



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

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Group Chairman's Factual Report

METEOROLOGY

CEN17MA183

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A. AIRCRAFT ACCIDENT

Location: Teterboro, New Jersey
Date: May 15, 2017
Time: 1529 eastern daylight time
1929 coordinated universal time (UTC)
Airplane: Learjet 35A; Registration: N452DA

B. METEOROLOGIST

Don Eick
Meteorologist Specialist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On May 15, 2017, at 1529 eastern daylight time, a Gates Learjet 35A, N452DA, operated by Trans-Pacific Jets, departed controlled flight while on a circling approach to runway 1 at the Teterboro Airport (TEB), Teterboro, New Jersey, and impacted a commercial building and parking lot. The captain and first officer died; no one on the ground was injured. The airplane was destroyed by impact forces and postcrash fire. The airplane was registered to A&C Big Sky Aviation LLC and operated by Trans-Pacific Air Charter LLC under the provisions of *14 Code of Federal Regulations Part 91* as a positioning flight. Visual meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan was filed. The flight departed from the Philadelphia International Airport (PHL), Philadelphia, Pennsylvania, about 1504 and was destined for TEB.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's 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 Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are eastern daylight time (EDT) based upon the 24 hour clock, local time is +4 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.

The accident site was based on the coordinates of latitude 40.82944° N, and longitude 74.060278° W, at an estimated elevation of 10 feet (ft).

E. FACTUAL INFORMATION

1.0 Synoptic Conditions

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 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 00-45H.

1.1 Surface Analysis Chart

The northeast section of the NWS Surface Analysis Chart for 1400 EDT is included as figure 1 with the approximate location accident site marked by a red star. The chart depicted a low pressure system at 989-hectopascals¹ to the northeast of the accident site, south of Nova Scotia associated with an occluded front, which wrapped around the low northeastward over the North Atlantic Ocean. The isobars or lines of constant pressure indicated a slight trough of low pressure extending from the low southwestward into New England and into northern New Jersey. A secondary low pressure system associated with another frontal wave was located to the east of Nova Scotia at 997-hPa with a cold front extending southwestward off the east coast into North Carolina, where the front extended west-northwestward into Kentucky. The front became a warm front into Indiana, northern Illinois, Iowa, and southern Minnesota to another low pressure system at 1006-hPa. A high pressure system at 1019-hPa was located over Michigan and Ohio immediately north of the warm front and to the west of the accident site.

The station models surrounding the accident site indicated sustained north-northwest winds of 10 to 15 knots, with a station immediately north in Poughkeepsie, New York reporting gusts to 30 knots. In addition, the station models reported scattered to broken sky cover, temperatures in the 60’s degrees Fahrenheit (F), with dew points in the 40’s° F. No significant weather or precipitation was reported over the area.

¹ Hectopascals (hPa) is the NWS new standard for reporting sea level pressure and is interchangeable with the term millibars (mb), which has the same unites. Standard sea level pressure is 1013.25-hPa.

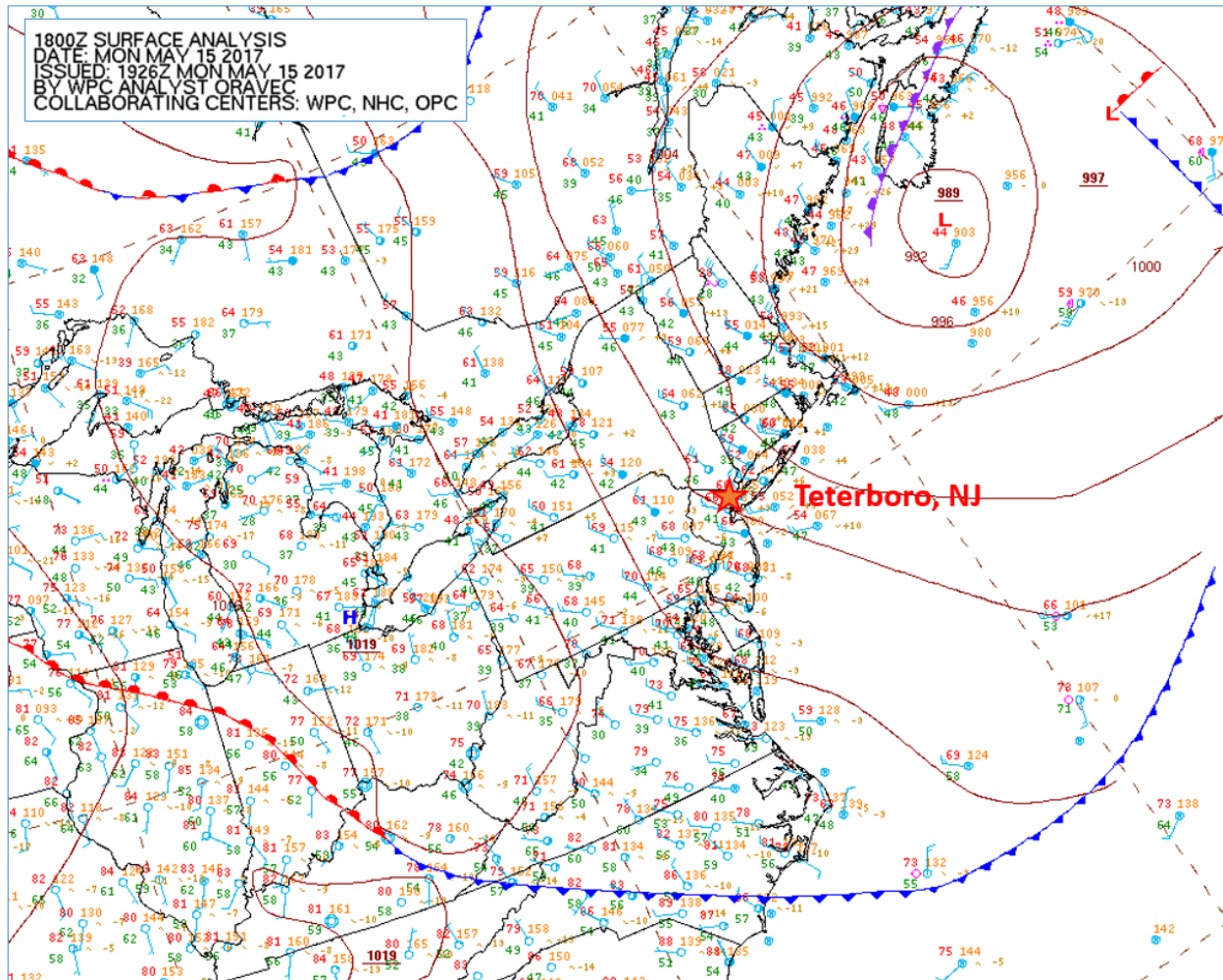


Figure 1 – Northeast section of the NWS Surface Analysis Chart for 1400 EDT

1.2 Radar Summary Chart

A review of the National radar mosaic indicated no significant weather echoes over the route of flight surrounding the period, therefore no significant icing, thunderstorms, or microburst type wind shear conditions existed during the period over the route of flight. The northeast section of the mosaic is included as figure 2.

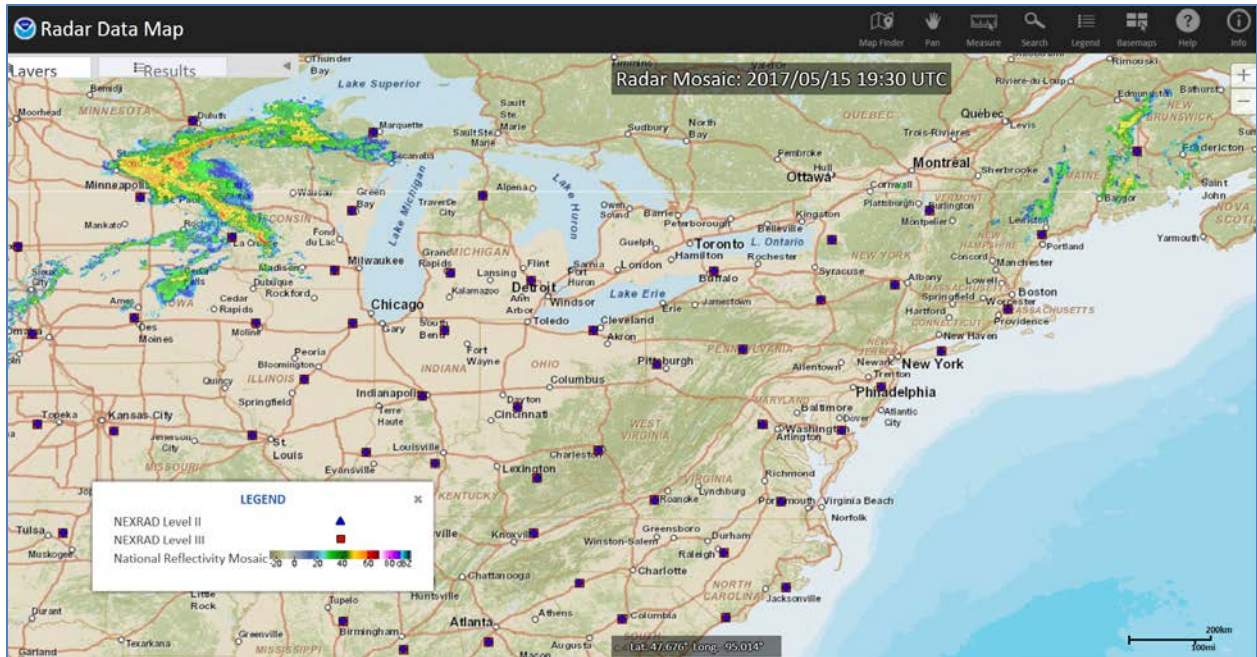


Figure 2 - National Radar Mosaic for 1530 EDT

1.3 Constant Pressure Charts

The NWS Storm Prediction Center (SPC) upper air charts for 850-, 700-, 500-, and 300-hPa for 0800 EDT (1200Z) on May 15, 2017 are included as figures 3 through 6 depicting the vertical structure of the atmosphere on the morning of the accident. The 850-hPa chart depicted the conditions at about 5,000 ft, the 700-hPa chart the conditions at 10,000 ft, 500-hPa at 18,000 ft or the mean atmosphere, and the 300-hPa chart for 30,000 ft and depicting the general location of the jet stream. All of the charts depicted a vertically stacked low pressure system off of Nova Scotia associated with the occluded frontal system with a relatively strong pressure or height gradient over the northeastern United States, with northwest to northerly winds over the region. A defined 100 knot jet stream was depicted moving southeastward across western New York, Pennsylvania, southern New Jersey, through eastern Maryland and Delaware during the period.

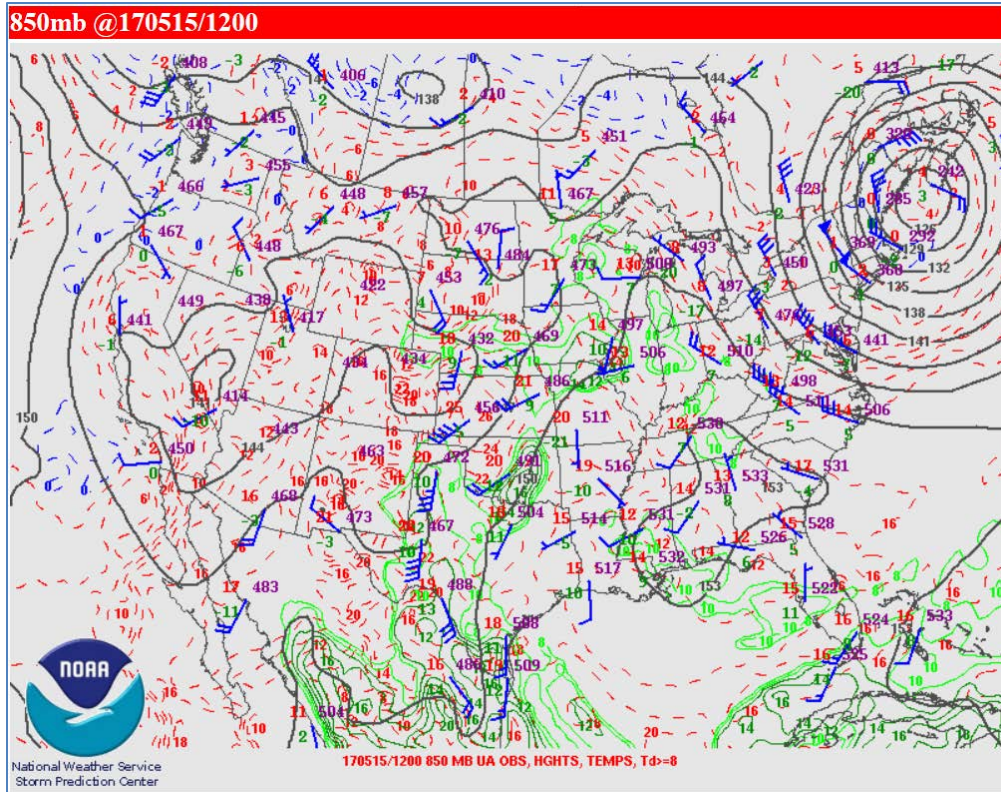


Figure 3 - NWS 850-hPa constant pressure chart for 0800 EDT

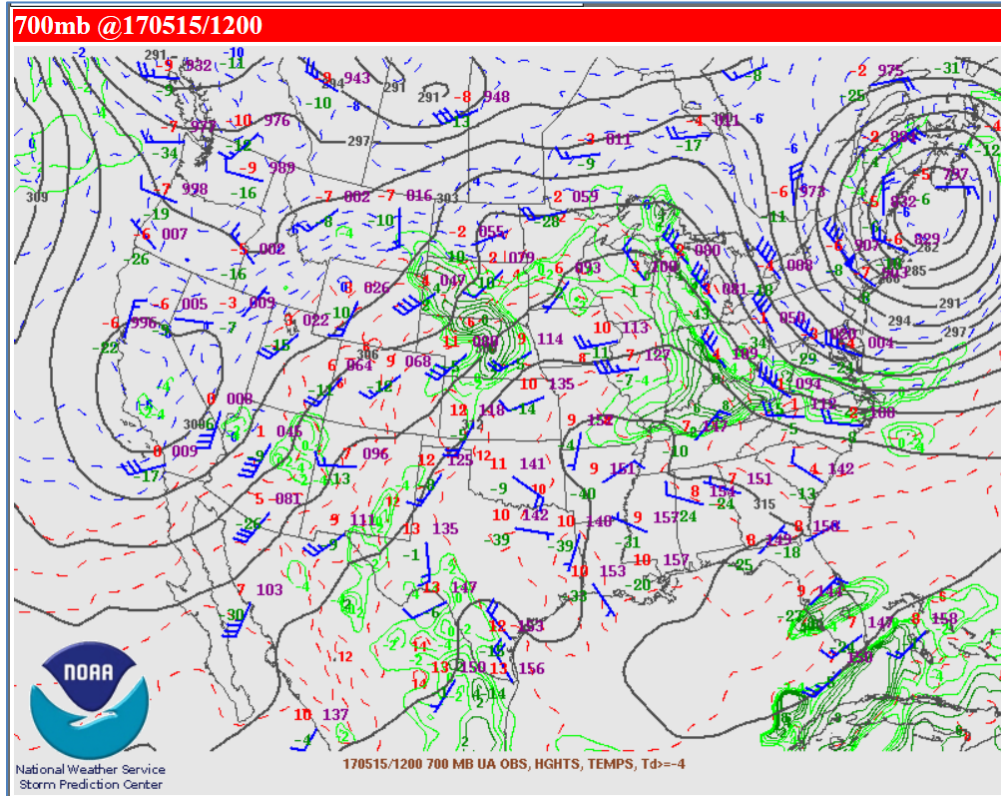


Figure 4 - NWS 700-hPa constant pressure chart for 0800 EDT

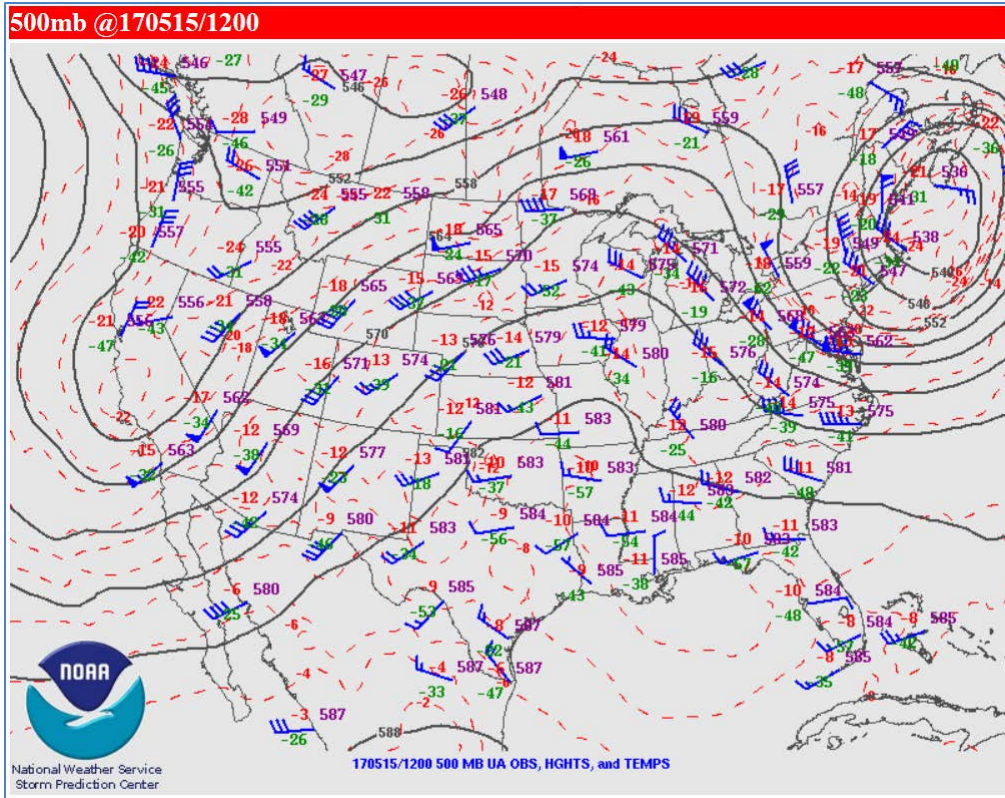


Figure 5 - 500-hPa constant pressure chart for 0800 EDT

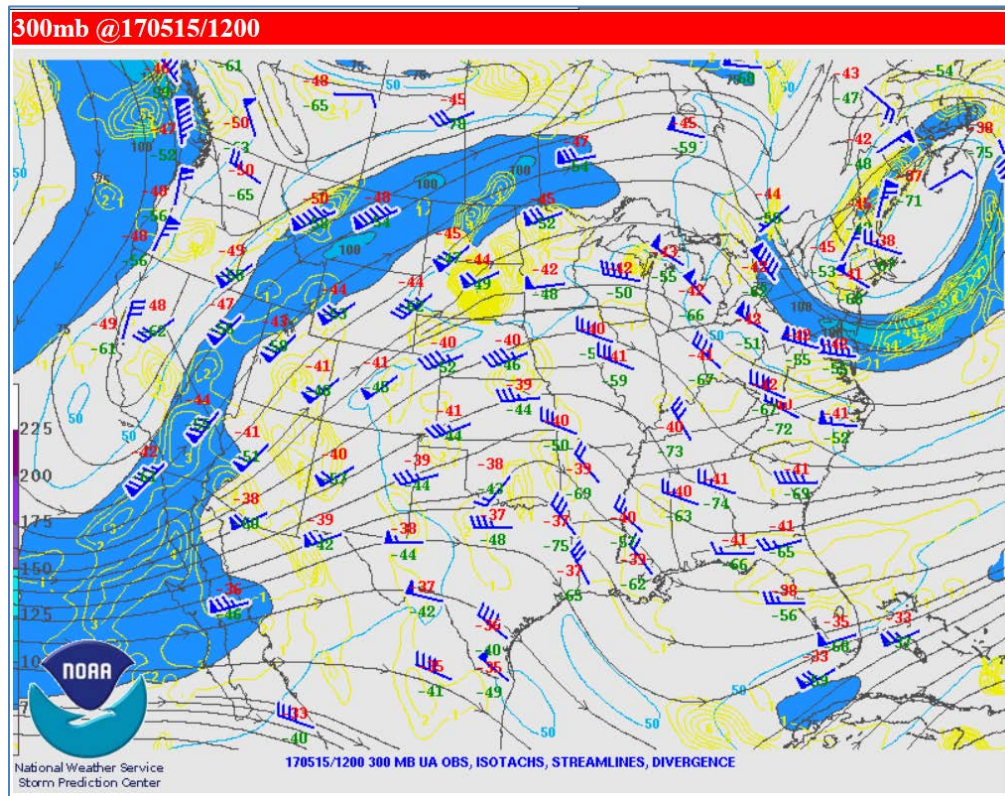


Figure 6 - 300-hPa constant pressure chart for 0800 EDT

ground level (agl) in this section. The local sectional chart for the area depicted the isogonic line or magnetic variation of 12° West over the region.

2.1 Destination – Teterboro Airport

The accident airplane was on approach to runway 1 at Teterboro Airport (KTEB), Teterboro, New Jersey, at an elevation of 8 ft. The airport had an Automated Surface Observation System (ASOS) and was augmented by air traffic control personnel. The observations reported surrounding the time of the accident were as follows:

KTEB routine weather observation at 1452 EDT, wind from 350° at 20 knots gusting to 30 knots, visibility 10 miles or more, scattered clouds at 4,500 ft, temperature 19° Celsius (C), dew point 6° C, altimeter 29.75 inches of mercury (Hg).

KTEB special weather observation at 1545 EDT, wind from 320° at 15 knots gusting to 32 knots, visibility 10 miles or more, scattered clouds at 4,500 ft, temperature 19° C, dew point 4° C, altimeter 29.75 inches of Hg. Remarks; smoke on approach.

A review of the daily weather log for KTEB indicated visual flight rule (VFR) conditions² prevailed with broken to scattered cloud cover over the area with no reported restrictions to visibility during the period and no precipitation reported on May 15th. The station reported a low temperature of 11° C (52° F), and a high temperature of 19° C (66° F), with a relative humidity of 50%. The raw observations were as follows:

METAR KTEB 151652Z 33016G33KT 10SM SCT050 16/06 A2975

METAR KTEB 151752Z 33013G34KT 10SM BKN045 18/06 A2976

METAR KTEB 151852Z 35020G30KT 10SM SCT045 19/06 A2975

Accident 1929Z

SPECI KTEB 151945Z 32015G32KT 10SM SCT045 19/04 A2975 RMK SMOKE ON APCH

A review of the observations indicated that there were no remark section added to the transmitted observations to supplement the primary conditions until after the accident, when at 1545 EDT (1945Z) smoke on approach was reported.

The 5-Minute ASOS observations surrounding the accident were also obtained for the period immediately surrounding the accident. The following are the KTEB 5-minute observations from 1350 through 1450 EDT:

*5-MIN KTEB 151850Z AUTO 34018G29KT 10SM -RA SCT055 18/06 A2974 180 44 600 350/18G29
RMK AO2 PK WND 33030/1812 SLP071 P0000 T01830061 TSNO \$*

² VFR conditions – are defined as no ceiling or layer of clouds as identified as broken or overcast, or the vertical visibility into a surface based obscuration greater than 3,000 ft and visibility greater than 5 statute miles. Marginal VFR conditions is a sub group and is defined as a ceiling between 1,000 to 3,000 ft, and/or visibility between 3 to 5 miles.

5-MIN KTEB 151855Z AUTO 32018G28KT 10SM -RA SCT055 18/07 A2974 180 46 600 330/18G28
RMK AO2 PK WND 30028/1855 P0000 T01830067 TSNO \$

5-MIN KTEB 151900Z AUTO 32022G31KT 10SM -RA BKN055 18/06 A2974 180 44 700 340/22G31
RMK AO2 PK WND 31031/1859 P0000 T01830061 TSNO \$

5-MIN KTEB 151905Z AUTO 35016G31KT 10SM -RA SCT055 18/06 A2974 180 44 700 360/16G31
RMK AO2 PK WND 31031/1859 P0000 T01830061 TSNO \$

5-MIN KTEB 151910Z AUTO 32017G28KT 10SM -RA FEW055 19/07 A2974 180 44 700 340/17G28
RMK AO2 PK WND 31031/1859 P0000 T01890067 TSNO \$

5-MIN KTEB 151915Z AUTO 32019G32KT 10SM -RA FEW055 19/06 A2974 180 43 700 330/19G32
RMK AO2 PK WND 33032/1912 P0000 T01890061 TSNO \$

5-MIN KTEB 151920Z AUTO 33020G32KT 10SM -RA SCT055 19/06 A2974 180 43 700 350/20G32
RMK AO2 PK WND 33032/1912 P0000 T01890061 TSNO \$

5-MIN KTEB 151925Z AUTO 34019G29KT 10SM -RA SCT055 19/06 A2974 180 43 700 350/19G29
RMK AO2 PK WND 33032/1912 P0000 T01890061 TSNO \$

Accident 1929Z

5-MIN KTEB 151930Z AUTO 33016G28KT 10SM -RA SCT055 19/06 A2974 180 43 700 350/16G28
RMK AO2 PK WND 33032/1912 P0000 T01890061 TSNO \$

5-MIN KTEB 151935Z AUTO 34014G28KT 10SM -RA FEW055 19/06 A2974 180 43 700 350/14G28
RMK AO2 PK WND 33032/1912 P0000 T01890061 TSNO \$

5-MIN KTEB 151940Z AUTO 32018G25KT 10SM -RA SCT060 19/07 A2974 180 43 800 330/18G25
RMK AO2 PK WND 33032/1912 P0000 T01940067 TSNO \$

The 5-minute observations from the ASOS differed from the transmitted METAR observations. The 5-minute ASOS observations indicated that the maintenance indicator was also on and required service of the system was needed. A further reviewed noted that the 5-minute data was reporting an erroneous report from the precipitation discriminator of light rain occurring during the period. This error resulted in the Automated Terminal Information Service (ATIS) broadcast "Zulu" report of light rain, which was not occurring and also impacted the supplementary data being transmitted in the remarks section.

The 5-minute observation current at the time of the 1452 EDT METAR and being broadcasted as ATIS "Zulu" and at the time of the accident were as follows:

KTEB 1450 EDT automated observation, wind from 340° true at 18 knots gusting to 29 knots, visibility 10 miles or more, light rain, scattered clouds at 5,500 ft, temperature 18° C, dew point 6° C, altimeter 29.74 inches of Hg, pressure altitude 180 ft, relative humidity 44%, density altitude 600 ft, wind 350° magnetic at 16 knots gusting to 28 knots. Remarks; automated observation system with a precipitation discriminator, peak wind from 330° true at 30 knots occurred at 1412 EDT, sea level pressure 1007.1-hPa, hourly precipitation a trace (less than 0.01 inch), temperature 18.3° C, dew point 6.1° C, thunderstorm sensor not operating, maintenance required on system.

KTEB 1530 EDT automated observation, wind from 330° true at 16 knots gusting to 28 knots, visibility 10 miles or more, light rain, scattered clouds at 5,500 ft, temperature 19° C, dew point 6° C, altimeter 29.74 inches of Hg, pressure altitude 180 ft, relative humidity 43%, density altitude 700 ft, wind 350° magnetic at 16 knots gusting to 28 knots. Remarks; automated observation system with a precipitation discriminator, peak wind from 330° true at 32 knots occurred at 1512 EDT, hourly precipitation a trace (less than 0.01 inch), temperature 18.9° C, dew point 6.1° C, thunderstorm sensor not operating, maintenance required on system.

The problem with the ASOS system was reported to the NWS on May 13, 2017 at 0749 EDT and a ticket for the maintenance technician was generated. The technician found a problem with Operator Interface Device (OID) which locked in the report of precipitation, once a new card was installed after the accident on May 15, 2017 at 1934 EDT, the erroneous report of light rain was removed, and the remarks section in the reports was restored.

The 1-minute ASOS wind data was obtained from the NWS surrounding the period and is included below in table format. The 1-minute observations include the average 2-minute wind, which is updated every 5-seconds and reported every minute. The second value is maximum 5-second wind reported during the minute, which is used to report gust values and peak wind. The wind data from 20-minutes prior to 10-minutes after the accident is presented below:

Time (EDT)	2-min Wind	Max 5-sec Wind
1509	319° 17	309° 21
1510	322° 17	319° 27
1511	326° 19	319° 27
1512	328° 21	329° 32 MAX
1513	319° 21	312° 26
1514	314° 19	320° 23
1515	320° 19	322° 29
1516	319° 20	313° 25
1517	322° 20	329° 27
1518	326° 20	346° 23
1519	330° 20	328° 29
1520	332° 20	326° 25
1521	329° 20	325° 28
1522	330° 17	343° 20
1523	328° 16	326° 23
1524	330° 18	312° 28
1525	336° 19	359° 25
1526	330° 21	325° 28
1527	330° 20	337° 27
1528	334° 17	324° 21
1529	333° 16	329° 18
1530	334° 16	316° 24
1531	330° 15	320° 23
1532	326° 14	304° 19
1533	332° 14	346° 18
1534	341° 15	349° 19
1535	337° 14	328° 19
1536	322° 14	306° 21
1537	313° 16	302° 22
1538	310° 18	307° 25
1539	312° 18	313° 21

2.2 Departure - Philadelphia International Airport

The accident airplane departed from Philadelphia International Airport (KPHL), Philadelphia, PA about 80 miles southwest of KTEB at 1504 EDT. The airport listed an elevation of 36 ft and also had an ASOS installed. The following conditions were reported at the time of departure:

KPHL routine weather observation at 1454 EDT, wind from 310° at 17 knots gusting to 28 knots, visibility 10 miles or more, a few clouds at 6,000 ft, few clouds at 25,000 ft, temperature 21° C, dew point 4° C, altimeter 29.82 inches of Hg. Remarks: automated observation system with a precipitation discriminator, peak wind from 320° at 30 knots at 1410 EDT, sea level pressure 1009.6-hPa, temperature 17.0° C, dew point 4.4° C.

The raw observations in standard code were as follows:

*METAR KPHL 151654Z 32015KT 10SM FEW060 FEW250 19/05 A2983 RMK AO2 PK WND 32027/1626
SLP099 T01940050*

*METAR KPHL 151754Z 32019G25KT 10SM FEW060 FEW250 21/04 A2982 RMK AO2 PK WND 33029/1714
SLP097 T02060044 10206 20133 58007*

*METAR KPHL 151854Z 31017G28KT 10SM FEW060 FEW250 22/04 A2982 RMK AO2 PK WND 32030/1810
SLP096 T02170044*

2.3 Surrounding Stations

The surrounding airports were also documented immediately surrounding the time of the accident. The raw observations were as follows:

LaGuardia Airport (KLGA), New York, NY was located 9 miles southeast at an elevation of 21 ft. The airport had an ASOS and was augmented by NWS certified observers and reported the following conditions:

*METAR KLGA 151851Z 32022G30KT 10SM SCT055 19/06 A2973 RMK AO2 PK WND 32033/1836 SLP066
T01940061*

*METAR KLGA 151951Z 32022G31KT 10SM SCT060 BKN250 20/06 A2973 RMK AO2 PK WND 32031/1941
SLP067 T02000056*

*METAR KLGA 152051Z 32017G31KT 10SM SCT060 SCT250 21/05 A2973 RMK AO2 PK WND 31038/2005
SLP069 T02060050 53001*

The maximum wind gust of 38 knots from the northwest occurred at 1505 EDT.

Essex County Airport (KCDW) was located 10 miles west in Caldwell, NJ at an elevation of 172 ft. The airport had an ASOS and reported the following conditions:

METAR KCDW 151853Z 33014G25KT 10SM SCT055 20/06 A2977 RMK AO2 SLP086 T02000056

*METAR KCDW 151953Z AUTO 34009G24KT 300V040 10SM FEW060 21/06 A2977 RMK AO2 PK WND
32027/1929 SLP084 T02110056*

*METAR KCDW 152053Z 31018G24KT 10SM SCT050 22/05 A2977 RMK AO2 PK WND 31034/2001 SLP085
T02170050 50000*

Newark Liberty International Airport (KEWR) located about 11 miles southwest in Newark, NJ at an elevation of 17 ft. The airport had an ASOS and reported the following conditions:

*METAR KEWR 151851Z 31019G32KT 10SM SCT055 SCT150 BKN250 20/05 A2975 RMK AO2 PK WND
32032/1842 SLP074 T02000050*

*METAR KEWR 151951Z 32018G27KT 10SM FEW055 SCT250 21/05 A2975 RMK AO2 PK WND 33032/1923
SLP073 T02110050*

*METAR KEWR 152051Z 32026G33KT 10SM FEW055 SCT250 22/04 A2975 RMK AO2 PK WND 33033/2050
SLP074 T02170044 51001*

Morristown Municipal Airport (KMMU), was located 19 miles west of KTEB in Morristown, NJ at an elevation of 187 ft, the airport had an Automated Weather Observation System (AWOS) and reported the following conditions:

KMMU 151845Z 35011G25KT 10SM SCT050 20/06 A2977

KMMU 151945Z 33015G26KT 10SM SCT050 19/05 A2977

KMMU 152045Z 33015G26KT 10SM SCT050 20/05 A2978

KMMU 152145Z 34012G26KT 10SM SCT060 20/05 A2980

John F. Kennedy International Airport (KJFK), New York, NY was located 19 miles south-southeast of KTEB at an elevation of 13 ft, the airport had an ASOS and reported the following conditions:

*METAR KJFK 151851Z 30022G33KT 10SM SCT055 BKN250 20/07 A2973 RMK AO2 PK WND 31037/1816
SLP067 T02000067*

*METAR KJFK 151951Z 32021G29KT 10SM SCT060 BKN250 20/06 A2974 RMK AO2 PK WND 31033/1919
SLP071 T02000061*

*METAR KJFK 152051Z 33025G34KT 10SM SCT060 SCT250 21/06 A2975 RMK AO2 PK WND 30035/2010
SLP073 T02060056 53007*

A review of the surrounding stations indicated winds from the west-northwest to the north with gusts from 27 to 38 knots surrounding the period, with visibility unrestricted, and cloud bases above 5,000 ft agl.

2.4 Observation Reporting Requirements

The NWS Federal Meteorological Handbook number 1, *Surface Weather Observation and Reports* (FMH-1) is the basic reference manual for the observing, reporting, and coding standards for the surface based meteorological observations. The standards are applicable to all Federal agency programs. The manual defines the types of reports, such as the aviation routine weather observation (METAR), special weather report (SPECI), and the criteria for the issuance of a special report. The manual also defined the normal elements of the observation containing the wind, visibility, runway visual range, present weather, sky condition, temperature, dew point, and altimeter setting collectively referred to as “the body of the report”. In addition, coded and/or plain language information which elaborates on data in the body of the report may also be appended to the observation in the “remarks section”. This information will vary depending on the type of weather station. Peak winds are typically added to the remarks when the 5-second wind average wind speeds exceed 25 knots.

The FMH number 8 is the *Aviation Weather Observations for Supplementary Aviation Weather Reporting Stations (SAWRS)*, which is intended to complement the instructions in FMH-1. One of the differences with SAWRS stations is with reporting of remarks, where several remarks, such as peak wind, beginning and ending of precipitation and thunderstorms, pressure rising and falling rapidly, sea-level pressure, and snow increasing rapidly remarks, are excluded. Thus, at SAWRS stations peak winds are not included in the remarks, and were reflected in the lack of remarks or specifically peak wind information at KMMU during the period.

2.5 Weather Display of METARs

A depiction of the METAR observations as posted by the NWS Aviation Weather Center (AWC) website at 1400 and 1500 EDT on May 15, 2017 are included as figure 8 and 9 respectively. A station model decode is located on the top of the 1400 EDT chart for reference. The depictions of the METARs during the period indicated VFR conditions prevailed with northwest to north-northwest winds at 10 to 20 knots sustained with gusts to 35 knots, with scattered to broken clouds over the region, with temperatures in the ranging from 66° to 70° F over the region.

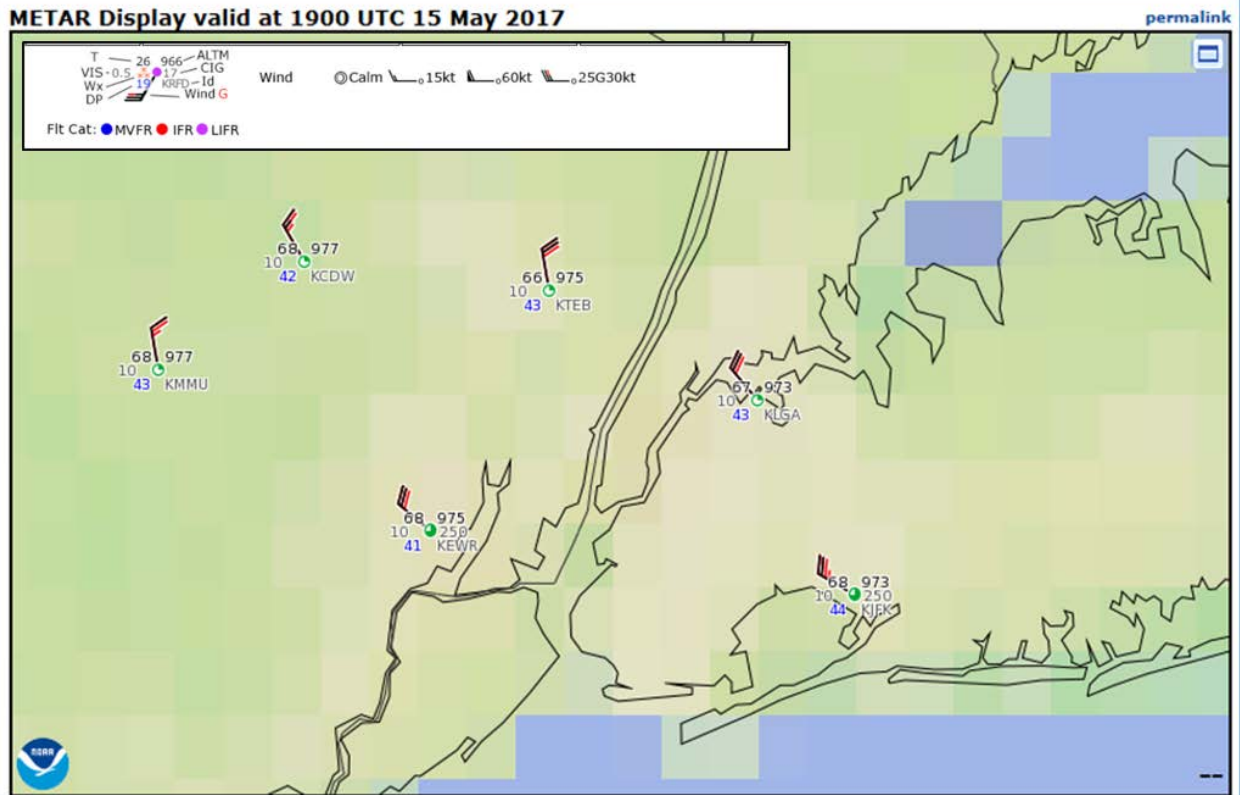


Figure 8 - METAR display at 1400 EDT

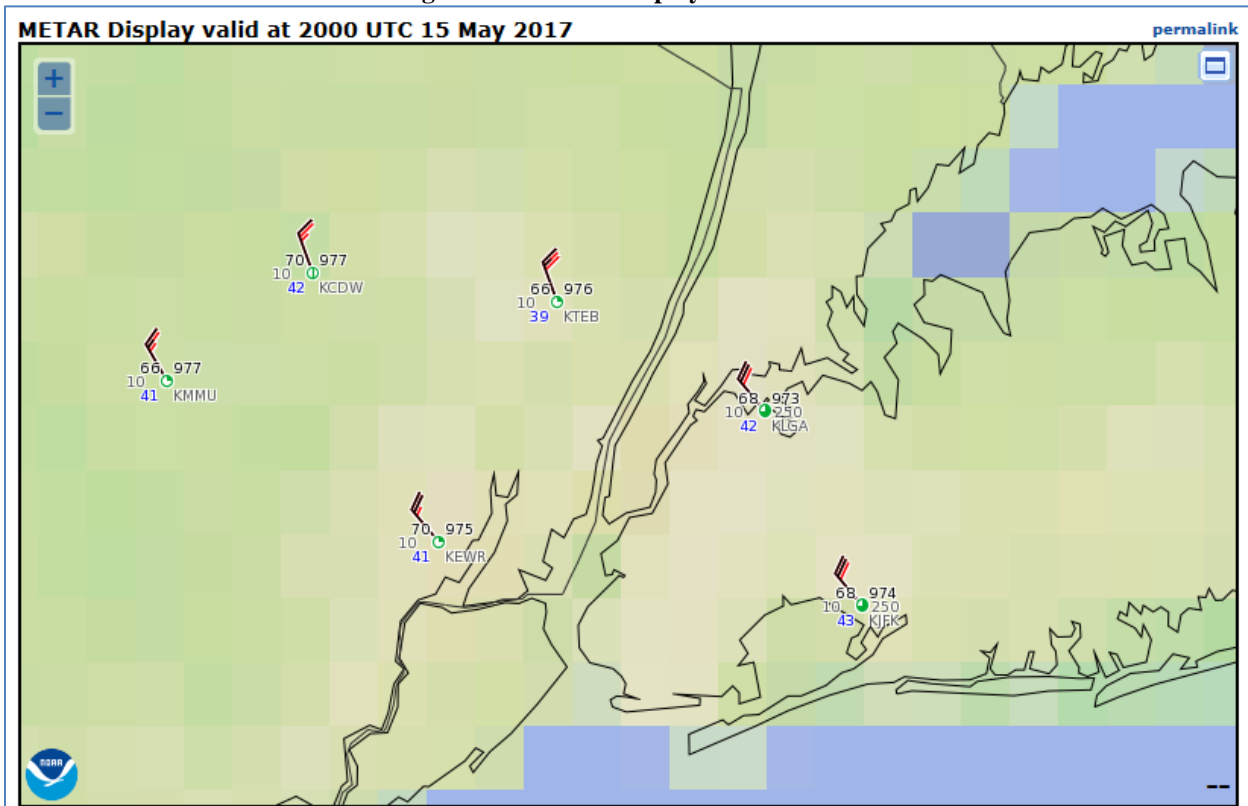


Figure 9 - METAR display at 1600 EDT

3.0 Sounding

The vertical structure of the atmosphere was documented by a high-resolution numerical model for the accident site location, and by two instrumented aircraft reports about the time and after the accident. The estimated cloud heights and other significant levels have been rounded to the nearest 10 or 100 ft as appropriate.

3.1 Numerical Model Sounding

A High Resolution Rapid Refresh (HRRR) numerical model data was obtained from the NOAA Air Resource Laboratory database for the location of the accident at 1500 EDT and is was plotted on a standard Skew-T log P diagram³ from the surface to 500-hPa or 18,000 ft utilizing RAOB software⁴ and is included as figure 10. The accident site elevation was estimated at 10 ft by the model with a surface temperature of 18.5° C (65° F), a dew point of 7.0° C (45° F), a relative humidity of 48%, surface wind from 320° at 11 knots, and a density altitude of 734 ft. The lifted condensation level (LCL)⁵ and the level of free convection (LFC)⁶ were at 4,500 ft agl, and the convective condensation level (CCL)⁷ at 4,770 ft agl. The precipitable water content was 0.87 inches with the sounding supported two cloud layers; the first between the LCL and LFC or from 4,500 ft agl with tops to 5,400 ft of cumulus type clouds, and the second layer with bases near 9,000 and estimated tops near 10,770 ft, where the layer had a relative humidity greater than 80% and supported scattered stratus type clouds. The freezing level was identified at 7,260 ft. The atmosphere below 5,000 ft was unstable to conditionally unstable, with conditions above 5,000 ft classified as stable with a Lifted Index of 7.0.

³ Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram 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.

⁴ RAOB software – The complete Rawinsonde Observation program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

⁵ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

⁶ Level of Free Convection (LFC) -The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

⁷ Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation starts. This is typically used to identify the base of cumuliform clouds, which are normally produced from surface heating and thermal convection.

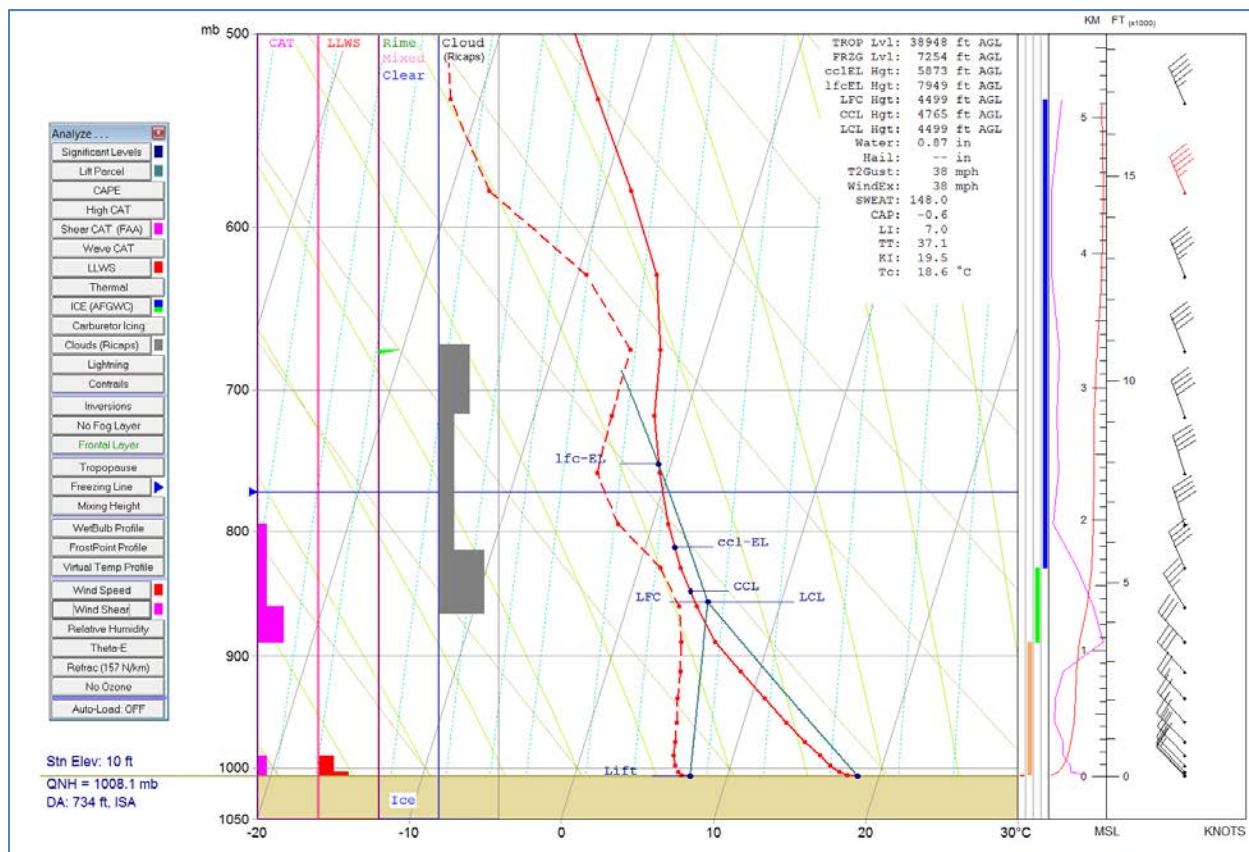


Figure 10 - HRRR numerical model over accident site for 1500 EDT

The model sounding wind profile indicated winds from the northwest veering to the north-northwest with height, with the mean 0 to 6 kilometers or 18,000 ft wind from 340° at 39 knots. The sounding also indicated a moderate and greater potential for low-level wind shear below 100 ft, and 97% probability of moderate turbulence between 3,500 and 4,500 ft with a vertical shear of 7.1 knots per 1,000 ft.

The following table is the derived height, pressure (mb⁸), temperature (T), dew point (Td), relative humidity (RH), wind direction and speed, clear air turbulence (CAT), low-level wind shear (LLWS), and icing potential from the surface to about 12,600 ft.

⁸ Mb – millibars is the older reference to sea level pressure and is interchangeable with hPa.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD/FF (deg/kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
10	1008	18.6	7.6	49	318/11			
38	1007	17.9	7.0	49	318/11	LGT	MODRT	
122	1004	17.3	6.7	50	318/16	LGT	LIGHT	
290	998	16.6	6.4	51	318/19	LGT	LIGHT	
543	989	15.7	6.1	53	319/22			
911	976	14.4	5.9	57	318/24			
1426	958	12.8	5.6	62	319/26			
2035	937	10.9	5.2	68	319/27			
2743	913	8.8	4.8	76	320/28			
3495	888	6.5	4.3	86	321/30	MDT		
4387	859	4.6	3.4	92	330/35	LGT		
5368	828	2.7	1.4	91	338/38	LGT		
6479	794	1.0	-2.3	79	344/39			
7735	757	-0.6	-4.7	74	344/40			
9156	717	-2.1	-4.9	81	341/40			
10768	674	-3.0	-5.0	86	340/42			TRC Rime
12601	628	-4.8	-9.4	70	340/45			

3.2 Aircraft In-Situ Reports

Several Aircraft Meteorological Data Relay (AMDAR) observations were documented from special instrumented aircraft that departed from KEWR at 1530 EDT and from KLGa at 1537 EDT. The aircraft that departed from KEWR was identified as aircraft #11792 and is included as figure 11. The aircraft that departed from KLGa was identified as aircraft #10862 and is included as figure 12.

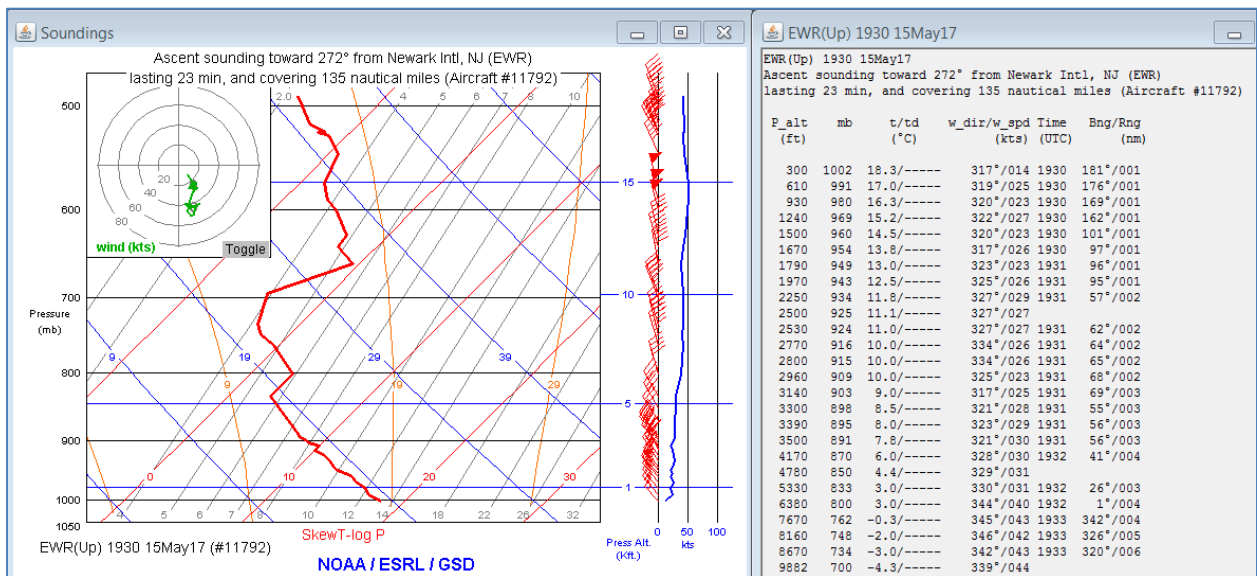


Figure 11 - AMDAR flight departure from KEWR at 1530 EDT

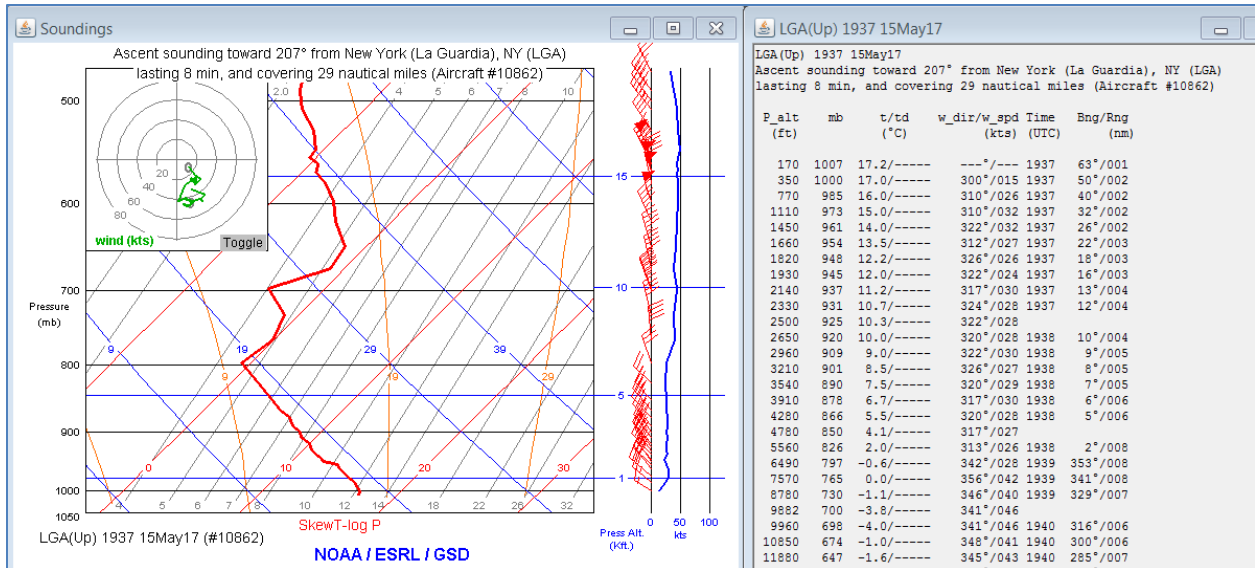


Figure 12 - AMDAR flight departure from KLGa at 1537 EDT

Both aircraft soundings depicted stronger northwest wind speeds near 32 knots immediately above the surface with defined temperature inversions above 5,000 ft through 12,000 ft. Both aircraft soundings depicted erratic plots below 3,000 ft, and depicted vertical wind shears and turbulence. The wind profiles showed northwest winds veering to the north through 10,000 ft and then back to the north-northwest with speeds of 50 knots at 15,000 ft, also again stronger than the model sounding.

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 13 (GOES-13) data was obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the 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.

Figure 13 is the GOES-13 infrared image at 4X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops typically associated with deep convection and high cirriform clouds. The image depicted scattered low cumulus clouds over the region, with no clouds directly overhead the accident site at the time.

Figure 14 is the GOES-13 visible image at 4X magnification, further depicting scattered fair weather cumulus type clouds over the area. While some transverse cloud band⁹ features were noted to the northwest, no significant cloud activity was identified over the accident site.

⁹ Transverse banding – Bands of clouds oriented perpendicular to the wind flow in which they are embedded. They are often best seen on satellite imagery. At low altitude they typically indicate the presence of a temperature inversion as well as directional shear in the low- to mid-level winds. At high altitudes, they often indicate strong vertical wind

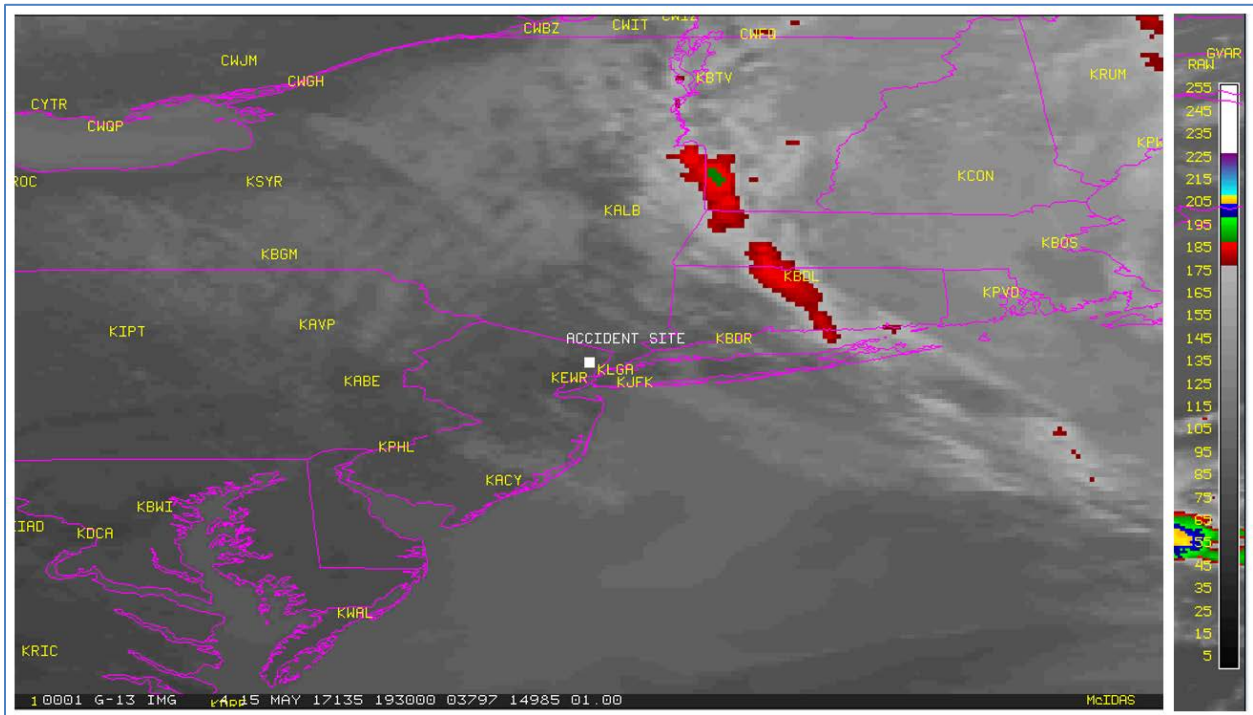


Figure 13 - GOES-13 infrared image for 1530 EDT

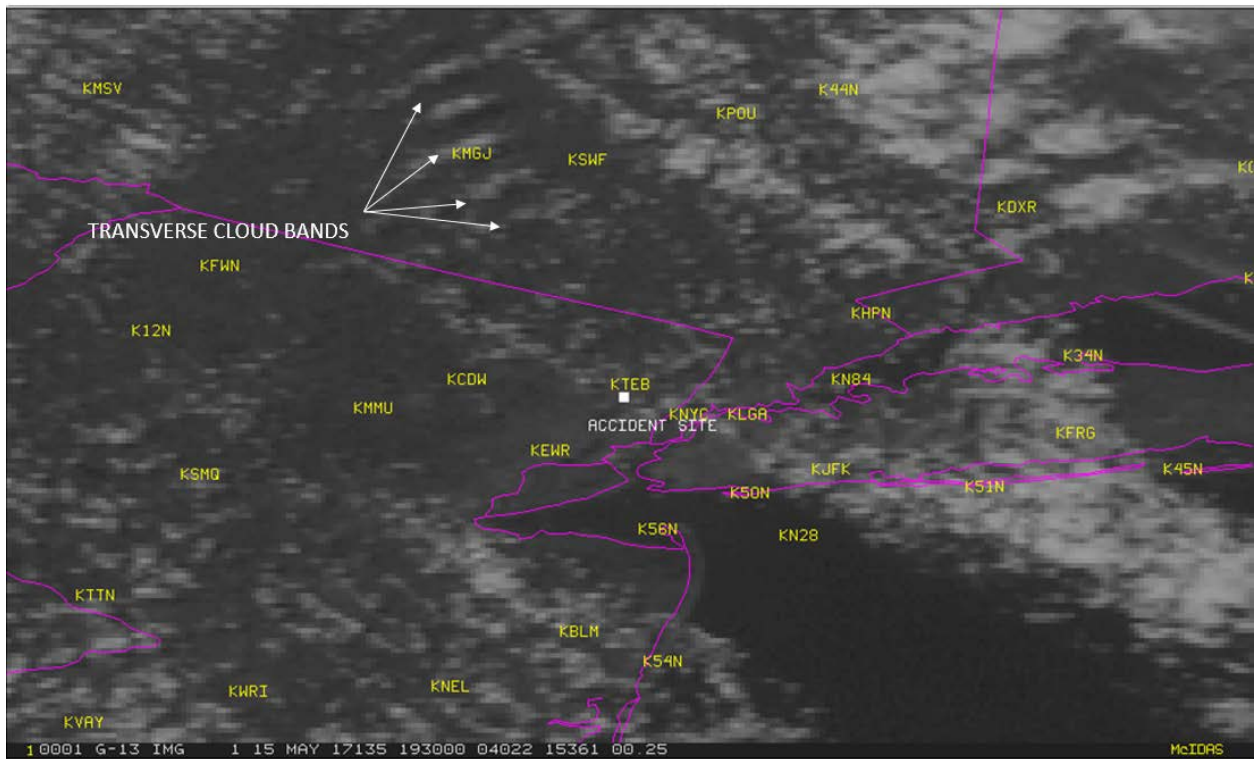


Figure 14 - GOES-13 visible image at 1530 EDT

shear and turbulent flow.

5.0 Pilot Reports

There were pilot reports (PIREPs) recorded over the region on the day of the accident. Prior to noon time on May 15, 2017 there were at least 10 pilot reports over the area reported LLWS with loss or gains of 10 to 20 knots of airspeed, and several reports of moderate to severe low-level turbulence from corporate and air carrier jet aircraft below 2,000 ft. One of the reports was an urgent pilot report over Teterboro recorded at 0948 EDT. An urgent pilot report (UUA) is classified as any report of tornadoes, funnel clouds, or waterspouts, severe or extreme turbulence, severe icing, hail, and any report of LLWS with airspeed fluctuations greater than 10 knots. According to Advisory Circular AC 00 – 54 “Pilot Windshear Guide”, wind shear is defined as any rapid change in wind direction or velocity, and severe wind shear is defined as a rapid change in wind direction or velocity causing airspeed changes greater than 15 knots or vertical speed changes greater than 500 ft per minute.

The following pilot reports or PIREPs were recorded within 100 miles of Teterboro surrounding the period from 1200 through 2000 EDT on May 15, 2017. The reports are provided in plain language taken from standard code and abbreviations, with time converted from UTC to EDT. Only the reports below 18,000 ft are included in the summary below. The reports were as follows:

Newark Liberty International Airport (EWR) routine pilot report (UA); Over – 10 miles north of TEB; Time – 1203 EDT; Altitude – 3,000 ft; Type aircraft – Bombardier Challenger 350 business jet (CL35); Turbulence – moderate.

Long Island Mac Arthur Airport (ISP), New York, NY routine pilot report; Over – on approach to runway 33L; Time – 1215 EDT; Altitude – 600 ft; Type aircraft – Boeing 737 air carrier jet; Turbulence – light turbulence with gain of 10 knots of airspeed.

John F. Kennedy International Airport (JFK) routine pilot report; Over – 5 miles southwest of JFK; Altitude – during climb out; Time – 1216 EDT; Type aircraft – Boeing 757 air carrier jet; Turbulence – moderate chop through 4,500 ft.

Philadelphia International Airport (PHL) routine pilot report; Over – 20 miles north of Yardley VORTAC¹⁰ (ARD); Time – 1233 EDT; Altitude – 4,000 ft; Type aircraft – Gulfstream 4 corporate jet; Temperature – 4° C; Wind - 310° at 25 knots; Turbulence – moderate turbulence at 4,000 ft.

Lehigh Valley International Airport (ABE), Allentown, PA routine pilot report; Over – 5 miles east of Stillwater VORTAC (STW), NJ; Time – 1235 EDT; Altitude – 5,000 ft; Type aircraft – Gulfstream 4 corporate jet; Sky condition – instrument meteorological conditions (IMC); Turbulence – moderate turbulence at 4,000 ft.

Bradley International Airport (BDL), Windsor Locks, CT routine pilot report; Over – on approach to runway 29; Time – 1254 EDT; Altitude – 500 ft; Type aircraft – Bombardier Global Express long range business jet; Turbulence – light with occasional moderate turbulence with a loss of 5 knots on final approach.

Lehigh Valley International Airport (ABE), Allentown, PA routine pilot report; Over – 10 miles northwest of ABE; Time – 1250 EDT; Altitude – 7,000 ft; Type aircraft – Beechcraft Baron multiengine airplane; Sky cover – visual meteorological conditions (VMC); Temperature – 6° C; Turbulence – smooth; Icing – negative.

Aeroflex-Andover Airport (12N), Andover, NJ routine pilot report; Over – 8 miles south of Stillwater VORTAC; Time – 1315 EDT; Altitude – 6,500 ft; Type aircraft – Piper Archer single engine airplane; Sky cover – scattered

¹⁰ VORTAC is a navigation aid consisting of a co-located VHF omnidirectional range (VOR) beacon and a distance measuring equipment (DME), which provides azimuth and range information. Unless otherwise noted the station name is collocated with the city.

clouds at 5,000 ft with tops at 5,500 ft; Temperature – minus 5° C; Turbulence – moderate turbulence below 5,000 ft, smooth above 5,000 ft.

Westchester County Airport (HPN), White Plains, NY routine pilot report; Over – KHPN; Time – 1316 EDT; Altitude – 800 ft; Type aircraft – Embraer Regional Jet (E190); Turbulence – light turbulence with +/- 15 knots of airspeed at and below 300 ft agl.

Hudson Valley Regional Airport (POU), Poughkeepsie, NY routine pilot report; Over – on final approach; Time – 1340 EDT; Altitude – 1,000 ft; Type aircraft – Piper Saratoga single engine airplane (PA32); Turbulence - +/- 10 knot airspeed on final.

Millville Municipal Airport (MIV), Millville, NJ routine pilot report; Over – KMIV; Time – 1350 EDT; Altitude – 500 ft; Type aircraft – Sikorsky Blackhawk helicopter (H60); Wind – from 360° at 20 knots; Remarks – absurdly VMC during descent.

Morristown Municipal Airport (MMU), Morristown, NJ routine pilot report; Over – on final to runway 5; Time - 1413 EDT; Altitude – 1,200 ft; Type aircraft – Cessna Citation Excel business jet (C56X); Remarks – LLWS +/- 20 knots of airspeed on 2 mile final approach at 1,200 ft and +/- 10 knots on short final.

Hudson Valley Regional Airport (POU), Poughkeepsie, NY routine pilot report; Over – POU; Time – 1418 EDT; Altitude – 1,000 ft; Type aircraft – Piper Seneca multiengine airplane (PA34); Sky cover – bases of clouds at 4,000 ft; Turbulence – moderate turbulence departing runway 33.

Long Island Mac Arthur Airport (ISP) routine pilot report; Over – on final approach to runway 33L; Time – 1454 EDT; Altitude – 2,000 ft; Type aircraft – Boeing 737 air carrier jet; Wind - +/- 8 knots of airspeed on final from 2,000 ft and below.

Danbury Municipal Airport (DXR), Danbury, CT routine pilot report; Over – 12 miles north of DXR; Time – 1455 EDT; Altitude – 3,500 ft; Type aircraft – Cirrus single engine airplane (SR22); Sky cover – scattered clouds at 4,800 ft, broken at 5,000 ft; Turbulence – light to moderate turbulence.

JFK routine pilot report; Over – 5 miles southwest of JFK; Time – 1503 EDT; Altitude – during climb out; Type aircraft – Canadair Regional Jet (CRJ9); Sky cover – broken clouds; Turbulence – moderate turbulence between 6,000 to 8,000 ft; Remarks – base of clouds at 6,000 ft with tops at 7,500 ft.

LaGuardia Airport (LGA) urgent pilot report (UUA); Over – LGA; Time – 1513 EDT; Altitude – 700 ft; Type aircraft - Canadair Regional Jet (CRJ9); Remarks – LLWS loss of 20 knots of airspeed.

Accident 1529 EDT

Morristown Municipal Airport (MMU) routine pilot report; Over – MMU; Time -1540 EDT; Altitude – 200 ft; Type aircraft – Bombardier Challenger corporate business jet (CL30); Remarks – LLWS +/- 20 knots of airspeed on short final to runway 5.

Poughkeepsie (POU) routine pilot report; Over – 1 mile southeast of POU; Time – 1600 EDT; Altitude – 1,000 ft; Type aircraft – Sikorsky S-76 helicopter; Wind – 320° at 23 knots; Turbulence – light chop.

Morristown (MMU) routine pilot report; Over – MMU; Time - 1610 EDT; Altitude – 200 ft; Type aircraft – Gulfstream G-5 corporate business jet; Remarks – +/- 15 knots of airspeed on short final to runway 5.

Long Island Mac Arthur Airport (ISP) urgent pilot report (UUA); Over – runway 33L; Time – 1613 EDT; Altitude – 1,000 ft; Type aircraft – Cessna Stationair (C206) single engine airplane; Wind - +/- 15 knots of airspeed with light to moderate turbulence.

Newark Liberty International Airport (EWR) urgent pilot report (UUA); Over – on final to runway 4R; Time – 1615 EDT; Altitude – 100 ft; Type aircraft – Embraer (E145) regional jet; Sky cover – clear; Weather – visibility 10 miles, Wind – from 340° at 24 knots gusting to 38 knots; Remarks – LLWS +/- 10 knots of airspeed.

Newark (EWR) urgent pilot report (UUA); Over – on final to runway 4R; Time – 1625 EDT; Altitude – 400 ft; Type aircraft – Boeing 757 air carrier jet; Sky cover – clear; Weather – visibility 10 miles; Remarks – LLWS +/- 10 knots of airspeed.

Morristown (MMU) routine pilot report; Over – MMU; Time - 1627 EDT; Altitude – 900 ft; Type aircraft – British Aerospace Hawker corporate business jet (H25B); Remarks – +/- 20 knots of airspeed on final for runway 5.

Essex County Airport (CDW) routine pilot report; Over – 2 mile final for runway 4; Time – 1639 EDT; Altitude – 1,000 ft; Type aircraft – Cessna Citation business jet (C525); Turbulence – extreme turbulence; Remarks - +/- 20 knots of airspeed.

Poughkeepsie (POU) routine pilot report; Over – 2 mile west of POU; Time – 1653 EDT; Altitude – 1,000 ft; Type aircraft – Cessna Citation Ultra corporate business jet (C560); Turbulence – moderate turbulence above 500 ft agl and smooth below.

Morristown (MMU) routine pilot report; Over – on final for runway 5; Time - 1656 EDT; Altitude – 2,000 ft; Type aircraft – Learjet 45 corporate business jet (LJ45); Turbulence – moderate turbulence with +/- 10 knots of airspeed.

Newark (EWR) routine pilot report; Over – 2 miles south of Somerset Airport (SMQ). Somerville, NJ; Time – 1709 EDT; Altitude – 3,000 ft; Type aircraft – Raytheon Beechjet corporate business jet (BE40); Wind – from 331 at 33 knots; Turbulence – occasional moderate turbulence.

Republic Airport (FRG), Farmington, NY urgent pilot report (UUA); Over – FRG; Time – 1727 EDT; Altitude – 1,000 ft; Type aircraft – Gulfstream Galaxy (GALX) corporate business jet; Remarks – LLWS +/- 10 knots of airspeed below 1,000 ft during descent to runway 32.

Morristown (MMU) routine pilot report; Over – MMU; Time - 1738 EDT; Altitude – 500 ft; Type aircraft – Dassault Falcon 20 (FA20) corporate business jet; Turbulence – light to moderate turbulence with +/- 12 knots of airspeed on final.

Essex County Airport (CDW), Caldwell, NJ routine pilot report; Over – final approach to runway 4; Time – 1909 EDT; Altitude – 300 ft; Type aircraft – Cessna Skyhawk (C172) single engine airplane; Turbulence – moderate turbulence with +/- 10 to 15 knots airspeed on short final for runway 4.

Newark (EWR) urgent pilot report (UUA); Over – 1 mile northeast of EWR; Time – 1912 EDT; Altitude – 100 ft; Type aircraft – Boeing 717 air carrier jet; Remarks – wind shear loss of 10 knots at 100 ft.

LaGuardia Airport (LGA) urgent pilot report (UUA); Over – LGA; Time – 1948 EDT; Altitude – 400 ft; Type aircraft - Canadair Regional Jet (CRJ7); Remarks – LLWS gain and loss of airspeed between 200 and 400 ft.

The raw PIREPs are included in an attachment 2.

6.0 Area Forecast

The Area Forecast (FA) is a forecast of 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 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 forecast that was current at the time of the accident was issued at 1345 EDT and was follows:

FAUS41 KPCI 151745

FAIW

-BOSC FA 151745

SYNOPSIS AND VFR CLDS/WX

SYNOPSIS VALID UNTIL 161200

CLDS/WX VALID UNTIL 160600...OTLK VALID 160600-161200

ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS

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...18Z STNR FNT SERN MN-NWRN IL-SERN IND-SERN KY-N CNTRL NC.

CDFNT N CNTRL NC-SERN NC CONTG SEWD INTO INTL WTRS. TROF FM SERN ME NWD INTO INTL WTRS. STG LOW 180S YSJ. HIGHS NRN LH AND SERN TN. 12Z STNR FNT FM INTL WTRS OFF SC CST ACRS NERN SC-SWRN NC-ERN KY-SWRN OH CONG AS WRMFNT ACRS NERN IND-SRN LM CONTG WNWWD. HIGH SWRN VA.

ME NH

NWRN ME/NRN NH...OVC030 TOP FL200. 03Z BKN030 TOP 100. OTLK...MVFR CIG.

NERN ME...OVC030 TOP FL200. TIL 22Z WDLY SCT -SHRA. 03Z OVC020. OTLK...MVFR CIG.

SWRN ME/SERN NH...OVC020 LYRD FL200. WND NW G25KT. 00Z OVC040. OTLK...VFR.

SERN ME...OVC015 TOP FL200. ISOL -SHRA. 00Z OVC025. OTLK...MVFR CIG.

VT

BKN030 OVC050 TOP FL200. ISOL -SHRA. WND NW G25KT. BECMG 2200 BKN050 TOP 120. 05Z BKN030. OTLK...MVFR CIG.

MA RI CT

WRN-CNTRL MA/CT..BKN050 LYRD FL200. WND NW 20G35KT. 23Z SCT-BKN050 TOP 120.

WND NW G25KT. 02Z SKC OR SCT CI. OTLK...VFR.

ERN MA/RI...BKN025 OVC040 TOP FL200. TIL 21Z WDLY SCT -SHRA. WND NW G25KT.

00Z BKN040. 03Z SCT-BKN050 TOP 120. OTLK...VFR.

NY LO

WRN NY/LO...SCT050. 21Z SKC OR SCT CI. OTLK...VFR.

N CNTRL-NERN NY...OVC040 TOP 120. TIL 00Z WND NW G25KT. 21Z BKN050. 05Z BKN040. OTLK...MVFR CIG.

S CNTRL NY...BKN040 TOP 120. WND NW G25KT. 00Z SCT080. OTLK...VFR.

CSTL PLAIN...BKN050 LYRD FL200. WND NW 20G35KT. 22Z SCT060. WND NW G25KT.

01Z SKC. OTLK...VFR.

RMNDR SERN NY...BKN040 LYRD FL200. WND NW G25KT. 23Z SCT-BKN050 TOP 120. WND NW G25KT. 02Z SKC OR SCT CI. OTLK...VFR.

PA NJ

WRN-S CNTRL PA...SKC. OTLK...VFR.

N CNTRL PA...SCT060. 23Z SKC. OTLK...VFR.

NERN PA/NRN NJ...BKN050 TOP 120. WND NW 20G30KT. 22Z SCT060. WND

NW G25KT. 01Z SKC. OTLK...VFR.

SERN PA/SRN NJ...SCT050. WND NW 20G30KT. BECMG 2301 SKC. OTLK...VFR.

....

The forecast for Pennsylvania and northern New Jersey expected broken clouds at 5,000 ft with tops to 12,000 ft, with wind from the northwest at 20 knots gusting to 30 knots.

7.0 Terminal Forecast

The NWS New York Forecast Office located in Upton, New York issued the following amended Terminal Forecast for KTEB at 1512 EDT:

*AMD TAF KTEB 151912Z 1519/1618 32020G32KT P6SM SCT060 SCT250
FM152200 32016G25KT P6SM FEW060
FM160000 31012G19KT P6SM SCT250
FM160300 30007KT P6SM SCT250*

The forecast expected northwest winds sustained at 20 knots with gusting to 32 knots, with VFR conditions prevailing with unrestricted visibility and clouds above 6,000 ft agl. Other TAFs for the New York and New Jersey area indicated similar conditions with VFR conditions and northwest winds gusting to 35 knots during the period. There was no forecast for LLWS in the TAF¹¹.

8.0 Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA Air Route Traffic Control Center's (ARTCCs).

There are four basic types of inflight aviation weather advisories: the Significant Meteorological Advisory (SIGMET), the Convective SIGMET, the Airmen's Meteorological Information (AIRMET), and the Center Weather Advisory (CWA). All of these advisories use the same location identifiers to describe the hazardous weather areas. The Severe Weather Watch Bulletins (WWs), with the associated Alert Messages (AWW) supplements these advisories.

There were no SIGMETs, Convective SIGMETs, CWAs, or Weather Watches current for the area prior to the accident. The only advisory current during the period was AIRMET Tango for moderate turbulence below 10,000 ft over the region. Another AIRMET for strong surface winds with gusts greater than 30 knots was also current but extended off the coast and did not impact the KTEB or New York area airports. A graphic depiction is included as figure 15 with the advisory following. There was no advisory current for any wind shear over the region.

¹¹ Wind Shear (WS) is typically included in the TAF if the wind speeds in the lowest 2,000 ft agl of the atmosphere are 30 knots or greater, or if multiple PIREPs are received of wind shear within 2,000 feet of the surface, causing an indicated air speed loss or gain of 20 knots or more. NWS Instruction 10-813.

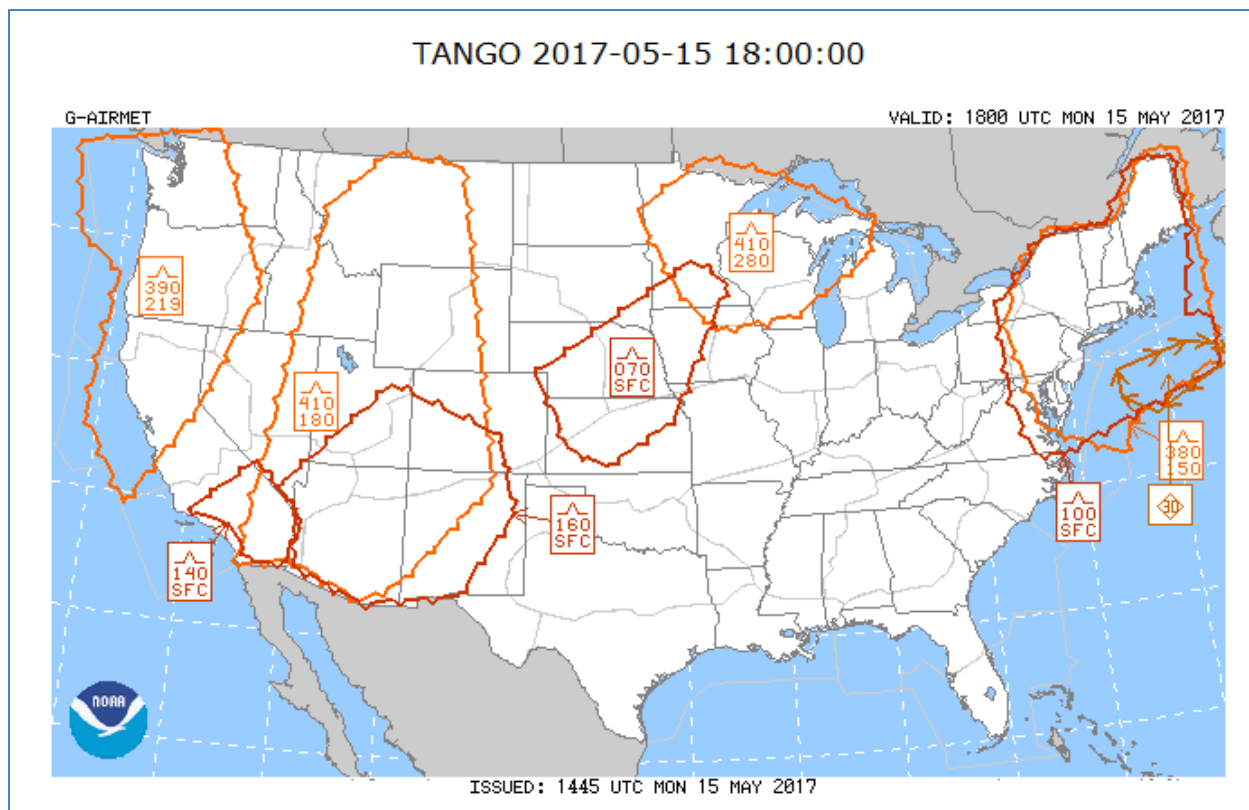


Figure 15 - Graphic AIRMET Tango valid for the period

WAUS41 KKCI 151445

WAIT

BOST WA 151445

AIRMET TANGO UPDT 4 FOR TURB AND STG SFC WND S VALID UNTIL 152100

*AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA WV MD DC DE VA NC AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO 20SW ORF TO
50NW CSN*

TO 50ENE YYZ TO YOW TO YSC TO 70NW PQI

MOD TURB BTN 150 AND FL380. CONDS CONTG BYD 21Z THRU 03Z.

*AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA LE WV MD DC DE VA AND CSTL WTRS
FROM 70NW PQI TO 50NE PQI TO 60SW YSJ TO 200SE ACK TO 160SE SIE TO 30ENE ECG TO
60SSW RIC TO 20NW ERI TO 40E YYZ TO 80NW SYR TO 20WSW MSS TO YSC TO 70NW PQI
MOD TURB BLW 100. CONDS CONTG BYD 21Z THRU 03Z.*

AIRMET STG SFC WND S...MA RI NY NJ MD DE VA CSTL WTRS

*FROM 40SSW HTO TO 100SE ACK TO 150ESE ACK TO 200SE ACK TO 180SE SIE TO 120SE SIE TO
40SSW HTO*

SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 21Z. ENDG 21-00Z.

*OTLK VALID 2100-0300Z...TURB NH VT MA RI CT NY LO NJ PA MD DC DE VA AND CSTL WTRS
BOUNDED BY YSC-40SSE PVD-90SE SIE-40S DCA-30WSW HAR-80NW SYR-20SE YOW-YSC
MOD TURB BTN FL260 AND FL420. CONDS DVLPG 21-00Z. CONDS CONTG THRU 03Z.*

9.0 Winds and Temperature Aloft Forecast

The NWS forecast winds and temperature aloft forecast valid for 1400 EDT and for use between 1000 and 1700 EDT for the region was as follows:

*WINDS ALOFT FORECASTS
DATA BASED ON 151200Z
VALID 151800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000*

<i>FT</i>	<i>3000</i>	<i>6000</i>	<i>9000</i>	<i>12000</i>	<i>18000</i>	<i>24000</i>	<i>30000</i>	<i>34000</i>	<i>39000</i>
<i>ACY</i>	<i>3125</i>	<i>3436+03</i>	<i>3338-02</i>	<i>3240-04</i>	<i>3441-15</i>	<i>3440-28</i>	<i>345043</i>	<i>324050</i>	<i>335653</i>
<i>JFK</i>	<i>3130</i>	<i>3539+02</i>	<i>3441-03</i>	<i>3339-04</i>	<i>3449-15</i>	<i>3453-27</i>	<i>354445</i>	<i>364452</i>	<i>334251</i>
<i>AVP</i>	<i>3224</i>	<i>3438+02</i>	<i>3541-02</i>	<i>3540-03</i>	<i>3440-15</i>	<i>3435-28</i>	<i>354743</i>	<i>344451</i>	<i>335354</i>
<i>BDL</i>	<i>3229</i>	<i>3547+01</i>	<i>3643-03</i>	<i>3536-07</i>	<i>3555-15</i>	<i>3561-27</i>	<i>355943</i>	<i>365252</i>	<i>344649</i>

The forecast for Atlantic City (ACY) for 3,000 ft indicated northwest winds or from 310° at 25 knots and at 6,000 ft from 340° at 36 knots with a temperature near 3° C. The forecast for JFK indicated winds at 3,000 ft from 310° at 30 knots.

10.0 Integrated Terminal Weather System

The FAA Integrated Terminal Weather System (ITWS) display for KEWR was documented surrounding the period to determine if any wind shear alerts or advisories were being depicted by the system over the area surrounding the period. The display incorporated the airports low-level wind shear alert system (LLWSAS), Terminal Doppler Weather Radar (TDWR), lightning display, ATC ribbon display of winds and wind shear advisories and is used by Air Traffic Control to issue advisories and warnings, and is also available to air carriers, and the CWSU.

Figures 16 and 17 are the ITWS displays from KEWR at 1526 and 1531 EDT respectively. Both images depicted no significant weather echoes over the area, no lightning, and no wind shear alerts or warnings being issued during the period. The KEWR ribbon display on the bottom right hand side of the display indicated a center field wind from 330° magnetic at 21 knots with gusts to 36 knots at 1426 EDT and from 340° magnetic at 22 knots gusting to 31 knots at 1431 EDT.

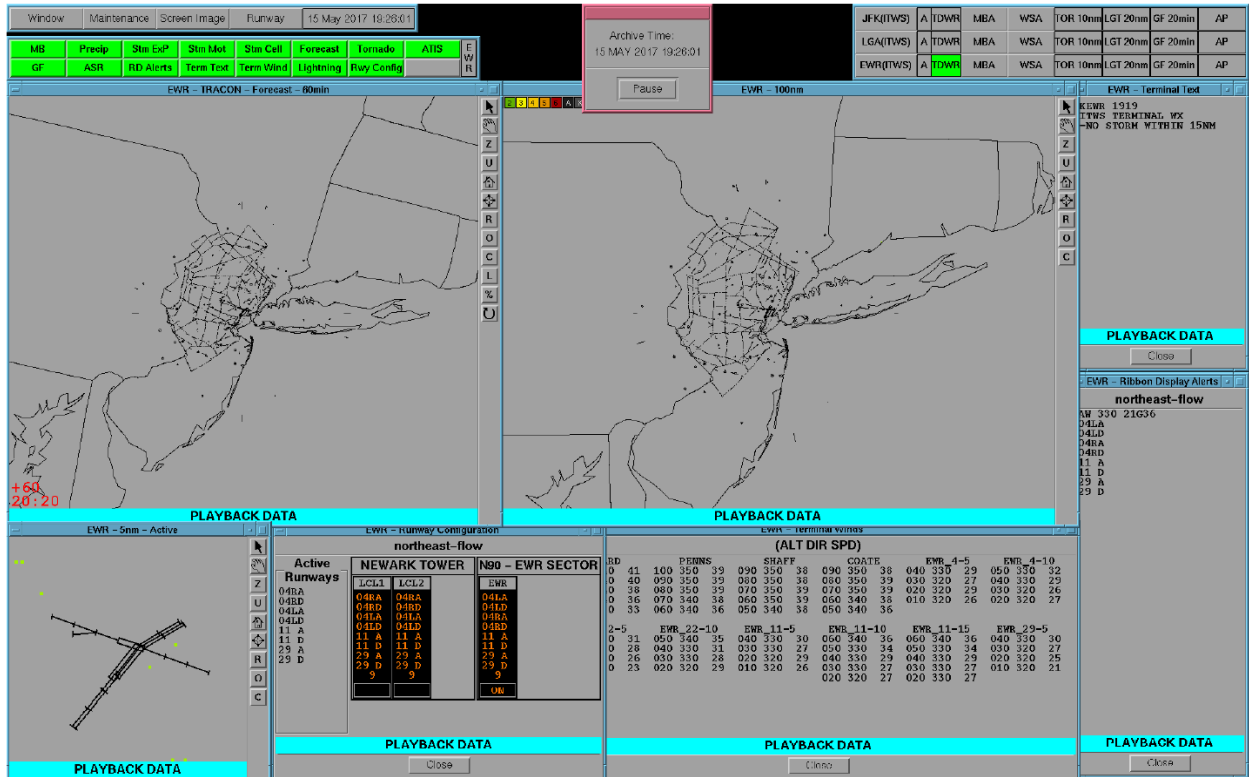


Figure 16 - ITWS display at 1526 EDT

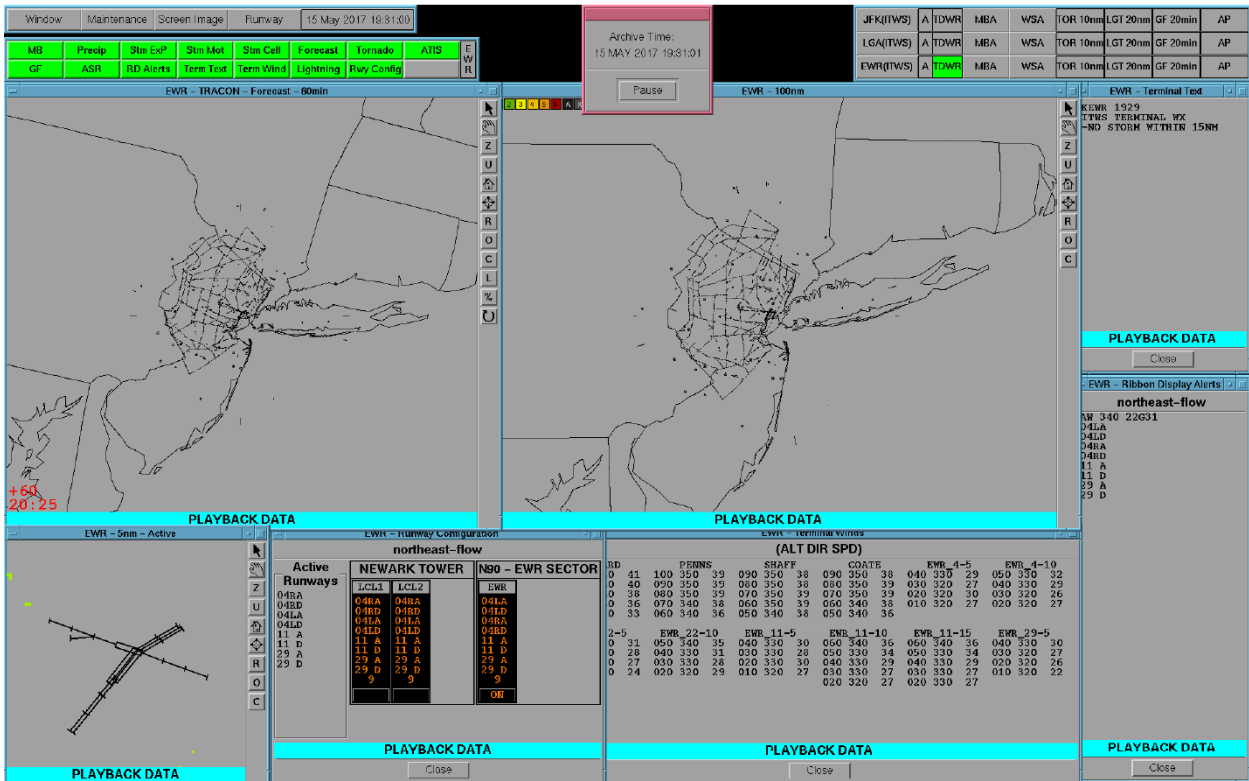


Figure 17 - ITWS display at 1531 EDT

11.0 Preflight Weather Briefing

The pilot in command filed a Direct Users Access Terminal System (DUATS) IFR flight plan at 1105 EDT from KPHL to KTEB for N452DA with an estimated departure of 1430 EDT with a requested altitude of 27,000 ft, with no alternated airport listed.

A search of FAA contract Automated Flight Service Station (AFSS) provider Lockheed Martin Flight Service (LMFS) and Leidos weather briefing services, DUATS providers, and ForeFlight indicated no further contacts for weather briefing information prior to departure. A search of FltPlan.com, indicated that the pilot accessed the web site for weather conditions for the route from KTEB to KBED at 0637 EDT, and for the route from KBED to KPHL at 0831 EDT. A screen copy of the route briefings are included as attachment 1. The briefings provided a pictorial display of the extended 7 day forecast of clouds, precipitation probability, and high and low temperatures expected and the last 3 hours of observations, terminal forecast, notice to airmen (NOTAMs) for the departure and destination airports specified, and nearby airport weather conditions and enroute PIREPs. The briefings did not include any synopsis, in-flight weather advisories, or winds aloft forecast. The web display does provide links to the NWS AWC site for AIRMET/SIGMET information, it is unknown if they were accessed; however, no significant NWS advisories were in effect at the time. There were no identified weather briefing for the route from KPHL to KTEB. It is therefore unknown what specific weather information the pilot reviewed on the return trip back into KTEB.

12.0 Astronomical Conditions

The United States Naval Observatory website was utilized to determine the astronomical conditions. The following conditions were determined for Teterboro, Bergen County, NJ on May 15, 2017.

Beginning of civil twilight	0507EDT
Sunrise	0539 EDT
Sun transit	1253 EDT
Accident	1529 EDT
Sunset	2007 EDT
End civil twilight	2038 EDT

At the time of the accident the Sun was 50° above the horizon at an azimuth of 241°.

F. LIST OF ADDENDUMS AND ATTACHMENTS

Attachment 1 – FltPlan.com weather briefings

Attachment 2 – Pilot Reports in raw format on May 15, 2017

Submitted by:

Don Eick
Senior Meteorologist

