National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

DCA23LA125

AIRPORTS

Specialist's Factual Report

July 28, 2023

A INCIDENT

Location: Queens, New York
Date: January 13, 2023
Time: 2044 eastern standard time (EST)
Airplane 1: Boeing 737-900ER, Delta Air Lines, N914DU
Airplane 2: Boeing 777-200, American Airlines, N754AN

B AIRPORTS SPECIALIST

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National Transportation Safety Board
Washington, DC

C DETAILS OF THE INVESTIGATION

The airport specialist remotely documented and gathered information pertaining to the airport movement areas at John F. Kennedy International Airport (JFK).

D FACTUAL INFORMATION

1.0 Airport Information

John F. Kennedy International Airport (JFK) was a publicly owned entity, operated by the Port Authority of New York and New Jersey (Port Authority). The airport property encompassed 5,200 acres at an elevation of 13 feet mean sea level. The airport reported 358,487 total operations (of which 343,058 were air carrier) for the 12 months ending March 31, 2022. The FAA certified JFK under 14 CFR Part 139 as a Class I airport with Index E aircraft rescue and firefighting (ARFF) capabilities.

The airport had 4 runways - runway 04L/22R, runway 04R/22L, runway 13L/31R, and runway 13R/31L. The American Airlines 777-200 involved in this incident was instructed to taxi from the ramp to Runway 4L via taxiway B and hold short of taxiway K. As the aircraft left the ramp, the ground controller cleared the 777-200 to cross runway 31L at taxiway K. Upon reaching the taxiway B/taxiway K intersection, the 777-200 continued straight to taxiway J, crossing runway 04L without ATC clearance. See figures 1 and 2. The Delta Air Lines 737-900ER was departing on runway 04L which was 12,079 feet in length by 200 feet wide, paved with grooved concrete, and had precision runway markings and high-intensity runway edge lighting installed.

Figure 1. Google Earth image of JFK, with the incident area circled in red.

Figure 2. Google Earth image of the incident area.

2.0 Lighting, Signage and Markings

The taxiway J/runway 04L/22R intersection was lighted and marked with taxiway edge lights, taxiway edge markings, an enhanced taxiway centerline, both elevated and in-pavement runway guard lights, hold short markings, and two surface painted holding position markings. See figure 3. The Port Authority provided the FAA-approved signage and marking plan from JFK's Airport Certification Manual (ACM). See figures 4 and 5.

Figure 3. Google Earth image of taxiway J/runway 04L intersection.

Figure 4. JFK's signage and marking plan for the incident area. [Source: Port Authority of NY and NJ.]

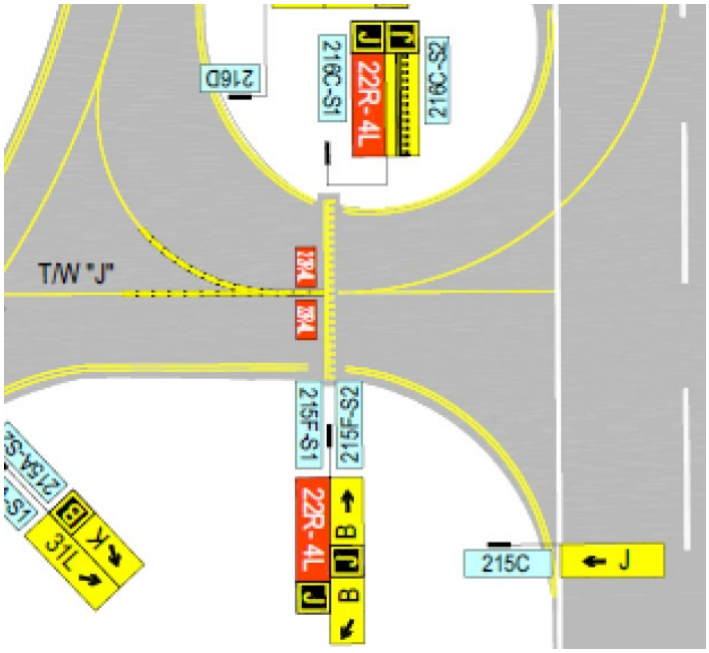

Figure 5. An enhanced view of the taxiway J/runway 04L/22R intersection from JFK's signage and marking plan showing the presence of the two vertical taxiway location signs collocated with runway holding position signs on either side of taxiway J. [Source: Port Authority of NY and NJ.]

Additionally, the Port Authority reported that a surface painted direction sign for taxiway K had been painted on taxiway B in the area of taxiway K on July 26, 2022. The Port Authority provided a photo of the sign as well as a dated invoice for the painting work. See figure 6. Also provided was an email sent the following day from the Port Authority to the FAA Air Traffic Organization (ATO) that included the photo. The Port Authority created a revised signage and marking plan for their ACM and submitted it to the FAA for approval on January 21, 2023. The new plan showed the presence and location of new surface painted direction sign for taxiway K. An enhanced view of the taxiway B/K/J area from JFK's revised signage and marking plan is shown as figure 7.

Figure 6. The surface painted direction sign for taxiway K painted on July 26, 2022. [Source: Port Authority of NY and NJ.]

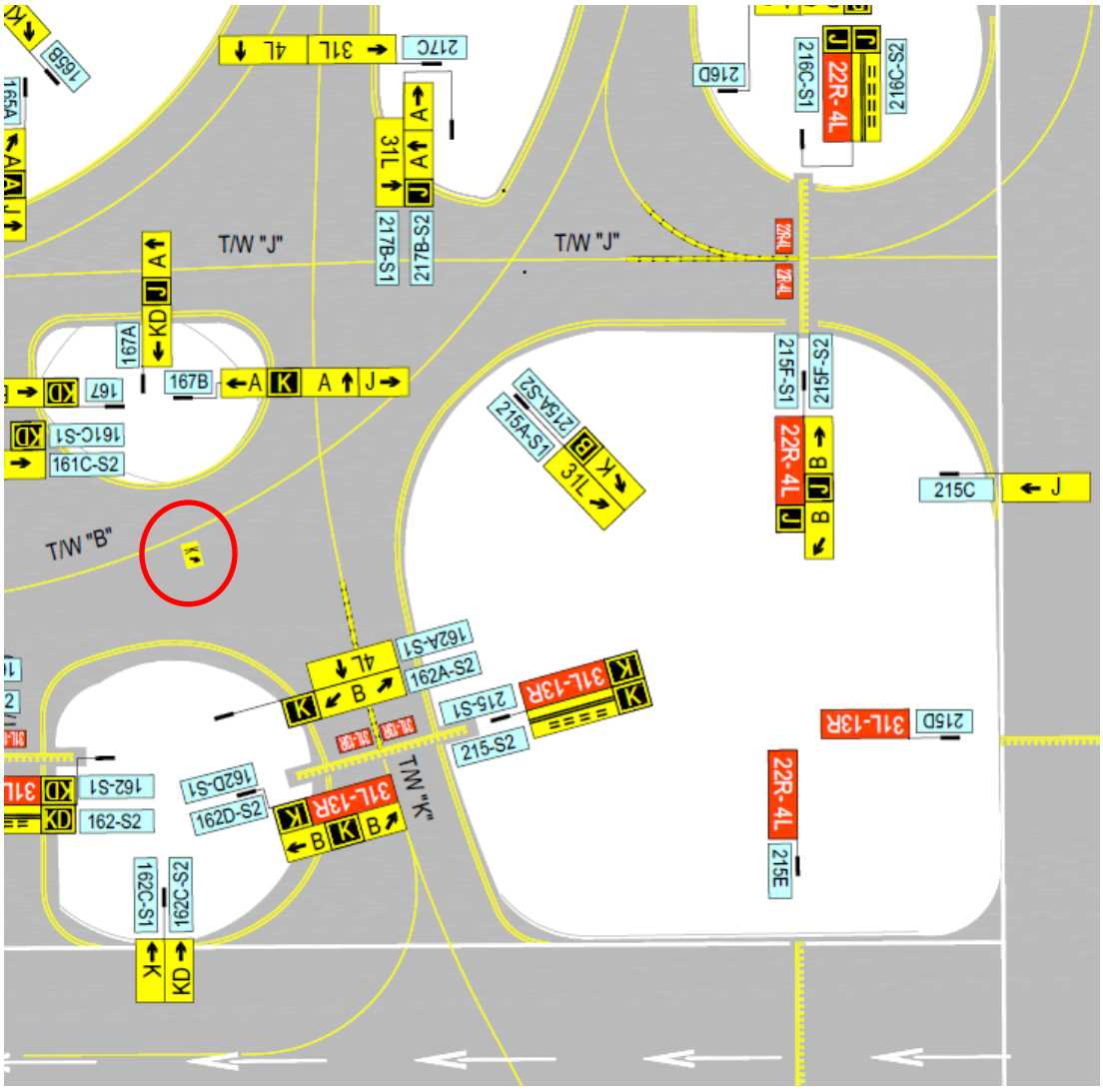

Figure 7. An enhanced view of the taxiway B/K/J area from JFK's new signage and marking plan showing the location of the new surface painted direction sign for taxiway K painted on July 26, 2022. (A red circle has been added for conspicuity in this NTSB report.) [Source: Port Authority of NY and NJ.]

3.0 Runway Status Lights

Runway Status Lights (RWSL) combine airport lighting equipment with airport surveillance systems to create an additional layer of runway safety by reducing the number and severity of runway incursions without interfering with normal airport operations. RWSL are installed at 20 U.S. airports, including JFK. According to FAA Advisory Circular 150/5340-30J Design and Installation Details for Airport Visual Aides, RWSL "display critical, time-sensitive safety status information directly to pilots and vehicle operators via in-pavement lights giving them an immediate indication of potentially unsafe situations."

3.1 RWSL System Overview

The RWSL system consists of an RWSL processor and a Field Lighting System (FLS). The RWSL processor receives surveillance data of aircraft and vehicles on or near the airport surface from the ground surface surveillance system, Airport Surveillence Detection System – Model X (ASDE-X). The RWSL processor uses these data to establish the presence and motion of aircraft and surface vehicles on or near the runways. It then determines when to activate and deactivate the Runway Entrance Lights (RELs) and Takeoff Hold Lights (THLs). Light commands are sent from the processor to the FLS. See figure 8.

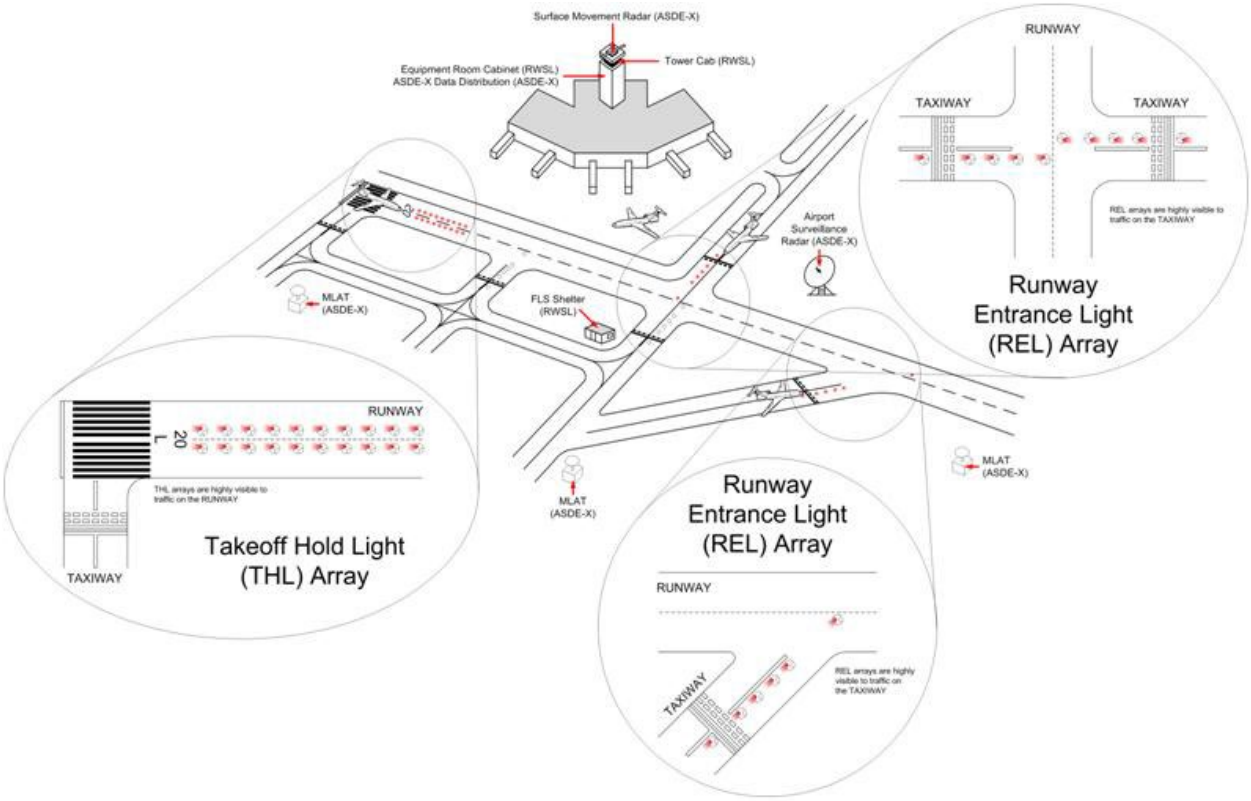

Figure 8. A pictogram of a RWSL system. [Source: FAA]

The FLS includes a Light Computer (LC), in-pavement light fixtures, and all light system circuitry. The FLS receives the light commands and illuminates or extinguishes the lights as commanded by the RWSL processor. The system automatically determines runway configurations and will adjust the activation or deactivation of RELs and THLs accordingly. The system automatically adjusts light intensity according to time of day.

The system illuminates red RELs if the runway is unsafe for entry or crossing and illuminates red THLs if the runway is unsafe for departure. The system

extinguishes the lights automatically as appropriate when the runway is no longer unsafe. See figures 8 and 9.

Figure 9. Illuminated red runway entrance lights at night. [Source: FAA]

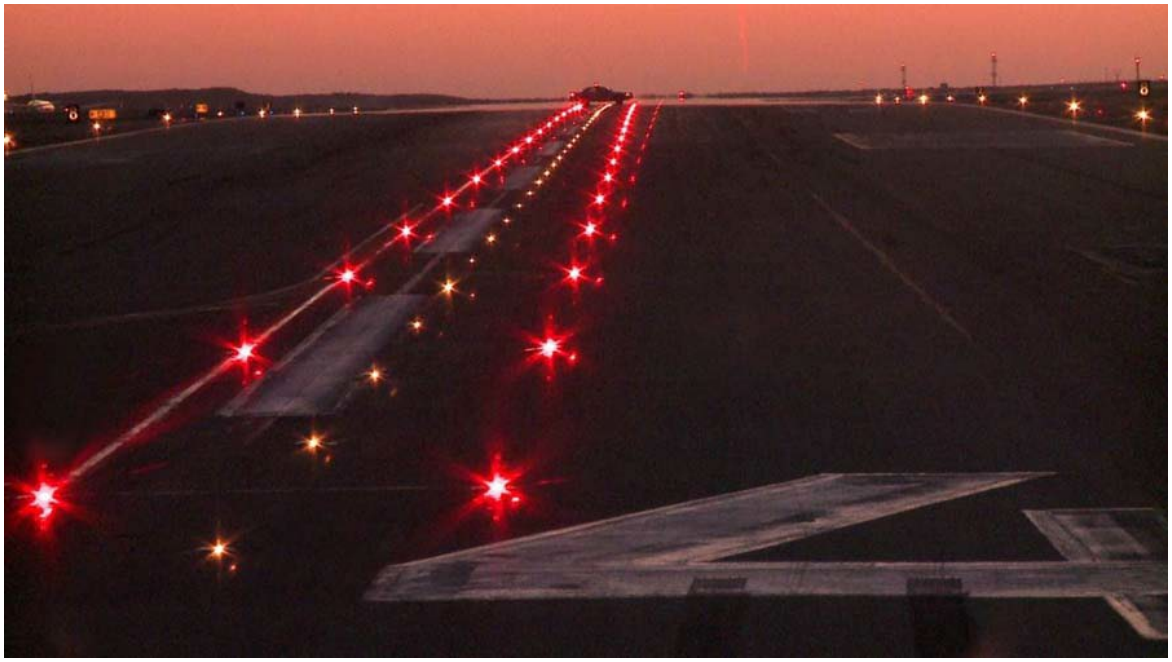

Figure 10. Illuminated red takeoff hold lights at dusk. [Source: FAA]

3.2 Runway Entrance Lights

RELs are located where a taxiway insects a runway and only indicate a runway's status – lack of such lights does not provide clearance to enter or cross a runway. RELs illuminate when an aircraft is taking off or landing on a runway, just prior to the

aircraft reaching the taxiway intersection. This allows air traffic controllers to use anticipated separation and keep the normal flow of traffic moving on the airport surface.

Per FAA Advisory Circular 150/5340-30J, RELs are installed parallel to the taxiway centerline and spaced laterally 2 feet from the taxiway centerline on the opposite side of taxiway centerline lights (if installed). A REL array will typically consist of a minimum of six unidirectional lights but may include more or less, depending on the distance between the runway centerline and the holding position. The first light in the taxiway segment is installed 2 feet prior to the runway holding position marking. The next to last light is installed 2 feet prior to the runway edge stripe. The last light in the array is installed 2 feet to the side of the runway centerline lights toward the intersecting taxiway.

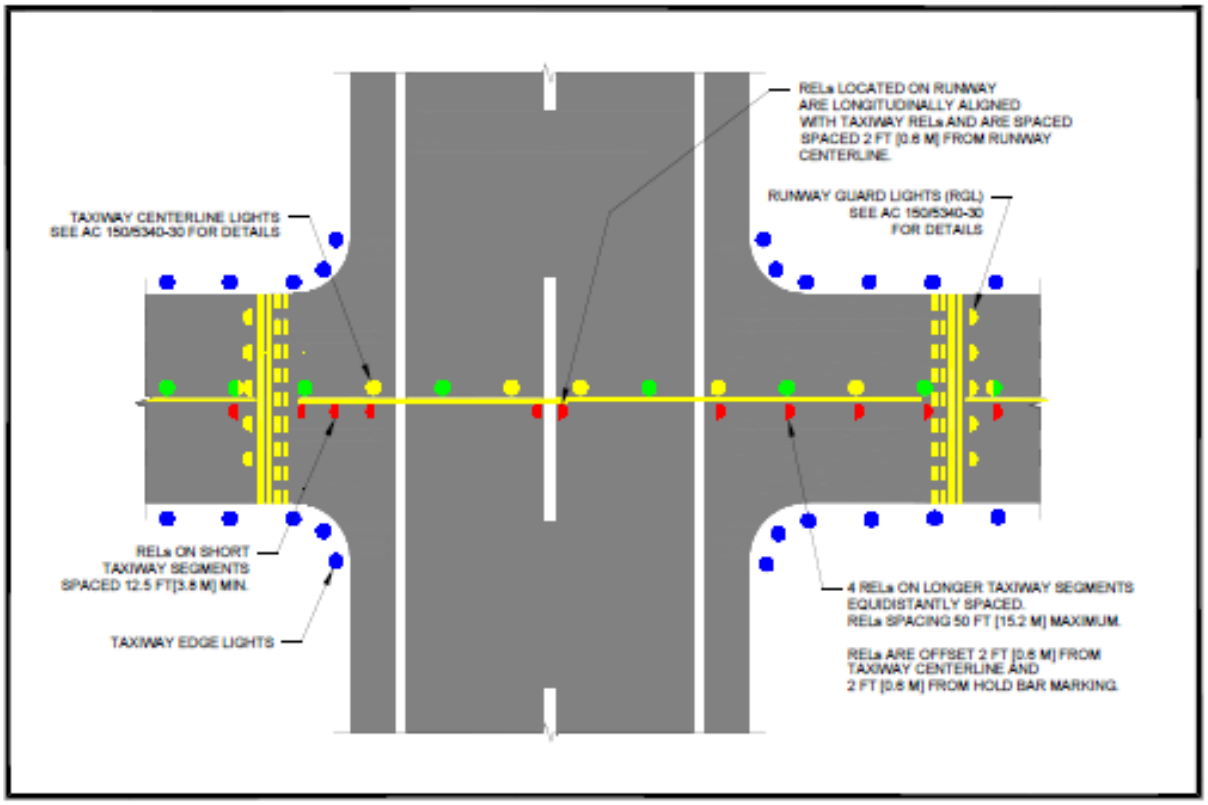

Figure 11. Placement of RELs at a 90-degree taxiway/runway intersection. [Source: FAA Advisory Circular 150/5340-30J]

3.3 Takeoff Hold Lights

THLs are illuminated when an aircraft is in position on a runway's takeoff hold area and an aircraft or vehicle is on the runway somewhere in front of it. THLs turn off

when the aircraft or vehicle is exiting the runway and no longer a hazard. Like RELs, THLs only indicate a runway's status, not an ATC clearance.

THLs are located on a runway's takeoff hold area and consist of a double row of unidirectional in-pavement red lights aligned with the runway centerline lights aimed toward the approach path to the runway. THLs begin at a point that is 375 ft from the runway threshold and are displaced 6 ft on either side of the runway centerline lights. THLs are placed every 100 ft for centerline lights that are spaced 50 ft apart (between the centerline lights in every other space). There will be 1500 ft of lights (32 lights) in the array.

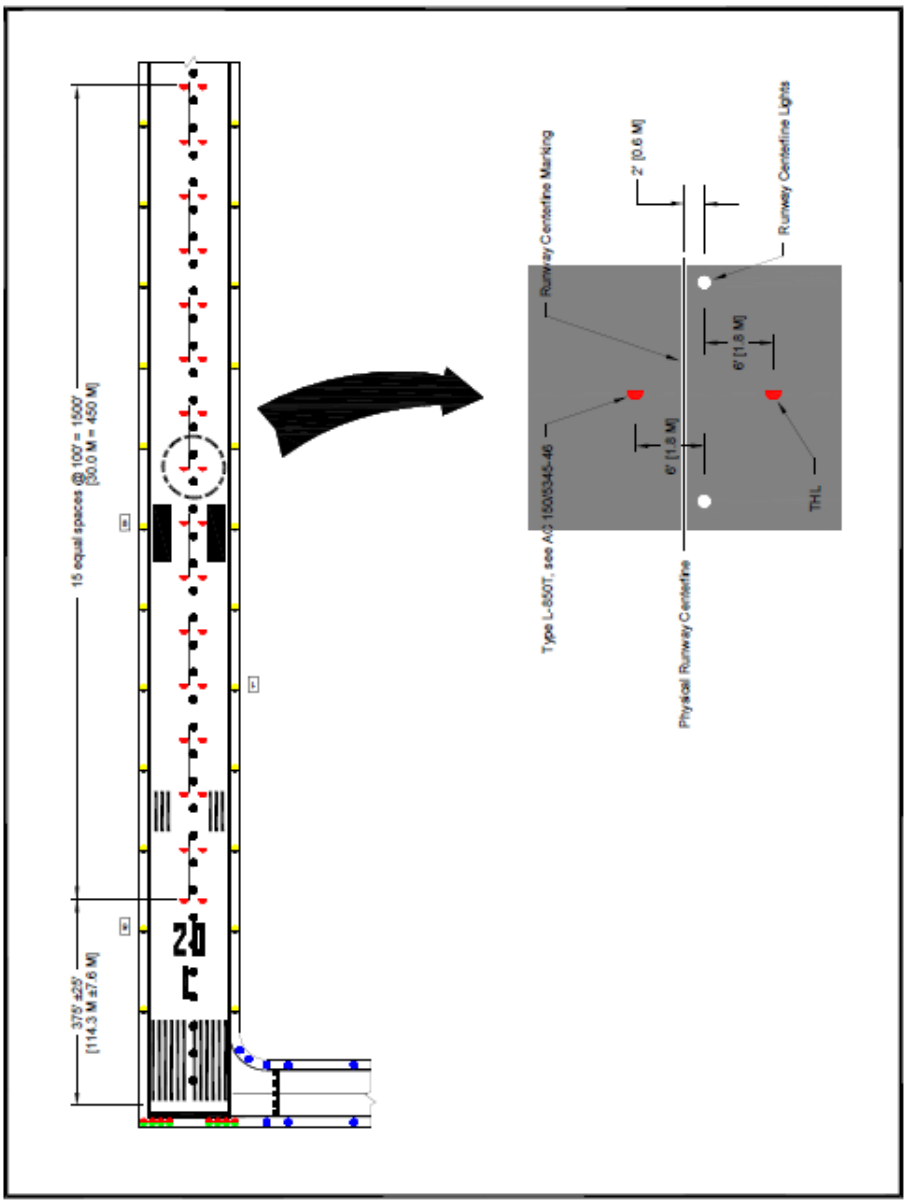

Figure 12. Placement of THLs. [Source: FAA Advisory Circular 150/5340-30J]

3.4 RWSL Operating Characteristics

The FAA's Runway Status Lights Pilot Reference Guide stated the following:

Operating Characteristics – Departing Aircraft: When a departing aircraft reaches 30 knots, all taxiway intersections with Runway Entrance Lights arrays along the runway ahead of the aircraft will illuminate. As the aircraft approaches a Runway Entrance Lights equipped taxiway intersection, the lights at that intersection extinguish approximately 2 to 3 seconds before the aircraft reaches it. This allows controllers to apply "anticipated separation" to permit Air Traffic Control to move traffic more expeditiously without compromising safety. After the aircraft is declared "airborne" by the system, all lights will extinguish.

Operating Characteristics – Arriving Aircraft: When an aircraft on final approach is approximately 1 mile from the runway threshold all sets of Runway Entrance Light arrays along the runway will illuminate. The distance is adjustable and can be configured for specific operations at particular airports. Lights extinguish at each equipped taxiway intersection approximately 2 to 3 seconds before the aircraft reaches it to apply anticipated separation until the aircraft has slowed to approximately 80 knots (site adjustable parameter). Below 80 knots, all arrays that are not within 30 seconds of the aircraft's forward path are extinguished. Once the arriving aircraft slows to approximately 34 knots (site adjustable parameter), it is declared to be in a taxi state, and all lights extinguish.

The NTSB requested that the FAA evaluate the operational algorithm/criteria for the RWSL installation at JFK to ensure that it was operating as described on the day of the incident. FAA ATO responded with a detailed analysis of the January 13, 2023, incident and concluded that "the JFK RWSL system [was] operating within the standard algorithm/criteria for RWSL light activations." See attachment 1 for additional information.

3.5 RWSL at JFK

The RWSL were installed in 2015 during JFK's 04L/22R reconstruction project. However, Port Authority personnel could not confirm "if the lights were commissioned when the runway reopened or if they were operationalized at a later date." According to the Port Authority, "the conceptualization, planning, installation, and maintenance of the RWSL system is the purview of the FAA [Tech Ops]." If Port Authority airport operations personnel noticed an issue with the RWSL system during routine patrols, FAA Tech Ops would be notified. The RWSL installation at JFK included THL on runway 31L and REL primarily at the intersection near runway 31L/04L and continuing down runway 04L to the intersection with runway 31R/13L. See figure 12.

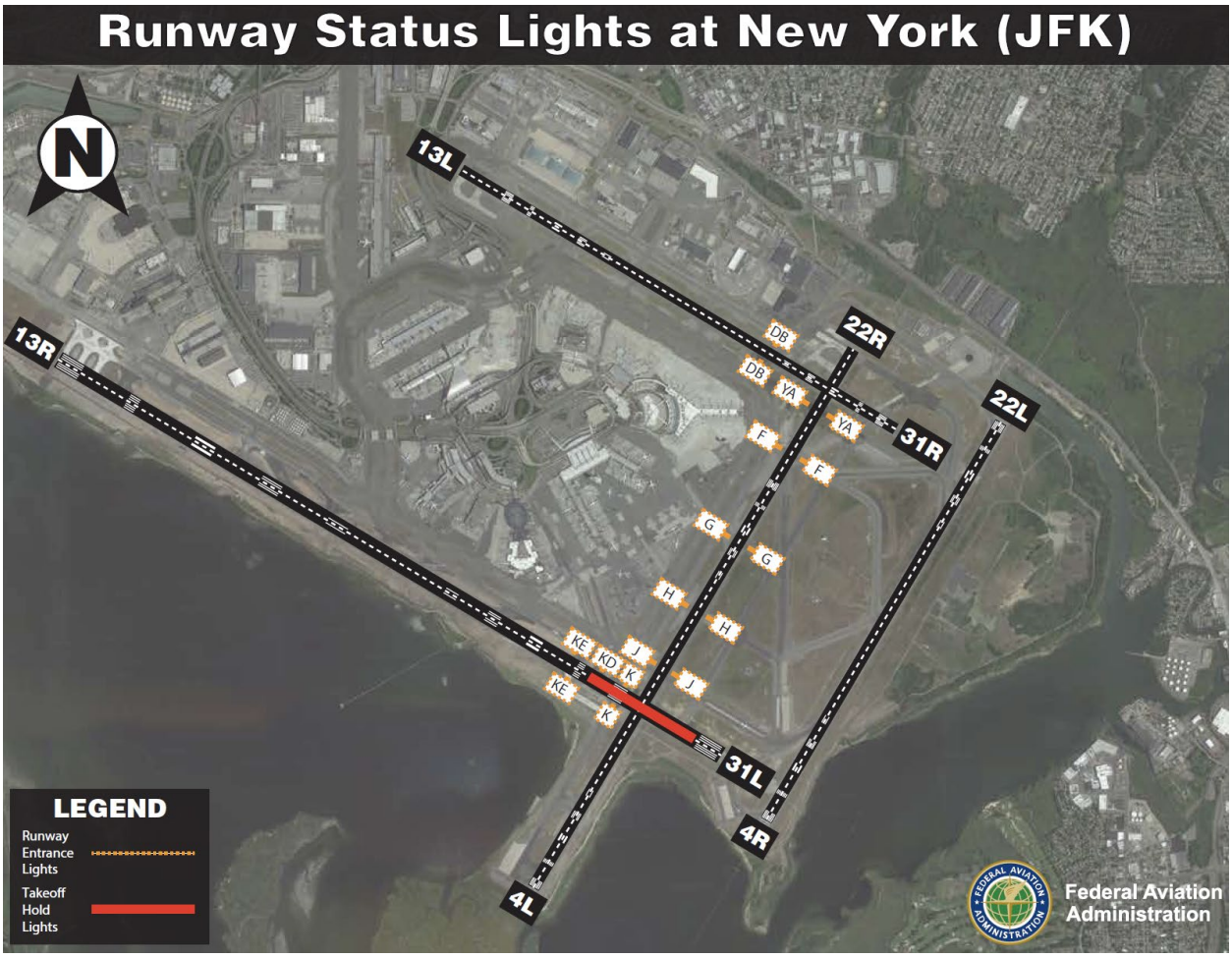

Figure 13. RWSL locations at JFK. REL locations are shown in outlined boxed with the taxiway designation. [Source: FAA]

The NTSB requested that the FAA research the installation at JFK and attempt to determine why those particular locations were chosen for THL and REL. The FAA responded that "extensive research conducted found no record of specific discussions regarding the JFK RWSL array locations… the normal process used by the FAA when it comes to determining RWSL locations is to coordinate with local Air Traffic and Airport Authority to come up with the number and location of light arrays based on several factors:

- Documented airfield hot spots
- Discussions with local ops and controllers
- Planned airfield projects
- Ground traffic taxi patterns
- Funding

Further, the FAA reported that "a review of the RWSL installation process at JFK shows that the initial request for the RWSL array locations were determined by

local FAA Air Traffic and Port Authority Personnel in 2009. This request did not include any request for THL arrays on Runway 4L-22R… the only request removed was the requested REL arrays on Runway 31L-13R and Runway 31R-13L where they intersected/crossed Runway 4L-22R. REL arrays cannot be installed on a runway-to-runway intersection for technical and safety reasons."

Figure 14. Nighttime photo taken just prior to the hold short marking at the taxiway J/runway 4L intersection. The taxiway centerline lights are green while the runway guard lights appear yellow/orange. [Source: Port Authority of NY and NJ.]

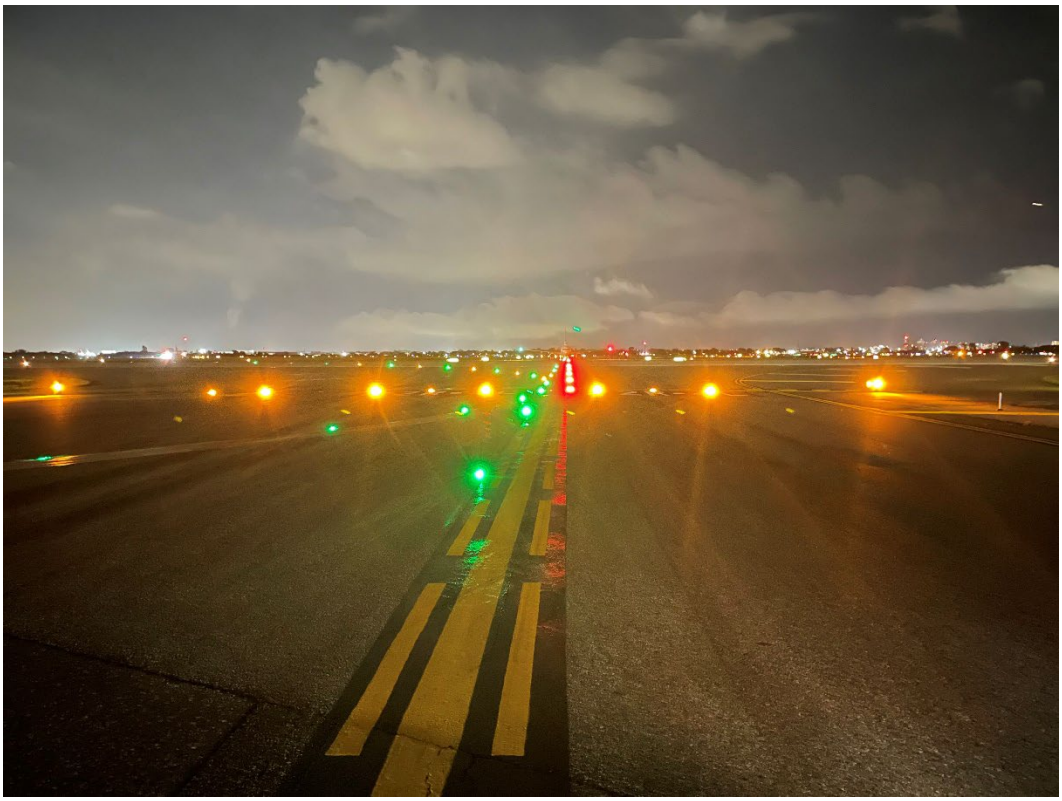

Figure 15. Nighttime photo just prior to the hold short marking at the taxiway J/runway 4L intersection with the runway entrance lights illuminated in red. [Source: Port Authority of NY and NJ.]

3.6 Post-incident Inspection

Port Authority airport operations personnel conducted a special inspection of the taxiways in the incident area at 2135 and noted "[taxiway] J, [taxiway] B and [taxiway] Y, signs, lighting and markings satisfactory at [taxiway] J between [taxiway] B and Y, also all taxiway and mandatory signs in the vicinity operational." However, it was noted that air traffic control had "switched from 04L/04R to runway 31L/31R prior to notifying Airport Operations. Due to this configuration change, the RWSL system could not be inspected because the system does not operate when a runway is no longer in use."

4.0 Hot Spots at JFK

According to the FAA a hot spot is defined as "a complex or confusing taxiway or taxiway and runway intersection. Hot spots have a history or potential risk of collision or runway incursion, and require heightened attention by pilots and drivers." FAA guidance about hot spots exists in FAA Order 7050.1B *Runway Safety Program.* Section 4.2 discusses Runway Safety Action Teams (RSAT) that "bring local airport stakeholders together at least once a year to identify risks to surface safety at that airport and develop plans to mitigate or eliminate those risks." One of the topics that

must be discussed during RSAT meetings is published airport hot spots, including whether additions or deletions of hotspots might be appropriate. While there are no specific criteria listed for additions and deletions, hot spots are not added to airport charts and diagrams without concurrance from members of the local RSAT team.

RSATs provide the foundation of the Runway Safety Program at individual airports. The NTSB requested that the FAA provide meeting minutes from all past JFK RSAT meetings as well as a written summary of actions taken at JFK regarding the addtion or removal of hot spots to JFK airport charts. The FAA provided meeting minutes from 2004, 2007, 2009, 2011, 2013, 2015, 2016, 2018, 2020, 2021, and 2022.

In May 2004, a JFK RSAT meeting was held to "improve ground safety at JFK, especially in the area of reducing runway incursions/surface incidents." One topic of discussion was the possible addition of hot spots at JFK. According to the FAA, pilot representatives at the meeting and expressed a desire to add hot spots to the airport's charts in certain areas. There was no agreement by the airport operator or FAA (ATO) to make these hot spots "official" or permanent. It was believed that if they were published through the National Aeronautical Charting Office (NACO), it would make the hot spot "official," which was not what the airport wanted. Therefore, an agreement was reached was to add five hot spots to the published Jeppesen charts and not the NACO charts. The JFK Air Traffic Control Tower manager completed this action item on June 14, 2004, and hot spots are shown on the chart in figure 13.

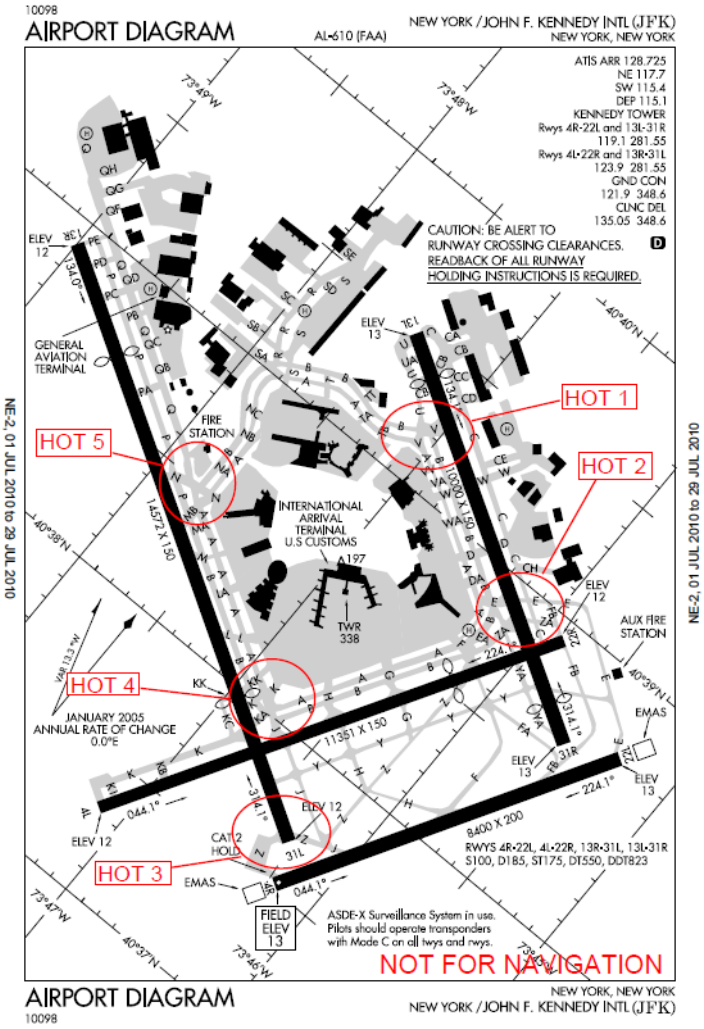

Figure 16. JFK's published July 2010 Jeppesen chart showing 5 hot spots.

According to the FAA, during a subsequent RSAT meeting it was noted, "JFK Airport has indicated the original Hot Spots depicted in Jeppesen are complex spots where many taxiways come together and is why they were originally identified as Hot Spots but have not had an incursion at these areas. They do not want to publish these locations in NACO as Hot Spots and would like to remove these depicted locations from Jeppesen." The hot spots were then removed from the JFK Jeppesen chart in 2010.

Additionally, the following information related to hot spots was noted:

- The meeting minutes from the October 2007 RSAT indicated that the JFK Air Traffic Control Tower manager stated that they were "currently working with the Port Authority to reduce the hot spots down to three. One particular hot spot discussed was the intersection of 4L-22R and 13R-31L around the area of TWY KA and KK. This area leads to two runway ends and is an area of concern

identified in the wrong runway event risk." At the same meeting the FAA's Runway Safety Program manager noted that JFK had 9 runway incursions in the previous 24 months of which one was a category 'A' event, two were category 'C' events, and six were category 'D' events. He also noted that JFK had all the "bells and whistles" including enhanced centerline markings and guard lights at every intersection.

- According to the FAA, during the 2011 RSAT, there was consensus between pilots, Port Authority and others to not maintain any hot spots at JFK due to many additional signage and marking improvements that the airport had made.

- During the 2015 RSAT, the FAA ATCT support manager at JFK noted "as far as hot spots are concerned, the entire airport is a hot spot."

- The meeting minutes from the October 2020 RSAT meeting noted that "hot spots were explained as areas with a history of potential risk for runway incursions. Previous hot spots at JFK were mitigated by the Port Authority, by updating surface markings, renaming taxiways and changing pavement angles. We do not have any hot spots at this time."

- The meeting minutes from the October 2022 RSAT meeting noted that "JFK has no published hotspots due to mitigations from the Port Authority regarding taxiway angles, signage and markings. Areas of concern continuously change due to the variety of runway configurations available."

After the January 13, 2023, runway incursion, the JFK ATCT performed a system safety review (SSR). The SSR team discussed the possibility of creating a taxiway hotspot in the taxiway K and taxiway J area for future charting cycles and referred the event to the Local Safety Council (LSC). It was thought that a hot spot could draw flight crew attention to that intersection and avoid an incorrect turn. The Corrective Action Plan (CAP) created by the LSC stated that "a collaborative effort resulted in a hot spot created for the June 15, 2023 [Jeppesen] map update… aimed at mitigating confusion in the area…" See figure 14. The JFK ATCT issued a letter to airmen on May 22, 2023, notifying them about the hot spot near the intersection of taxiways B, K, and J that would become effective on June 15, 2023. It advised flight crews to "maintain additional attention to the intersection while JFK is departing [runway] 4L. The taxi route for [runway] 4L departures is via [taxiway] K. The turn from [taxiway] B onto [taxiway] K is more than 90 degrees and is in close proximity to [taxiway] J. If flight crews mistakenly turn on [taxiway] J when JFK is departing [runway] 4L it will result in a runway incursion."

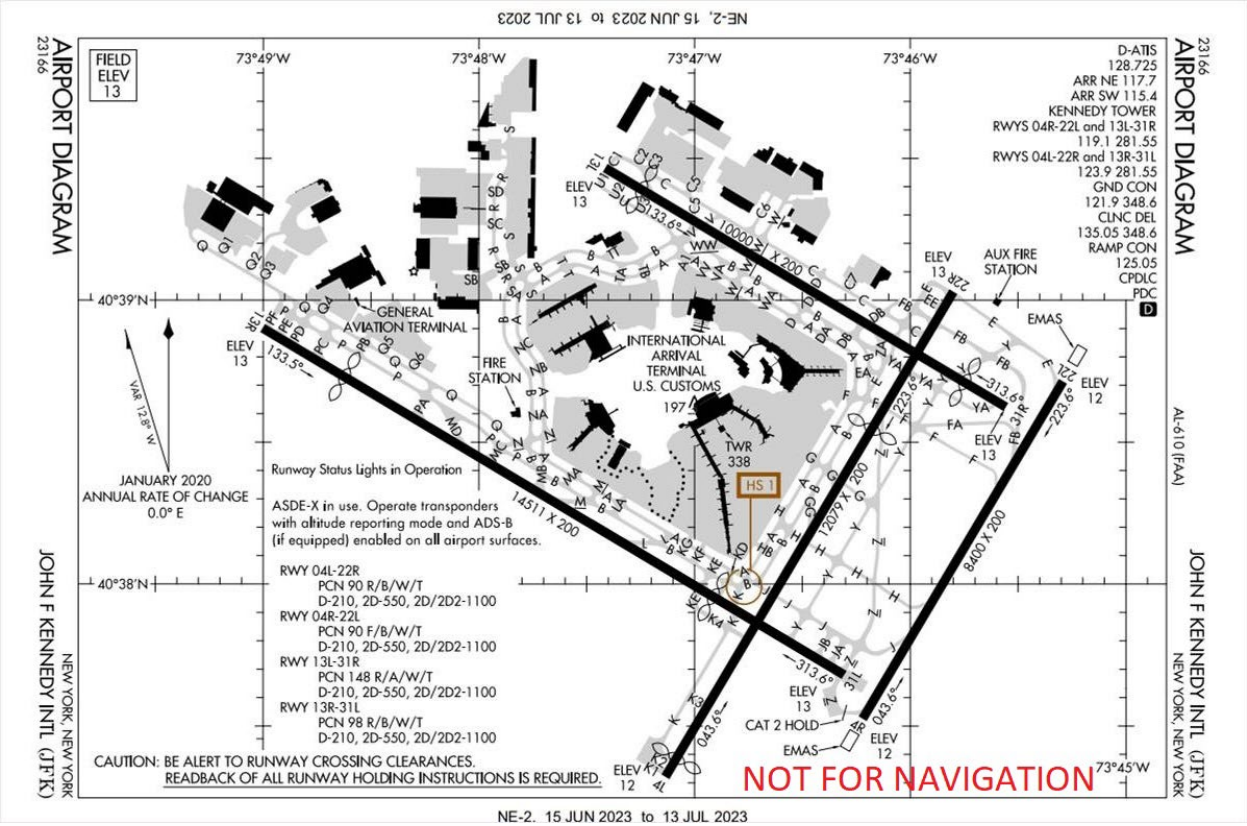

Figure 17. JFK's published June 15, 2023, Jeppesen chart showing a new hot spot at the intersection where the January 13, 2023, incident took place.

E LIST OF ATTACHMENTS

Attachment 1: FAA response to NTSB questions

Submitted by:

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