International Civil Aviation Organization
North American, Central American and Caribbean Office

WORKING PAPER

E/CAR/CATG/9 — WP/15
24/07/25

Ninth Eastern Caribbean Civil Aviation Technical Group (E/CAR/CATG/9) Meeting
Miami, United States, 28 to 31 July 2025

Agenda Item 4: Update of the E/CAR/CATG Work Programme and Activities

IMPACT OF SPACE-X SUPER-HEAVY ROCKET LAUNCHES ON ATS OPERATIONS WITHIN THE PIARCO FIR

(Presented by Trinidad and Tobago)

EXECUTIVE SUMMARY

This working paper summarises the activities of the Trinidad and Tobago Air Navigation Services Provider related to the management of air traffic services during SpaceX Super-Heavy rocket launching activities.

Action:	• The suggested actions are presented in Section 4. • Guidance on improvement is presented in Section 3.
Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Environmental
References:	• AO/TF/5/ATFM/TF/7/CIIFRA/9 – Orlando, United States, 3 to 7 March 2025 • ICAO Annex 11: *Air Traffic Services* • ICAO Doc 4444: Procedures for Air Navigation Services - *Air Traffic Management* • ICAO Doc 9971: *Manual of Collaborative Air Traffic Flow Management*

1. Introduction

1.1 This paper provides an update to the E/CAR CATG 9 meeting on the activities of the Trinidad and Tobago Air Navigation Services Provider (ANSP), related to the SpaceX Super Heavy rocket launches.

1.2 The following decision was included as part of the report AO/TF/5/ATFM/TF/7/CIIFRA/9 – Orlando, United States, 03 to 07 March 2025:

a) Decision: 'AO/TF/5/ATFM/TF/7/CIIFRA/9/5 *ACTIVATION OF AN AD HOC GROUP FOR THE DEVELOPMENT OF STANDARDIZED PROCEDURES FOR USE DURING SPACE*

OPERATIONS' The Ad hoc Group shall establish procedures to ensure safety during space operations.

2. Discussion

2.1 The AO/TF/5/ATFM/TF/7/CIIFRA/9/5 meeting decided that it is necessary to develop a set of contingency procedures/terminologies that provide clear guidance to both ANSPs and Aircraft Operators during space operations.

2.2 According to ICAO Annex 11, there are three (3) main ways to categorize portions of airspace that may have some type of restriction to aircraft operations:

a) Prohibited Area;
b) Restricted Area; and
c) Danger Area.

However, it has been recognized that some States/ANSPs utilize different terminology to indicate airspace restrictions/contingency areas. As an example, the United States utilizes the following terms:

a) Aircraft Hazard Area (AHA): In the Federal Aviation Administration (FAA) regulations, an aircraft hazard area refers to a defined airspace where activities could be hazardous to non-participating aircraft if not conducted in a controlled environment. These areas are established to protect (i.e., separate) aircraft from potential dangers associated with launches, re-entries, or other activities involving falling debris or potential hazards. They are activated via NOTAM (Notices to Airmen) and pilots should be aware of their locations and restrictions.

b) Debris Response Area (DRA): The DRA is a contingency response when unplanned debris is present in the airspace. It allows the FAA to direct aircraft to exit the airspace and prevent others from entering. A DRA is activated only if an anomaly occurs with a launch vehicle and is available in airspace equipped with adequate surveillance and/or radio coverage to communicate with airborne pilots. It remains active until debris from the launch vehicle has fallen to the surface.

c) 10^{-7} Area: The FAA uses a risk classification system that defines different levels of risk based on the probability of an event occurring and the potential severity of its consequences. 10^{-7} areas have the same risk level as a DRA.

2.3 During a Civil Air Navigation Services Organization (CANSO) ATFM Data Exchange Network for the Americas (CADENA) meeting held on 17 July 2025, ANSPs discussed the various terms utilized to inform aircraft operators about airspace restrictions/contingency areas associated with SpaceX Super-Heavy Rocket Launches. It was agreed by all that standardized terminology was required within the Region that would be clearly understood by all stakeholders. The ICAO North American, Central American & Caribbean Aeronautical Information Management Regional Officer (NACC/AIM RO) indicated that this matter was discussed during the Eighth North American, Central American and Caribbean Working Group (NACC/WG) Aeronautical Information Management Implementation Task Force Meeting (AIM/TF/8) held

during 08 to 11 July 2025. The ICAO NACC Air Traffic Management (ATM) RO indicated that the Airspace Management and Capacity Balancing (AMCB) TF will be working with the AIM TF to address this issue.

2.4 **SpaceX Super-Heavy Rocket Launch Impact History**

2.4.1 The SpaceX facility had its first super-heavy rocket launch on 20 April 2023, with eight (8) additional launches since then. Up to SpaceX Super-Heavy Flight-9, no launch had been fully successful although there were iterative improvements with three (3) booster recoveries and one (1) upper stage successful return. However, due to the high failure rate of previous launches, ANSPs are required to plan and collaboratively take appropriate measures to ensure the safety of Air Traffic Services (ATS) within the regional airspace.

2.4.2 The impact of SpaceX Super-Heavy Flight-7's failure (16 January 2025) greatly affected the provision of ATS within the Region, when falling debris was reported outside the declared danger areas by various pilots and individuals. Trinidad and Tobago was not provided with any prior information indicating that any portion of airspace within the Piarco Flight Information Region (FIR) was at risk during the operation, and therefore, did not implement any strategic measures. There was a failure with the SpaceX Super-Heavy Flight-7 mission and at time 2258 UTC, San Juan CERAP advised Piarco ACC that their airspace was closed until further advised. Piarco ACC had to implement tactical measures which involved the holding of several aircraft; and some flights even had to return to points of departure within the Piarco FIR or be diverted to land in Trinidad and Tobago. The challenges posed by this launch made it clear that specific and harmonized procedures were required. Additionally, the Collaborative Decision Making (CDM) process was critical between ANSPs, aircraft operators and other relevant stakeholders.

2.4.3 In the lead up to SpaceX Super-Heavy Flight-8, information on a defined *'debris response area'* within the Piarco FIR, labelled as *'10^{-7}'* was provided to Trinidad and Tobago by the FAA Space Operations Office through the CADENA platform. The information indicated that whilst this area was not deemed a danger area specifically for the launch, there was a possibility (*10^{-7})*, that should there be a failure during the rocket's climb out, that this area would become a contingency area. Trinidad and Tobago decided to treat the *'10^{-7}'* area as a danger area and promulgated the required NOTAM in coordination with Antigua and Barbuda and Guadeloupe. The decision to treat this area as a danger area was based on the high failure rate of previous SpaceX Super-Heavy missions and the chaotic effect of the failed SpaceX Super-Heavy Flight-7 mission on air traffic control and aircraft operators. Additionally, a portion of the defined area extended into oceanic airspace and Trinidad and Tobago had to consider the difficulty in communicating with oceanic flights should this area be treated as a '*contingency area'*. SpaceX Super-Heavy Flight-8 launched on 06 March 2025 and also experienced a failure. Once again, San Juan CERAP advised Piarco ACC that their airspace was closed, however, on this occasion, based on the proactive measure that Trinidad and Tobago had utilized, there were significantly less challenges for ATC and to aircraft operators within the Piarco FIR.

2.4.4 With regard to SpaceX Super-Heavy Flight-9, the FAA ATO Space Operations provided a significantly expanded 'DRA/*'10^{-7}'* area which extended across the Caribbean Region and ended in Atlantico FIR (SBA0). This expansive area significantly impacted both Piarco FIR and Cayenne FIR. CADENA facilitated a series of wide-spanning, collaborative meetings during pre-planning for SpaceX Super-Heavy Flight-9, between CADENA, FAA Space Operations Office, ANSPs (including EUROCONTROl) and Airline Operators. These meetings sought to develop harmonized strategies to mitigate risk and minimize disruptions to air traffic services.

2.4.5 In addition to discussions with adjacent FIRs, Trinidad and Tobago held two (2) CDM meetings with the ANSPs from within the Eastern Caribbean (E/CAR) States/Territories. During these meetings Trinidad and Tobago relayed information gathered from adjacent FIRs during the CADENA teleconferences. Trinidad and Tobago also proposed and coordinated a plan of action for the traffic management within the E/CAR Region during the event. These measures included Calculated Take Off Times (CTOT) (for flights that filed to fly through the danger area) and the implementation of Minutes in Trail (MINIT) initiated by adjacent ANSPs. Trinidad and Tobago in collaboration with E/CAR ANSPs developed and published the relevant NOTAMs to provide operators with advance guidance on activation of the danger areas. Additionally, Trinidad and Tobago activated an ad hoc Flow Management Unit (FMU) which operated specifically for this event. The Unit provided pre-tactical information based on flight plan data and operated live (via MS Teams platform) throughout the event in order to make any required tactical decisions.

2.5 Challenges Experienced

2.5.1 These SpaceX Super-Heavy rocket launches and the associated risks pose severe disturbance to the provision of ATS within the Piarco FIR. Due to the extent of the possible *DRA/10*$^{-7}$ areas, a significant portion of airspace within the Piarco FIR was closed to ensure safety. Apart from the effect to flight operations and ATC, there is a significant amount of planning related to this event due to the many variables and uncertainties. As an example, for SpaceX Super-Heavy Flight-9, between 12 – 27 May 2025, Trinidad and Tobago was involved in eight (8) CADENA planning meetings (external stakeholders) as well as, two (2) meetings with the ANSPs within the Piarco FIR. This is a considerable drain on human resources for all stakeholders involved and required additional staffing.

2.5.2 There were some Traffic Management Measures (TMMs) that created additional workload for Piarco ACC. As an example, an adjacent ANSP instituted a process whereby the measure to be implemented depended upon the trajectory of the aircraft after the common boundary position. Piarco ACC was required to analyse flight trajectories within that ANSP's FIR (based on FPL information); and then, institute the relevant TMMs. This posed additional workload on ATC within the Piarco FIR.

2.5.3 Although the coordination and preparation prior to SpaceX Super-Heavy Flight-9 was significantly improved from previous launches, there are still some areas that require improvement. Some ANSPs decided to handle the event tactically based on their capabilities and resources. It should be noted that when tactical measures are applied, they affect both adjacent ANSPs and operators.

3. Recommendations

3.1 There is a requirement to standardize the classification of reserved airspace related to launch debris across the Region to avoid misinterpretation by operators or stakeholders.

3.2 There is a requirement for ANSPs to engage in the CDM process in the strategic stage leading up to the rocket launch event. TMMs need to be discussed and agreed to by all parties. Where an ANSP decides to handle the event tactically, it should provide proposed measures to adjacent ANSPs and information on possible TMMs to operators, to reduce the levels of uncertainty which have occurred in the past.

3.3 There is a requirement for a mechanism which allows ANSPs across the Region (including E/CAR TMAs) to participate in a *'live'* communication forum in order to coordinate tactical decisions which may arise due to unforeseen developments during these launch activities.

4. Suggested Actions

4.1 The meeting is invited to:

a) Take note of the information provided in this Paper;

b) Encourage E/CAR States/Territories/International organisations to continue working with the E/CAR ATM Committee, to implement harmonised procedures which safely and efficiently facilitate the provision of ATS when rocket launching activities affect the region; and

c) Provide other recommendations to improve collaborative ATFM in the E/CAR Region.

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