National Transportation Safety Board

Office of Aviation Safety
Washington, D.C. 20594-2000
December 29, 2004

METEOROLOGICAL FACTUAL REPORT

DCA05MA004

A. ACCIDENT

Location: Kirksville, Missouri
Date: October 19, 2004
Time: 1945 central daylight time (0045 UTC[1] October 20, 2004)
Aircraft: American Connection flight 5966, Jetstream 3200, registration N875JX

B. METEOROLOGICAL SPECIALIST

Donald E. Eick
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

No group members were assigned to the investigation.

C. SUMMARY

At approximately 1945 central daylight time (CDT), October 19, 2004, a Corporate Airlines Inc., operating as American Connection flight 5966, BAE Systems Jetstream 3200, N875JX, operating in accordance with 14 CFR Part 121, crashed while the flight was on approach to the Kirksville Regional Airport, Kirksville, Missouri. The flight was conducting a non-precision LOC/DME Runway 36 approach. Eleven of the 13 passengers and the two flight crewmembers were fatally injured. The two surviving passengers received serious injuries. The airplane was destroyed by impact and post-impact fire. The reported weather was visibility 3 miles in mist and an overcast ceiling at 300 feet.

D. DETAILS OF INVESTIGATION

[1] UTC is the abbreviation for Universal Coordinated Time.

All the weather data used in this report was obtained from official National Weather Service (NWS) sources including the National Climatic Data Center (NCDC), the Aviation Digital Data Service (ADDS), and from on site through interviews. All times are Coordinated Universal Time (UTC) based upon the 24-hour clock. Local time of Central Daylight Time (EDT) is +5 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.

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 Silver Spring, 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.

1.01 Surface Analysis Chart

NWS Surface Analysis Chart for 0000Z on October 20, 2004, is included as Figure 1 and depicted the conditions within an hour of the accident. The chart depicted a frontal wave or low-pressure system over western Kentucky along a frontal system with a central sea level pressure of 1009-millibars (mb)[2]. To the northeast of the low, the front was defined as a stationary front across Ohio and Indiana. With a cold front defined from the low over Kentucky southwestward across into the boot heel of Missouri, Arkansas, Oklahoma and into Texas, before turning northward. Over the Great Lakes region a cold-core high pressure system was indicated with a ridge of high pressure extending southwestward into Wisconsin, Iowa, northern Missouri, Kansas, and Nebraska. The accident site was north or on the cold air side of the stationary and cold fronts and south of the high pressure ridge axis.

[2] Millibars is interchangeable with the term of hectopascals (hPa) and has the same units.

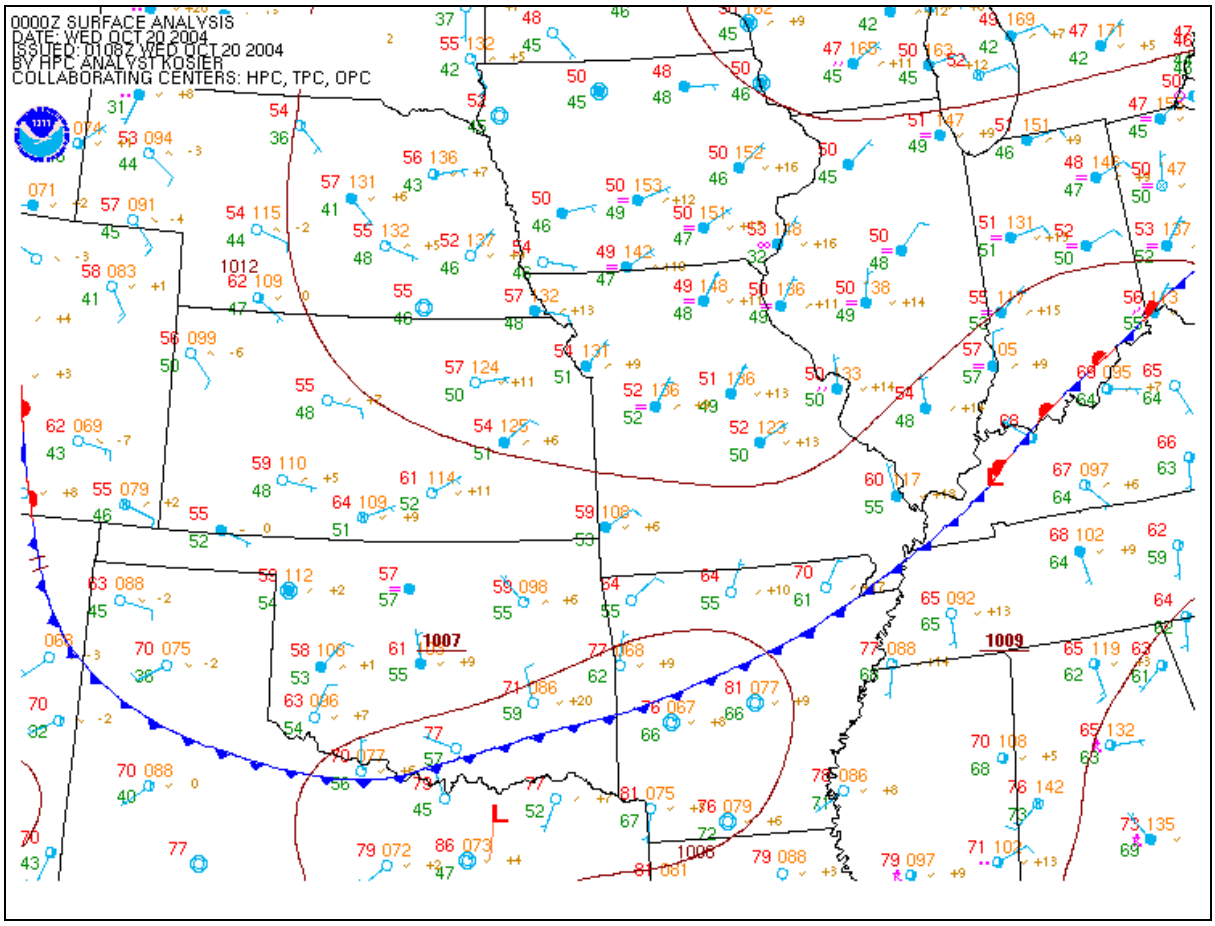

Figure 1 – NWS Regional Surface Analysis Chart for 0000Z

The station models on the regional surface analysis chart over northern Missouri indicated winds from the north to northeast at 10 knots or less, visibility obscured in mist, overcast skies, temperatures in the upper 40's to low 50's (degrees Fahrenheit (F)), and temperature dew point spreads of 2 degrees or less.

1.0.2 Weather Depiction Chart

The NWS Weather Depiction Chart for 0100Z is included as Figure 2, and depicted the general flight categories immediately after the accident. The chart depicted a large area of Instrument Flight Rule (IFR) conditions[3] over the central United States, including over the accident site due to low ceilings and visibility. The closest Marginal Visual Flight Rule (MVFR)

[3] IFR conditions are defined as a ceiling or lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration of less than 1,000 feet agl and/or visibility less than 3 statute miles.

conditions[4] were depicted over western and southern Missouri, and over portions of Iowa. The closest VFR conditions[5] were depicted to the west over Kansas and to the south over Arkansas.

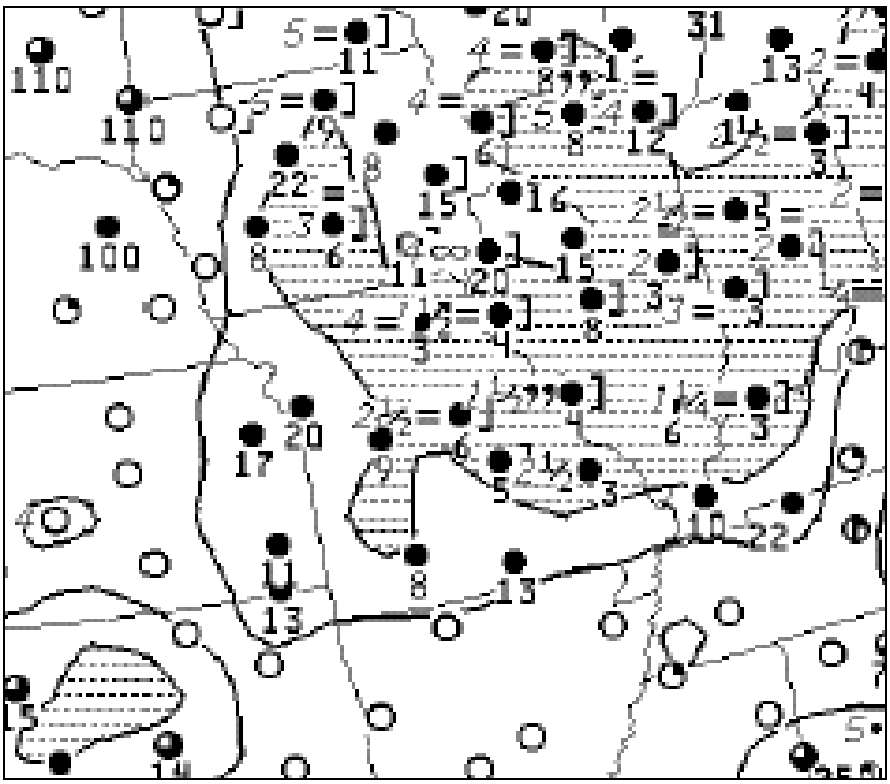

Figure 2 – NWS Weather Depiction Chart for 0100Z

The station models on the regional weather depiction chart indicated visibility from 2 1/2 to 4 miles in mist with overcast ceilings ranging from 300 to 800 feet over northeastern Missouri and western Illinois in the vicinity of the accident site. Conditions in the St. Louis area reported similar conditions with overcast skies with visibility 2 1/2 miles in drizzle and overcast sky conditions with a ceiling at 400 feet.

1.0.3 Radar Summary Chart

The southeast portion of the NWS Radar Summary Chart for 0020Z is included as Figure 3. The chart depicted a large area of radar echoes across the eastern and southeast United States, with two severe weather watches current over Mississippi and Alabama. Several intense to extreme intensity echoes were depicted over extreme southeast Missouri, Tennessee, and

[4] MVFR conditions are defined as a ceiling between 1,000 and 3,000 feet inclusive and/or visibility from 3 to 5 miles inclusive.

[5] VFR conditions are defined as no ceiling or a ceiling greater than 3,000 feet and visibility greater than 5 miles.

Kentucky in the vicinity of the frontal system moving southeast at 11 to 13 knots. No echoes (NE) were identified over northern Missouri or western Illinois along the route of flight and the accident site.

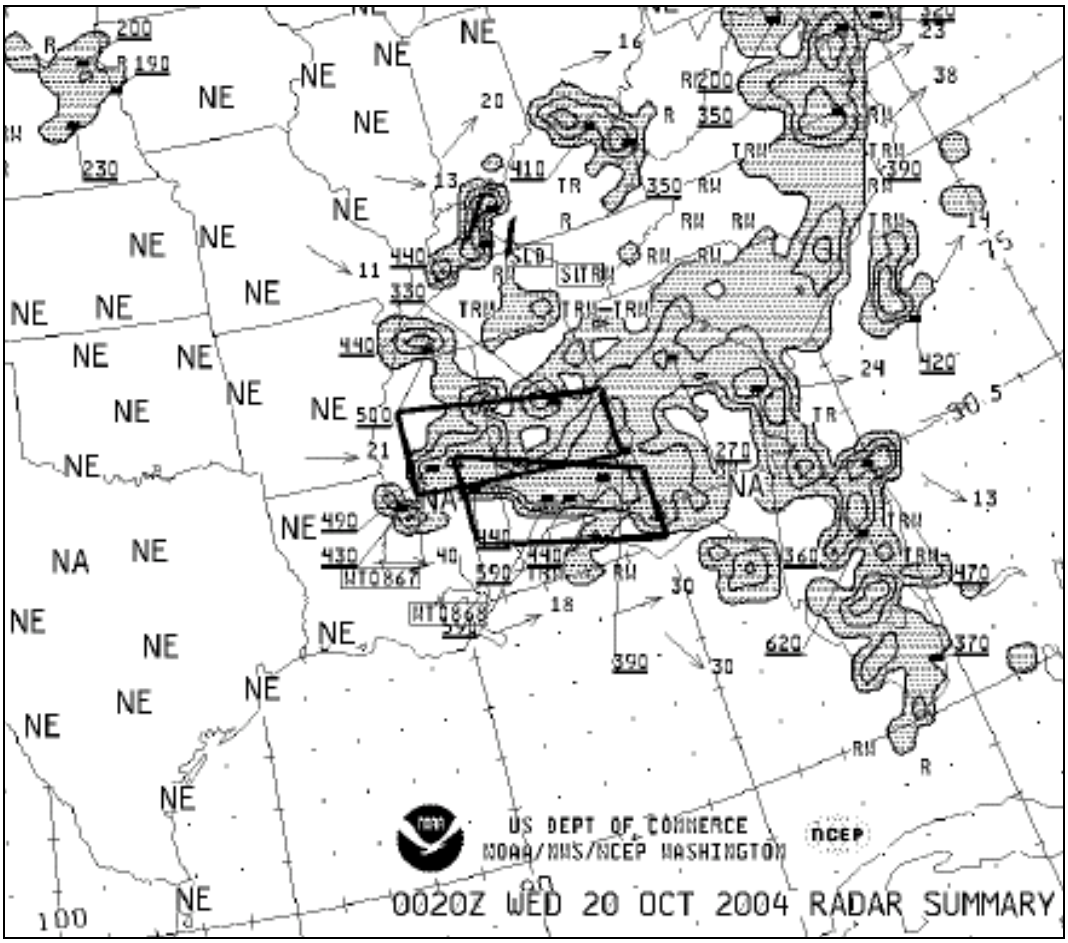

Figure 3 – NWS Radar Summary Chart for 0020Z

1.0.4 Constant Pressure Chart

The NWS 850-mb Constant Pressure Chart for 0000Z on October 20, 2004, depicting the conditions at approximately 5,000 feet is included as Figure 4. The chart depicted an upper level low pressure system over Missouri in the general location of St. Louis with a cyclonic wind flow pattern around the system. Another low pressure system was depicted over northern Ohio.

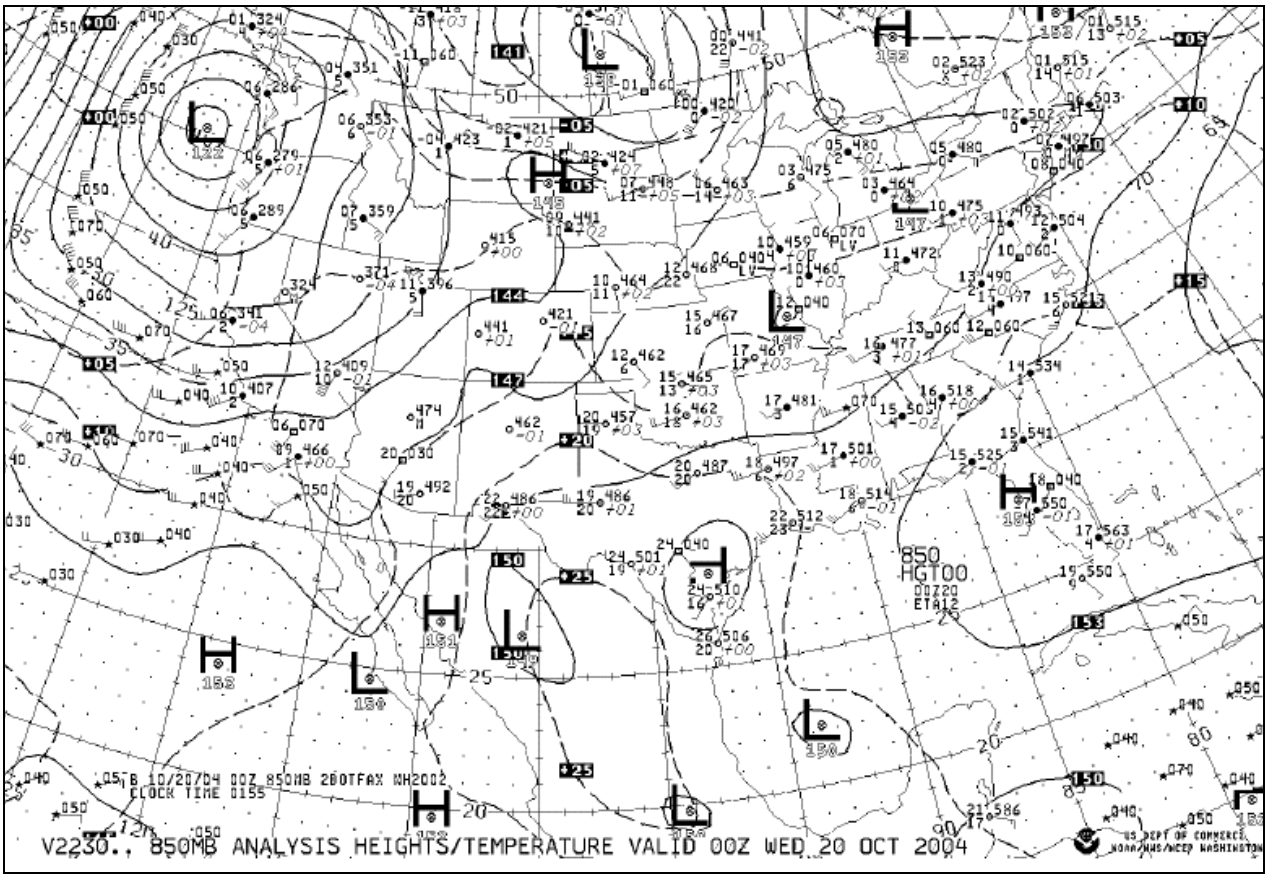

Figure 4 – 850-mb Constant Pressure Chart for 0000Z

The isotherms or lines of equal temperature were out of phase with the contour lines and indicated slight cold and warm air advection patterns around the low pressure system in eastern Missouri, supporting the frontal wave at the surface. The isotherms indicated temperatures over the route of flight from St. Louis to Kirksville ranged from 12 to 10 degrees C at approximately 5,000 feet.

The station models over Illinois immediately north-northeast and east of the accident site indicated near saturated conditions with temperature-dew point spreads of 4 degrees or less.

2.0 Kirksville Regional Airport

The Kirksville Regional Airport (KIRK) at an elevation of 966 feet msl is located approximately 6 miles southeast of Kirksville, Missouri. The accident site was located approximately 2 miles south of the airport reference point. The airport has an Automated Surface Observation System (ASOS) and has NWS certified observers located at the station to augment the system as necessary. On the October 19, 2004, the ASOS station was physically relocated by the NWS from a position near the terminal building to a position located on the western side of runway 18-36 and south of the turf runway 09-27. This position is located approximately 4,406 feet north from the touchdown zone of runway 18, and 760 feet west of the runway centerline. The new location was found to be meteorologically representative of the airport and runway

approach area. This relocation was required due to planned hangar expansion at the airport and took approximately 8 hours for the disconnection, relocation, and calibration of the sensors. During the relocation manual weather observations were taken by the NWS certified observers at the station, and no notice to airmen was required since operations were never adversely affected. Once the installation was completed and the sensors calibrated the weather observers also indicated that it reported representative conditions that they were reporting and the system was re-certified by the NWS as operational prior to the accident.

The Kirksville ASOS receives regularly schedule maintenance approximately every 30 days and the maintenance history for the last 16 months of the system indicated no significant operational problems surrounding the period. The last maintenance item was reported on October 4 and 5, 2004, for normal maintenance and to check on sensor errors due to a power interruption, which was fixed remotely.

2.0.1 METARs

The following conditions were reported by the ASOS surrounding the period of the accident and are provided in plain language from the standard Meteorological Aerodrome Report (METAR) format, with clouds heights reported above ground level (agl):

KIRK automated observation at 2255Z, wind from 020 degrees at 7 knots, visibility 5 miles in haze, ceiling overcast at 900 feet, temperature 10 degrees C, dew point missing, altimeter setting 29.93 inches of Mercury (Hg).

KIRK automated observation at 2355Z, wind from 030 degrees at 7 knots, visibility 6 miles in mist, ceiling overcast at 700 feet, temperature and dew point 9 degrees C, altimeter setting 29.95 inches of Hg. Remarks: automated observation system, ceiling 400 variable 900 feet, sea level pressure 1014.8-mb, no precipitation reported within 6-hours, temperature 9.4 degrees C, dew point 8.9 degrees C, 3-hour pressure tendency risen 1.1-mb, thunderstorms sensor not operating[6].

KIRK special automated weather observation at 0019Z, wind from 040 degrees at 5 knots, visibility 3 miles in mist, ceiling overcast at 300 feet, temperature and dew point 9 degrees C, altimeter setting 29.95 inches of Hg. Remarks: automated observation system, thunderstorm sensor not operating.

KIRK automated weather observation at 0055Z, wind from 030 degrees at 7 knots, visibility 4 miles in mist, ceiling overcast at 300 feet, temperature and dew point 9 degrees C, altimeter setting 29.96 inches of Hg. Remarks: automated observation system, sea level pressure 1015.2-mb, thunderstorm sensor not operating.

KIRK special automated weather observation at 0113Z, wind from 040 degrees at 5 knots, visibility 5 miles in mist, ceiling overcast at 500 feet, temperature and dew point 9 degrees C,

[6] Thunderstorm sensor (ALDARS) is not presently installed at the station.

altimeter setting 29.95 inches of Hg. Remarks: automated observation system, ceiling 300 variable 800 feet, thunderstorm sensor not operating.

2.0.3 ASOS High Resolution Data

The 5-minute ASOS data from KIRK was downloaded and obtained from the NWS Regional Forecast Office located in Kansas City/Pleasant Hill, Missouri. The observation at the time of the accident indicated the following:

KIRK 5-minute automated ASOS observation at 0045Z, wind from 020 degrees at 6 knots, visibility 5 statute miles in mist, ceiling overcast at 300 feet, temperature and dew point 9 degrees C, altimeter 29.96 inches of Hg, pressure altitude 930 feet, relative humidity 96 percent, density altitude 500 feet, wind 020 degrees magnetic at 6 knots. Remarks: automated system, ceiling 200 variable 600 feet, thunderstorm sensor not operating.

The hourly data in raw format is included below which includes the date, time in Central Standard Time (CST), with the general standard METAR format, followed by pressure altitude, relative humidity, density altitude, and magnetic wind. The observation from 0000Z through 0055Z were as follows:

10/19/04 18:00:31 5-MIN KIRK 200000Z AUTO 04007KT 5SM BR OVC005 09/09 A2995
940 96 500 030/07 RMK AO2 CIG 003V007 TSNO

10/19/04 18:05:31 5-MIN KIRK 200005Z AUTO 04007KT 5SM BR OVC005 09/09 A2994
950 96 500 040/07 RMK AO2 CIG 003V009 TSNO

10/19/04 18:10:31 5-MIN KIRK 200010Z AUTO 04006KT 4SM BR OVC005 09/09 A2995
940 96 500 040/06 RMK AO2 CIG 003V007 TSNO

10/19/04 18:15:31 5-MIN KIRK 200015Z AUTO 04007KT 4SM BR OVC003 09/09 A2995
940 96 500 040/07 RMK AO2 TSNO

10/19/04 18:20:31 5-MIN KIRK 200020Z AUTO 04006KT 3SM BR OVC003 09/09 A2995
940 96 500 030/06 RMK AO2 TSNO

10/19/04 18:25:31 5-MIN KIRK 200025Z AUTO 03007KT 3SM BR OVC003 09/09 A2995
940 96 500 030/07 RMK AO2 TSNO

10/19/04 18:30:31 5-MIN KIRK 200030Z AUTO 03007KT 3SM BR OVC003 09/09 A2995
940 96 500 020/07 RMK AO2 TSNO

10/19/04 18:35:31 5-MIN KIRK 200035Z AUTO 02006KT 4SM BR OVC003 09/09 A2996
940 96 500 020/06 RMK AO2 TSNO

10/19/04 18:40:31 5-MIN KIRK 200040Z AUTO 03007KT 4SM BR OVC003 09/09 A2996 930 96 500 020/07 RMK AO2 CIG 002V006 TSNO

10/19/04 18:45:31 5-MIN KIRK 200045Z AUTO 02006KT 5SM BR OVC003 09/09 A2996 930 96 500 020/06 RMK AO2 CIG 002V006 TSNO

10/19/04 18:50:31 5-MIN KIRK 200050Z AUTO 03006KT 5SM BR OVC003 09/09 A2996 930 96 500 020/06 RMK AO2 SLP152 T00940089 TSNO

10/19/04 18:55:31 5-MIN KIRK 200055Z AUTO 03007KT 4SM BR OVC003 09/09 A2996 930 96 500 030/07 RMK AO2 SLP152 T00940089 TSNO

3.0 Upper Air Data

The closest representative sounding with the conditions over the accident site was from the NWS Lincoln (KILX), Illinois, location number 74560, located approximately 145 miles east-northeast at an elevation of 584 feet. The 0000Z sounding was plotted on a standard Skew-T log P diagram[7], along with the observed and derived stability parameters and is included as Figure 5. The sounding indicated a Lifted Condensation Level (LCL) or approximate base layer of the clouds once lifted at 980-mb or 331 feet agl (915 feet msl). The sounding depicted moist saturated conditions from the surface to approximately 700-mb or approximately 10,000 feet msl, where relative humidity was greater than 75 percent. The temperature profile indicated a frontal inversion between 925 to 860-mb or between 2,000 to 4,500 feet msl. Another inversion or isothermal layer where temperature remained constant with increasing altitude was noted between approximately 9,000 to 11,500 feet, with dry air above. The freezing level was located at 12,359 feet. The sounding had a Lifted Index of 12.9, indicating an absolutely stable atmosphere.

[7] 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.

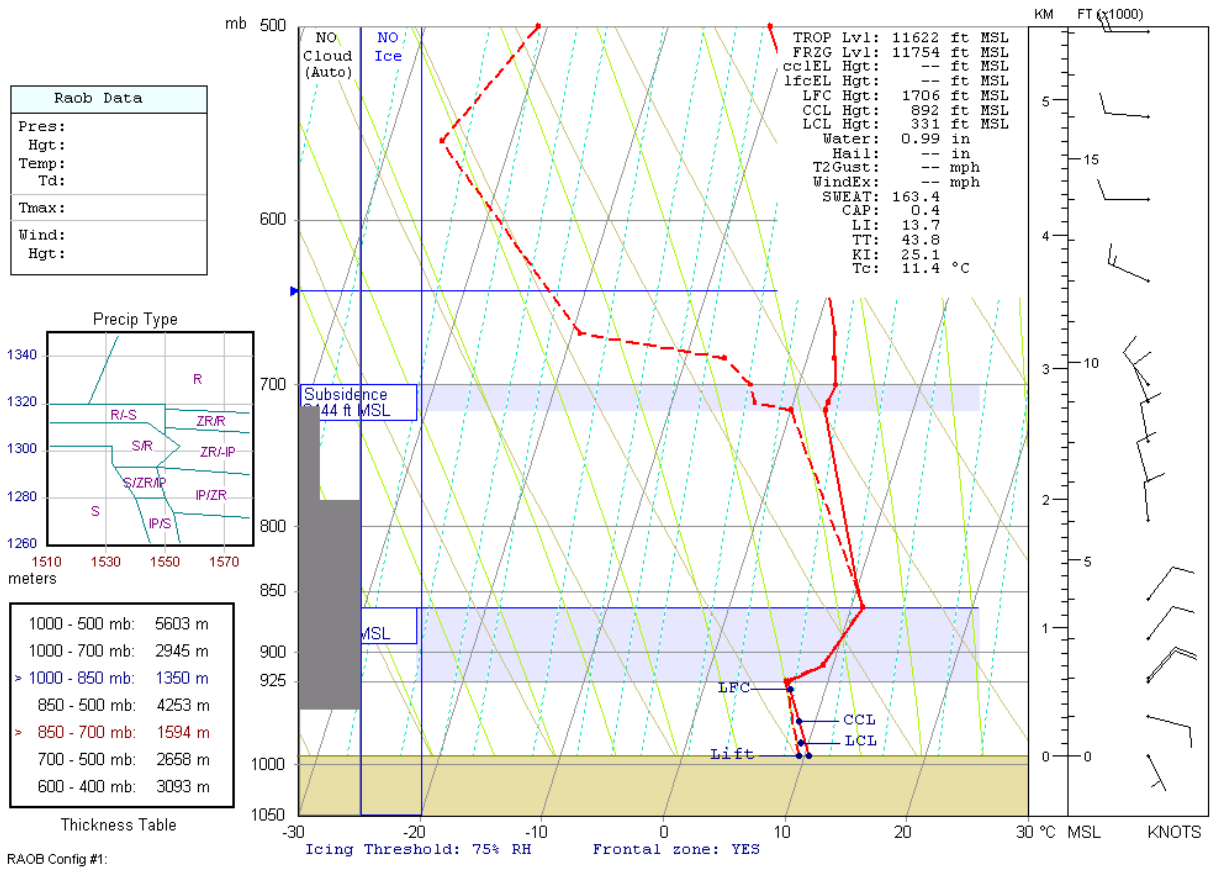

Figure 5 – KILX 0000Z sounding

The wind profile indicated a surface wind from the southeast backing (counter clockwise) with height to the northeast and north through 10,000 feet, with wind speeds of 12 knots or less. The wind at 12,000 feet was from 295 degrees at 14 knots. The observed winds were as follows:

Altitude (msl)	Wind (deg./kts)
1,000 feet	105˚ 09 knots
2,000 feet	040˚ 12 knots
3,000 feet	035˚ 11 knots
4,000 feet	035˚ 10 knots
6,000 feet	355˚ 10 knots

4.0 Satellite Data

The Geostationary Operational Environmental Satellite number 12 (GOES-12) data was obtained from the NWS Kansas City/Pleasant Hill Office, as well as from the National Transportation Safety Boards Man-computer Interactive Display System (McIDAS) workstation. The infrared imagery long wave (band 4) at a wavelength of 10.7 microns (µm), and short wave (band 2) at a wavelength of 3.9 µm provided a 4-kilometer (km) resolution with radiative cloud

top temperatures. The water vapor imagery or band 3 at a resolution of 8 km was also documented. The satellite imagery surrounding the time of the accident was reviewed and the closest images documented below.

Figure 6 is the GOES-12 infrared image at 0045Z with a standard temperature enhancement curve applied to highlight the higher and thicker clouds associated with deep convection. The station locations across the area have also been applied for reference. The image depicted no organized convective area over the area and only low-to-mid level cloud cover over Missouri, including over the accident site.

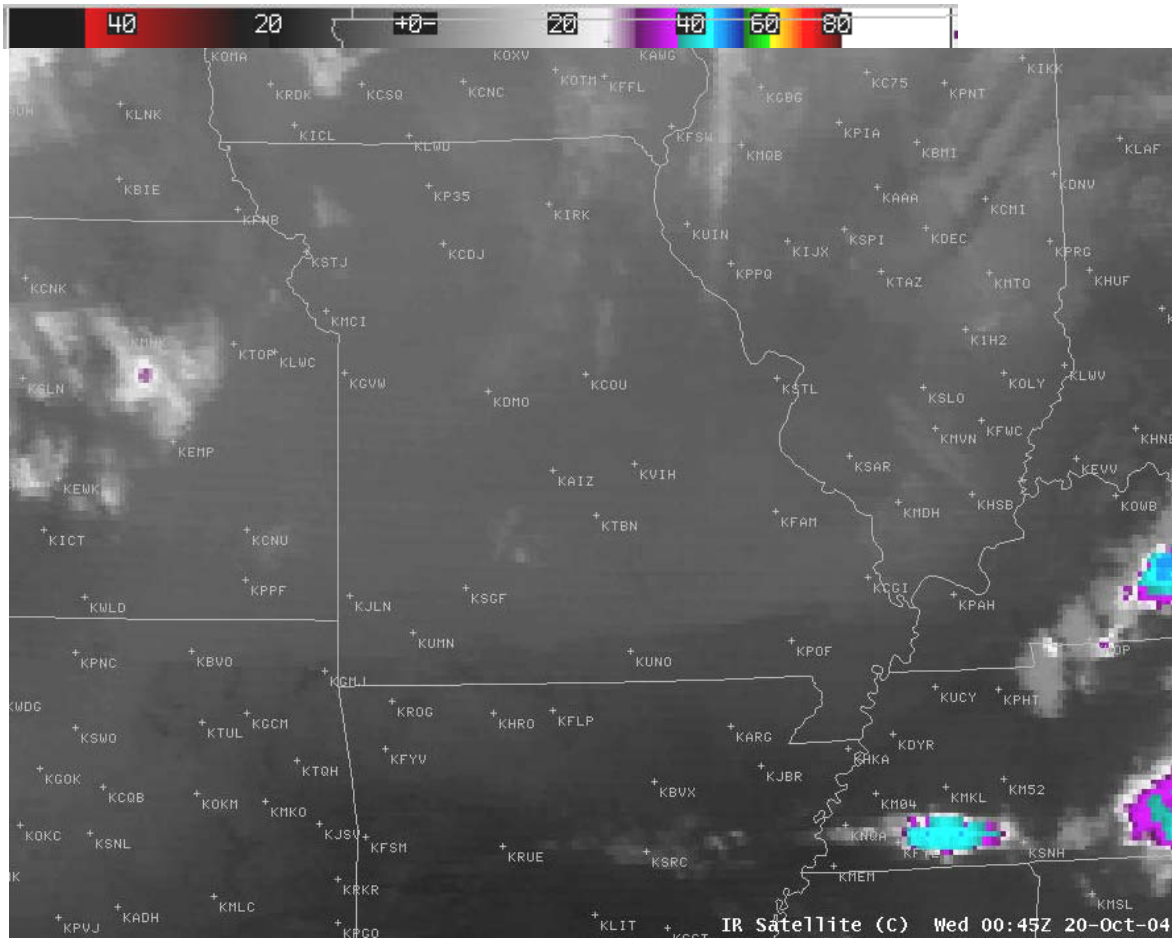

Figure 6 – GOES-12 band 4 infrared satellite image for 0045Z

Figure 7 is the short wave band 2 infrared image for 0045Z used to highlight low-level cloud and fog features. The image depicts a large area of low stratiform type clouds extending over Iowa, eastern Kansas, almost all of Missouri accept the extreme southeast section of the state, and Illinois. The accident site is under a large area of overcast conditions, defined as stratiform type clouds or nimbostratus. The radiative cloud temperature is in the range of 10 degrees C, which corresponded with cloud tops in the range of 5,000 feet.

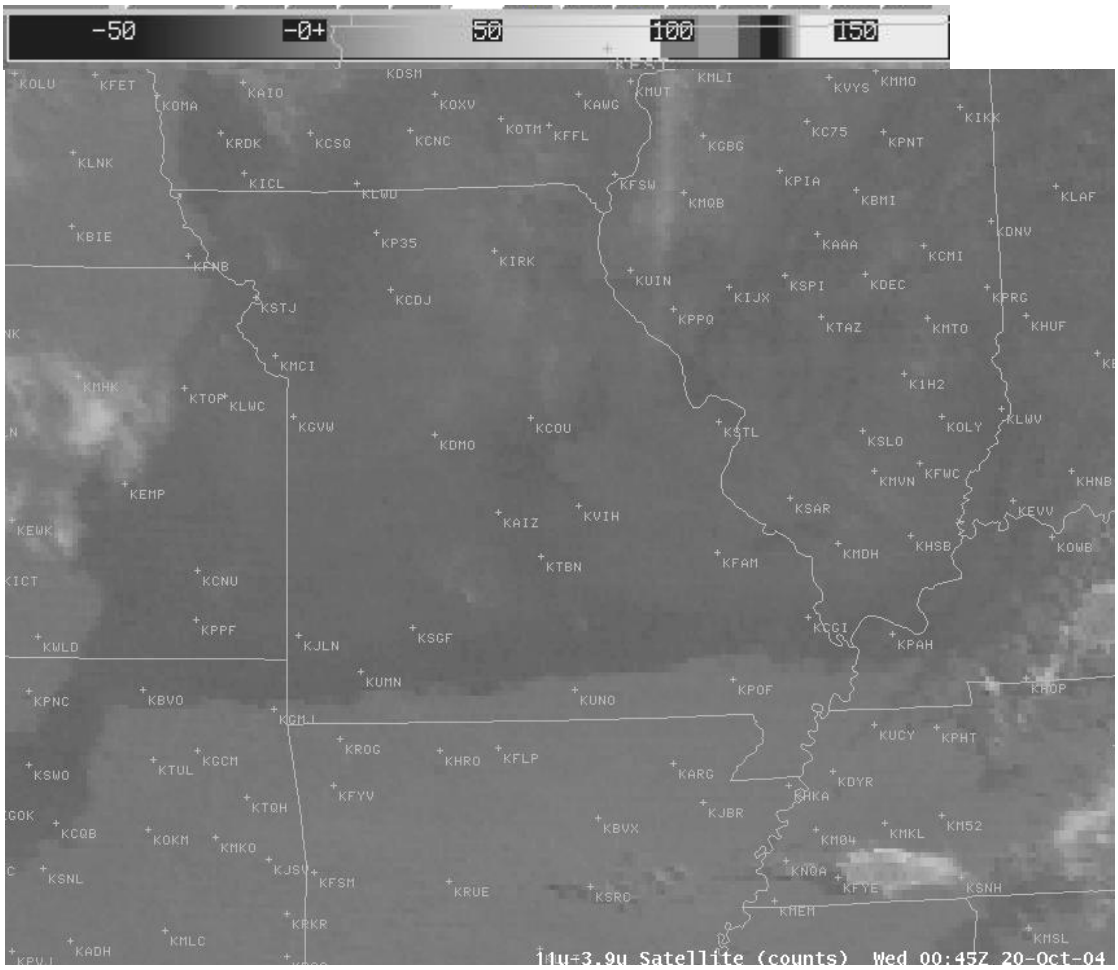

Figure 7 – GOES-12 band 2 infrared image for 0045Z

Figure 8 is the GOES-12 water vapor imagery for 0045Z. Significant areas of turbulence are often represented by sharp differences in the boundaries between moist and dry air, where strong vertical motions are found and are referred to as moisture channel darkening. No such areas were identified across northern Missouri.

Several small bands of convective activity were identified over Kentucky, Tennessee, Mississippi, and Alabama, with a defined area of cumulonimbus clouds identified over southern Alabama. The accident site was absent of any such strong cloud features.

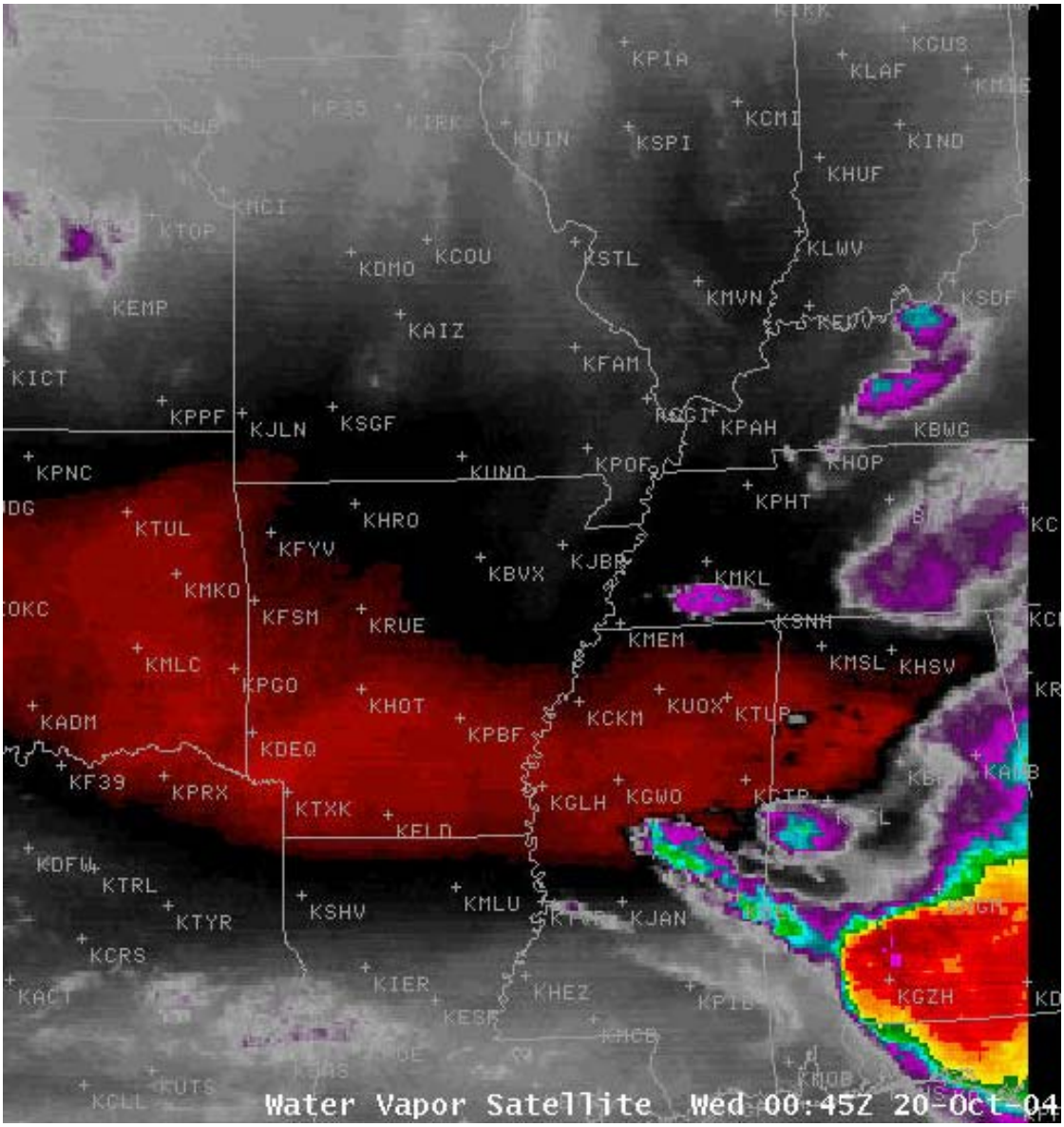

Figure 8 – GOES-12 Water Vapor imagery for 0045Z

5.0 Weather Radar Information

The NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) mosaic radar images surrounding the period were reviewed and the 0058Z image included as Figure 9. The image depicted large areas of ground clutter or non-meteorological echoes surrounding the radar sites across the region, indicating a strong low-level inversion and ducting of the radar beam. Several small areas of convective activity were identified over Kentucky and Tennessee, with no precipitation echoes identified over Missouri.

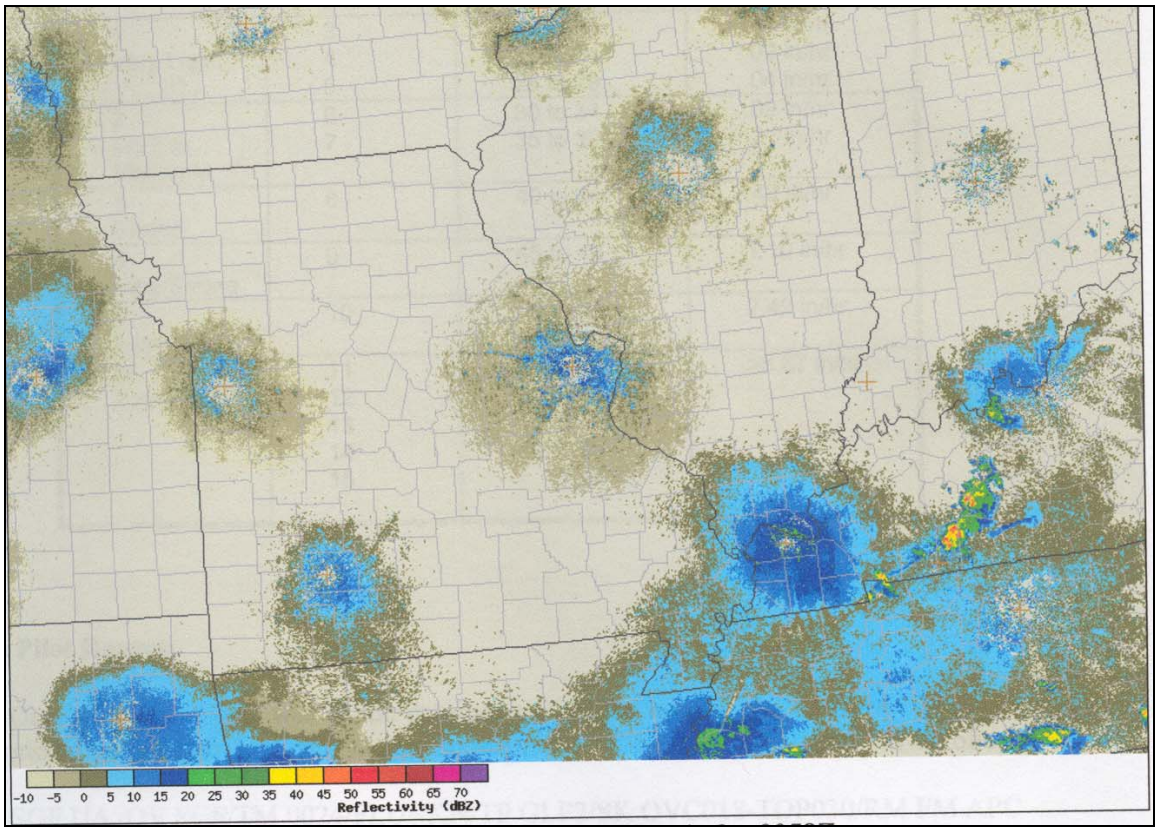

Figure 9 – Regional Radar Mosaic for 0058Z

5.0.1 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[8] it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ[9]), 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

[8] 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 (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.

[9] dBZ - 10 log Ze

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

6.0 Pilot Reports

Only one pilot report was in the database within the hour of the accident. That report was reported over Springfield (KSGF) in the southern part of the state. That report is as follows:

Springfield (SGF) routine pilot report (UA); Over – Springfield (SGF); Time – 0024Z; Flight level – unknown; Type aircraft – Gulfstream 2; Sky cover – overcast clouds with bases at 1,800 feet and tops at 3,000 feet; Remarks – report from approach control.

7.0 Area Forecast

The Area Forecast (FA) is an aviation forecast of general weather conditions over an area the size of several states. It is used to determine forecast en route weather and to interpolate conditions at airports that do not have Terminal Aerodrome Forecasts (TAFs) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues special reports as necessary, usually in the form of an AIRMET. The region that covers Missouri is under the Chicago (KCHI) regional forecast. The forecast valid for this accident was issued at 1845Z on October 19, and was valid until 0700Z.

The header warned users to see the latest AIRMET Sierra for IFR conditions and mountain obscuration.

The forecast for Missouri indicated ceilings broken to overcast from 1,000 to 1,500 feet agl with tops to 4,500 feet, with occasional scattered clouds at 2,500 feet agl over western and southern sections of the state. The outlook from 0700Z through 1300Z expected IFR conditions due to low ceilings and visibility in mist.

8.0 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 and/or aircraft dispatcher in a 14 CFR Part 121 operation to evaluate on the basis of experience and the operational limits of the aircraft.

AIRMET[10] Sierra update 6 was issued for IFR conditions and mountain obscuration at 1942Z and was valid until 0200Z. The advisory was current for portions of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Lake Superior, Lake Michigan, Michigan, and Indiana. The advisory was enclosed by the navigation fixes from Winnipeg, Manitoba (YWG), to Thunder Bay, Ontario (YQT), to Dells, Wisconsin (DLL), to Peck, Michigan (ECK), to Ft. Wayne, Indiana (FWA), to Covington, Kentucky (CVG), to Farmington, Missouri (FAM), to 30 miles east of Oswego, Kansas (OSW), to Kansas City, Missouri (MKC), to Brainerd, Minnesota (BRD), to Winnipeg, Manitoba (YWG). The advisory warned of occasional to widespread ceilings below 1,000 feet agl and visibility below 3 statute miles in mist and fog. The conditions were expected to continue beyond 0200Z through 0800Z. This advisory covered the route of flight and the accident site.

The NWS also had AIRMET Sierra for mountain obscuration for portions of Kentucky current, which did not impact the route of flight.

AIRMET Zulu update 3 was current for icing until 0200Z for portions of North Dakota, Minnesota, Wisconsin, Lake Superior, Michigan, Lake Michigan, and Lake Huron. The advisory was enclosed from Winnipeg, Manitoba (YWG), to Thunder Bay, Ontario (YQT), Sault Ste. Marie, Michigan (SSM), to Wiarton, Ontario (YVV), to Peck, Michigan (ECK), to Dells, Wisconsin (DLL), to Bemidji, Minnesota (BJI), to Minot, North Dakota (MOT), to 60 miles northeast of Williston, North Dakota (ISN), to Winnipeg, Manitoba (YWG). The advisory was for occasional moderate to rime to mixed icing-in-clouds and in-precipitation between the freezing level and 20,000 feet. The freezing level was identified from 4,000 to 10,000 feet

[10] AIRMET – AIRman's METeorological Information. In-flight weather advisories issued only to amend the area forecast concerning weather phenomena which are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualifications. AIRMETs concern weather of less severity than that covered by SIGMETs or Convective SIGMETs. AIRMETs cover moderate icing, moderate turbulence, sustained winds of 30 knots or more at the surface, widespread areas of ceilings less than 1,000 feet and/or visibility less than 3 miles, and extensive mountain obscurement.

sloping northwest to southeast across the region. The conditions were expected to end over most sections by 0200Z, except over upper Michigan and Lake Superior portions. The accident site was south of this advisory.

Another AIRMET for icing was also current for portions of South Dakota and Nebraska and was enclosed by the navigation fixes from Aberdeen, South Dakota (ABR), to Omaha, Nebraska (OVR), to McCook, Nebraska (MCK), to Sidney, Nebraska (SNY), to Scottsbluff, Nebraska (BFF), to 70 miles northwest of Rapid City, South Dakota (RAP), to Aberdeen, South Dakota (ABR). The advisory was for occasional moderate rime to mixed icing-in-clouds and in-precipitation between 9,000 and 20,000 feet. The conditions were expected to spread eastward and continue beyond 0200Z through 0800Z. The accident site was east-southeast of this area.

AIRMET Tango indicated that no significant turbulence was expected except in the vicinity of convective activity.

No SIGMETs, Convective SIGMETs, or Severe Weather Forecast Alerts were current over Missouri during the period. A map depicting these advisories is included as Figure 10. AIRMET Sierra for IFR conditions was the only weather advisory current over the route of flight and the accident site.

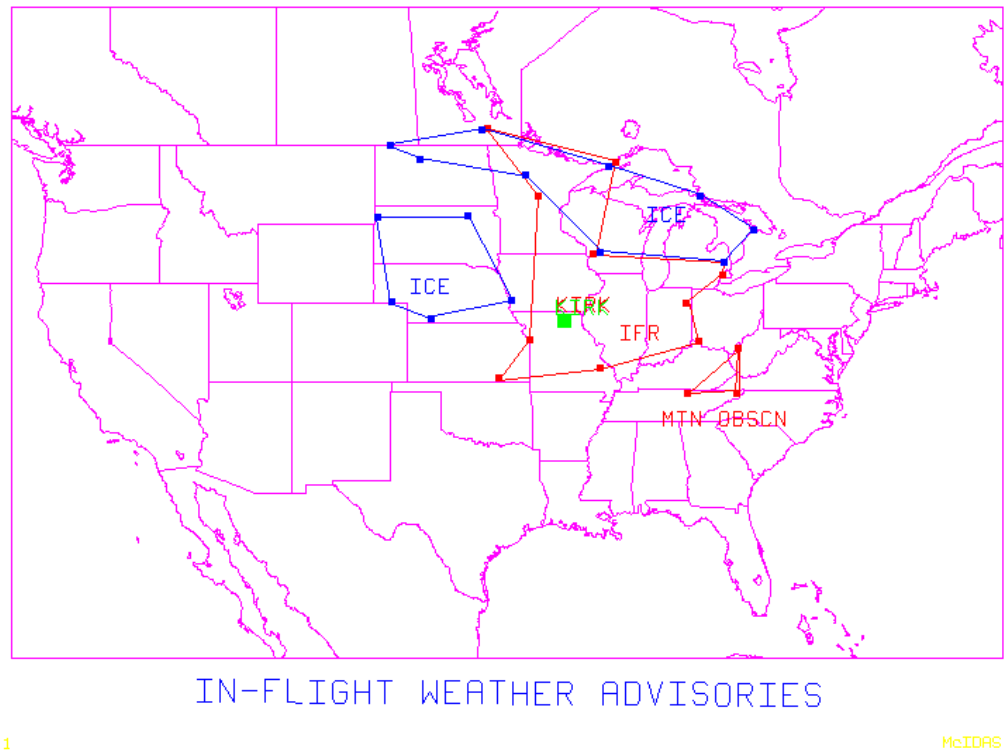

Figure 10 – NWS AIRMET Advisories

9.0 Terminal Aerodrome Forecast (TAF)

The NWS does not issue a Terminal Aerodrome Forecast (TAF) for KIRK and as an operational requirement Corporate Airlines contracts for meteorological services from Meteorlogix an Enhanced Weather Information System (EWINS) provider. The Meteorlogix's forecast or commonly called a "RAMTAF" current at the time the flight was dispatched as follows:

KIRK RAMTAF issued at 2121Z and valid from 2100Z to 1700Z on October 20, 2004. From 2100Z, wind from 040 degrees at 5 knots, visibility 4 miles in mist, ceiling overcast at 800 feet. From 0300Z, wind from 040 degrees at 5 knots, visibility 2 miles in mist, ceiling overcast at 500 feet. From 0900Z, wind from 040 degrees at 5 knots, visibility 2 miles in mist, ceiling overcast at 400 feet, temporarily between 0900Z and 1400Z visibility 1/2 mile in fog, ceiling overcast at 200 feet. From 1400Z, wind from 060 degrees at 5 knots, visibility 4 miles in mist, ceiling overcast at 1,000 feet. From 1600Z, wind from 060 degrees at 5 knots, visibility 5 miles in mist, ceiling overcast at 1,500 feet.

10.0 Pre-Departure Weather Briefing Packages

A copy of the weather document issued with the dispatch release is included as Attachment 1. The document defines what weather information was issued to the flight prior to departure from St. Louis. The document includes the reported and forecast weather conditions for the route of flight and alternate airports, including notice to airmen and company related field condition reports. The KIRK RAMTAF as included in section 9.0 above does not automatically get printed on to the document and was issued separately.

11.0 NWS Public Hazardous Weather Statement

The NWS Kansas City/Pleasant Hill Regional Forecast Office responsible for the Kirksville area issued the following hazardous weather advisory to the general public on October 19, 2004:

> HAZARDOUS WEATHER OUTLOOK
> NATIONAL WEATHER SERVICE KANSAS CITY/PLEASANT HILL MO
> 1247 PM CDT TUE OCT 19 2004
>
> THIS HAZARDOUS WEATHER OUTLOOK IS FOR NORTHWEST...NORTH CENTRAL AND WEST CENTRAL MISSOURI...AS WELL AS EXTREME EASTERN KANSAS.
>
> THIS AFTERNOON AND TONIGHT
>
> AREAS OF FOG AND DRIZZLE WILL PERSIST THROUGHOUT THE AFTERNOON...WITH FOG EXPECTED TO BECOME MORE DENSE DURING THE EVENING AND OVERNIGHT HOURS. LOW LYING AREAS AND AREAS ALONG RIVERS AND LAKES MAY SEE VISIBILITIES DIP TO LESS THAN ONE HALF MILE DURING THE OVERNIGHT HOURS.

12.0 Interviews

Several interviews were conducted with individuals regarding the weather conditions surrounding the time of this accident. The interviews included the NWS certified weather observers at Kirksville, the Flight Dispatcher responsible for issuing the release and flight following for flight 5966, and a pilot and his wife who landed at KIRK within the hour prior to the accident. Those interviews follow below.

12.0.1 Weather Observers Statements

The two weather observers who worked on October 19 were interviewed regarding the weather conditions surrounding the accident on October 20, 2004. Mr. Jody Sayre, the Supervisor of the Kirksville Regional Airport was on duty during the morning, and then returned to the airport in response to the accident. Mr. David Hall, Airport Operator, was on duty at the time of the accident. Both Mr. Sayre and Mr. Hall hold current NWS weather observation certificates and are trained and certified by the FAA to operate the airport crash fire and rescue vehicle. Mr. Hall also holds an FAA aircraft and power plant certificate.

Mr. Hall worked from 1300Z to 1800Z (0800-1300 CDT) running his own aircraft maintenance shop at the airport on October 19, and then worked for the city airport from 1800Z to 0200Z (1300 to 2100 CDT). His responsibilities at the airport included providing fuel service, operating the airport crash fire and rescue truck, and providing weather augmentation as required. He received his weather observers training and certificate in 1984 and has been working for the city airport since then, Mr. Hall was one of the primary weather observers between 1984 and 1998 before the NWS ASOS was installed at the field that eliminated the requirement for manual observations.

On October 19, 2004, Mr. Hall was working at the firehouse next to the terminal and was waiting on the arrival of Corporate Airlines flight 5966, a scheduled flight. He heard flight 5966 on the Kansas City Center's (KZKC) frequency being vectored inbound and cleared for the localizer distance measuring equipment (LOC DME) approach to runway 36. He heard no distress call or anything unusual; except that the aircraft never arrived and he did not hear the aircraft fly over the field on a missed approach. A short time later, he received from an individual who reported that an Amish farmer living south of the airport came to his house to report an aircraft crash. Upon receiving the call Mr. Hall began emergency notification. At that time, he noted the visibility was 5 miles in mist and the ceiling was overcast at 500 feet. He also checked the emergency frequency 121.5 mHz and did not hear an emergency locator transmitter (ELT) signal being broadcast.

Mr. Hall stated the weather was LIFR to IFR conditions throughout the day. The ceiling and visibility had improved through the afternoon into the early evening just prior to the accident, then ceilings started deteriorate. He noted no precipitation or any adverse weather during that period. He also noted that the runway lights were on all day due to the IFR conditions, and that the Medium intensity Approach Light Systems (MALS) were on at the approximate time of the accident and appeared to be at the medium to high intensity setting. He could not see the Visual Approach Slope Indicator (VASI) lights, but indicated they all are turned on at the same time.

Mr. Hall indicated that two aircraft landed in the hour prior to the accident and one corporate jet, a Gulfstream (G-IV), landed within an hour after the accident.

Mr. Hall and his supervisor, Jody Sayre, both indicated that ceilings and visibilities tend to be lower south of the airport because of local features. They both indicated that at the time of the accident the weather appeared to deteriorate somewhat, but improved during the evening.

12.0.2 Flight Dispatcher for Corporate Airlines

The Flight Dispatcher responsible for the planning and release of flight 5966, Janet McGee, was interviewed on October 21, 2004, regarding her work cycle, workload, planning, flight following, and notification procedures following the accident. Mrs. McGee obtained her dispatch certificate from Sheffield's Dispatch Academy in Fort Lauderdale, Florida, in 1996. Mrs. McGee also holds a private pilot certificate. After obtaining her dispatch certificate, she was hired by Florida Gulf Airlines, a US Airways commuter service, where she was a Flight Follower for one month, then was hired by Corporate Airlines in October 1996, as a Flight Dispatcher. Between 1999 and 2004, she taught general aviation, meteorology and dispatch courses at Middle Tennessee State University. She returned to Corporate Airlines in March 2004, as a part-time Flight Dispatcher and then full time in October 2004.

The Corporate Airlines dispatch office is normally staffed with three shifts; a morning (0400 to 1400 local), a midday (0800 to 1800 local), and evening (1200 to 2200 local). On the day of the accident Mrs. McGee was working the last day of her evening shift on a 3-day schedule (4 days on/4 days off and 3 days on/3 days off fixed schedule). She was well rested and reported no computer or other flight planning system equipment problems.

Corporate Airlines utilizes several different weather systems to obtain information including American Airlines SABRE System, for weather text data; and Meteorologix for terminal forecasts referred to as "RAMTAFs" for airports that do not have NWS TAFs issued for them, such as KIRK. The weather and dispatch system she utilized had access to radar mosaic and satellite imagery overlaid with aircraft situation display (ASD) information to track their aircraft with respect to the weather. She also indicated they had excellent air-to-ground radio communication capability if they needed to reach a flight en route with weather updates and to consult with the crew regarding the best course of action.

On the day of the accident, Mrs. McGee indicated the workload was heavy but manageable due to the extensive area of low ceilings across the central United States. Minimums based on visibility, she added, were not an issue during her shift. Her normal workload is planning, releasing, and flight following approximately 30 flights during the course of her 10-hour shift. The flight plan for flight 5966 was "canned" and had a prepared route and altitude of 12,000 feet between KSTL and KIRK. She entered the expected payload into the system and planned the flight with two alternates, Quincy (KUIN) and St. Louis (KSTL), because of the marginal weather conditions. She then added 50-minutes of hold fuel to the required fuel to the most distant alternate. Close to the release time approximately one hour and fifteen minutes prior to

departure she reviewed all the weather again for the airport and alternates and issued the release. She recalled the KIRK weather had visibility of 4 miles in mist with a ceiling of 700 feet, and the RAMTAF unchanged with visibility 2 to 4 miles in mist and ceilings from 400 to 600 feet. She described everything was normal with the flight planning, she had an experienced flight crew, the airplane was fine with no maintenance issues or Minimum Equipment List (MEL) restrictions, and that the weather was "operational". She did indicate that the weather conditions were lower during the day with regards to ceiling and visibility, but had improved with the day and she believed everything was OK. She did not have any communications with the flight crew prior to departure or while it was en route.

Mrs. McGee was notified at approximately 0050Z by "Brian" at the KIRK station that flight 5966 was late and that a civilian called and reported an airplane down 4 miles south of the airport. She then called the Chicago Center (KZAU) and was advised that flight 5966 was not in their sector and then called the Kansas City Center (KZKC) looking for flight 5966. The KZKC Supervisor "Nancy" then advised her that flight 5966 was off their scope and they had assumed it landed. She then called the Quincy (KUIN) station looking to see if the flight had diverted to that airport. Upon learning that it had not, she immediately called the Manager of Dispatch to come in and help her with the remaining airborne flights and started the emergency phone tree.

Present during the interview were Donald Eick, Shavonne Reed, and Kevin Cline, Director of Operations of Corporate Airlines who further helped describe the details and working setup of the airline.

12.0.3 Pilot Interview

Dr. John P. Hall, a commercial instrument rated pilot and his wife, flew their Cessna 182 to KIRK at approximately 2340Z on October 19, an hour prior to the accident. He was contacted on October 21, 2004, and asked to provide a synopsis of the weather conditions he encountered while inbound to KIRK on the evening of the accident. Dr. and Mrs. Hall both described an overcast layer of clouds over the area with tops between 3,500 to 4,000 feet. They also flew the LOC DME approach for runway 36 and broke out of the clouds at approximately 1,600 feet msl (534 feet agl). The approach appeared normal with regards to height and terrain clearance and they both indicated that they encountered no rain, turbulence, icing, or low-level wind shear. Dr. Hall mentioned a slight crosswind, which was not that operationally significant. They summarized the approach as smooth in solid Instrument Meteorological Conditions (IMC) with visibility 4 miles in mist.

13.0 Weather Support for Corporate Airlines

The specific operation specifications were reviewed to verify the sources of weather support used by Corporate Airlines, and to review the dispatch policy regarding low ceilings and visibility.

13.0.1 Operations Specifications

Section A-10 "Aeronautical Weather Data" in the Corporate Airlines Operation Specifications lists the American Airlines "SABRE" System and METEORLOGIX as approved sources of weather data and forecast to control flight operations. METEORLOGIX is the contract service, specifically designed to provide terminal forecasts for those stations that do not usually issue TAFs.

13.0.2 Marginal Conditions

Current Federal Aviation Regulations (FAR's) 121.619 and 121.625 states that an additional destination alternate airport (second alternate) is required and will be listed on the dispatch release anytime the destination and first alternate weather is forecast to be marginal. Corporate Airlines defines "marginal" as when:

A. The destination weather will be considered marginal whenever it is forecast to be less than 1,000 feet ceiling or less than three milesvisibility from the time beginning one-hour prior to until one hour after, the estimated time of arrival.

B. The first alternate weather is considered marginal if it is forecast to have less than a 600 feet ceiling or less than two miles visibility at the estimated time of arrival.

14.0 Astronomical Data

The U.S. Naval Observatory located in Washington, D.C. indicated the following astronomical data for Kirksville, Missouri on October 19, 2004:

Sunset:	2324Z (1824 CDT)
End of civil twilight:	2352Z (1852 CDT)
Altitude of the moon:	18.8 degrees above the horizon
Azimuth of the Moon:	199 degrees true
Phase of the Moon:	waxing crescent with 36 % of disk illuminated

Donald E. Eick
NTSB Senior Meteorologist

Attachment 1 – Weather Document issued to Flight 5966

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19  2330  778408 MQY-XJM
WXM-FLT CEA5966/19 STL IRK RTE  41 ALT UIN STL TOA      192330
SKD  2342/0035Z REVISION  1

 MAP FEATURES WEST
VALID 19/1430Z-20/1100Z
INTENSE LOW PRESSURE SYSTEM OFFSHORE OF THE PACIFIC NW WILL
CONTINUE TO PROVIDE WIDESPREAD RAIN SHOWERS TO NRN CA WITH
SCT SHOWERS EXPECTED ACROSS MUCH OF CA/OR/WA DURING TUESDAY
AFTERNOON/EVENING.  THIS ACTIVITY WILL CONTINUE TO SPREAD
INLAND ACROSS NV/UT/SRN ID/WY AND BRING SCT RAIN/SNOW SHOWERS
TO THE INTERMOUNTAIN WEST BY LATE EVENING TUESDAY.  SCT SNOW
SHOWERS ARE EXPECTED IN THE HIGHER ELEVATIONS OF THE NRN CA
SIERRA MTNS AND THE WASATCH MTNS IN UT.  LOW PRESSURE LOCATED
ACROSS SRN MANITOBA WILL CONTINUE TO MOVE NE DURING THE DAY
TUESDAY.  SCT SHOWERS ARE EXPECTED WITH THIS FEATURE ACROSS
ND/MN/SRN MANITOBA/WRN ONTARIO.
  TSTM OUTLOOK...NO ORGANIZED AREAS OF TSTMS EXPECTED DURING
THE DAY TUESDAY.
WNI/MH



STL
  192251Z 34007KT 2SM BR OVC005 11/10 A2990 RMK AO2 SLP127
     T01060100

IRK
  192255Z AUTO 02007KT 5SM HZ OVC009 10/ A2993 RMK AO2
      SLP141 T0100 TSNO
UIN
  192254Z AUTO 05006KT 4SM BR OVC006 10/09 A2992 RMK AO2
     CIG 005V010 SLP133 T01000094


STL TAF KSTL 191732Z 191818 36007KT 4SM BR OVC005
      FM0000 01006KT 5SM BR OVC008
      FM0700 03005KT 2SM BR OVC005 TEMPO 0913 1/2SM FG OVC002
      FM1300 05006KT 4SM BR OVC009
UIN TAF AMD KUIN 192227Z 192218 03008KT 4SM BR OVC006
      FM0300 03005KT 3SM BR OVC008
      FM1400 06007KT 4SM BR OVC010

MK1   WST 192255
 CONVECTIVE SIGMET 84E
 VALID UNTIL 0055Z
 FL GA AL MS
 FROM 30NE SQS-ATL-30SW TLH-20ESE JAN-30NE SQS
 AREA EMBD SEV TS MOV FROM 27035KT. TOPS ABV FL450.
 TORNADOES...HAIL TO 2 IN...WIND GUSTS TO 60KT POSS.

 CONVECTIVE SIGMET 85E
 VALID UNTIL 0055Z
 FL GA
 FROM 40SSE IRQ-10WNW CRG-40ENE ABY-40SSE IRQ
 AREA EMBD TS MOV FROM 25030KT. TOPS TO FL390.

 CONVECTIVE SIGMET 86E
 VALID UNTIL 0055Z
 FL AND CSTL WTRS
 FROM CRG-70E CRG-20ENE ORL-30W ORL-CRG
 AREA SEV TS MOV FROM 28015KT. TOPS ABV FL450.
 HAIL TO 1 IN...WIND GUSTS TO 50KT POSS.
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```
 CONVECTIVE SIGMET 87E
 VALID UNTIL 0055Z
 FL AND CSTL WTRS
 FROM 40W VRB-30S VRB-MIA-40S FMY-40W VRB
 AREA TS MOV LTL. TOPS ABV FL450.

 CONVECTIVE SIGMET 88E
 VALID UNTIL 0055Z
 MD VA NC
 FROM 30WSW SBY-10NNW RDU
 LINE EMBD TS 40 NM WIDE MOV FROM 25030KT. TOPS TO FL380.

 CONVECTIVE SIGMET 89E
 VALID UNTIL 0055Z
 NY RI CSTL WTRS
 FROM 120SE ACK-180SE ACK
 LINE EMBD TS 35 NM WIDE MOV FROM 25025KT. TOPS TO FL370.

 CONVECTIVE SIGMET 90E
 VALID UNTIL 0055Z
 NC

MK2   WST 192255
 CONVECTIVE SIGMET 37C
 VALID UNTIL 0055Z
 TN AL MS
 FROM 30ENE MEM-30NNW MSL
 LINE SEV TS 25 NM WIDE MOV FROM 28020KT. TOPS TO FL440.
 TORNADOES...HAIL TO 1 IN...WIND GUSTS TO 50KT POSS.

 OUTLOOK VALID 200055-200455
 FROM CVG-50SE CVG-BNA-40SSW CEW-LEV-70SE LCH-30SW MLU-30W
 MEM-PXV-CVG
 REF WW 866 867.
 WST ISSUANCES EXPD. REFER TO LATEST ACUS01 KWNS FROM STORM
 PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

 FISCHER


NOTAMS
 09/103 STL 12R/30L NONSTD MARKING WEF 0409150345
 10/144 STL UAV 5000/BLW 6NMR STL298033/13SE H19 AVOIDANCE ADZD

 1330-2130 DLY WEF 0410191330-0410222130
 10/154 STL TOWER 698  84 AGL  2 W LGTS OTS  ASR 1063205  TIL
 0411030926
 10/004 IRK ASOS 121.125 OTS WEF 0410191300-0410192330
 06/019 UIN 18/36 CLSD

  FTZ 10/150 FTZ VOR OTS WEF 0410191400-0410191900
  MSP 08/002 MSP VOR OTS WEF 0408021200
  ONA 10/001 ONA VOR/DME OTS WEF 0410041500
  MKT 10/004 MKT VOR VOICE OTS
  PPI 10/010 PPI NDB OTS
FIELD CONDITIONS

IRK 192032
FC/
FC
-FIELD REPORT-  STATION- KIRKSVILLE DATE- 10/19 TIME- 1531
EXISTING TAA
RWYS-------STATUS------CONDITIONS---REMARKS------------------
 36/18      OPEN        DRY         BRAG
```

```
FOR AFTER HOURS ASSISTANCE CNTC             AT
.
DEICING IN EFFECT Y/N  N   LOCATION
CORPORATE AIRLINES OPS FREQUENCY  130.00
REMARKS ..................................................
 ..........................................................
UPDATED BY  BRIAN SALSBERRY..  PHONE NO  6270100

UIN 191919
FC/
FC
-FIELD REPORT-  STATION- QUINCY     DATE- 19OCT TIME- 1420
EXISTING TAA
RWYS-------STATUS------CONDITIONS---REMARKS------------------
 4/22       OPEN        DRY         BRAG
 13/31      OPEN        DRY         BRAG
 18/36      CLOSED

FOR AFTER HOURS ASSISTANCE CNTC  D.EVANS    AT  217-222-4867
.
DEICING IN EFFECT Y/N  N   LOCATION
CORPORATE AIRLINES OPS FREQUENCY  130.00
REMARKS ..................................................
 TAXIWAY E CLOSED.........................................
UPDATED BY  DAWN EVANS.......  PHONE NO  217-885-3120
  END DATA
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