NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 18, 2017

Weather Study

METEOROLOGY

DCA17IA020

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A. INCIDENT

Location: New York, New York
Date: October 27, 2016
Time: about 1940 EDT (2340 UTC)[1]
Airplane: Boeing 737-700; N278EA

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On October 27, 2016, about 1942 eastern daylight time, Eastern Air Lines flight 3452, a Boeing 737-700, registration N278EA overran runway 22 during its landing roll at New York's La Guardia Airport. The chartered passenger flight, operated under the provisions of Title 14 *Code of Federal Regulations* Part 121, originated from Fort Dodge Regional Airport, Fort Dodge, Iowa. The flight departed about 1623 central daylight time. The 9 crew and 39 passengers evacuated the aircraft via airstairs. Night instrument meteorological conditions prevailed at the time of the incident and an instrument flight plan had been filed.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist did not travel in support of this incident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in eastern daylight time (EDT) for October 27, 2016, directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Coordinates used for the incident location: 40.769167° north latitude, 73.885000° west longitude, elevation of about 20 feet.

[1] UTC – abbreviation for Coordinated Universal Time

E. WEATHER INFORMATION

1.0 Surface Observations

An Automated Surface Observing System (ASOS) was located at LaGuardia Airport (LGA)[2] in New York, New York, which was the incident location. Figure 1 presents a map depicting the ASOS location. Reports from LGA during the times surrounding the incident time, which were augmented by a certified weather observer, are presented here:

[1826 EDT] SPECI KLGA 272226Z 10008KT 3SM RA BKN015 OVC022 14/11 A3014 RMK AO2 SFC VIS 4 P0006 T01390106 VISNO R22 SW $=

[1847 EDT] SPECI KLGA 272247Z 10010KT 3SM RA BR BKN009 OVC015 13/11 A3014 RMK AO2 SFC VIS 4 P0012 $=

[1851 EDT] METAR KLGA 272251Z 09009KT 3SM RA BKN009 OVC015 13/11 A3014 RMK AO2 SFC VIS 4 SLP205 P0014 T01330106 $=

[1951 EDT] METAR KLGA 272351Z 10010G15KT 3SM RA BR OVC010 13/12 A3010 RMK AO2 SFC VIS 4 SLP192 P0032 60061 T01330117 10139 20072 58018 $=

[2009 EDT] SPECI KLGA 280009Z 09007KT 3SM -RA BR OVC009 13/12 A3009 RMK AO2 SFC VIS 5 P0005 T01330122 $=

At 1851 EDT, LGA reported a wind from 090° at 9 knots, visibility of 3 statute miles, moderate rain, ceiling broken at 900 feet above ground level (agl), overcast clouds at 1,500 feet agl, temperature of 13° Celsius (C) and a dew point temperature of 11°C, altimeter setting of 30.14 inches of mercury; remarks included: station with a precipitation discriminator, surface visibility of 4 statute miles, precipitation accumulation of 0.14 inches since previous hourly report[3], maintenance needed on the system.

At 1951 EDT, LGA reported a wind from 100° at 10 knots with gusts to 15 knots, visibility of 3 statute miles, moderate rain, mist, ceiling overcast at 1,000 feet agl, temperature of 13°C and a dew point temperature of 12°C, altimeter setting of 30.10 inches of mercury; remarks included: station with a precipitation discriminator, surface visibility of 4 statute miles, precipitation accumulation of 0.32 inches since previous hourly report[4], precipitation accumulation of 0.61 inches during previous three hours, maintenance needed on the system.

Five-minute data from the LGA ASOS for about an hour surrounding the incident are provided here:

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[2] The National Weather Service (NWS) uses the 4-digit International Civil Aviation Organization (ICAO) format for station identifiers (as seen in the body of some formatted weather observations). This report uses the 3-digit International Air Transport Association format for station identification, which does not use the geographic designating digit ("K" for stations in the continental U.S. and "P" for U.S. stations in Alaska and the Pacific region) as found in the ICAO format.

[3] The previous hourly report occurred at 1751 EDT.

[4] The previous hourly report occurred at 1851 EDT.

[1845 EDT] 5-MIN KLGA 272245Z 09009KT 3SM RA BR BKN011 OVC015 13/11 A3014 -170 86 -400 100/09 RMK AO2 SFC VIS 4 P0012 $

[1850 EDT] 5-MIN KLGA 272250Z 09009KT 3SM RA BR BKN009 OVC015 13/11 A3014 -170 86 -400 100/09 RMK AO2 SFC VIS 4 SLP205 P0013 T01280106 $

[1855 EDT] 5-MIN KLGA 272255Z 06007KT 3SM +RA BR BKN009 OVC013 13/11 A3014 -170 86 -300 080/07 RMK AO2 SFC VIS 3 P0001 T01330111 $

[1900 EDT] 5-MIN KLGA 272300Z 08006KT 3SM +RA BR BKN008 OVC013 13/11 A3013 -170 86 -400 090/06 RMK AO2 P0005 T01280106 $

[1905 EDT] 5-MIN KLGA 272305Z 08007KT 3SM +RA BR OVC008 13/11 A3013 -160 89 -400 090/07 RMK AO2 P0008 T01280111 $

[1910 EDT] 5-MIN KLGA 272310Z 10012G16KT 3SM +RA BR BKN008 OVC013 13/11 A3012 -160 89 -400 110/12G16 RMK AO2 P0011 T01280111 $

[1915 EDT] 5-MIN KLGA 272315Z 09011KT 3SM RA BR BKN008 OVC013 13/11 A3012 -160 89 -400 110/11 RMK AO2 SFC VIS 4 P0013 T01280111 $

[1920 EDT] 5-MIN KLGA 272320Z 09009KT 3SM RA BR OVC008 13/11 A3012 -160 86 -300 100/09 RMK AO2 SFC VIS 4 P0014 T01330111 $

[1925 EDT] 5-MIN KLGA 272325Z 08008KT 050V120 3SM RA BR BKN008 OVC013 13/12 A3012 -150 89 -300 090/08 060V130 RMK AO2 SFC VIS 3 P0016 T01330117 $

[1930 EDT] 5-MIN KLGA 272330Z 09009KT 3SM +RA BR BKN008 OVC013 13/12 A3011 -150 89 -300 110/09 RMK AO2 P0021 T01330117 $

[1935 EDT] 5-MIN KLGA 272335Z 07008KT 3SM RA BR BKN008 OVC013 13/12 A3011 -150 89 -300 090/08 RMK AO2 P0023 T01330117 $

[1940 EDT] 5-MIN KLGA 272340Z 08009KT 3SM RA BR OVC008 13/12 A3011 -140 89 -300 100/09 RMK AO2 SFC VIS 3 P0027 T01330117 $

[1945 EDT] 5-MIN KLGA 272345Z 09007G15KT 3SM +RA BR BKN008 OVC012 13/12 A3011 -140 89 -300 110/07G15 RMK AO2 SFC VIS 4 SLP195 P0030 60059 T01330117 10139 20072 57014 $

At 1940 EDT, the LGA five-minute ASOS report indicated a wind from 080° at 9 knots, visibility of 3 statute miles, moderate rain, mist, ceiling overcast at 800 feet agl, temperature of 13°C and a dew point temperature of 12°C, altimeter setting of 30.11 inches of mercury, pressure altitude[5] of -140 feet, relative humidity of 89 percent, density altitude[6] of -300 feet, magnetic wind from 100° at 9 knots; remarks included: station with a precipitation discriminator, surface visibility of 3 statute miles, precipitation accumulation of 0.27 inches since 1850 EDT, maintenance needed on the system.

[5] The height of the standard atmosphere at which the station pressure would be observed.
[6] The pressure altitude corrected for temperature variations from the standard atmosphere.

At 1945 EDT, the LGA five-minute ASOS report indicated a wind from 090° at 7 knots with gusts to 15 knots, visibility of 3 statute miles, heavy rain, mist, ceiling broken at 800 feet agl, overcast clouds at 1,200 feet agl, temperature of 13°C and a dew point temperature of 12°C, altimeter setting of 30.11 inches of mercury, pressure altitude of -140 feet, relative humidity of 89 percent, density altitude of -300 feet, magnetic wind from 110° at 7 knots with gusts to 15 knots; remarks included: station with a precipitation discriminator, surface visibility of 4 statute miles, precipitation accumulation of 0.30 inches since 1850 EDT, precipitation accumulation of 0.59 inches during previous three hours, maintenance needed on the system.

Selected parameters[7] from the LGA ASOS one-minute observations for 11 minutes surrounding the incident time are presented here:

Time	W_Dir	W_Mag	G_Dir	G_Mag	Precip
1935	073°	8	061°	12	0.01
1936	070°	9	079°	12	0.01
1937	077°	9	080°	11	0.01
1938	081°	8	098°	10	0.01
1939	081°	9	085°	12	0.00
1940	083°	9	084°	12	0.01
1941	082°	9	079°	12	0.00
1942	085°	9	090°	12	0.00
1943	090°	9	086°	15	0.01
1944	091°	8	096°	9	0.01
1945	094°	7	111°	10	0.01

Wind data from the Low Level Windshear Alert System (LLWAS) at LGA for the incident period was obtained from the FAA and is included in Attachment 1. The LLWAS wind data is archived in 10-second increments. In the following example, the date/time (UTC) is in **red text**, the "CF" is the two-minute average wind direction (magnetic) and magnitude (knots) with any gusts (knots) calculated from the "Airport Wind"[8] remote station readings are in **blue text**, and the 10-second wind direction (magnetic) and magnitude (knots) from each individual remote station (in this example for remote station 1, identified by "RS#01") are in **green text**. Remote Sensor position information is also included in Attachment 1.

03-01-2016 17:54 :54 *RT* ***CF: 010 16 G00*** *NwAvg: 006 18 RS#01 :* ***010 18*** *Ddiff +004 Sdiff 00*

Figure 1 presents a map of the LLWAS Remote Station locations, along with the location of the ASOS.

[7] W_Dir = Direction of two-minute averaged wind (true); W_Mag = Magnitude of two-minute averaged wind (knots); G_Dir = Direction of five-second averaged wind (true); G_Mag = Magnitude of five-second averaged wind (knots); Precip = one-minute precipitation accumulation (inches).

[8] The LGA LLWAS remote station acting as the "Airport Wind" was Remote Station #1.

Figure 1 – LGA LLWAS Remote Station and ASOS locations.

2.0 Weather Radar

WSR-88D Level-II weather radar imagery from Upton, New York (KOKX), is presented in figure 2. KOXK was located about 46 miles east of the incident site at an elevation of about 140 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KOKX 0.521° tilt would have "seen" altitudes above the incident location of between about 1,750 and 6,400 feet msl. The KOKX imagery at the incident time identified reflectivity features consistent with light to moderate rain throughout the region.

Figure 3 and 4 present VAD wind profiles[9] for the Terminal Doppler Weather Radars (TDWR) at John F. Kennedy International Airport (JFK) and Newark Liberty International Airport (EWR), respectively. The JFK TDWR (TJFK) was located about 11 miles south of the incident site, and the EWR TDWR (TEWR) was located about 21 miles southwest of the incident site. Both VAD wind profiles show a south-southeast wind at about 20 knots at 1,000 feet agl, with the wind veering to a south-southwest wind at about 40 knots at 3,000 feet agl.

[9] VAD wind profile - A plot of horizontal winds as a function of height above a Doppler Radar. The display is plotted with height as the vertical axis and time as the horizontal axis (a so-called time-height display), which then depicts the change in wind with time at various heights.

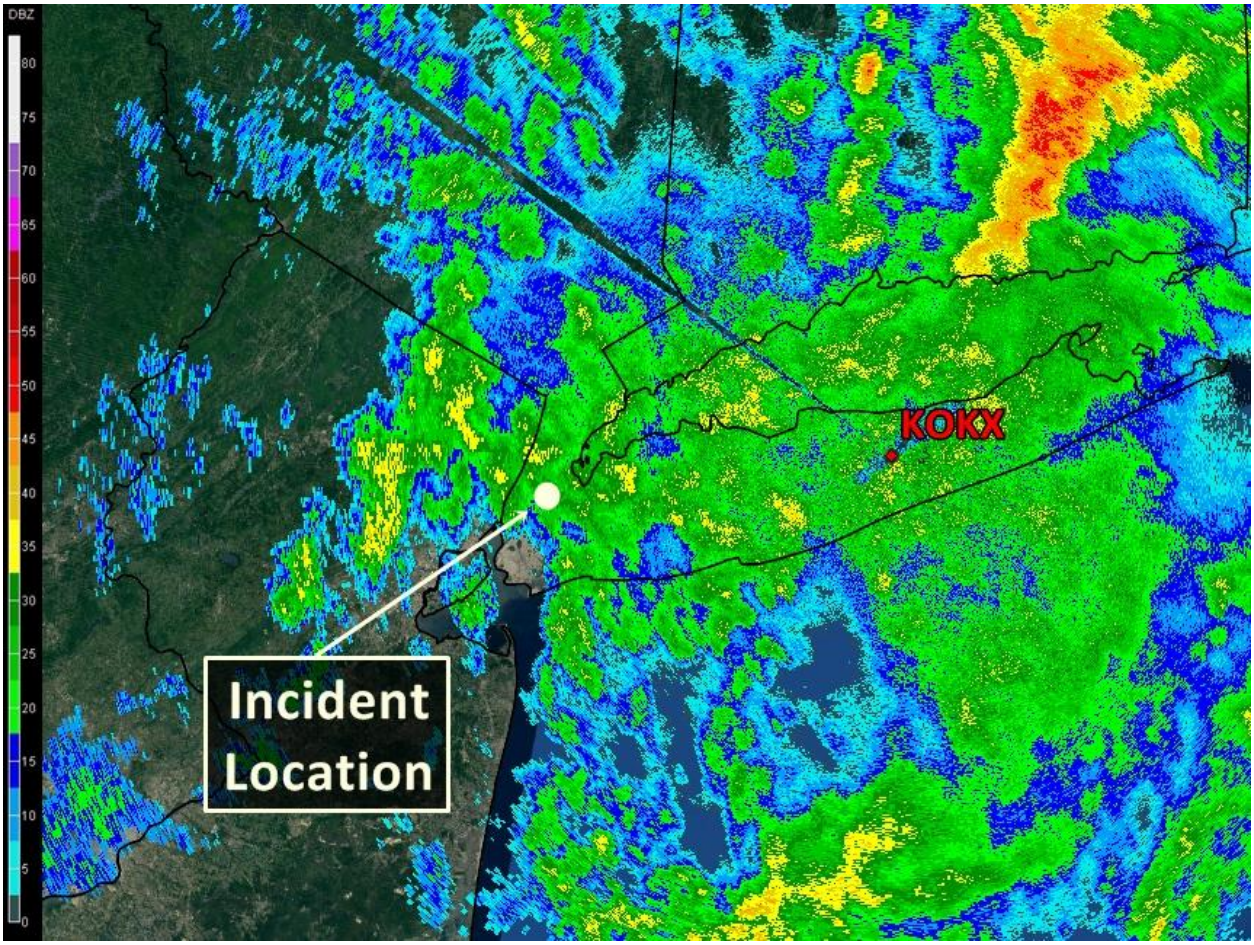

Figure 2 – KOKX 0.521° Level-II reflectivity product from 1938 EDT.

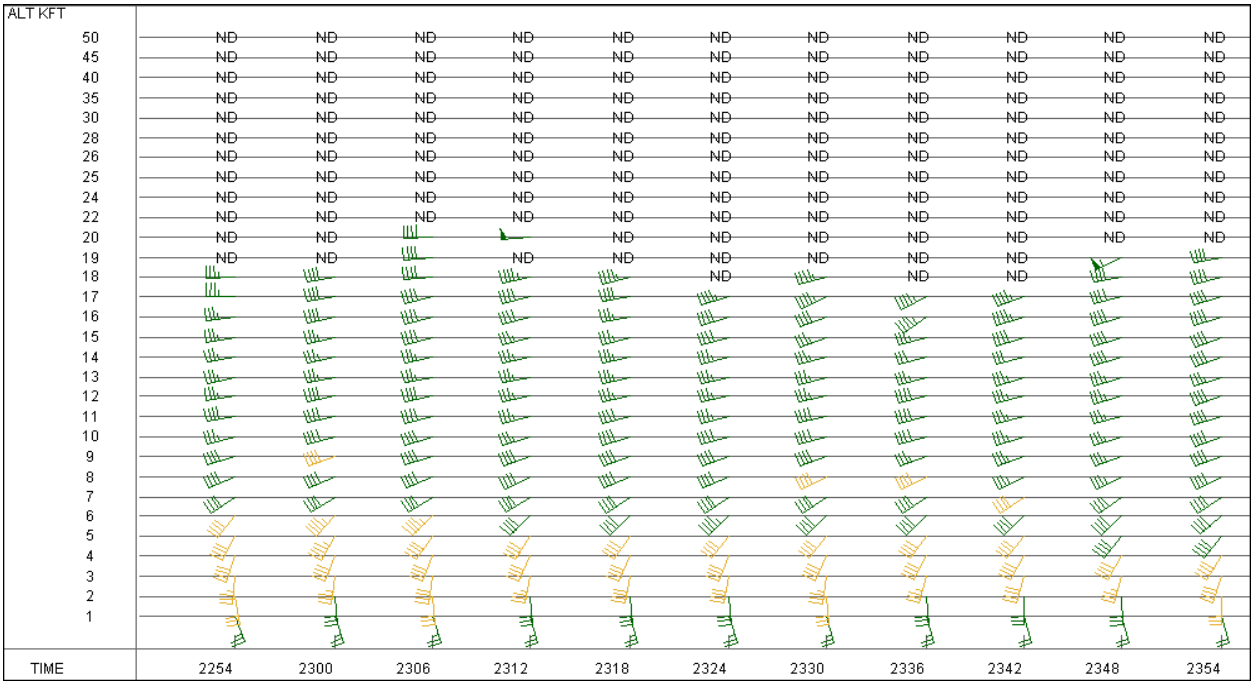

Figure 3 – TJFK VAD wind profile for the times surrounding the incident time. Time is UTC.

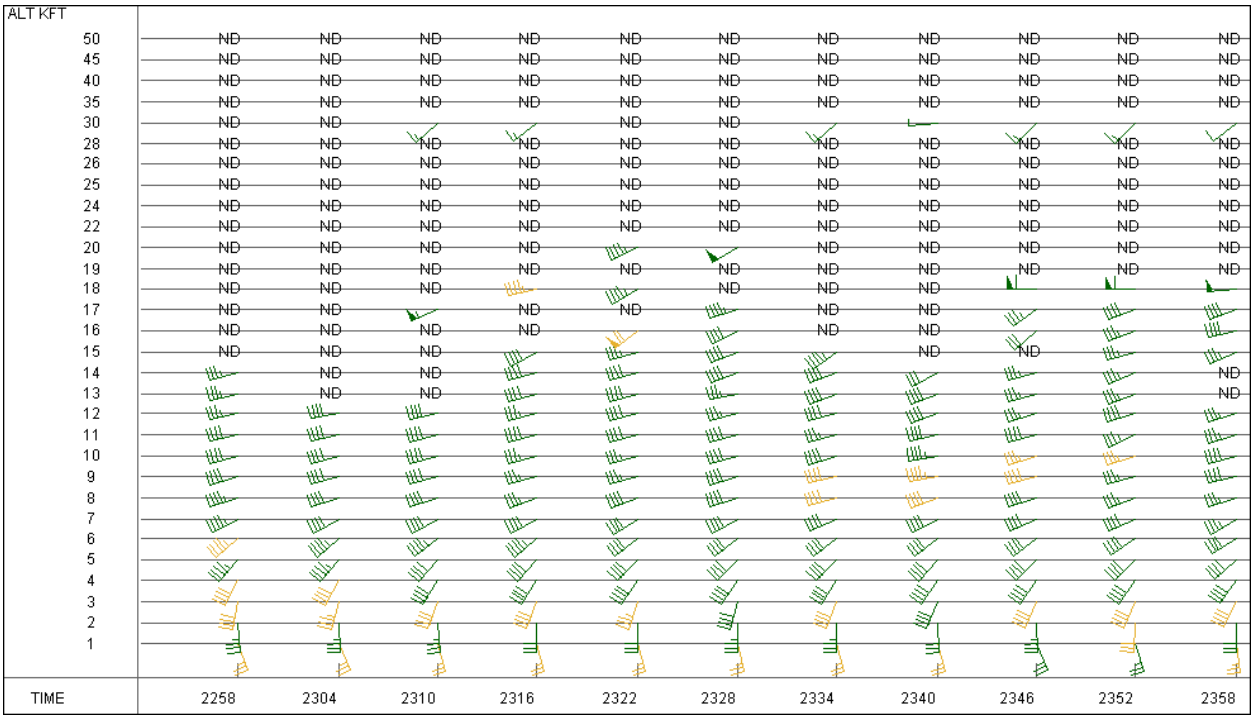

Figure 4 – TEWR VAD wind profile for the times surrounding the incident time. Time is UTC.

The Federal Aviation Administration provided screen shots of the Integrated Terminal Weather System (ITWS) Situation Display applicable for LGA for the time period surrounding the incident. The LGA ITWS Situation Display screenshot for 1940:00 EDT is provided in figure 5. LGA ITWS Situation Display screenshots between 1930:00 and about 1950:30 EDT (at 30-second intervals) are presented in Attachment 2.

Runway-specific wind information and any windshear alert products available on the ribbon display inside the LGA air traffic control tower may be seen in the "Ribbon Display Alerts" window in figure 5 and the images in Attachment 2.

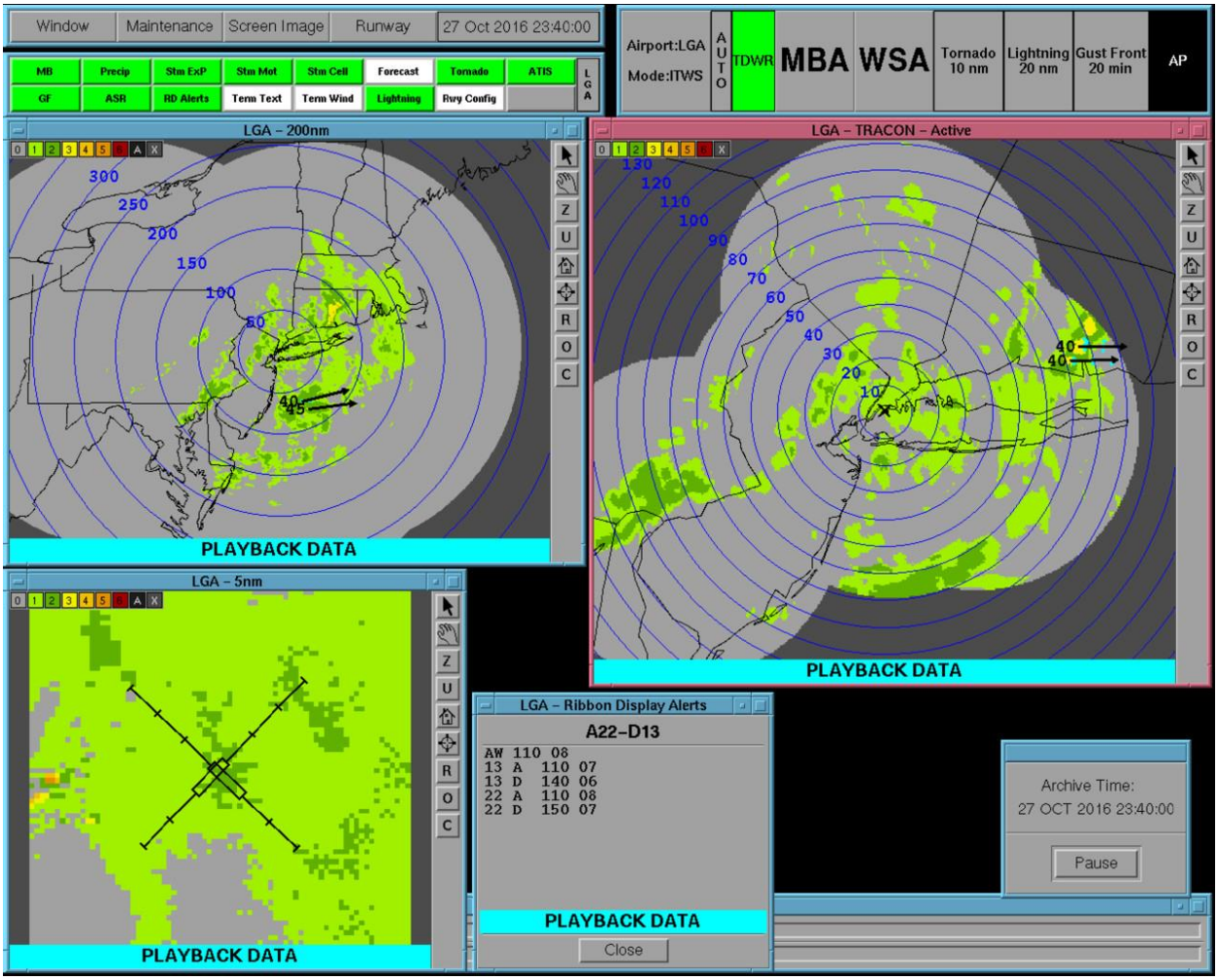

Figure 5 - LGA ITWS Situation Display screenshot for 1940:00 EDT.

3.0 Pilot Reports

Publicly-disseminated pilot reports[10] disseminated by the National Oceanic and Atmospheric Administration within about 3.5 hours prior to the incident at LGA are presented here.

LGA UA /OV LGA/TM 2117/FLSFC/TP B737/RM BRA MEDIUM RY 22=

LGA UA /OV LGA/TM 2126/FL018/TP B737/RM BASES REPORTED AT 1800 FT=

LGA UA /OV LGA/TM 2135/FLSFC/TP B737/RM BRAG RY 4=

LGA UA /OV LGA/TM 2138/FL017/TP E145/SK BASES 1700 OVERCAST=

[10] Only pilot reports with the WMO header UBNY** were considered. PIREPs broadcast only over air traffic control frequencies were not considered.

LGA UA /OV 050/TM 2142/FL050/TP A320/WV 180@46=

LGA UA /OV LGA/TM 2230/FLSFC/TP E190/RM BRAG RY 22=

LGA UA /OV LGA/TM 2335/FLSFC/TP CRJ2/RM BRA GOOD TO MEDIUM RY 22=

4.0 Upper Air Data

Meteorological data (including moisture information) from an AMDAR-reporting[11] aircraft departing LGA before the incident occurred are presented below. Altitude is pressure altitude in feet[12], wind direction (W-Dir) is referenced to true north, wind magnitude (W-Mag) is in knots, and temperature (Temp) and dew point temperature (D_Temp) is in °C.

Time	Latitude	Longitude	Altitude	W-Dir	W-Mag	Temp	D_Temp
1934	40.769	-73.863	-50	092°	5	10.7°	10.7°
1934	40.769	-73.863	270	127°	10	10.7°	10.7°
1934	40.769	-73.853	610	137°	17	10.1°	10.1°
1934	40.769	-73.853	970	146°	22	9.6°	9.6°
1934	40.749	-73.843	1220	153°	26	8.8°	8.8°
1934	40.749	-73.843	1350	158°	26	8.6°	8.6°
1935	40.749	-73.833	1450	162°	29	8.1°	8.1°
1935	40.749	-73.823	1580	165°	28	7.8°	7.8°
1935	40.749	-73.823	1700	163°	27	7.6°	7.6°
1935	40.749	-73.813	1840	162°	29	7.1°	7.1°
1935	40.749	-73.803	2070	167°	31	6.8°	6.8°
1935	40.749	-73.793	2350	166°	32	6.3°	6.3°
1935	40.769	-73.793	2690	166°	34	5.8°	5.8°
1935	40.769	-73.783	3000	174°	34	5.3°	5.3°
1935	40.769	-73.783	3270	179°	34	4.8°	4.8°
1936	40.779	-73.763	4240	191°	38	3.6°	3.6°
1936	40.819	-73.753	4990	205°	40	3.1°	3.1°
1936	40.829	-73.763	5910	218°	42	1.8°	1.8°
1937	40.869	-73.783	7410	226°	44	0.1°	0.1°
1937	40.879	-73.803	8920	246°	38	-1.8°	-1.8°

[11] *AMDAR* has been a generally-accepted, worldwide term for automated weather reports from commercial aircraft.
[12] These altitudes are calculated from the aircraft's static pressure according to the International Standard Atmosphere regardless of altitude (1013.25 hPa is always surface pressure).

5.0 Terminal Aerodrome Forecasts

Terminal Aerodrome Forecasts (TAF) were issued for LGA by the NWS WFO in Upton, New York. Presented here are TAFs issued for LGA in the hours leading up to the incident.

At 1539 EDT a TAF was issued for LGA that forecasted for the incident time: wind from 160° at 13 knots with gusts to 20 knots, visibility of one statute mile, moderate rain, mist, ceiling broken at 700 feet agl, overcast clouds at 1,200 feet agl.

KLGA 271939Z 2720/2818 11011KT 6SM -RA SCT015 OVC025
FM272100 14014G22KT 3SM -RA BR SCT007 OVC015
FM272300 16013G20KT 1SM RA BR BKN007 OVC012
FM280200 21011KT 3SM -RA BR OVC015
FM280500 28012G19KT P6SM BKN025
FM281000 29016G22KT P6SM BKN035
FM281500 30018G26KT P6SM BKN040=

At 1723 EDT a TAF was issued for LGA that forecasted for the incident time: wind from 140° at 14 knots with gusts to 22 knots, visibility of 3 statute miles, light rain, mist, scattered clouds at 700 feet agl, ceiling overcast at 1,500 feet agl.

KLGA 272123Z 2721/2818 10010KT 5SM -RA SCT015 OVC025
FM272200 14014G22KT 3SM -RA BR SCT007 OVC015
FM280000 17015G21KT 1SM RA BR BKN007 OVC012
FM280300 21011KT 3SM -RA BR OVC015
FM280500 28012G19KT P6SM BKN025
FM281000 29016G22KT P6SM BKN035
FM281500 30018G26KT P6SM BKN040=

At 1903 EDT a TAF was issued for LGA that forecasted for the incident time: wind from 100° at 12 knots, visibility of 3 statute miles, light rain, mist, scattered clouds at 700 feet agl and ceiling overcast at 1,500 feet agl.

KLGA 272303Z **2723/2818 10012KT 3SM -RA BR SCT007 OVC015**
FM280000 15015G21KT 1SM RA BR BKN007 OVC012
FM280300 21011KT 3SM -RA BR OVC015
FM280500 28012G19KT P6SM BKN025
FM281000 29016G22KT P6SM BKN035
FM281500 30018G26KT P6SM BKN040=

6.0 SIGMETs

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories active for the incident location at the incident time.

7.0 Aviation Section of the Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 1743 EDT by the NWS Weather Forecast Office in Upton, New York. The aviation portion of the AFD is presented here.

FXUS61 KOKX 272143
AFDOKX
Area Forecast Discussion
National Weather Service New York NY
543 PM EDT Thu Oct 27 2016

.AVIATION /22Z THURSDAY THROUGH TUESDAY/...
Low pressure and a warm frontal boundary converge upon the area this evening, followed by a cold frontal passage after midnight. Widespread MVFR/IFR conditions through tonight with gradual improvement to VFR following the cold frontal passage late tonight. Rain may be occasionally heavy this evening with isolated thunder possible at the coastal terminals.
Appears warm front is making progress north of the south coastal terminals...and should see winds veer to the SE/S for the remainder of the coastal terminals this evening. This veering of winds should be accompanied by gusts of 20-25 kt for NYC and LI terminals. E/NE less than 10 kt at KSWF...and possibly holding E at KHPN.
Following the cold frontal passage after midnight, conditions should improve to vfr vsby/mvfr cigs with a gusty W/NW wind. W/NW winds should gradually ramp up through Friday morning with gusts 25-30 kt on Friday.
NY Metro Enhanced Aviation Weather Support...
Detailed information, including hourly TAF wind component forecasts, can be found at: http:/www.weather.gov/zny/n90
KJFK TAF Comments: Conds likely vary btwn mvfr/ifr this evening in light to moderate rain. S/SE gusts to 25 kt likely this evening.
KLGA TAF Comments: Conds likely vary btwn mvfr/ifr this evening in light to moderate rain. S/SE gusts to 25 kt possible this evening.
KEWR TAF Comments: Conds likely vary btwn mvfr/ifr this evening in light to moderate rain. S/SE gusts to 20 kt likely this evening.
KTEB TAF Comments: Conds likely vary btwn mvfr/ifr this evening in light to moderate rain.
KHPN TAF Comments: Winds may veer to the SE after 00z. Conds likely vary between IFR and VLIFR this evening in light to moderate rain.
KISP TAF Comments: Conds likely vary btwn mvfr/ifr this evening. S/SE gusts to 25 kt likely.
.OUTLOOK FOR 18Z FRIDAY THROUGH TUESDAY...
.Friday Afternoon...VFR with strong northwest flow. Gusts 25-30kt.
.Saturday...VFR. Gusty southwest flow possible along the coast.
.Sunday...Low chance of showers, mainly in the afternoon.
.Monday and Tuesday...VFR.

8.0 CWSU Products

There were no Center Weather Advisories (CWA) issued by the Center Weather Service Unit (CWSU) at the New York Air Route Traffic Control Center (ZNY) that were active for the incident site at the incident time.

At 0742 EDT, the following Meteorological Impact Statement was issued by the ZNY CWSU that identified rain and instrument flight rules conditions developing in New York City by the afternoon, with surface wind gusts between 20 and 25 knots from the southeast after 1300 EDT.

> FAUS20 KZNY 271143
> ZNY MIS 01 VALID 271145-272000
> ...FOR ATC PLANNING PURPOSES ONLY...
> MOD TURB SFC TO FL250 AND MOD ICING UP TO FL210 THROUGHOUT ZNY. RAIN AND IFR CONDS DEVELOPING NYC AND PHL BY THIS AFTN. SE SFC WIND GUSTS 20 TO 25KT AFT 17Z.

9.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for 40° 46' north latitude and 73° 53' west longitude, indicated the following:

SUN

Sunset	1757 EDT
End Civil Twilight	1826 EDT

MOON

Moonset	1646 EDT

F. LIST OF ATTACHMENTS

Attachment 1 - Wind data from the Low Level Windshear Alert System at LaGuardia Airport.

Attachment 2 - Screenshots from the LaGuardia Airport Integrated Terminal Weather System Situation Display between 1930:00 and 1950:31 EDT.

Submitted by:

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Mike Richards
Senior Meteorologist

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