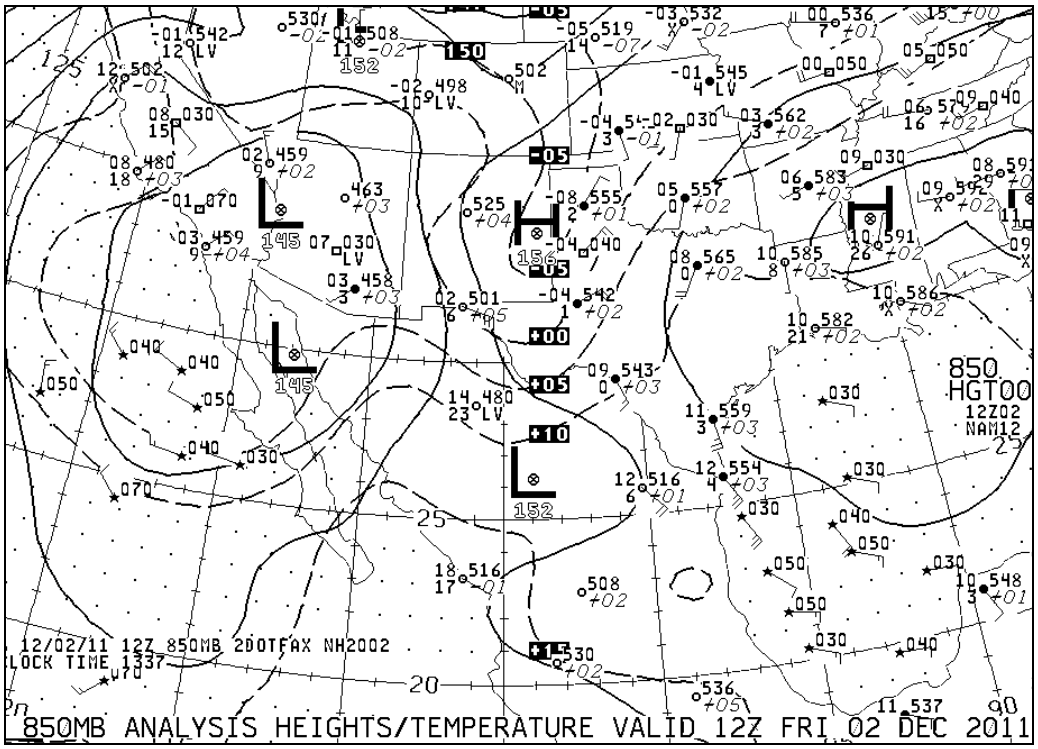

Figure 3 - NWS 850-hPa Constant Pressure Chart for 0600 CST

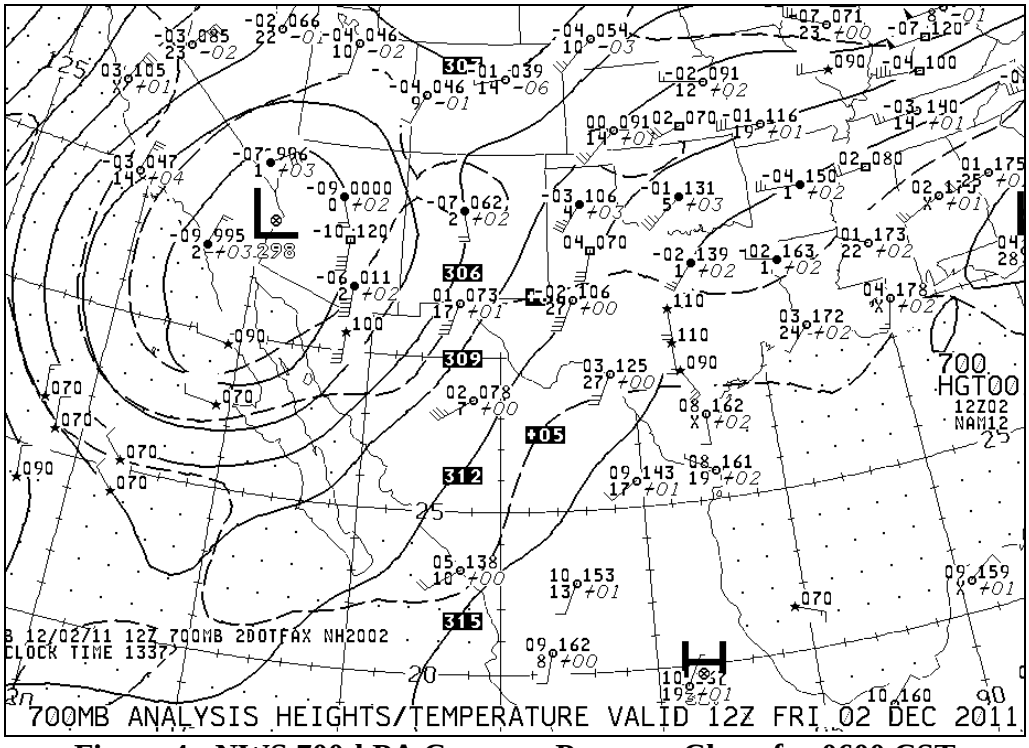

Figure 4 - NWS 700-hPA Constant Pressure Chart for 0600 CST

2.0 Surface Observations

The official NWS Meteorological Aerodrome Reports (METARs) and special reports (SPECIs) surrounding the period were documented for the departure and the closest airport to the accident site. The cloud heights are reported above ground level (agl).

2.1 Midland Airpark (KMDD), Midland, Texas

Midland Airpark at an elevation of 2,803 feet and a magnetic variation of 7° east had an unaugment Automated Weather Observation System (AWOS) and reported the following conditions surrounding the time of the accident:

Midland (KMDD) weather observation at 0755 CST, automated, wind from 030° at 10 knots, visibility 3 miles in light rain, scattered clouds at 600 feet, ceiling broken at 1,100 feet, overcast at 1,600 feet, temperature 1° Celsius (C), dew point temperature 0° C, altimeter 30.32 inches of mercury (Hg). Remarks: automated observation system, temperature 1.2° C, dew point 0.3° C.

Midland (KMDD) weather observation at 0815 CST, automated, wind from 030° at 9 knots, visibility 1 3/4 miles in mist, scattered clouds at 300 feet, ceiling overcast at 800 feet, temperature and dew point 1° C, altimeter 30.31 inches of Hg. Remarks: automated observation system, temperature 1.2° C, dew point 0.5° C.

The observations indicated that the observation would have indicated a 7 knot tailwind and 6 knot cross wind for landing on runway 25 during the period. The raw observations in standard code surrounding the period from 0255 through 1055 CST were as follows:

METAR KMDD 020855Z AUTO 03015G20KT 10SM OVC022 04/M01 A3032 RMK AO2 T00401015=

METAR KMDD 020915Z AUTO 04019G23KT 10SM OVC022 04/M02 A3032 RMK AO2 T00381016=

METAR KMDD 020935Z AUTO 04015KT 10SM OVC020 04/M01 A3032 RMK AO2 T00361015=

METAR KMDD 020955Z AUTO 05017G23KT 10SM OVC020 03/M01 A3032 RMK AO2 T00341014=

METAR KMDD 021015Z AUTO 05015G22KT 10SM OVC020 03/M01 A3033 RMK AO2 T00311013=

METAR KMDD 021035Z AUTO 05018G23KT 10SM OVC018 03/M01 A3030 RMK AO2 T00291010=

METAR KMDD 021055Z AUTO 04011KT 10SM OVC016 03/M01 A3032 RMK AO2 T00261009=

METAR KMDD 021115Z AUTO 04013KT 7SM OVC014 03/M01 A3031 RMK AO2 T00251006=

METAR KMDD 021135Z AUTO 04013KT 7SM OVC014 02/00 A3031 RMK AO2 T00201001=

METAR KMDD 021155Z AUTO 04011KT 5SM -DZ OVC014 02/00 A3031 RMK AO2 T00181001=

METAR KMDD 021215Z AUTO 05012KT 4SM BR SCT007 OVC014 02/00 A3031 RMK AO2 T00170001=

METAR KMDD 021235Z AUTO 04009KT 2 1/2SM -RA SCT005 BKN010 OVC014 02/00 A3031 RMK AO2 T00150002=

METAR KMDD 021255Z AUTO 04009KT 3SM -RA SCT005 OVC010 02/00 A3032 RMK AO2 T00150004=

METAR KMDD 021315Z AUTO 04007KT 4SM RA BKN005 BKN010 OVC015 01/01 A3031 RMK AO2 T00140005=

METAR KMDD 021335Z AUTO 02009KT 4SM -RA BKN008 OVC013 01/00 A3032 RMK AO2 T00130004=

METAR KMDD 021355Z AUTO 03010KT 3SM -RA SCT006 BKN011 OVC016 01/00 A3032 RMK AO2 T00120003=

Accident 1410Z

METAR KMDD 021415Z AUTO 03009KT 1 3/4SM BR SCT003 OVC008 01/01 A3031 RMK AO2 T00120005=

METAR KMDD 021435Z AUTO 03009KT 1 3/4SM BR OVC006 01/01 A3032 RMK AO2 T00130005=

METAR KMDD 021455Z AUTO 03010KT 1 1/4SM BR OVC006 01/01 A3032 RMK AO2 T00120005=

METAR KMDD 021515Z AUTO 04009KT 2SM BR BKN004 OVC011 01/01 A3031 RMK AO2 T00120005=

METAR KMDD 021535Z AUTO 04008KT 2 1/2SM BR BKN004 OVC009 01/01 A3032 RMK AO2 T00130005=

METAR KMDD 021555Z AUTO 03007KT 2SM BR OVC006 02/01 A3031 RMK AO2 T00150007=

METAR KMDD 021615Z AUTO 04007KT 2SM DZ OVC006 01/01 A3031 RMK AO2 T00140007=

METAR KMDD 021635Z AUTO 03006KT 3SM RA OVC006 02/01 A3031 RMK AO2 T00150007=

METAR KMDD 021655Z AUTO 36004KT 2SM RA OVC008 02/01 A3031 RMK AO2 T00150006=

2.2 Midland International Airport (KMAF), Midland, Texas

The next closest station was from Midland International Airport (KMAF), located approximately 8 miles southwest of Midland Airpark and the accident site, at an elevation of 2,872 feet and a magnetic variation of 7° east. The airport had a federally installed, maintained, and augmented Automated Surface Observation System (ASOS) and reported the following conditions at the approximate time of the accident:

Midland weather observation at 0802 CST, wind from 010° at 10 knots, visibility 2 miles in mist, ceiling broken at 500 feet, overcast at 900 feet, temperature 1° C, dew point -1° C, altimeter 30.30 inches of Hg. Remarks: automated observation system, rain ended at 0800 CST, ceiling 400 variable 800 feet, hourly precipitation less than 0.01 inches.

After the accident, between 1011 and 1117 CST a period of unknown freezing precipitation (UP) was recorded at the station, before turning back to rain and drizzle with temperatures near freezing. The raw observations during the period were as follows:

METAR KMAF 020853Z AUTO 04013KT 10SM OVC023 03/M03 A3031 RMK AO2 PK WND 04027/0802 SLP245 T00331028 55002=

METAR KMAF 020953Z AUTO 04016KT 10SM OVC019 03/M02 A3031 RMK AO2 SLP246 T00281022=

METAR KMAF 021053Z AUTO 04016G21KT 10SM OVC017 02/M02 A3030 RMK AO2 SLP247 T00171022=

SPECI KMAF 021115Z AUTO 03012KT 9SM OVC013 02/M02 A3030 RMK AO2=

METAR KMAF 021153Z 04013KT 4SM -RA BR SCT009 OVC013 01/M01 A3029 RMK AO2 RAB51 SLP248 P0000 60000 T0011101110050 20011 58004=

SPECI KMAF 021207Z 04014KT 2 1/2SM -RA BR FEW007 OVC014 01/M01A3029 RMK AO2 P0000=

SPECI KMAF 021227Z 04011KT 2 1/2SM -RA BR BKN007 OVC014 01/M01A3029 RMK AO2 CIG 004V009 P0001=

METAR KMAF 021253Z 03010KT 2 1/2SM BR OVC007 01/M01 A3030 RMK AO2 RAE35 CIG 004V009 SLP252 P0001 T00061006=

SPECI KMAF 021310Z 04011KT 3SM BR BKN005 OVC010 01/M01 A3030 RMK AO2=

METAR KMAF 021353Z 01009KT 3SM -RA BR OVC007 01/M01 A3030 RMK AO2 RAB11 CIG 004V012 SLP254 P0000 T00061006=

SPECI KMAF 021402Z 01010KT 2SM BR BKN005 OVC009 01/M01 A3030 RMK AO2 RAE00 CIG 004V008 P0000=

Accident 1410Z

METAR KMAF 021453Z 02011KT 1 3/4SM BR OVC007 01/M01 A3030 RMK AO2 RAE00 CIG 004V009 SLP255 P0000 60001 T00061006 51002=

SPECI KMAF 021520Z 03011KT 2 1/2SM BR BKN005 OVC010 01/M01A3030 RMK AO2 RAB06E19 CIG 004V009 P0000=

SPECI KMAF 021531Z 03010KT 3SM BR SCT005 OVC010 01/M01 A3031RMK AO2 RAB06E19 CIG 007V012 P0000=

SPECI KMAF 021533Z 03009KT 2 1/2SM BR BKN007 OVC010 01/M01 A3031 RMK AO2 RAB06E19 CIG 004V010 P0000=

SPECI KMAF 021548Z 04007KT 2 1/2SM BR SCT005 OVC010 01/00 A3031 RMK AO2 RAB06E19 CIG 008V013 P0000=

METAR KMAF 021553Z 06007KT 2 1/2SM BR BKN005 OVC010 01/00 A3031 RMK AO2 RAB06E19 CIG 004V009 SLP259 P0000 T00060000=

SPECI KMAF 021646Z 36005KT 4SM BR OVC005 01/00 A3030 RMK AO2 UPB11E35RAB15E25 P0000=

METAR KMAF 021653Z 36005KT 4SM BR OVC005 01/00 A3030 RMK AO2 UPB11E35RAB15E25 SLP257 P0000 T00110000=

SPECI KMAF 021710Z 02004KT 2SM UP BR OVC005 01/00 A3029 RMK AO2 UPB08 P0000=

METAR KMAF 021753Z 01005KT 3SM -DZ BR OVC005 01/00 A3027 RMK AO2 UPB08E17DZB31 SLP248 P0000 60001 T00110000 10011 20006 58012=

2.3 Odessa-Schlemeyer Field (KODO), Odessa, Texas

The next closest airport was from Odessa-Schlemeyer Field (KODO), located in Odessa, Texas, or approxiamtely16 miles southwest of KMDD at an elevation of 3,004 feet. The airport had an ASOS and reported the following condition at the approximate time of the accident:

Odessa (KODO) weather at 0753 CST, automated, wind from 020° at 9 knots, visibility 1 3/4 miles in unknown precipitation and mist, ceiling overcast at 700 feet agl, temperature and dew point 0° C, altimeter 30.30 inches of Hg. Remarks; automated observation system, rain began at 0705 and ending at 0708 CST, ceiling 300 variable 1,100 feet, sea level pressure 1025.6-hPa, hourly precipitation less than 0.01 inches, temperature and dew point 0.0° C.

The raw observations surrounding the period were as follows:

METAR KODO 020853Z AUTO 04017G21KT 10SM OVC024 03/M02 A3031 RMK AO2 SLP248 T00281022 55006=

METAR KODO 020953Z AUTO 03014KT 10SM OVC020 02/M02 A3032 RMK AO2 SLP252 T00221022=

METAR KODO 021053Z AUTO 03012KT 9SM OVC016 01/M02 A3031 RMK AO2 SLP251 T00111017=

SPECI KODO 021102Z AUTO 03012KT 8SM OVC014 01/M02 A3031 RMK AO2=

METAR KODO 021153Z AUTO 03012KT 2 1/2SM BR OVC010 01/00 A3030 RMK AO2 CIG 007V012 SLP249 T00060000 10044 20006 58004=

SPECI KODO 021209Z AUTO 04011KT 2SM BR OVC007 01/00 A3030 RMK AO2 CIG 004V012=

SPECI KODO 021242Z AUTO 04012KT 2SM BR SCT005 OVC013 00/00 A3031 RMK AO2 UPB26E37 P0000=

METAR KODO 021253Z AUTO 04008KT 2SM UP BR BKN005 OVC013 01/00 A3031 RMK AO2 UPB26 SLP253 P0000 T00060000=

SPECI KODO 021306Z AUTO 02010KT 1 3/4SM -RA BR BKN007 OVC013 00/00 A3031 RMK AO2 UPE05RAB05 P0000=

SPECI KODO 021317Z AUTO 03010KT 2SM UP BR BKN005 BKN009 OVC014 00/00 A3032 RMK AO2 RAB05E08 P0000=

METAR KODO 021353Z AUTO 02009KT 1 3/4SM UP BR OVC007 00/00 A3030 RMK AO2 RAB05E08 CIG 003V011 SLP256 P0000 T00000000=

Accident 1410Z

METAR KODO 021453Z AUTO 03009KT 2SM BR BKN005 OVC012 01/00 A3030 RMK AO2 UPE46 SLP256 P0000 60000 T00060000 50002=

SPECI KODO 021510Z AUTO 02007KT 1 1/2SM BR BKN005 OVC010 00/00 A3031 RMK AO2 CIG 003V007=

METAR KODO 021553Z AUTO 05008KT 1 3/4SM BR OVC009 00/00 A3030 RMK AO2 UPB19E28 CIG 004V010 SLP257 P0000 T00000000=

SPECI KODO 021615Z AUTO 02007KT 2SM BR OVC007 00/00 A3031 RMK AO2 CIG 003V010=

SPECI KODO 021634Z AUTO 02005KT 1 3/4SM BR OVC007 01/01 A3031 RMK AO2 CIG 004V009=

METAR KODO 021653Z AUTO 03006KT 2 1/2SM BR OVC007 01/00 A3030 RMK AO2 CIG 004V009 SLP259 T00060000=

2.4 Big Spring McMahon-Wrinkle Airport (KBPG), Big Spring, Texas

Big Spring McMahon-Wrinkle Airport (KBPG), located in Big Spring, Texas, approximately 31 miles east of KMDD at an elevation of 2,573 feet had an AWOS without a precipitation discriminator and reported the following conditions at the approximate time of the accident:

Big Spring (KBPG) weather at 0815 CST, automated, wind from 020° at 8 knots, visibility 2 1/2 miles (weather missing), ceiling overcast at 800 feet agl, temperature 1° C, dew point 0° C, altimeter 30.33 inches of Hg.

The raw operations immediately surrounding the accident were as follows:

METAR KBPG 021355Z AUTO 01009KT 5SM OVC006 02/00 A3033 RMK AO1=

Accident 1410Z

METAR KBPG 021415Z AUTO 02008KT 2 1/2SM OVC008 01/00 A3033=

METAR KBPG 021435Z AUTO 36011KT 4SM OVC008 02/00 A3033=

METAR KBPG 021455Z AUTO 35012G15KT 5SM OVC010 02/00 A3033 RMK AO1=

3.0 Upper Air Data

The 0600 CST (1200Z) NWS Midland upper air sounding or rawinsonde observation (RAOB) site number 72265 was plotted on a standard Skew-T log P diagram[2] utilizing RAOB[3] software is included as figure 5 from the surface to 500-hPa or 18,000 feet.

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

[3] RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamopras, Pennsylvania.

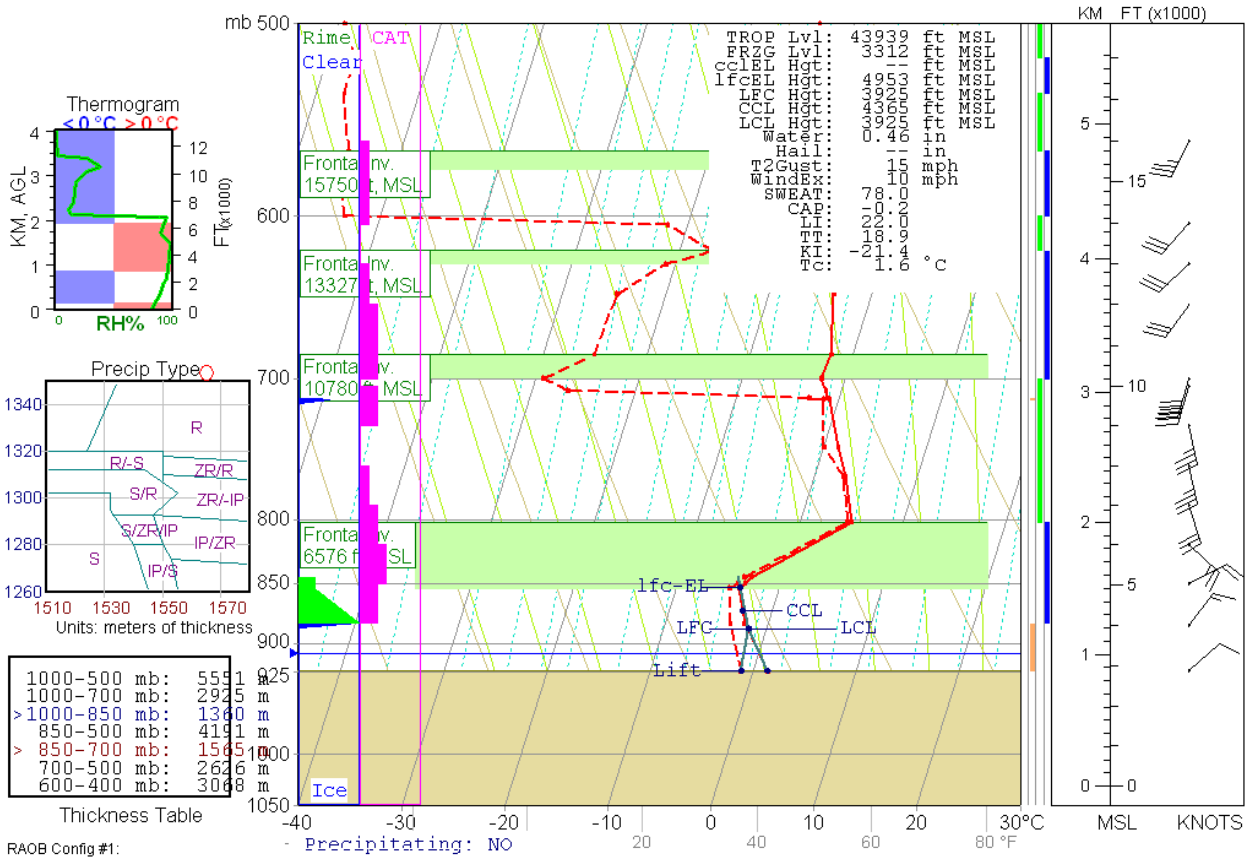

Figure 5 - 0600 CST Midland upper air sounding

The Midland sounding depicted a moist low-level environment with the relative humidity greater than 80% from the surface through 10,000 feet and supported low nimbus type clouds with light precipitation, with a precipitable water value was 0.46 inches. The freezing level was identified at 451 feet agl with a defined temperature inversion associated with the frontal zone south of the area at 6,576 feet msl, where temperatures rose above freezing again between 6,000 and 9,000 feet. Several other shallow temperature inversions were also noted below 18,000 feet with temperatures remaining below freezing in those layers. As a result of the multiple inversions the Lifted Index (LI) was 22, and indicated an absolutely stable atmosphere. The lifted condensation level (LCL) or approximate base of the clouds was identified at 887-hPa or 1,064 feet agl, and was coincident with the level of free convection (LFC) . The convective condensation level (CCL) was identified at 872-hPa or 1,504 feet agl. The tropopause was identified at approximately 43,900 feet.

The sounding wind profile indicated a surface wind from the northeast or from 045° at 11 knots with wind shifting abruptly to the south and southwest above the frontal inversion at 6,500 feet and increasing in speed. The mean 0 to 6 kilometer (or 18,000 feet) wind was from 205° at 27 knots. The level of maximum wind was identified at 36,000 feet from 240° at 82 knots.

Figure 6 is a table of the observed and derived parameters for turbulence and icing from the sounding through 21,000 feet. The turbulence parameters indicated a high potential for moderate and greater turbulence between 2,000 and 4,000 feet agl (4,900 and 7,000 feet msl) and between

9,000 and 10,000 feet in and below the inversions where strong vertical wind shears were concentrated. The derived icing parameters based on the Smith-Feddes techniques[4] also support icing in-clouds and in-precipitation above the freezing level and 5,000 feet. A potential shallow layer of severe clear icing conditions was detected at approximately 1,192 feet agl (4,053 feet msl) based on this technique with the LWC of 1.974 grams/meter^3, a relative humidity of 90%, and a temperature of -2.3° C, which produced a probability of 60% of occurrence.

A search of aircraft soundings indicated no instrumented aircraft landing or departing the Midland area surrounding the period. The closest aircraft soundings in Lubbock, Texas also depicted strong low level temperature inversions capping below freezing temperatures.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (AF)	LLWS	Icing - Type (S-F clouds)
2861	924	1.4	-1.2	83	45 / 11			
4053	883	-2.3	-3.7	90	35 / 14			SVR Clear
4921	854	-3.9	-4.8	93		L-M		TRC Rime
5043	850	-3.5	-4.2	95	60 / 22			TRC Rime
5196	845	-3.1	-3.7	96		MDT		TRC Rime
6000	820				135 / 25			
6576	802	5.0	4.6	97		L-M		
7000	789				165 / 32			
7734	768	3.0	2.8	99		LGT		
8000	760				170 / 35			
8470	747	1.4	0.0	90				
9000	732				170 / 35			
9661	714	-0.9	-1.5	96				LGT Clear
9698	713	-1.1	-2.9	88				TRC Clear
9882	708	-1.5	-26.5	13		L-M		
10000	705				195 / 38			
10178	700	-2.3	-29.3	11	195 / 38			
10780	684	-2.1	-25.1	15		L-M		
12000	653				215 / 29			
12265	646	-3.7	-24.7	18		LGT		
12996	628	-4.9	-20.9	27	225 / 29			
13327	620	-4.7	-16.7	38				
13958	605	-5.9	-21.9	27	220 / 30			
14171	600	-6.5	-53.5	1				
15302	574	-8.5	-55.5	1				
15750	564	-7.1	-55.1	1		LGT		
16000	558				205 / 34			
17139	534	-10.3	-57.3	1				
18003	516	-11.3	-57.3	1				
18793	500	-13.3	-59.3	1	215 / 34			
20014	476	-16.3	-54.3	2	220 / 34			
20327	470	-17.1	-39.1	13				
21176	454	-18.9	-35.9	21				
21501	448	-19.5	-29.5	41				
21995	439	-20.7	-29.7	44				

Figure 6 – Table of the Midland sounding parameters

[4] Smith-Feddes method is a function of cloud liquid water content (LWC), cloud height, sky cover, and the presence of precipitation.

4.0 Satellite Data

The Geostationary Operational Environmental Satellite number 13 (GOES-13) data was obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison (UW) in Madison, Wisconsin, and processed utilizing the Safety Board's Man-computer Interactive Data Access System (McIDAS) software. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident. The infrared long wave imagery (band 4) at a wavelength of 10.7 microns (μm) provided standard satellite image with radiative cloud top temperatures with a resolution of 4 km. The visible imagery (band 1) at a wavelength of 0.65 μm provided a resolution of 1 km.

Figures 7 and 8 are the GOES-13 infrared images for 0802 (1402Z) and 0815 CST (1415Z) over the area at 4X magnification, and figures 9 and 10 the visible images for the same periods at 2X magnification and with a brightness enhancement applied due to the low level of visible light at the time of the morning. The images depict an extensive area of low overcast stratiform type clouds with a middle layer of clouds extending over western Texas and the accident site. The radiative cloud tops temperatures at 0802 and 1815 CST ranged from 243° to 240° Kelvin or from -30.16° to -33.16° C, which corresponded to cloud tops between 27,000 and 28,000 feet.

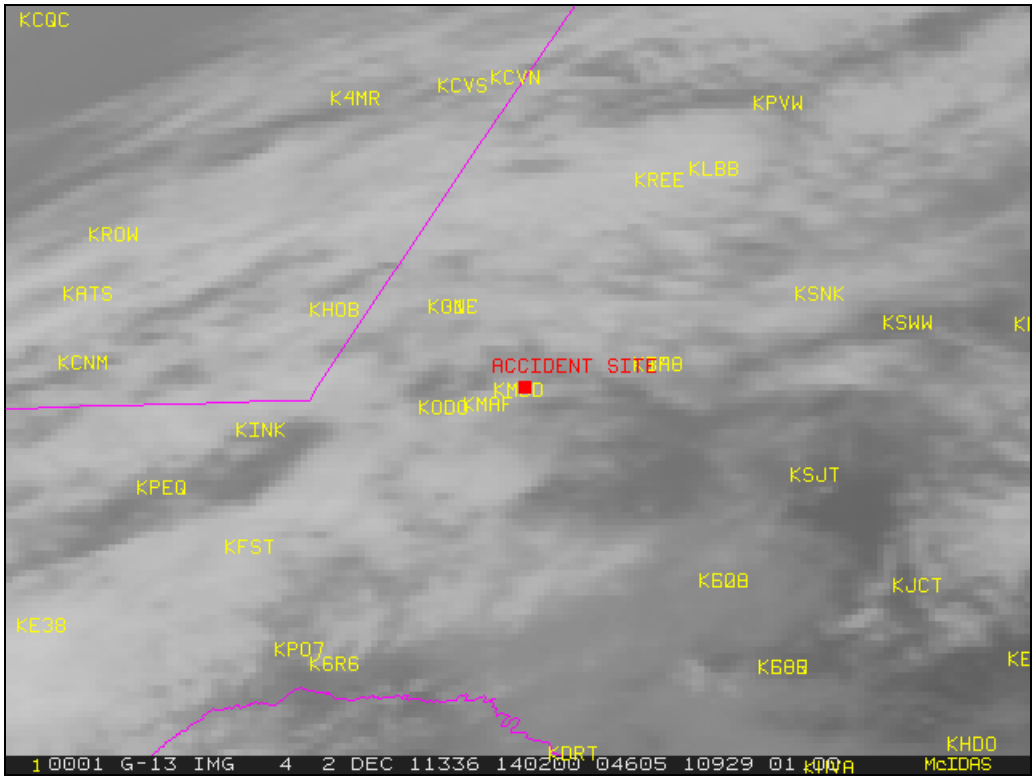

Figure 7 - GOES-13 infrared image at 0802 CST

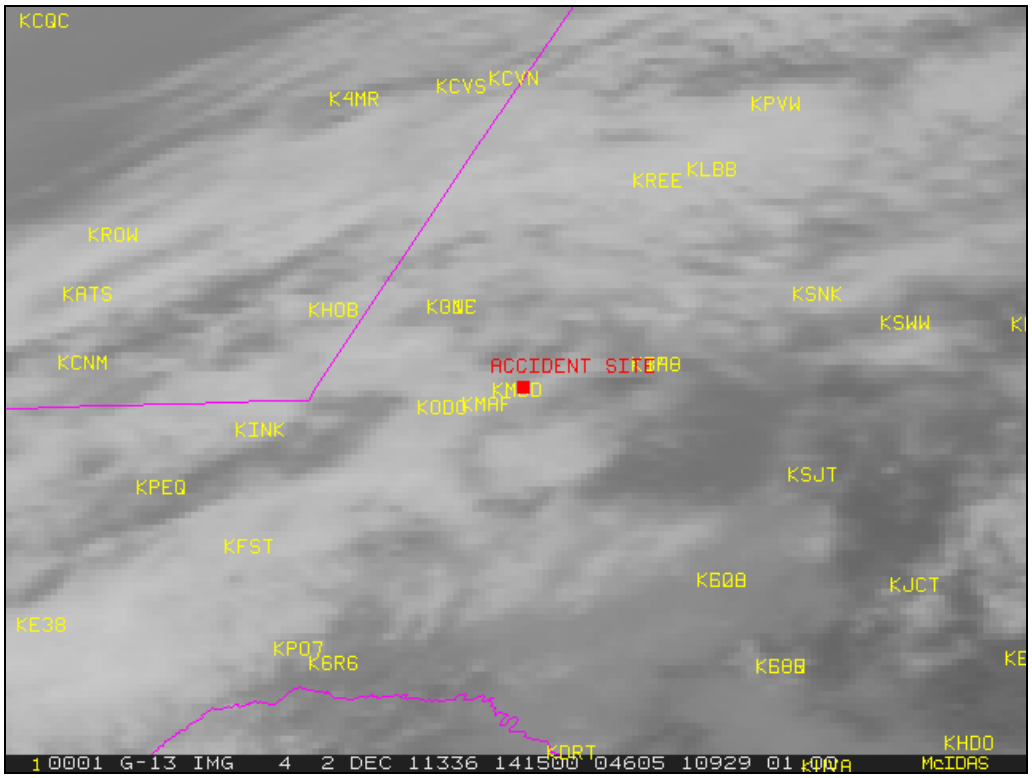

Figure 8 - GOES-13 infrared satellite image at 0815 CST

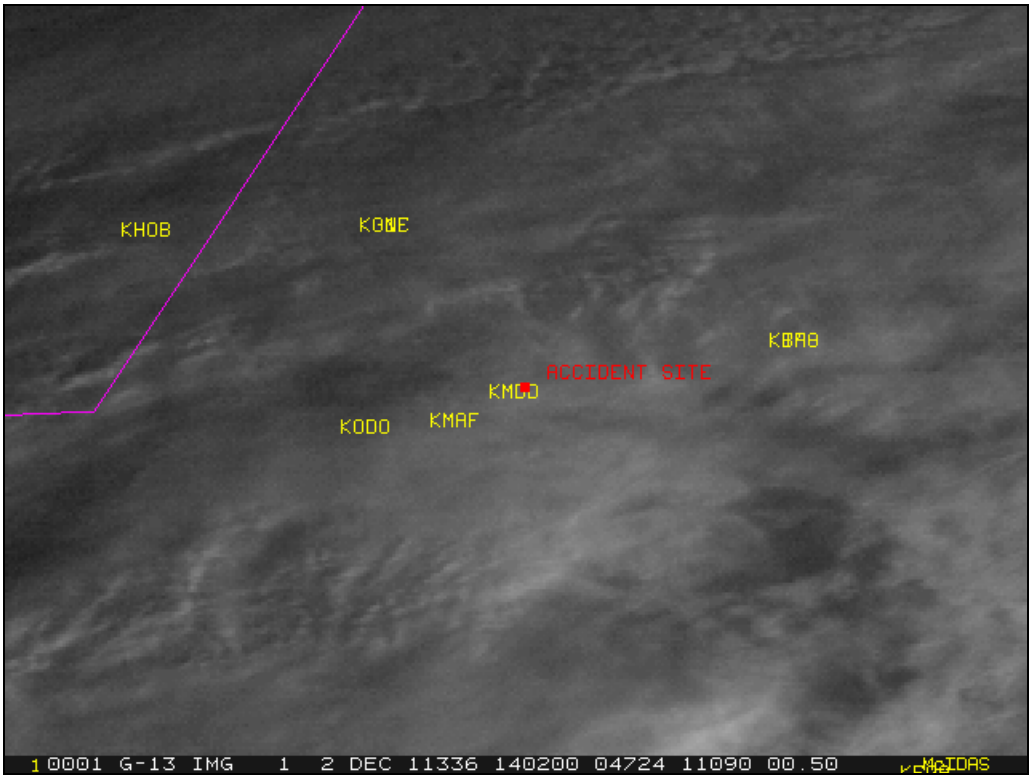

Figure 9 - GOES-13 visible image at 0802 CST

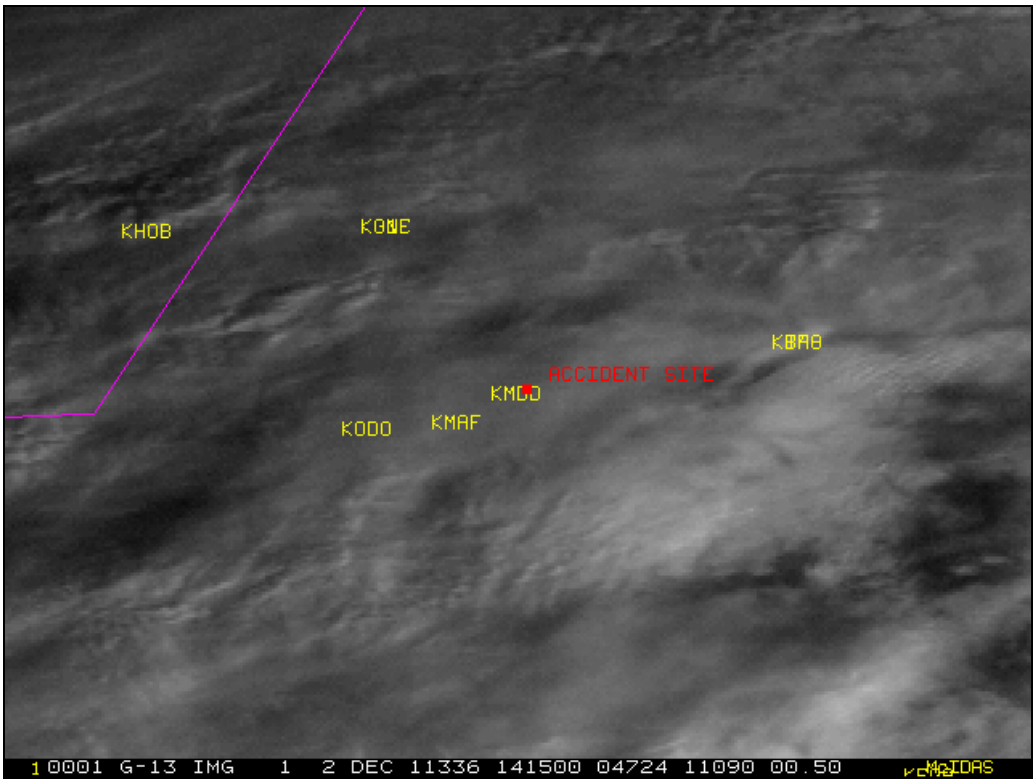

Figure 10 - GOES-13 visible image at 0815 CST

5.0 Weather Radar Information

The NWS Midland (KMAF) Weather Surveillance Radar-1988, Doppler (WSR-88D) was located approximately 8 miles southwest of the accident site. The level II archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

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

5.1 Volume Scan Strategy

The WSR-88D is a computer controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D's Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the six minute volume scan.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has several scanning strategies depending on if severe

convection is expected. The most common is the non-severe convective mode where the radar makes 9 elevation scans from 0.50° to 19.5° every six minutes. Mode B is the clear air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the accident the KMAF WSR-88D radar was operating in the clear air mode VCP-31. The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.

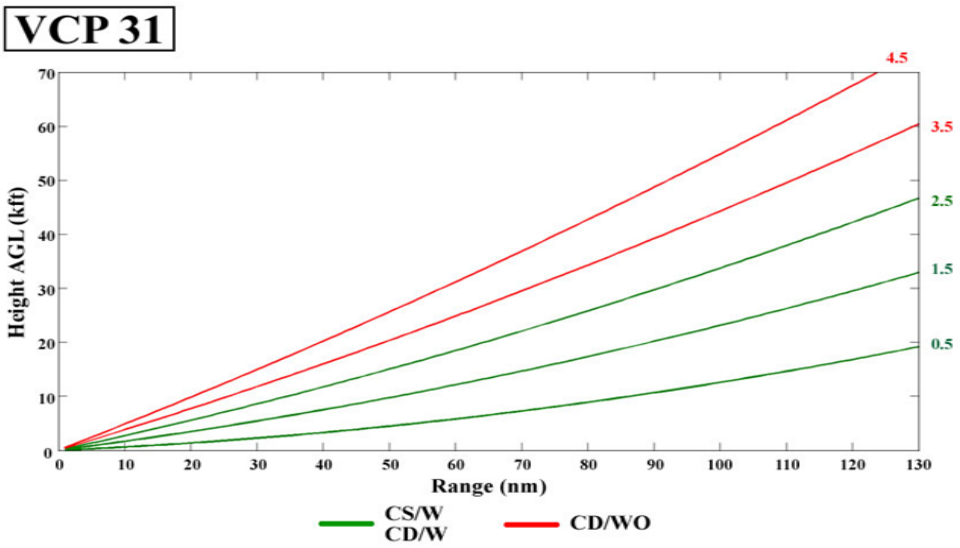

Figure 11- VCP-31 clear air scanning mode

5.2 Beam Height Calculation

Assuming standard refraction[5] of the 0.95° radar beam of the KMAF WSR-88D with an antenna height of 2,962 feet and a distance of 8 miles, the following table shows the approximate beam height and width information of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5°	3,430 feet	3,030 feet	3,840 feet	810 feet

5.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[6] it is a function of the drop size distribution, number of particles per

[5] Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

[6] Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid

unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ[7]), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0	< 5	
	1	5 to 9	
	2	10 to 14	
1	3	15 to 19	.01 in/hr
Very Light	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2	6	30 to 34	.09 in/hr
Light to	7	35 to 39	.21 in/hr
Moderate			
3	8	40 to 44	.48 in/hr
Strong			
4	9	45 to 49	1.10 in/hr
Very			
Strong			
5	10	50 to 54	2.49 in/hr
Intense			
6	11	55 to 59	>5.67 in/hr
Extreme	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

5.4 Base Reflectivity

The KMAF 0.5 base reflectivity image for 0807 CST (1407Z) on December 2, 2011 is included as figure 12. The image depicted a large area of very light intensity echoes surrounding the Midland area associated with the ground clutter associated with the temperature inversion and the ducting of the radar beam towards the surface, and an area of echoes near 25 to 30 dBZ approximately 8 miles northeast of the accident site were identified with false echoes which did not move or change intensity with time. The radar did detect several areas of very light intensity echoes surrounding the area on the order of -10 to 10 dBZ likely associated with drizzle and/or very light intensity rain running north to south, and to the east of the radar site. Two light intensity areas were depicted along N90QL's flight track on the order of 5 to 10 dBZ, while the aircraft descended from 18,000 through 10,000 feet.

(frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glaze ice.

[7] dBZ - 10 log Ze

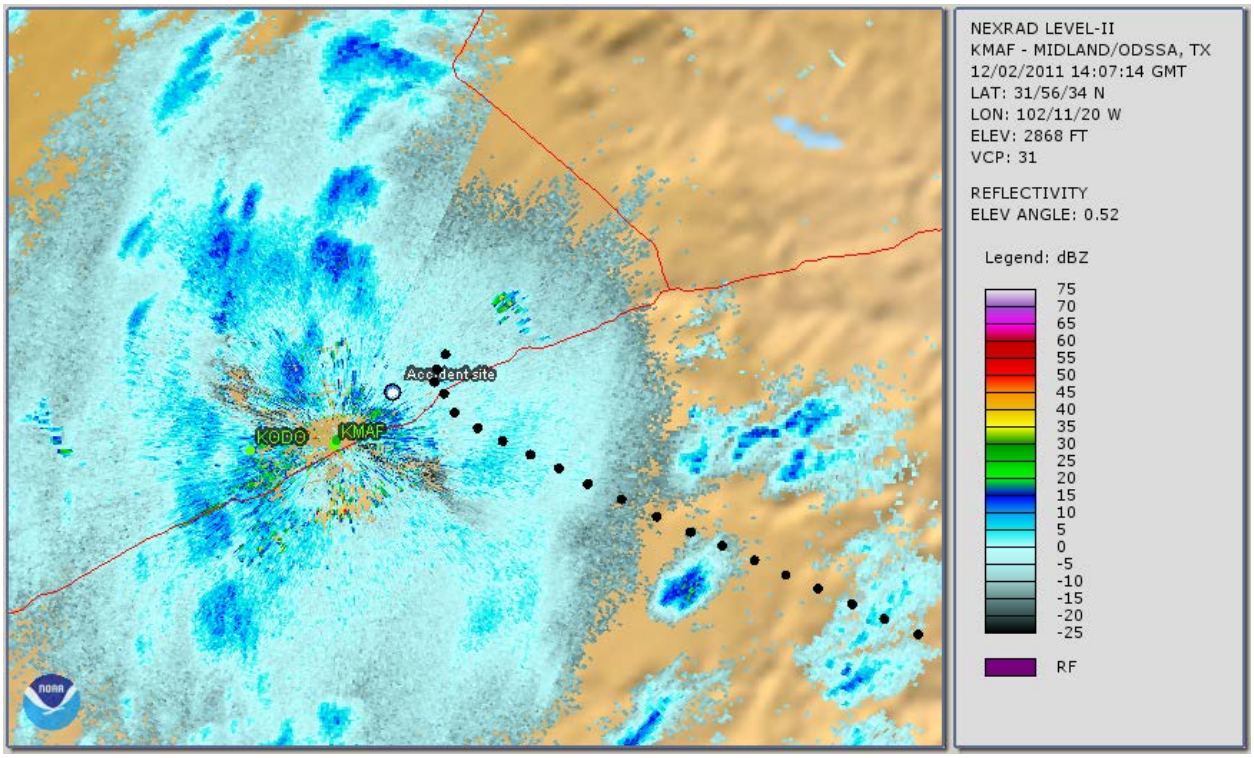

Figure 12 - KMAF WSR-88D 0.5° base reflectivity image at 0807 CST

6.0 Pilot Reports

The following pilot reports (PIREPs) were recorded in the NWS data base over central and western Texas surrounding the period. The reports are as follows in chorological order:

AMA UA /OV KAMA/TM 0145/FLUNKN/TP B733/WX FZDZ/IC MOD RIME/RM MOD RIME DURGC RWY 4 8000-5000FT AWC-WEB:SWA=

AMA UA /OV AMA /TM 0147 /FL080 /TP B737 /SK OVC048/TOP080 /TA 02 /IC MOD RIME /RM DURD=

AMA UA /OV PNH130015 /TM 0219 /FLUNKN /TP B737 /TA 00 /IC MX MOD RIME /RM DURD FROM 050=

LBB UA /OV LBB270012 /TM 0310 /FL051 /TP C206 /TA M03 /IC MOD CLR=

CDS UA /OV GTH /TM 0600 /FL120 /TP PAY1 /TA M07 /IC LGT/MOD RIME=

Reports within 3 hours of the accident:

DFW UA /OV KDFW/TM 1250/FL140/TP MD82/SK CLDS BASES 004 TOPS 120/RM AWC-WEB:KZFW=

LBB UA /OV LBB270015 /TM 1311 /FL080 /TP C208 /TA 03 /IC TRACE RIME=

DAL UA /OV DAL130006 /TM 1311 /FL075 /TP B737 /SK OVC003-TOP072 /RM DURC=

SJT UA /OV SJT225005 /TM 1342 /FLUNKN /TP SW4 /SK OVC034-TOP048/SKC /RM DURD/THN LYR 007AGL=

Accident 1410Z

AMA UA /OV PNH075050/TM 1440/FL260/TP BE20/TA -22/IC LIGHT MIXED/RM /ZAB=

DAL UA /OV KDFW090020/TM 1455/FL100/TP A320/TB LGT 100-120/RM AWC-WEB:KZFW=

SJT UA /OV SJT190014/TM 1545/FL160/TP C750/IC LGT RIME/RM AWC-WEB:KZFW=

LBB UA /OV LBB /TM 1612 /FL048 /TP C310 /TA M03 /IC TRACE MX=

DAL UA /OV DAL /TM 1652 /FLUNKN /TP CRJ2 /SK OVC007-TOP060 /RM DURD=

ACT UA /OV ACT135040/TM 1658/FL130/TP C210/IC MOD RIME 130-135/RM AWC-WEB:KZFW=

MAF UA /OV MAF270005 /TM 1707 /FL050 /TP LJ60 /TA M04 /IC LGT RIME 050-BLO=

FTW UA /OV KXBP135010/TM 1800/FL150/TP LJ55/TA M10/IC LGT RIME/RM AWC-WEB:KZFW=

7.0 Terminal Aerodrome Forecast

The closest NWS Terminal Aerodrome Forecast (TAF) to the accident site was issued for Midland International Airport (KMAF). Although a TAF is only valid for a 5 miles radius around the airport center point, pilot's and weather briefers will often utilize the closest TAF to get a better time specific forecast other than what is provided by the Area Forecast, which is the legal forecast for airports that do not have a TAF issued for them.

Prior to the N90QL departure from Wharton, Texas, at approximately 0626 CST the TAF current for Midland was as follows:

Midland (KMAF) forecast issued at 0401 CST, expected wind from 040° at 14 knots gusting to 20 knots, visibility 5 miles in light drizzle, with a ceiling overcast at 1,500 feet agl, with a temporarily condition between 0600 and 0800 CST of visibility 1/2 mile in moderate freezing drizzle, and an expected overcast ceiling at 700 feet. From 0800 through 2400 CST, the forecasted expected the wind from 040° at 11 knots, visibility 1 mile in light drizzle, ceiling overcast at 700 feet.

The next scheduled forecast was issued at 0527 CST and expected from 0600 CST wind from 040° at 14 knots gusting to 20 knots, visibility better than 6 miles, with ceiling overcast at 1,500 feet agl, with a temporary condition between 0600 and 0900 CST of 5 miles in light freezing drizzle and ceiling overcast at 700 feet. After 0900 CST wind from 040° at 11 knots, visibility 3 miles in light drizzle, with a ceiling overcast at 700 feet.

The raw forecasts were as follows:

KMAF 021001Z 0210/0306 04014G20KT 5SM -DZ OVC015
TEMPO 0212/0214 1/2SM FZDZ OVC007
FM021400 04011KT 1SM -DZ OVC007=

TAF KMAF 021127Z 0212/0312 04014G20KT P6SM OVC015
TEMPO 0212/0215 5SM -FZDZ OVC007
FM021500 04011KT 3SM -DZ OVC007
TEMPO 0215/0218 1SM -DZ OVC003
FM021800 06008KT P6SM OVC015
FM030600 13012KT 5SM -RA BR OVC008=

8.0 Area Forecast

The NWS 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 (IFR) 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 which do not have a terminal forecast (TAF) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues specials reports as necessary usually in the form of an AIRMET. The Dallas-Fort Worth (KDFW) regional forecast that was current at the time of the accident was issued at 0445 CST and valid through 1700 CST on December 2, 2011. The pertinent section of the forecast is in bold print and was as follows:

FAUS44 KKCI 021045 2011336 1031
FA4W
-DFWC FA 021045
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 030500
CLDS/WX VALID UNTIL 022300...OTLK VALID 022300-030500
OK TX AR TN LA MS AL
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS**...**CDFNT OVR** WRN KY-NERN AR-**NERN TX-CNTRL TX BY 18Z BECMG
***NR STNR OVR SERN OK-CNTRL TX.** HI PRES OVR ERN PTN FA THRU 05Z.*
.
NWRN TX
PNHDL...OVC060 TOP 120. 15Z OVC050 TOP 140. VIS 3-5SM -FZRA/BR.
OTLK...IFR CIG FZRA 02Z RASN BR.
S PLAINS...OVC040 TOP 100. OCNL VIS 3-5SM -FZDZ. BECMG 1719 TOP 120. VIS 3SM -DZ/BR.
OTLK...IFR CIG DZ BR.
RMNDR...OVC025 TOP 100. VIS 3-5SM BR. TIL 15Z -RA. OTLK...IFR CIG BR.
.
SWRN TX
MTNS WWD...OVC050-070 TOP 100. MTNS -FZDZ. BECMG 1719 BKN070 BKN120 TOP FL180.
OTLK...VFR 03Z MVFR CIG RA BR.
***RMNDR...OVC025-035 TOP 100. VIS 3-5SM -DZ/BR.** 18Z VIS 3-5SM BR. SRN PTN WDLY SCT -SHRA.*
OTLK...IFR CIG BR 01Z TSRA.
.
N CNTRL TX
WRN HLF...OVC020 TOP 140. VIS 3-5SM -RA BR. 20Z TOP 100. OCNL VIS 3SM BR.
OTLK...IFR CIG BR 01Z TSRA.

ERN HLF...OVC015 TOP 120. VIS 3-5SM -RA/BR. 17Z OVC020 TOP 100. OTLK...MVFR CIG.
.
NERN TX
SCT025 OVC060 TOP 120. 15Z SCT030 BKN080. 18Z SCT080 BKN CI. OTLK...VFR.
.
SERN TX
ERN HLF...SCT080 SCT-BKN CI. 18Z SCT CI. OTLK...VFR.
WRN HLF...BKN010 BKN060 TOP 100. OCNL VIS 3SM BR. 15Z BKN025. 18Z SCT040 SCT150. OTLK...VFR 04Z CSTL PLAIN IFR CIG BR.
.
S CNTRL TX
CSTL PLAINS...BKN025 BKN040 TOP 100. WDLY SCT -SHRA. *16Z SCT025BKN050 TOP 120. WDLY SCT -SHRA. WND SE 20G30KT. OTLK...VFR TIL 00Z SHRA WND.*
LWR RIOGD VLY...SKC. 15Z BKN030 TOP 080. 17Z BKN040 TOP 100. WND SE 20G30KT. OTLK...MVFR CIG.
RMNDR...
SWRN PTN..BKN035 TOP 080. 17Z TOP 100. WND SE G25KT. ISOL -SHRA. 20Z BKN045 TOP 120. WDLY SCT -SHRA. WND SE G25KT. OTLK...VFR TIL 01Z SHRA WND.
ELSW..OVC020-030 TOP 100. VIS 3-5SM -RA/BR. *17Z OVC030 TOP 140. WDLY SCT -SHRA. OTLK...MVFR CIG SHRA.*
.

The forecast for the route from south central to southwest Texas expected broken to overcast cloud cover from 2,000 to 3,000 feet with cloud tops to 10,000 feet with visibility 3 to 5 miles in light rain and mist. The forecast was amended by the AIRMET Sierra below

9.0 In-Flight Weather Advisories

The NWS issues in-flight weather advisories designated as Severe Weather Forecast Alerts (AWW's), Convective SIGMET's (WST's), SIGMET's (WS's), Center Weather Advisories (CWA's), and AIRMET's (WA's). In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions, which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft. The following advisories were issued during the period:

Severe Weather Forecast Alert (AWW) – None current for Texas during the period.

Convective SIGMETs - None current for Texas during the period.

AIRMETs – The NWS AWC issued the following advisories at 0345 CST:

WAUS44 KKCI 020845 *2011336 0842*
WA4S
-DFWS WA 020845
AIRMET SIERRA UPDT 1 FOR IFR AND MTN OBSCN VALID UNTIL 021500
.
AIRMET IFR...TX
FROM 40NE TCC TO 40S CDS TO 50S FST TO 40SW MRF TO 30ENE ELP TO INK TO 40NE TCC CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.
.

AIRMET IFR...OK TX
FROM 40S CDS TO 30NNE TTT TO 50ESE IAH TO 20NNW CRP TO 20S LRD TO DLF
TO 50S FST TO 40S CDS
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.
.
AIRMET MTN OBSCN...TX
FROM 60W INK TO 20ESE FST TO 80SSE FST TO 90S MRF TO ELP TO 60W INK
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 15Z THRU 21Z.
....
WAUS44 KKCI 020845 2011336 0900
WA4T
DFWT WA 020845
AIRMET TANGO UPDT 1 FOR TURB VALID UNTIL 021500
.
AIRMET TURB...OK TX
FROM 30NNE CDS TO 40S SPS TO 50SW SJT TO 60S MRF TO ELP TO INK TO 20NW TXO TO 30NNE CDS
MOD TURB BLW 080. CONDS CONTG BYD 15Z ENDG 15-18Z.
....
WAUS44 KKCI 020845 2011336 0839
WA4Z
-DFWZ WA 020845
AIRMET ZULU UPDT 1 FOR ICE AND FRZLVL VALID UNTIL 021500
.
AIRMET ICE...TX
FROM 40NE TCC TO 50NNE CDS TO 30SSW CDS TO INK TO 40NE TCC
MOD ICE BTN FRZLVL AND 090. FRZLVL SFC-080. CONDS CONTG BYD 15Z ENDG 15-18Z.
.
FRZLVL...RANGING FROM SFC-140 ACRS AREA
MULT FRZLVL BLW 110 BOUNDED BY OSW-RZC-70ESE RZC-50SE FSM-
20NE MLC-30WSW JCT-40WSW MRF-ELP-INK-30ESE TBE-50W LBL-OSW
MULT FRZLVL BLW 090 BOUNDED BY 40NNE FWA-CVG-40W HNN-50SE BNA-
40SSW ARG-RZC-OSW-50W LBL-30NNW GLD-40WNW SLN-40SE MCI-40NNE FWA
***SFC ALG** 70SSE ELP-**60NW MRF-60SSE LBB**-70NE CDS-30SE OSW*
***040 ALG 30WSW INK-40E MAF**-20NNE ABI-40ESE OKC-40WSW RZC-20ERZC*
080 ALG 50WSW MRF-30SSW SJT-50ESE MLC-40S DYR-20NW MSL-50W GQO-30WSW HMV
120 ALG 20SSE DLF-40SW LFK-20NW BTR-20E MCB-50ENE CEW
....

Center Weather Advisories (CWA) – Dallas Ft. Worth CWSU issued several advisories for an area in the immediate vicinity of the Dallas Fort Worth Airports, which did not impact the route of flight. The advisories were as follows:

FAUS21 KZFW 021336
ZFW1 CWA 021345
ZFW CWA 102 VALID UNTIL 021545
FROM 30ENE ABI-30ESE TTT-45W ACT-30ENE ABI
AREA 50 MI WIDE OF WDSPRD CIGS AOB OVC005 AND VIS OCNLY 1-3SM BR/DZ.
CONDS CONTG BYD 1545Z.
=
FAUS21 KZFW 021534
FAUS21 KZFW 021145
ZFW1 CWA 021145
ZFW CWA 101 VALID UNTIL 021345
FROM 25SE TTT-ACT

AREA 50 MI WIDE OF WDSPRD CIGS AOB OVC005 AND VIS OCNLY 1-3SM BR/DZ. CONTG BYD 1345Z.

Figure 13 is a plot of the NWS AIRMETs current at the time of the accident overlaid on the GOES-13 infrared satellite image at the time of issuance of the advisories at 0345 CST. AIRMET Sierra for IFR conditions prevailed over the route and the accident site for low ceilings and visibilities in mist, and AIRMET Tango for moderate turbulence below 8,000 feet was valid for the destination area. AIRMET Zulu for moderate icing extended immediately northwest of the accident site.

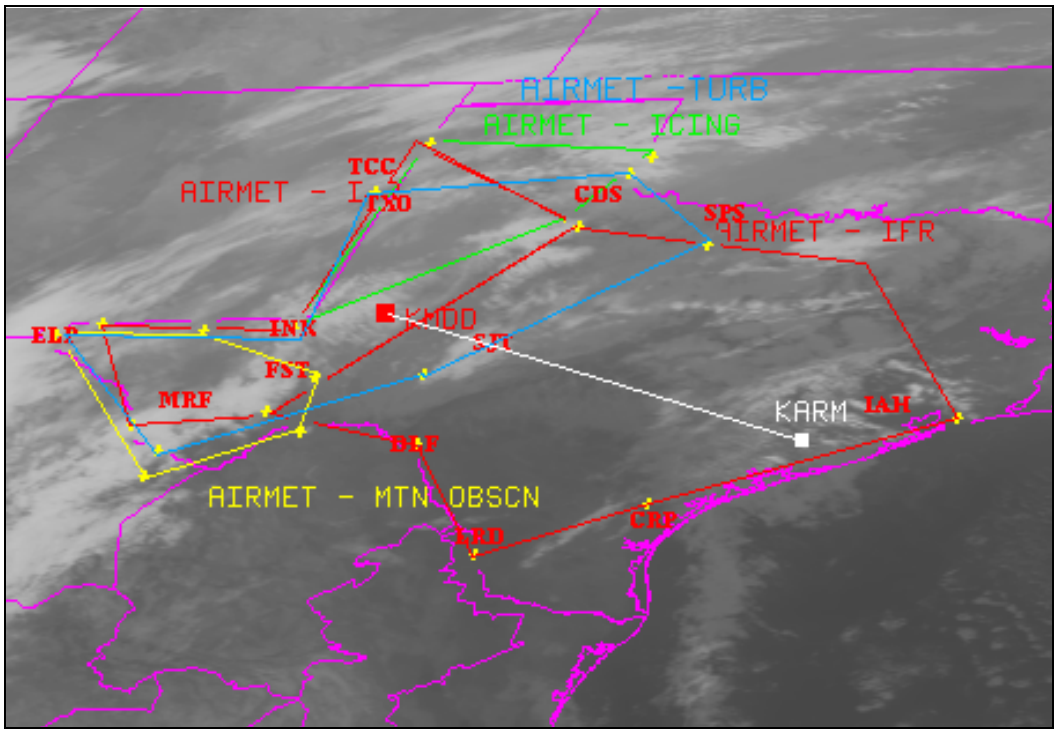

Figure 13 - NWS AIRMETs current at the time of the accident

10.0 Current icing Product

The NWS Aviation Weather Center's Current Icing Products (CIP) were documented to determine what guidance and information was available during the period regarding potential icing. That search determined the only icing conditions over the Midland area were between 3,000 and 4,000 feet. The icing probability, icing severity, and supercooled large water droplets (SLD) images for 3,000 and 4,000 feet at 0800 CST (1400Z) are included as figures 14 through 19, with the Midland airport indicated by a star. The images depicted a 40 to 50% probability of icing conditions over the Midland region with the highest severity intensity as a trace of icing; however, there was also a greater than 50% probability of SLD which implies the most hazardous case of icing potential.

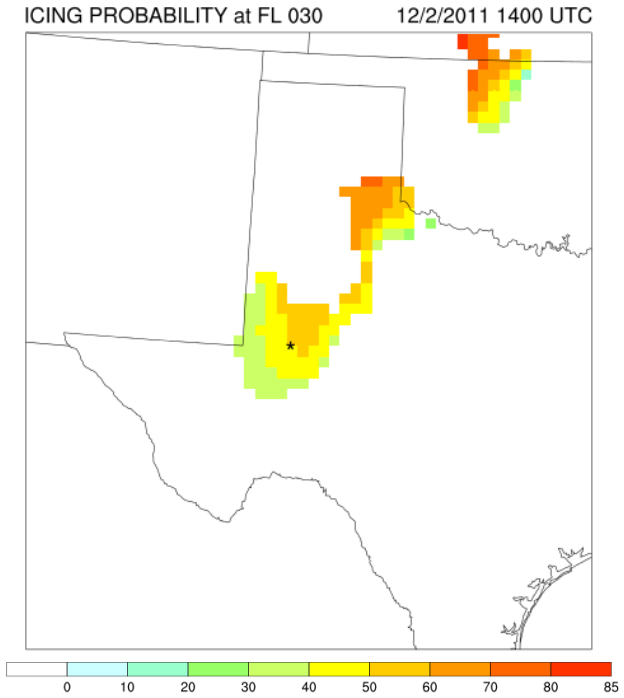

Figure 14 - CIP Probability of icing conditions at 3,000 feet for 0800 CST

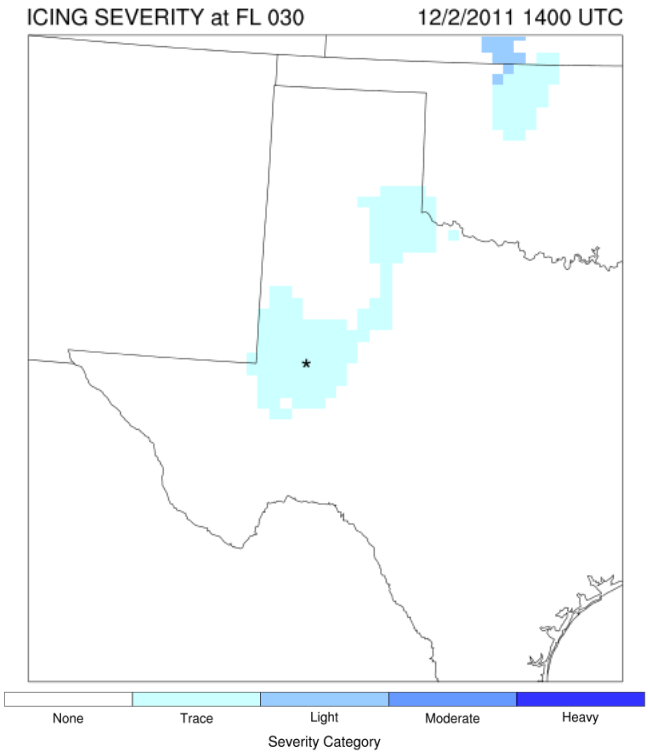

Figure 15 - CIP Icing Severity at 3,000 feet for 0800 CST

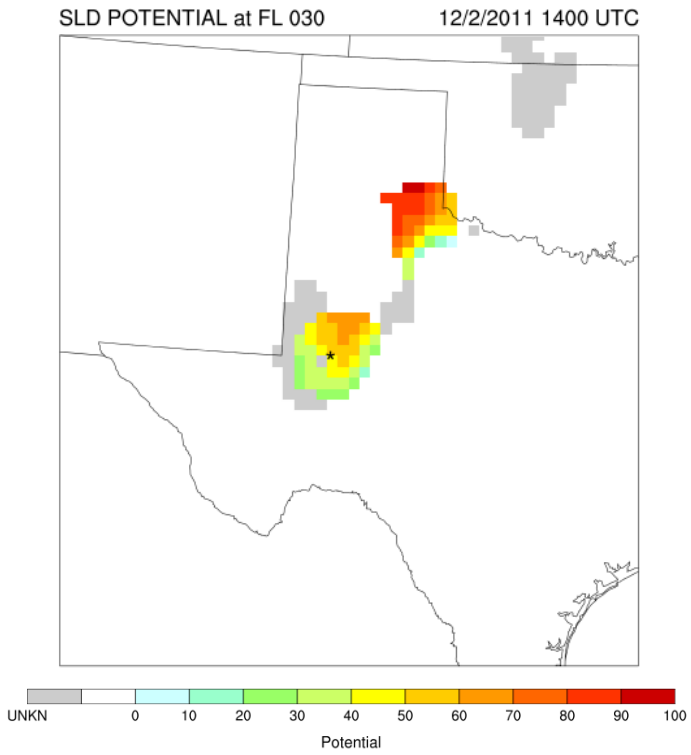

Figure 16 - SLD Probability at 3,000 feet for 0800 CST

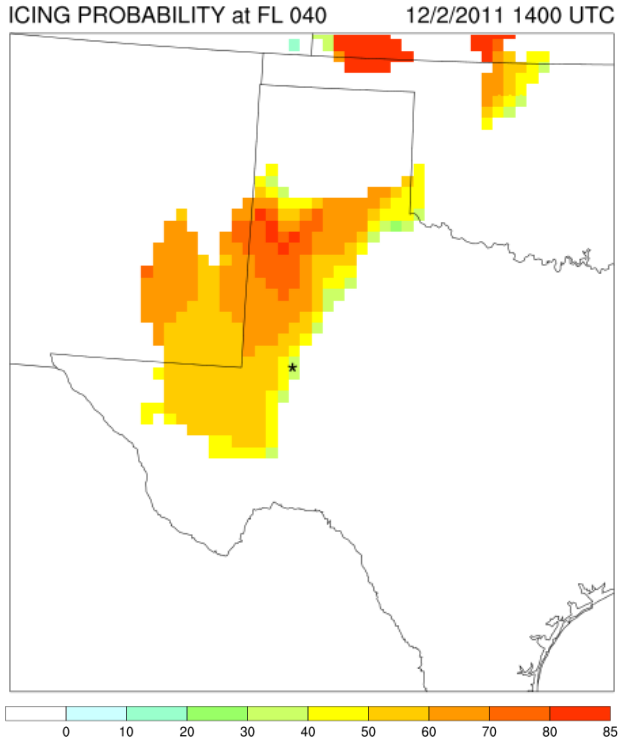

Figure 17 - CIP Icing probability at 4,000 feet for 0800 CST

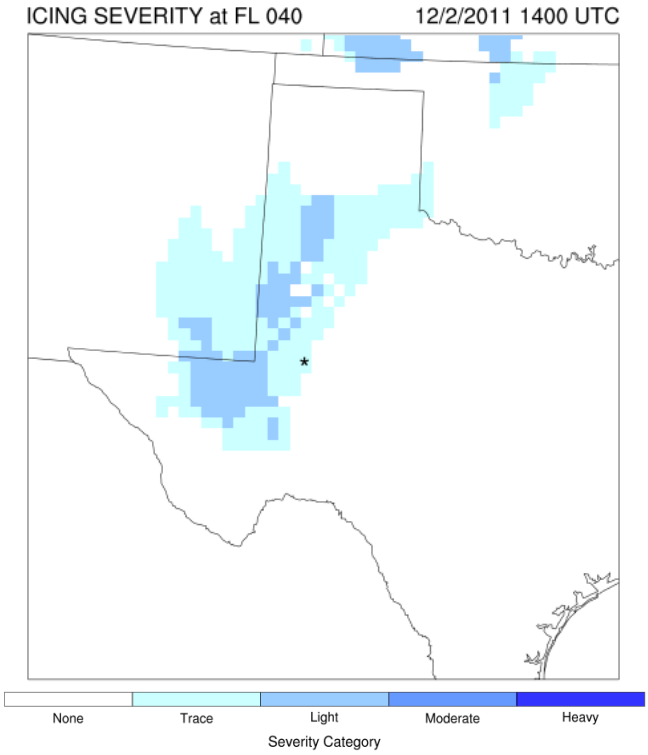

Figure 18- CIP icing severity at 4,000 feet for 0800 CST

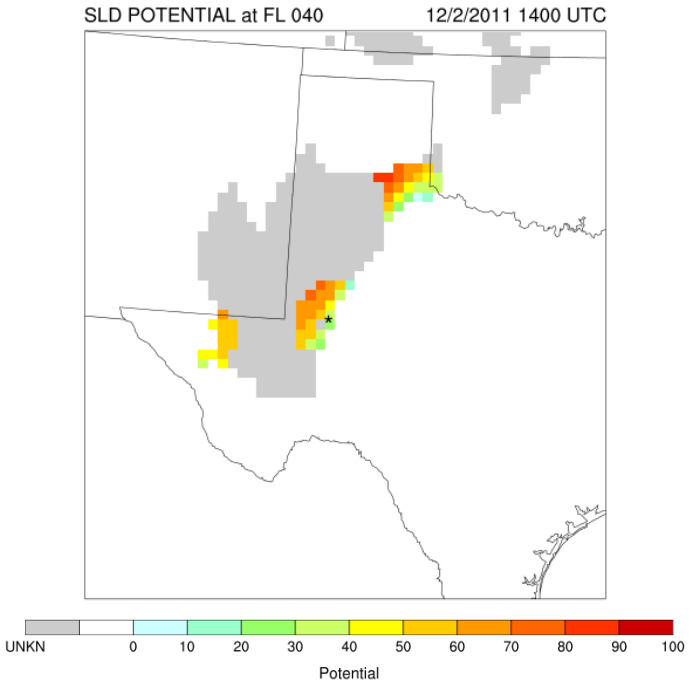

Figure 18 - SLD potential at 4,000 feet for 0800 CST

11.0 Preflight Weather Briefing

The pilot of N90QL contacted the Federal Aviation Administration (FAA) contract Automated Flight Service Station (AFSS) and obtained several outlook weather briefings prior to departure and then to filed an IFR flight plan for the flight. Outlook briefings are intended for planning purposes only for flights with departure time more than 6 hours in the future. The full transcripts of those briefings are included in the NTSB docket for the accident.

The first briefing was at 1444 CST on December 1, 2011. Specific points in the briefing include that the prognostic chart was referenced with the potential for a cold front moving across the area with a greater than 50% probability of rain showers. The entire route of flight was expected to be impacted by IFR conditions with low ceilings and visibilities in mist and drizzle. The briefer also referred to an AIRMET Zulu for icing conditions extending in the Midland area and that due to the near freezing temperatures expected after the passage of the cold front, that freezing precipitation was a concern during the morning period. The briefer expressed the need for the pilot to obtain a full standard weather briefing prior to departing in the morning based on the expected conditions. The pilot of N90Ql acknowledged and indicated that they would definitely do so. Before finishing the briefing, the briefer again emphasized getting an updated or standard briefing prior to departure, and the pilot again acknowledged "you bet I'll do that and we'll be talking to you later then" and terminated the call at 1451 CST.

The pilot of N90QL called again at 2105 CST and obtained another outlook briefing, which discussed the frontal system expected to move through the area with low ceilings and visibilities. The TAF for KMAF was discussed with the potential for light freezing drizzle during the morning hours. The pilot then filed an IFR flight plan with KMAF as the alternate airport for KMDD.

The pilot of N90QL called again at 0501 CST on December 2, 2011 and obtained a full standard weather briefing. The AFSS briefer first provided the current AIRMETs for IFR conditions and moderate turbulence below 8,000 feet that were in effect for the route. The briefer than provided an analysis of the current radar mosaic and the frontal position, and provided current conditions across the region, which included Midland Airpark weather at wind 040° at 11 knots, visibility 10 miles, ceiling overcast at 1,600 feet, temperature 3° C, dew point -1° C, and altimeter 30.30 inches of Hg. No pilot reports were available over the route of flight. The pilot of N90QL indicated they would check back in later and the briefing terminated.

The pilot of N90QL called back at 0612 CST immediately prior to departure specifically checking on the current and forecast conditions for the Midland area. The AFSS briefer asked if he needed any of the adverse weather conditions, and was advised by the pilot of N90QL that he had already obtained that information a couple of hours prior. The briefer then provided the current Midland Airpark conditions, which included a ceiling overcast at 1,400 feet agl and visibility 5 miles in light drizzle, temperature 2° C, dew point 0° C. The briefer then provided the Midland (KMAF) TAF from 0800 CST which included a 50% probability of ceiling overcast at 700 feet and visibility 5 miles in light freezing drizzle. From 0900 to 1200 CST ceiling overcast 700 feet, visibility 3 miles in drizzle, with a 50% probability of ceiling overcast at 300 feet, visibility 1 mile in light drizzle. And indicated that the freezing drizzle was only expected between 0600 and 0900 CST (12Z to 15Z) in the forecast, but commented that he would not

guarantee that the conditions would improve. The pilot of N90QL indicated that's all he needed and thanked the briefer and the call then terminated at 0615 CST.

12.0 NWS Area Forecast Discussion

The NWS Midland Weather Service Forecast Office (WSFO) issued the following Area Forecast Discussion (AFD) providing additional details regarding the reasoning behind their forecast for other meteorologist that may be utilizing their forecast and products. Although this is not a standard aviation product, the forecast discusses further details regarding the TAF issued. The discussions issued surrounding the period at 0543 and 0811 CST or at the approximate time of the accident were as follows:

FXUS64 KMAF 021143 2011336 1143
AFDMAF
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE MIDLAND/ODESSA TX
543 AM CST FRI DEC 2 2011
.DISCUSSION...
SEE AVIATION DISCUSSION BELOW.
&&
.AVIATION...
THESE TAFS SHOULD BE LOOKED AT AS TREND FORECASTS AS SPECIFICS WILL BE DIFFICULT TO NAIL DOWN WITH PATCHY DRIZZLE...FREEZING DRIZZLE...AND RAIN CAUSING CIG/VIS TO FLUCTUATE A BIT THIS MORNING. *CONDITIONS WILL BE WORST THIS MORNING AS MOISTURE OVERRIDES A SURFACE FRONT THAT HAS MOVED THROUGH WEST TEXAS BUT THERE WILL BE SOME IMPROVEMENT THIS AFTERNOON. STILL...VFR CONDITIONS NOT EXPECTED AS NIGHTFALL BRINGS A RETURN OF IFR CIGS AND AN UPPER DISTURBANCE INCREASES RAIN CHANCES FOR ALL SITES. THERE MAY BE ISOLATED TS TONIGHT BUT HAVE LEFT OUT OF TAFS WITH THIS ISSUANCE.*
HENNIG
&&
.PREV DISCUSSION... /ISSUED 449 AM CST FRI DEC 2 2011/
DISCUSSION...
BIG CHANGES ALREADY OCCURRING ACROSS THE FORECAST AREA THIS MORNING AS A STRONG COLD FRONT HAS PLUNGED TO MEXICO. ***FOG AND LIGHT RAIN AND LIGHT FREEZING DRIZZLE ARE BEGINNING TO DEVELOP AT 10Z ACROSS THE SOUTHEAST NEW MEXICO PLAINS AND THE GUADALUPE MOUNTAINS. KMAF RADAR ALSO INDICATING LIGHT RETURNS DEVELOPING ACROSS THE PERMIAN BASIN AS WELL. AS TEMPERATURES FALL TO FREEZING LIGHT FREEZING RAIN AND FREEZING DRIZZLE WILL BE COMMON ACROSS SOUTHEAST NEW MEXICO AND PORTIONS OF THE NORTHERN PERMIAN BASIN THIS MORNING. WILL EXTEND THE FREEZING RAIN ADVISORY UNTIL NOON CST AS THE LATEST NAM DATA INDICATES THAT TEMPERATURES WILL BE VERY SLOW TO INCREASE LATE THIS MORNING. BY THIS AFTERNOON TEMPERATURES SHOULD SQUEAK ABOVE FREEZING MOST AREAS SO THE THREAT OF FREEZING PRECIPITATION SHOULD DIMINISH. ONE POSSIBLE EXCEPTION IS THE GUADALUPE MOUNTAINS THIS AFTERNOON BUT PRECIPITATION IS EXPECTED TO DECREASE IN THAT AREA THIS AFTERNOON.*** *PRECIPITATION AMOUNTS AND CHANCES WILL INCREASE TONIGHT ACROSS THE FORECAST AREA AS THE UPPER LOW APPROACHES THE AREA. A WIDE VARIETY OF WEATHER IS ANTICIPATED. NAM BUFR FORECAST SOUNDINGS SUGGEST THAT THE SOUTHEAST NEW MEXICO PLAINS AND GUADALUPE MOUNTAINS WILL HAVE A MIXTURE OF SLEET...SNOW...FREEZING RAIN AND RAIN. A VERY PRONOUNCED WARM LAYER AT AROUND 800 MILLIBARS OF +2 TO +5 CELSIUS WILL LIMIT SNOW ACCUMULATIONS TO LESS THAN AN INCH IN THESE AREAS OVERNIGHT. NAM SOUNDINGS*

SUGGEST FREEZING RAIN COULD BE A CONCERN ACROSS THE LEA COUNTY PLAINS AND GUADALUPE MOUNTAINS TONIGHT. LATER SHIFTS WILL NEED TO MONITOR. FURTHER EAST RAIN IS LIKELY WITH A SLIGHT CHANCE TO A CHANCE OF THUNDERSTORMS ACROSS THE PERMIAN BASIN AND THE LOWER TRANS PECOS ALONG AND EAST OF A WAVE DEVELOPING ON A WARM FRONT IN THE STOCKTON PLATEAU. PRECIPITATION IN THE FORM OF SHOWERS WILL BE CONFINED TO THE PERMIAN BASIN SATURDAY MORNING AS THE UPPER LEVEL SYSTEM EXITS NORTHEAST OF THE REGION. TEMPERATURES WILL FINALLY WARM CLOSER TO NORMAL SATURDAY AS DOWNSLOPE FLOW MODIFIES THE AIR. BEYOND SATURDAY MORE INCLEMENT WEATHER IS EXPECTED SUNDAY THROUGH AT LEAST MONDAY NIGHT AND POSSIBLY TUESDAY AS SEVERAL LARGE UPPER LOWS FORM AND SLOWLY DIG ACROSS THE ROCKIES. THESE UPPER LOWS WILL PROVIDE A CONTINUAL SUPPLY OF DEEP COLD AIR AND LIFT TO CONTINUE THE THREAT OF SNOW ACROSS MANY SECTIONS OF THE FORECAST AREA.
BY NEXT WEDNESDAY THROUGH FRIDAY THE UPPER LEVEL SYSTEM SHOULD FINALLY PUSH EAST OF THE REGION WITH DRY CONDITIONS AND TEMPERATURES WARMING CONSIDERABLY BUT STILL REMAINING BELOW NORMAL.
&&
*.**MAF WATCHES/WARNINGS/ADVISORIES...***
NM...FREEZING RAIN ADVISORY UNTIL 11 AM MST THIS MORNING FOR THE FOLLOWING ZONES... CENTRAL LEA COUNTY...EDDY COUNTY PLAINS...GUADALUPE MOUNTAINS OF EDDY COUNTY...NORTHERN LEA COUNTY...SOUTHERN LEA COUNTY.
TX...HIGH WIND WARNING UNTIL 8 AM MST THIS MORNING FOR THE FOLLOWING ZONES... GUADALUPE MOUNTAINS.
FREEZING RAIN ADVISORY UNTIL NOON CST /11 AM MST/ TODAY FOR THE FOLLOWING ZONES... ANDREWS...BORDEN...DAWSON...GAINES...GUADALUPE MOUNTAINS ...MARTIN...VAN HORN AND HIGHWAY 54 CORRIDOR.
&&
$$

Update issued at 0811 CST:

FXUS64 KMAF 021411
AFDMAF
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE MIDLAND/ODESSA TX
811 AM CST FRI DEC 2 2011
.UPDATE...
STATUS OF THE FREEZING RAIN ADVISORY.
&&
.DISCUSSION...
WARM AIR ADVECTION OVER A COLD DOME OF MODIFIED ARCTIC AIR WAS SATURATING THE ATMOSPHERIC COLUMN FROM THE TOP DOWN. ***WIDESPREAD DRIZZLE...LIGHT RAIN AND FOG WERE RESULTING ACROSS SOUTHEAST NEW MEXICO AND WEST TEXAS...BUT MAINLY NORTH OF INTERSTATE 10. THE PRECIPITATION WAS FALLING AS FREEZING DRIZZLE...LIGHT FREEZING RAIN...ALONG WITH SOME FREEZING FOG...TO THE NORTH OF SNYDER..MIDLAND...WINK AND GUADALUPE PASS LINE WHERE THE SURFACE FREEZING LINE WAS WAVERING.*** *AFTER CALLING AROUND THE AREA...SOME ICING OF ROADS HAS OCCURRED IN NORTHERN PORTIONS OF EDDY AND LEA COUNTY WHERE DRY...COLDER AIR SINKING SOUTH HAS COMBINED WITH LIGHT LIQUID PRECIPITATION TO WET BULB TEMPERATURES INTO THE UPPER 20S.* ***EXPECT THE PRECIPITATION TO CONTINUE THROUGH THE MORNING...WITH PRECIPITATION MAINLY IN THE FORM OF FREEZING DRIZZLE NORTH AND DRIZZLE SOUTH. SINCE SOME ADDITIONAL LIGHT ICE ACCUMULATIONS COULD STILL OCCUR WITHIN THE FREEZING RAIN ADVISORY AREA...*** *WILL LEAVE THE CURRENT PRODUCT INTACT. TEMPERATURES WILL HOVER RIGHT AROUND 32 DEGREES JUST SOUTH OF THE ADVISORY AREA FROM THE UPPER TRANS PECOS...EASTWARD ACROSS THE CENTRAL PERMIAN*

BASIN AND WESTERN LOW ROLLING PLAINS. SINCE NOT AS MUCH WET BULBING WILL BE POSSIBLE IN THESE AREAS DUE TO THE HIGHER DEWPOINTS...AND WEAK DRY AIR ADVECTION AT THE SURFACE...WILL NOT EXTEND THE FREEZING RAIN ADVISORY ANY FURTHER SOUTH AT THIS TIME. THE HIGH WIND WARNING WILL BE ALLOWED TO EXPIRE AT 02/15Z. THE GUADALUPE PASS ASOS HAS BEEN ERRANTLY REPORTING WIND GUSTS OVER 100 MPH IN THE LAST HOUR OR SO. THINK LIGHT ICE ACCUMULATIONS HAVE SABOTAGED THE WIND SENSOR AS THE SURFACE PRESSURE GRADIENT HAS SLACKENED CONSIDERABLY THIS MORNING. ALSO...WE MAY ADJUST HIGH TEMPERATURES FOR THIS AFTERNOON...ESPECIALLY ACROSS THE NORTHERN CWA WHERE TEMPERATURES MAY NOT RISE MUCH. WILL ADDRESS THESE WITH THE CANCELLATION...OR EXTENSION...OF THE FREEZING RAIN ADVISORY LATER THIS MORNING.
&&
.PRELIMINARY POINT TEMPS/POPS...

BIG SPRING TX	*40*	*34*	*59*	*30*	*/*	*60*	*70*	*50*	*10*
CARLSBAD NM	*38*	*34*	*57*	*27*	*/*	*60*	*50*	*10*	*0*
DRYDEN TX	*61*	*53*	*72*	*45*	*/*	*30*	*20*	*20*	*20*
FORT STOCKTON TX	*50*	*40*	*64*	*31*	*/*	*40*	*20*	*10*	*10*
GUADALUPE PASS TX	*38*	*32*	*52*	*26*	*/*	*50*	*50*	*10*	*0*
HOBBS NM	*38*	*33*	*48*	*26*	*/*	*60*	*70*	*10*	*0*
MARFA TX	*52*	*34*	*59*	*27*	*/*	*20*	*20*	*0*	*10*
MIDLAND INTL AIRPORT TX	*40*	*35*	*59*	*29*	*/*	*60*	*70*	*30*	*0*
ODESSA TX	*40*	*36*	*59*	*30*	*/*	*50*	*70*	*30*	*0*
WINK TX	*43*	*35*	*61*	*28*	*/*	*50*	*40*	*10*	*0*

&&
*.**MAF WATCHES/WARNINGS/ADVISORIES...***
NM...FREEZING RAIN ADVISORY UNTIL 11 AM MST THIS MORNING FOR THE FOLLOWING ZONES... CENTRAL LEA COUNTY...EDDY COUNTY PLAINS...GUADALUPE MOUNTAINS OF EDDY COUNTY ...NORTHERN LEA COUNTY...SOUTHERN LEA COUNTY.
TX...HIGH WIND WARNING UNTIL 8 AM MST THIS MORNING FOR THE FOLLOWING ZONES... GUADALUPE MOUNTAINS.
FREEZING RAIN ADVISORY UNTIL NOON CST /11 AM MST/ TODAY FOR THE FOLLOWING ZONES... ANDREWS...BORDEN...DAWSON...GAINES...GUADALUPE MOUNTAINS...MARTIN...VAN HORN AND HIGHWAY 54 CORRIDOR.
&&

The freezing rain advisory extended immediately northwest through northeast of Midland County as indicated on the County map below (figure 20), the advisories follow in section 13 below.

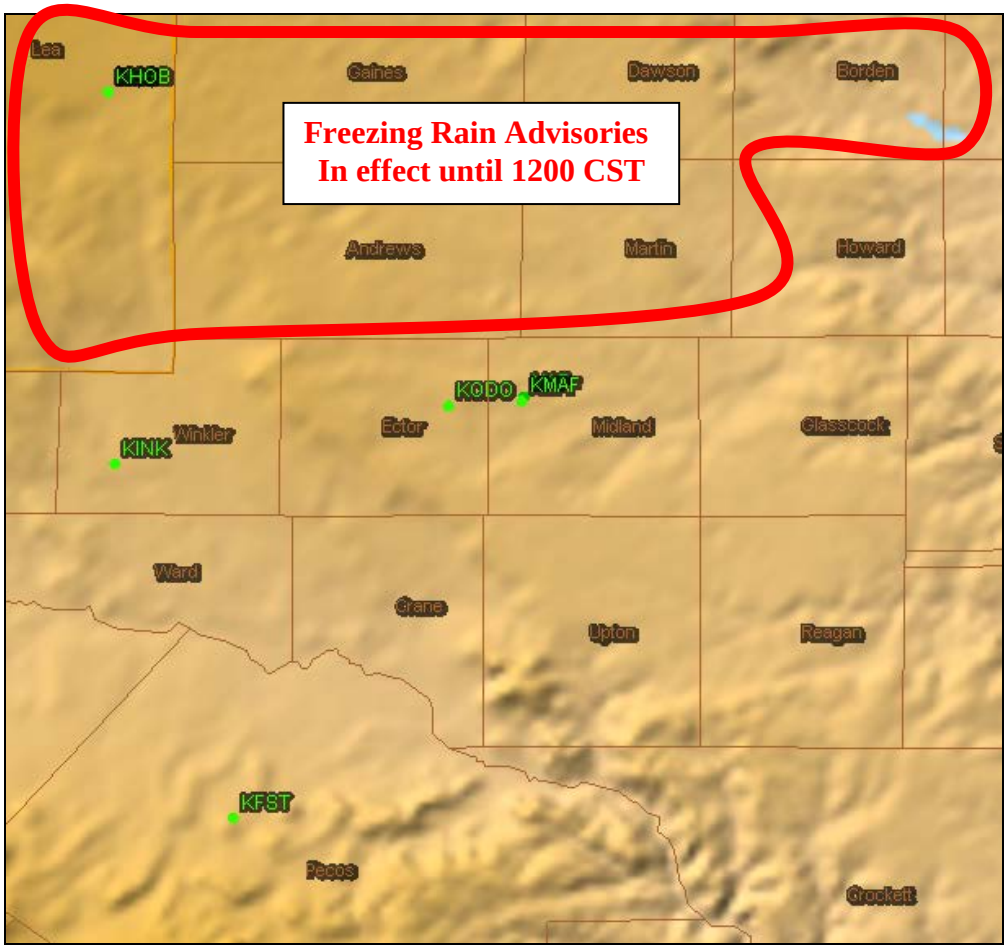

Figure 19 - County map surrounding the Midland area

13.0 NWS Winter Weather Advisories

The NWS Midland Weather Service Forecast Office also had the following winter weather advisories current surrounding the period:

WWUS44 KMAF 021015 2011336 1015
WSWMAF
URGENT - WINTER WEATHER MESSAGE
NATIONAL WEATHER SERVICE MIDLAND/ODESSA TX
415 AM CST FRI DEC 2 2011
...A FREEZING RAIN ADVISORY REMAINS IN EFFECT THIS MORNING FOR SOUTHEAST NEW MEXICO...THE NORTHWEST AND NORTHERN PERMIAN BASIN...AND THE GUADALUPE MOUNTAINS...
.MCUH COLDER AIR WILL FILTER INTO THE AREA THIS MORNING IN THE WAKE OF A STRONG COLD FRONT. WARMER AIR WILL BE LIFTED UP AND OVER THE FRONT AND AS MOISTURE DEEPENS...FREEZING PRECIPITATION IN THE FORM OF LIGHT FREEZING RAIN AND LIGHT FREEZING DRIZZLE WILL DEVELOP. MOST PRECIPITATION IS EXPECTED TO BE IN THE FORM OF LIGHT FREEZING DRIZZLE.
TXZ051-021800-
/O.EXB.KMAF.ZR.Y.0001.000000T0000Z-111202T1800Z/

MARTIN-
INCLUDING THE CITY OF...STANTON
415 AM CST FRI DEC 2 2011
...FREEZING RAIN ADVISORY IN EFFECT UNTIL NOON CST TODAY...
THE NATIONAL WEATHER SERVICE IN MIDLAND/ODESSA HAS ISSUED A FREEZING RAIN ADVISORY ...WHICH IS IN EFFECT UNTIL NOON CST TODAY.
** EVENT...LIGHT FREEZING RAIN AND LIGHT FREEZING DRIZZLE.*
** TIMING... THROUGH NOON CST.*
** IMPACTS...LIGHT ICE ON BRIDGES...OVERPASSES...AND OTHER ELEVATED SURFACES AFFECTING TRAVEL FRIDAY MORNING. REDUCED VISIBILITIES OF LESS THAN ONE MILE CAN BE EXPECTED IN PLACES... ESPECIALLY NEAR THE MOUNTAINS.*
** ICE ACCUMULATIONS...LESS THAN FIVE HUNDREDTHS OF AN INCH.*
PRECAUTIONARY/PREPAREDNESS ACTIONS...
A FREEZING RAIN ADVISORY MEANS THAT PERIODS OF FREEZING RAIN OR FREEZING DRIZZLE WILL CAUSE TRAVEL DIFFICULTIES. BE PREPARED FOR SLIPPERY ROADS. SLOW DOWN AND USE CAUTION WHILE DRIVING.
&&
$$
NMZ027>029-033-034-TXZ045>047-050-057-258-021800-
/O.EXT.KMAF.ZR.Y.0001.000000T0000Z-111202T1800Z/
GUADALUPE MOUNTAINS OF EDDY COUNTY-EDDY COUNTY PLAINS-NORTHERN LEA COUNTY - CENTRAL LEA COUNTY-SOUTHERN LEA COUNTY-GAINES-DAWSON-BORDEN-ANDREWS-VAN HORN AND HIGHWAY 54 CORRIDOR-GUADALUPE MOUNTAINS-
INCLUDING THE CITIES OF...QUEEN...ARTESIA...CARLSBAD...CARLSBAD CAVERNS NP...TATUM ...HOBBS...LOVINGTON...EUNICE...JAL...SEMINOLE...LAMESA...GAIL...ANDREWS...VAN HORN... GUADALUPE MOUNTAINS NP...PINE SPRINGS
415 AM CST FRI DEC 2 2011 /315 AM MST FRI DEC 2 2011/
...FREEZING RAIN ADVISORY NOW IN EFFECT UNTIL NOON CST /11 AM MST/ TODAY...
** EVENT...LIGHT FREEZING RAIN AND LIGHT FREEZING DRIZZLE.*
** TIMING...THROUGH 12 PM CST (11 AM MST).*
** IMPACTS...LIGHT ICE ON BRIDGES...OVERPASSES...AND OTHER ELEVATED SURFACES AFFECTING TRAVEL FRIDAY MORNING. REDUCED VISIBILITIES OF LESS THAN ONE MILE CAN BE EXPECTED IN PLACES... ESPECIALLY NEAR THE MOUNTAINS.*
** ICE ACCUMULATIONS...LESS THAN FIVE HUNDREDTHS OF AN INCH.*
PRECAUTIONARY/PREPAREDNESS ACTIONS...
A FREEZING RAIN ADVISORY MEANS THAT PERIODS OF FREEZING RAIN OR FREEZING DRIZZLE WILL CAUSE TRAVEL DIFFICULTIES. BE PREPARED FOR SLIPPERY ROADS. SLOW DOWN AND USE CAUTION WHILE DRIVING.
&&

14.0 Astronomical Data

The United Stated Naval Observatory website provided the following astronomical data for Midland, Midland County, Texas on December 2, 2011:

SUN	
Beginning of civil twilight	0705 CST
Sunrise	0732 CST
Accident	0810 CST
Sun transit	1238 CST
Sunset	1744 CST
End of civil twilight	1810 CST

MOON

Moonrise	1302 CST
Moonset	0121 CST on December 3, 2011

15.0 ATC Transcript

The FAA Air Traffic Control (ATC) transcript that is in the docket indicated that Ameriflight Inc. (AMF3911) was on frequency while N90QL was approaching Midland, and provided a pilot report of icing conditions encountered in their departure. They advised ATC that they picked up light clear ice at 5,000 feet through 6,000 feet, with warm temperatures aloft and indicated that at 8,000 feet the outside air temperature was +8° C. The controller and asked if N90QL had heard the icing report and the pilot of N90QL acknowledged in the affirmative.

F. LIST OF ATTACHMENTS

Attachment 1: Flight track data used in this report obtained from Flight Aware

Submitted by:

Donald Eick
NTSB Senior Meteorologist

Attachment 1: Flight track data obtained from Flight Aware for N90QL on December 2, 2011. Data has been formatted for use in plotting program used at the NTSB.

Time, Latitude, Longitude, Altitude

12:25, 29.2856,-96.2169, 1000
12:26, 29.2528,-96.2300, 4500
12:27, 29.2783,-96.2836, 6200
12:28, 29.3058,-96.3322, 7000
12:29, 29.3292,-96.3811, 8900
12:30, 29.3603,-96.4444, 8900
12:31, 29.3956,-96.5103, 9000
12:32, 29.4267,-96.5714, 10400
12:33, 29.4581,-96.6300, 11300
12:34, 29.4869,-96.6933, 12200
12:35, 29.5161,-96.7497, 13600
12:36, 29.5414,-96.8033, 14600
12:37, 29.5706,-96.8575, 15700
12:38, 29.5978,-96.9114, 16600
12:39, 29.6247,-96.9653, 17200
12:40, 29.6558,-97.0267, 17900
12:41, 29.6808,-97.0781, 18600
12:42, 29.7081,-97.1319, 19400
12:43, 29.7331,-97.1836, 19900
12:44, 29.7600,-97.2400, 20000
12:45, 29.7908,-97.2992, 20000
12:46, 29.8197,-97.3581, 20000
12:47, 29.8506,-97.4197, 20000
12:48, 29.8794,-97.4764, 20000
12:49, 29.9081,-97.5353, 20000
12:50, 29.9328,-97.5894, 20000
12:51, 29.9653,-97.6561, 20000
12:52, 29.9922,-97.7103, 20000
12:53, 30.0228,-97.7744, 20000
12:54, 30.0517,-97.8264, 20000
12:55, 30.0842,-97.8933, 20000
12:56, 30.1108,-97.9475, 20000
12:57, 30.1431,-98.0144, 20000
12:58, 30.1697,-98.0689, 20000
12:59, 30.2019,-98.1356, 20000
13:00, 30.2283,-98.1925, 20000
13:01, 30.2606,-98.2594, 20000
13:02, 30.2872,-98.3142, 20000
13:03, 30.3175,-98.3739, 20000
13:04, 30.3458,-98.4333, 20000
13:05, 30.3781,-98.4981, 20000
13:06, 30.4103,-98.5653, 20000
13:07, 30.4403,-98.6272, 20000
13:08, 30.4683,-98.6894, 20000
13:09, 30.5006,-98.7519, 20000
13:10, 30.5286,-98.8142, 19700
13:11, 30.5606,-98.8814, 19200
13:12, 30.5944,-98.9489, 18700
13:13, 30.6261,-99.0186, 18400
13:14, 30.6542,-99.0761, 18000
13:15, 30.6917,-99.1511, 18000

13:16, 30.7214,-99.2161, 18000
13:17, 30.7511,-99.2786, 18000
13:18, 30.7811,-99.3414, 18000
13:19, 30.8106,-99.4064, 18000
13:20, 30.8383,-99.4664, 18000
13:21, 30.8681,-99.5292, 18000
13:22, 30.8997,-99.5944, 18000
13:23, 30.9294,-99.6572, 18000
13:24, 30.9589,-99.7225, 18000
13:25, 30.9864,-99.7828, 18000
13:27, 31.0525,-99.9231, 18000
13:28, 31.0825,-99.9867, 18000
13:29, 31.1125,-100.0506, 18000
13:30, 31.1425,-100.1169, 18000
13:31, 31.1722,-100.1833, 18000
13:32, 31.2022,-100.2475, 18000
13:33, 31.2322,-100.3092, 18000
13:34, 31.2619,-100.3758, 18000
13:35, 31.2894,-100.4397, 18000
13:36, 31.3214,-100.5042, 18000
13:37, 31.3511,-100.5683, 18000
13:38, 31.3786,-100.6350, 18000
13:39, 31.4083,-100.6967, 18000
13:40, 31.4381,-100.7611, 18000
13:41, 31.4675,-100.8278, 18000
13:42, 31.4972,-100.8900, 18000
13:43, 31.5267,-100.9569, 17700
13:44, 31.5600,-101.0289, 16500
13:45, 31.5914,-101.0983, 15400
13:46, 31.6247,-101.1703, 14300
13:47, 31.6539,-101.2400, 13300
13:48, 31.6853,-101.3072, 12300
13:49, 31.7167,-101.3767, 11200
13:50, 31.7458,-101.4439, 10200
13:51, 31.7789,-101.5164, 9000
13:52, 31.8161,-101.5914, 8000
13:53, 31.8492,-101.6639, 7100
13:54, 31.8825,-101.7264, 7000
13:55, 31.9117,-101.7867, 7000
13:56, 31.9408,-101.8467, 7000
13:57, 31.9683,-101.8994, 6500
13:58, 32.0019,-101.9500, 5100
13:59, 32.0428,-101.9717, 4500
14:00, 32.0672,-101.9925, 4500
14:01, 32.0944,-101.9867, 4500
14:02, 32.1264,-101.9686, 4500