



ANSP CONSIDERATIONS FOR MANAGING SPACE OPERATIONS

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Contents

1. Introduction

1.1 Objective

Due to the rising number of space operations around the world, CANSO understands many countries are grappling with the complexity of the coordination required to manage such activities' effect on their airspace system's safety and efficiency. This document provides guidance to Air Navigation Service Providers (ANSPs) on how to safely integrate space operators into the airspace system.

1.2 Scope

Today, most space launches are concentrated at spaceports in relatively few States, but those launches and subsequent re-entries affect airspace systems around the world, so all ANSPs should consider potential impacts. The airspace of concern for integration of space operations is generally up to flight level 600. Well-defined danger areas are used to integrate such operations.

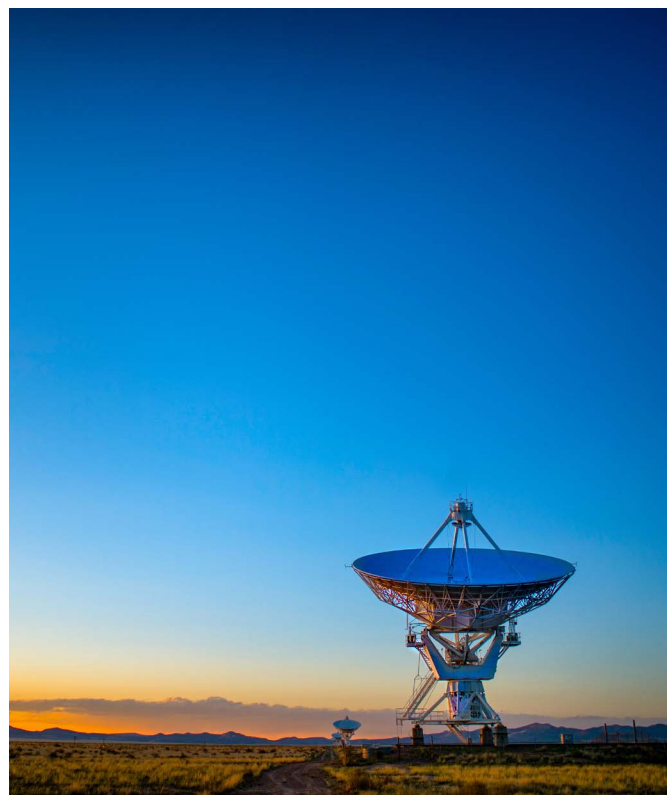
Along with the ANSP managing daily operations, this document makes frequent reference to two other related sets of responsibilities: the Space State Regulator (SSR), who regulates commercial space operations and spaceports, and a Civil Aviation Authority (CAA), who regulates civil aviation. We recognise that these roles may be performed by the same office as the ANSP (in the case of smaller States), or by separate offices within one organisation (e.g., the FAA in the U.S.A.), or by separate organisations.

This document outlines various operational activities ANSPs should consider to safely integrate space transportation activities. We address two types of ANSP readers: the coordinating ANSP, controlling airspace in which a launch or re-entry takes place, and the integrating ANSP whose airspace may be affected. The coordinating ANSP will find considerations for their operation in all sections of the document. While the integrating ANSP will appreciate all sections, they may choose to focus on sections 3.1 - 3.3, and 4.2. Both types of ANSPs will benefit from the summary of considerations in section 5.

1.3 Growing Need for Management of Space Operations (Background)

Traditionally, space operations were conducted by the military or a State space agency (e.g., NASA in the U.S.A. or JAXA in Japan). Recent advancements in technology and private sector investment and the rising demand for space research, products, and services are creating significant growth in the commercial space sector. Private companies are now launching operations with payloads that include low-earth orbit satellites, parts or supplies to support space stations, and space tourists. There were 186 successful launches in 2022, representing a 28 per cent increase (41 more) over those that occurred in 2021.¹

Space operations must pass through airspace systems and are, therefore, another type of operation ANSPs must consider. Throughout this document, we refer to these as Launch or Re-entry (L/R) operations, and we refer to the operators as Launch or Re-entry Operators (LROs).



¹ <https://www2.deloitte.com/us/en/insights/industry/aerospace-defense/future-of-space-economy.html>

1. Introduction

1.3 Growing Need for Management of Space Operations (Background) (continued)

ANSPs integrating space transportation operations typically publish NOTAMs defining danger areas (also known as aircraft hazard area) or other special use airspace to protect non-participating individuals and aircraft. The shape, duration, and location of the danger area is unique to the space transportation operation. A launch may occur from a predefined range or from a mobile launcher.

Launch vehicles are not categorised as aircraft since they do not currently require ambient air for propulsion or navigation. Therefore, launch and re-entry vehicles are not within the remit of ICAO and fall under a different set of regulations than aircraft.

L/R vehicles must pass through airspace that is regulated or controlled by ANSPs or civil aviation authorities. Although this passage represents only a small fraction of the overall space mission, it is helpful to maintain an overview of all the phases of space operations.

Figure 1 shows typical phases of a vertical lift launch designed to deliver a payload. The danger areas are designed to encompass airspace at risk from all components of the space operation. Depending on the mission and size of the launch vehicle, the trajectory may impact multiple flight information regions (FIRs).

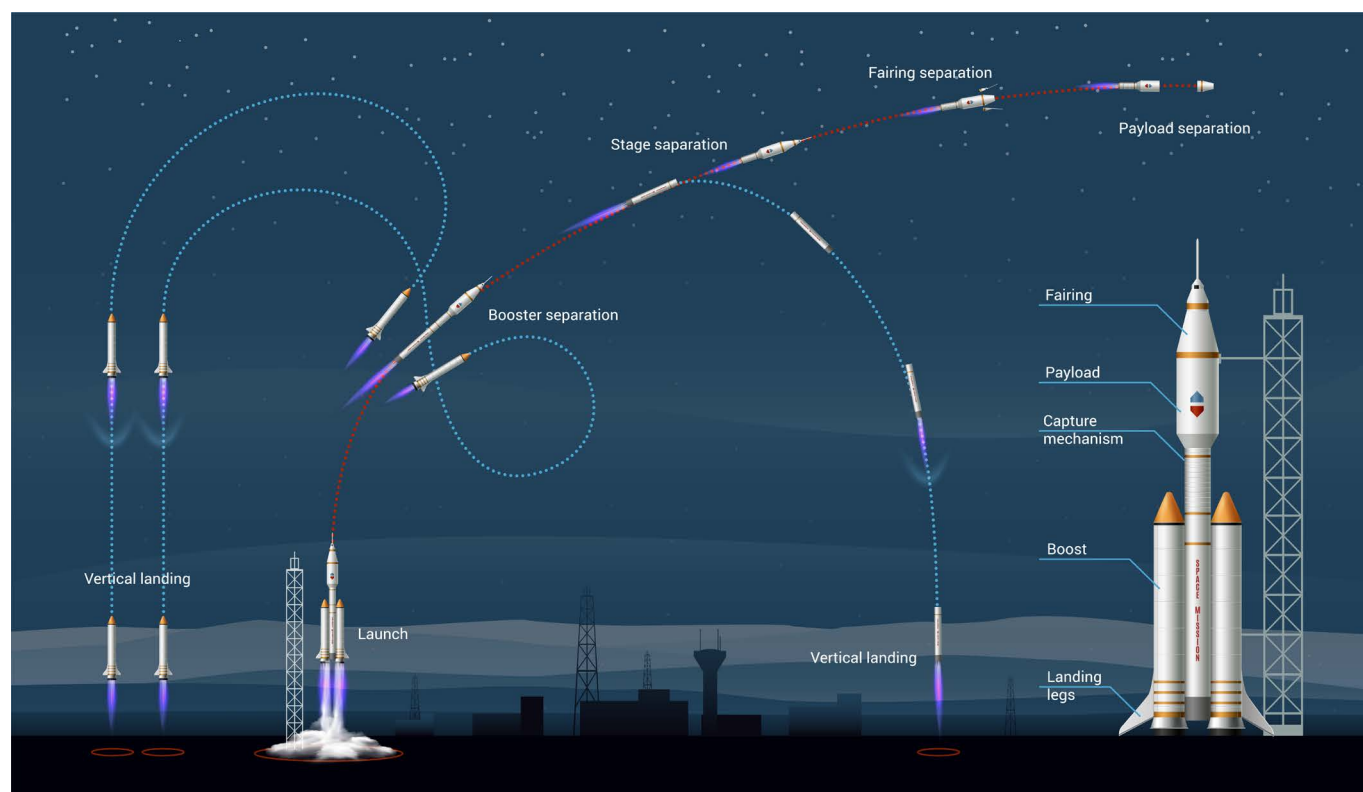


Figure 1 – Phases of a typical space operation.

1. Introduction

1.4 Levels of ANSP Involvement

As mentioned earlier, there are two possible levels of involvement for an ANSP. The ANSP in whose controlled airspace the launch or re-entry is taking place is the *coordinating ANSP*. They coordinate management of the danger area with other ANSPs whose airspace may be affected, called the *integrating ANSPs*. Depending on the coordinating ANSP's procedures, the danger area request may come from the LRO. In some States, the State or LRO will conduct some of the activities identified as the role of the coordinating ANSP. For example, there are instances in which the LRO can promulgate an international NOTAM from ANSPs without prior intergovernmental coordination. Integrating ANSPs may publish associated NOTAMs defining danger areas.

The combination of coordinating ANSPs, integrating ANSPs, and LROs must ensure safety of the airspace system and non-participating airspace users. Figure 2 shows FIRs around the world that were affected by launches from the United States of America during 2022 and the first quarter of 2023. In these instances, the United States' FAA was the coordinating ANSP, while the others were integrating ANSPs.

ANSPs integrating L/R operations should fully engage in strong communication between CAAs and SSRs. Each ANSP or CAA should clearly define expectations for air traffic managers to integrate such operations into their systems.

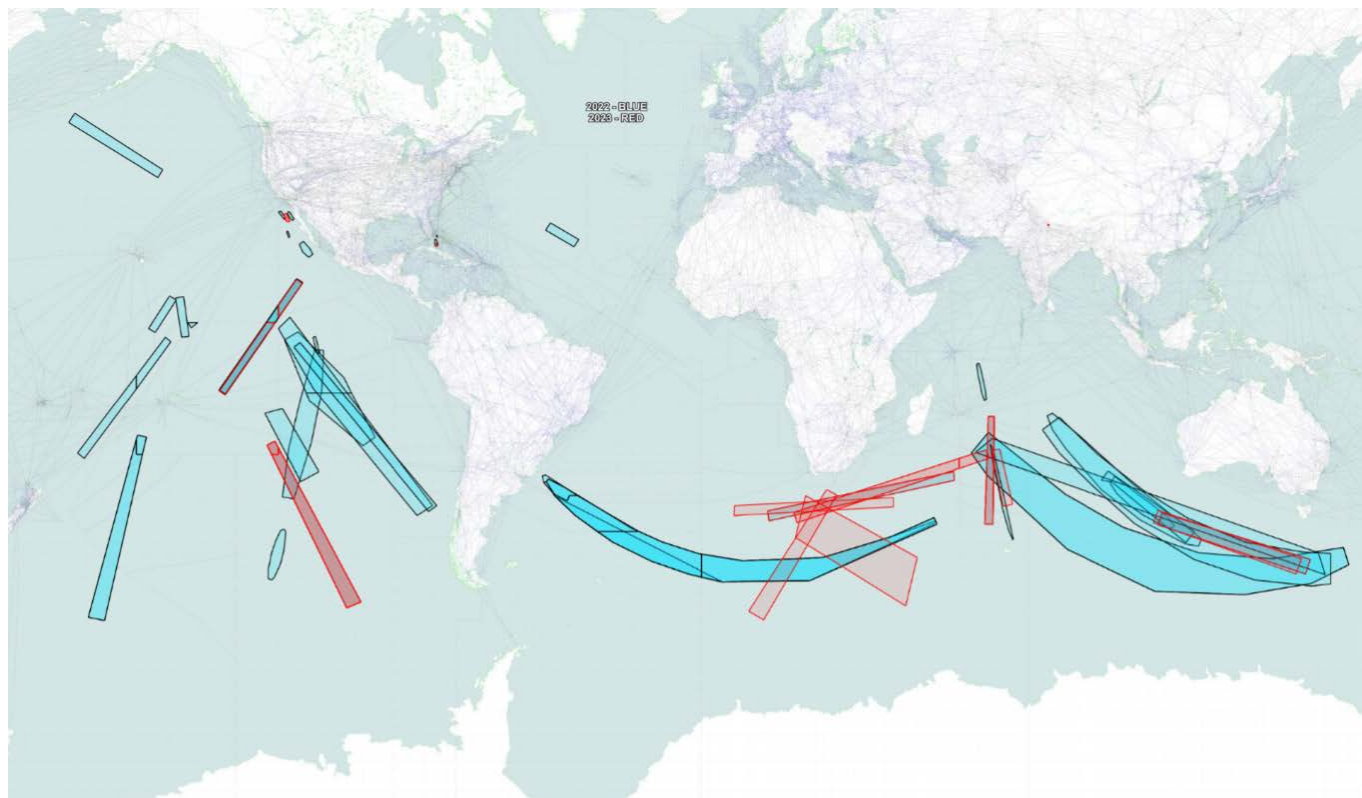


Figure 2 – Flight Information Regions (FIRs) across the globe affected by space transportation operations from the United States in 2022 and the first quarter of 2023.

2. Terms and Acronyms

Airspace Management Plan (AMP)	A planning document that lays out how the ANSP will manage the airspace.
Air Navigation Service Provider (ANSP)	A public or a private legal entity providing air navigation services within a specified region.
Air Traffic Control (ATC)	Set of procedures, practices, and personnel who provide air traffic separation services.
Air Traffic Control Officer (ATCO)	An individual employed by the air navigation service provider who directly provides air traffic control services.
Air Traffic Management (ATM)	The collection of air traffic control services and airspace management services to maintain safe and efficient movement of aircraft.
Air Traffic Flow Management (ATFM)	A set of services that contribute to safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.
Air Traffic Services (ATS)	A generic term meaning, variously, flight information service, alerting service, air traffic advisory service, or air traffic control service (area control service, approach control service, or aerodrome control service).
Air Traffic Service Unit (ATSU)	A subset of the ANSP responsible for providing air traffic control services, communication, and navigation assistance to aircraft in their assigned airspace.
CANSO ATFM Data Exchange Network for the Americas (CADENA)	Processes and procedures in the Latin America and Caribbean region used to facilitate data sharing and common situational awareness in air traffic management.
Civil Aviation Authority (CAA)	The agency of a sovereign State given responsibility, by agreement or statute, to determine and administer regulations to ensure that aircraft are operated safely.
Collaborative Decision Making (CDM)	The set of processes and practices to foster collaborative air traffic management decisions and data exchange among members of the air traffic management community.
Coordinating ANSP	An ANSP taking a primary role in coordinating space operations and airspace management activities with other ANSPs who may be affected.
Danger Area	A region of Special Use Airspace around a launch or recover operation to protect non-participating individuals and aircraft.
Debris Response Area (DRA)	Contingency areas that are activated in the event of a launch malfunction.

2. Terms and Acronyms

Flight Information Region (FIR)	A specified region of airspace in which a flight information service and an alerting service are provided and delegated to a State responsible for the operational control.
Flow Constrained Area (FCA)	An artifact used in air traffic flow management that defines a region of airspace, flight filters, and time interval to identify flights subject to a constraint.
Integrating ANSP	An ANSP who may be affected by space operations addressed by a coordinating ANSP.
Launch operator	Any person or organisation wishing to transit airspace with a vehicle designed to launch cargo or passengers into space.
Launch vehicle	A vehicle built to operate in, or place a payload in, outer space or a suborbital rocket.
Letter of Agreement (LOA)	A formal written document stating how air traffic facilities will interact in a specialised situation.
Launch or Re-entry Operations (L/R)	The act of launching or recovering a space operation.
Launch or Re-entry Operator (LRO)	The entity conducting the launch or re-entry operation. Also known as launch and recovery operation.
NOTAM	A notice distributed by means of telecommunication containing information concerning the establishment, condition, or change in any aeronautical facility, service, procedure, or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.
State Space Regulator (SSR)	A state agency that regulates space launches, space re-entries, and spaceport operations.
Safety Management System (SMS)	A systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies, and procedures.

3. Integration Considerations

In this chapter, we summarise the ANSP considerations for integrating L/R operations into airspace systems. The considerations are broken down into four key phases for a L/R operation: Notification for Airspace, Airspace Planning, Day-of Activities, and Post Operations Analysis. A summary figure of the different phases is in Figure 3 below.

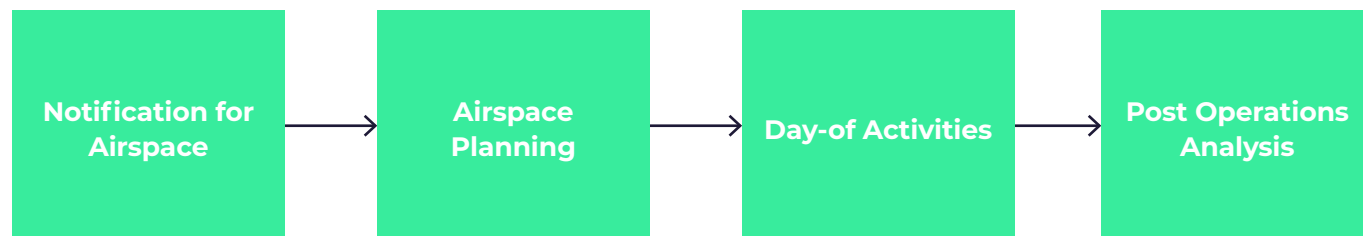


Figure 3 – Key Phases for a L/R Operation.

3.1 Notification for Airspace

In this section, we provide recommendations to the ANSP for how to handle a request for airspace. This applies to the coordinating ANSP, not the integrating ANSP.

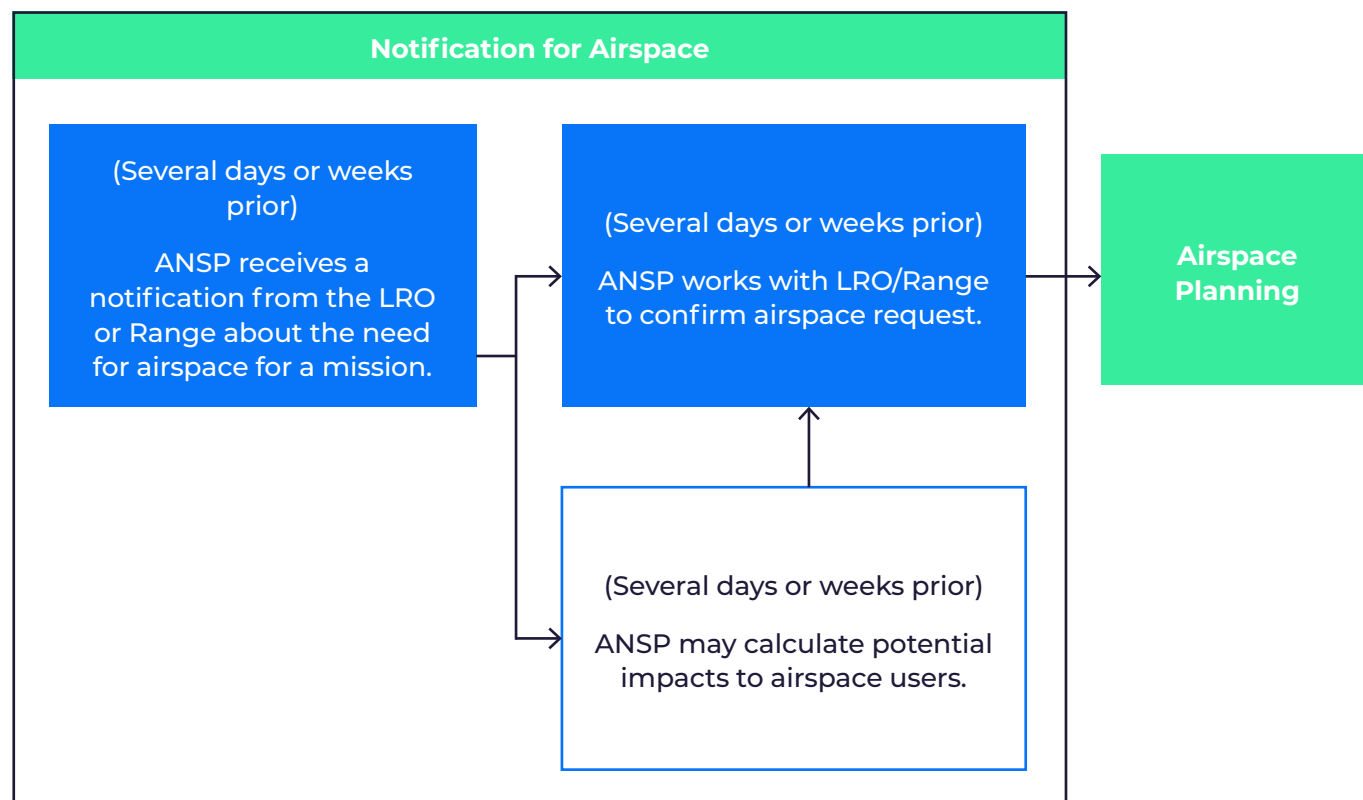


Figure 4 – Activities within Notification of Airspace Phase.

3. Integration Considerations

3.1.1 LRO/Range Request for Airspace

Airspace requests should be made by the LRO well in advance (e.g., 10-15 days). In some States, the request goes to the coordinating ANSP, while in other states, it goes to the SSR. There are cases in which timing of the operation is not known well in advance, as can happen with some military operations.

Ideally, this airspace request would take the form of a *notice of intent*, containing the following information:

- Launch information: Mission name, site, date, and backup date
- Primary and backup launch windows
- Type of vehicle
- Mission type (launch, re-entry, airborne launch)
- Geographical extent of danger area(s) defined by coordinates (latitude and longitude, in compliance with ISO 6709 standards)
- Any relevant supplemental information, e.g., the location and geographical extent of potential falling debris that may be activated in the event of a failed operation.

The subsequent notice of intent may be formed solely by the LRO, or it may be formed in collaboration with the SSR or CAA before the coordinating ANSP receives it. Timing of the operation and size/shape of the danger area may lead to subsequent conversation and negotiation. The ANSP may then be able to provide feedback on the notice of intent. So, the ANSP (possibly in conjunction with the SSR and CAA) should consider the exact process of generation, transmission, negotiation, and acceptance of the notice of intent.

Once receiving the finalised notice of intent, the coordinating ANSP should then request danger areas to be published via NOTAM(s) by the integrating ANSPs as soon as practicable, ideally at least seven days prior to an operation.² LROs should note that conflicting airspace demands in busier regions mean that early engagement with ANSPs (phone calls, emails, etc.) will reduce the risk of requests for airspace for L/R operations being refused.

3.1.2 Coordinating ANSP May Perform Airspace Impact Assessment

The coordinating ANSP who receives the notice of intent from the LRO or the SSR should review the information from the perspective of impact to air traffic management services and airspace. Assessment considerations for the coordinating ANSP may include the following:

- What type of impact will this have on ATC or other airspace users?
- Are there other activities of a similar type taking place or requested?
- Can the space transportation operation be moved to a less impactful time of day, or is this a time-sensitive operation with a narrow launch window?
- Does the operation require support from an air traffic flow management (ATFM) measure (e.g., rerouting program)?
 - What other FIRs will be affected by the proposed danger area(s) and potential ATFM measures?
- Payload priority considerations, e.g. payloads sponsored by the military or government.

The coordinating ANSP may work with the LRO to adjust L/R window time or duration based on airspace impact and efficiency considerations. Information should be shared with integrating ANSPs during the airspace analysis phase so it is available in a timely manner for planning.

² Recommended by ICAO Document 10066, "Aeronautical Information Management"

3. Integration Considerations

3.2 Airspace Planning

In this section, we provide recommendations to the ANSP for how to plan airspace management activities missions that have been approved prior to the day of operation. This would apply mainly to the coordinating ANSP, but the integrating ANSP may do planning for their own airspace.

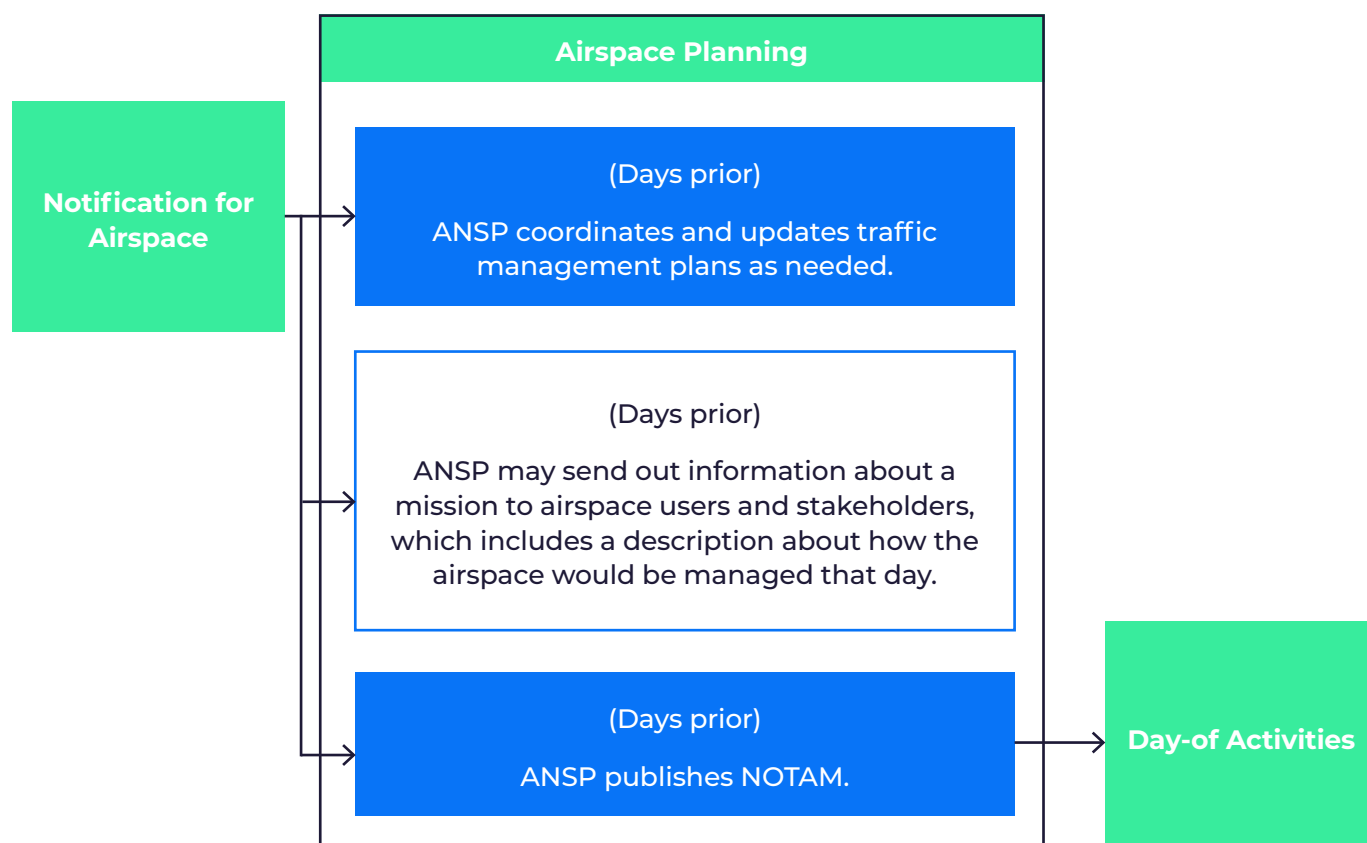


Figure 5 – Activities within Airspace Planning Phase.

3. Integration Considerations

3.2.1 NOTAMs Formation and Dissemination

Depending on State requirements, when possible, coordination should be affected a minimum of seven days in advance, in accordance with guidance contained in ICAO Procedures for Air Navigation Services – Aeronautical Information Management (PANS-AIM, Doc. 10066), the ICAO Aeronautical Information Services Manual (Doc. 8126) and the PANS – ICAO Abbreviations and Codes (PANS - ABC, Doc. 8400).

NOTAMs issued for space launch, transit, and re-entry operations should be generated and processed in accordance with current ICAO Provisions and State Regulator approved procedures. In accordance with The NOTAM Code section of ICAO Doc. 8400 (the PANS-ABC), the following NOTAM code should be used:

- QRDCA/IV/BO/W – Where ‘Q’ indicates it is a code abbreviation for use in the composition of NOTAM; where “RD” stands for “Danger Area” and ‘CA’ stands for ‘Activated’; and where the ‘I’ and ‘V’ indicate the danger area is applicable to IFR traffic and VFR traffic, respectively; and where the ‘BO’ indicates the NOTAM is of operational significance for Pre-flight Information Bulletin (PIB) entry and concerning flight operations; and where ‘W’ indicates the scope is considered ‘air display’.
- QRTCA/IV/BO/W – Where ‘RT’ stands for ‘Temporary Restricted Area’ and ‘CA’ stands for ‘Activated’.

Airspace managers may choose to activate different types of airspace in support of space operations, including warning areas, danger areas, falling debris areas, or other forms of altitude reservations (ALTRVs). Size and geometry of danger areas should have already been determined by the appropriate state regulator. It is recommended that States coordinating space operations limit the number of coordinates for danger areas to mitigate risk of error and undue burden of workload for the publishing ANSP.

3.2.2 Development and Dissemination of an Airspace Management Plan

The ANSP should consider the need for an airspace management plan (AMP) for each mission. An AMP is a planning document that lays out how the ANSP will manage the airspace. In some cases, the ANSP may determine that standard airspace procedures will sufficiently address the situation. When an AMP is warranted, it can be a very simple document, or more extensive, depending on complexity of the LRO and impacted airspace. An extensive AMP would ideally include the following:

- Background describing the type of activity, and pertinent information;
- Launch or re-entry primary launch date and backup dates;
- Description of the danger area(s) written as a general location and size;
- General operational impact describing the effect on the affected airspace;
- Images or screenshots including the danger area(s) and other areas as appropriate;
- Traffic flow management plan, possibly including traffic flow management measures³ to coordinate and implement with ANSPs and ATSUs on the day of the event;
- Route availabilities for non-participating aircraft operators;
- Expected tactical initiatives, e.g. miles-in-trail, that are pre-coordinated between affected ANSPs and ATSUs to implement while supporting operations;
- Supporting air traffic flow management measures;
- Letters of Agreement (LOAs) that may be established between facilities;
- Contingency plans in the event of a failed operation (e.g. activation procedures for falling debris).

The AMP should be distributed to affected ANSPs, air traffic service units (ATSUs), other offices within the ANSP, and other affected airspace user groups.

³ Also known as air traffic flow management initiatives, these measures include ground delay programs and rerouting programs.

3. Integration Considerations

3.3 Day-of Activities

In this section, we provide recommendations to the ANSP for managing airspace on the day of the space operation. All regulatorily required letters of agreement/intent within an ANSP, LROs / Ranges, and with other ANSPs are in place.

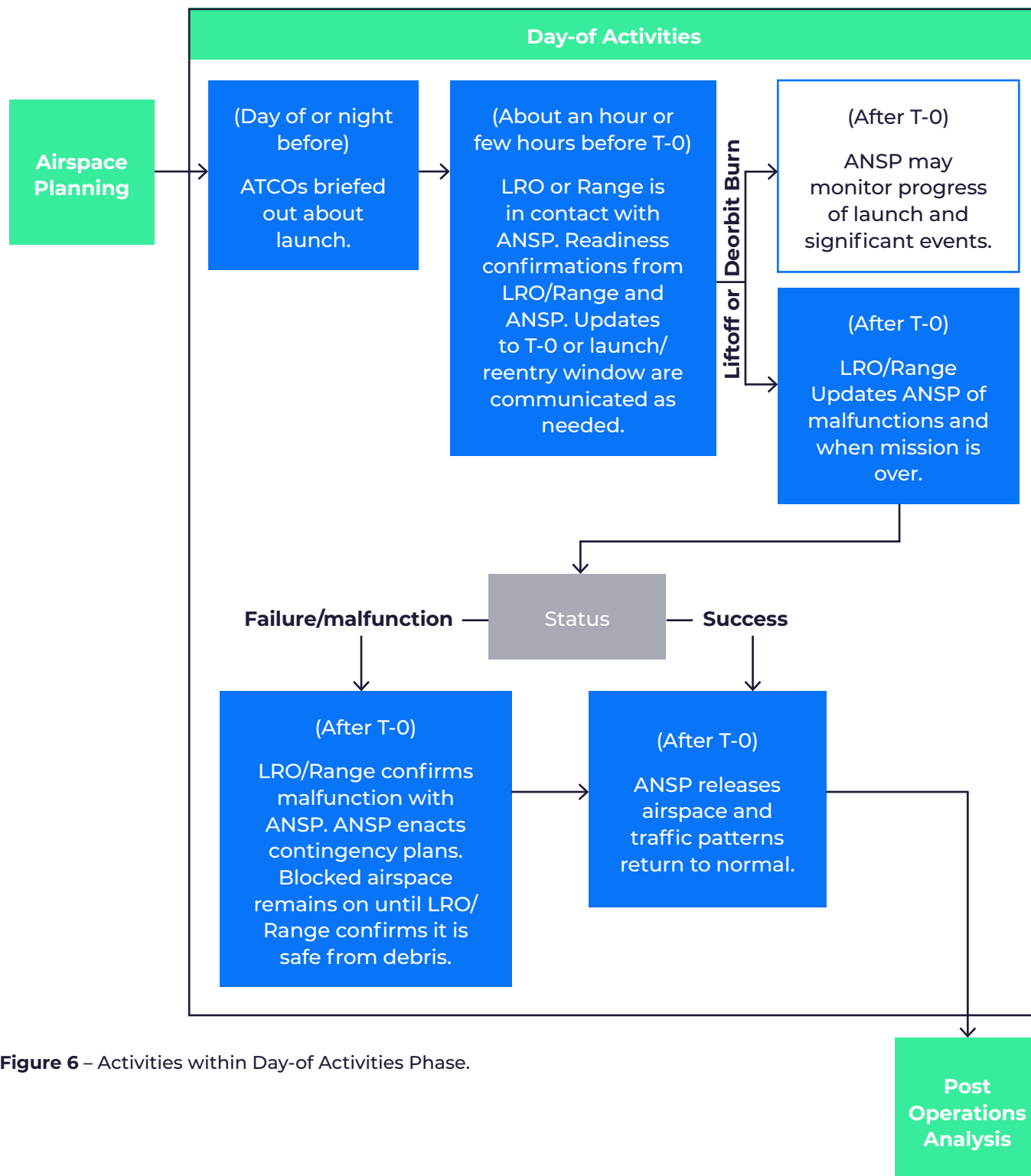


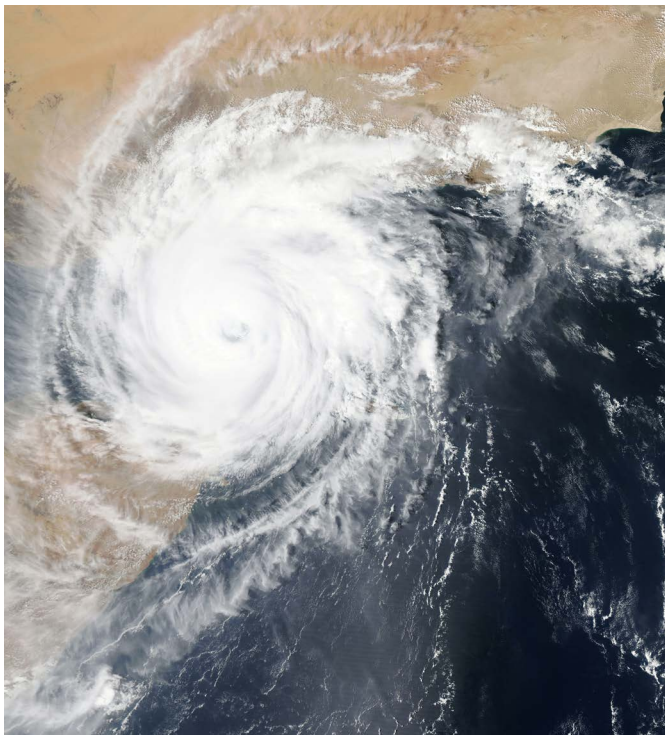
Figure 6 – Activities within Day-of Activities Phase.

3. Integration Considerations

3.3.1 Technology and Systems Readiness

We assume that the coordinating and integrating ANSPs determined the technological status and systems readiness to integrate space operations the day before the launch or re-entry operation. A technological and systems readiness assessment should include review of the following:

- Ability to process NOTAMs;
- Ability to draw or depict danger areas on ATM and ATFM automation displays to increase situational awareness and increase safety;
- Communication mechanisms;
 - Conference call capabilities;
 - List of stakeholder individuals, organisations, or relevant bodies who may need updates on the day of operations
- Ability to integrate space operations data into ATM/ATFM automation or procedures;
- Automation to facilitate the submission, planning, coordination, and management of space operations for the ANSP/ATSU;
- Data exchange standards for communicating space data for ATM purposes.



3.3.2 Maintain Situational Awareness

3.3.2.1 AMP Awareness

All stakeholders should be aware of the information in the AMP prior to the operation. Coordination is often point-to-point, and contact between affected parties should be in accordance with existing LOAs. Other tools to consider include:

- Planning teleconferences;
- Telephone hotline or chat tool for popup questions and issues;
- Operational information displays via official web pages.

3.3.2.2 Mission Awareness

Throughout the operational day, ANSPs, ATSUs, and other stakeholders should maintain situational awareness of the space operation mission status. This would include:

- Launch readiness (countdown) status and re-entry readiness;
- Delay notifications (if any);
- Notification of irregular, unexpected or unplanned events, such as unexpected falling debris, that may trigger a contingency plan;

The LOA will define the processes that ensure the ANSP receives up-to-date information in a timely fashion from the LRO

3.3.2.3 Weather Awareness

Weather conditions and forecasts should be tracked throughout the day. There are two types of weather concerns. One is weather directly affecting the space operation. The mission could be jeopardised by excessive temperatures, high winds, convective activity, or even solar activities. These are largely concerns for the LRO, and they affect the ANSP indirectly because they could change mission plans (e.g., delayed or postponed launch).

The other type of concern is weather directly affecting the air traffic and airspace surrounding the danger areas. For instance, aircraft may be deviating around weather, which affects the airspace management plan.

3. Integration Considerations

3.3.3 Monitoring and Managing Airspace

3.3.3.1 NOTAMs Management

It may be possible to release airspace prior to the NOTAM end time if space operations are successful within regular or expected parameters. If airspace is released early, tactical use is coordinated through real-time communications (e.g. a hotline) for all stakeholders to get operational information simultaneously.

3.3.3.2 Time-based Airspace Management

Techniques and procedures can be developed to determine exactly which sections of airspace will be closed to aircraft during an operation and for how long the closure should remain active. This is an effective alternative to closing large sections of airspace for long periods of time, simply because they might be used by the LRO. Dynamic launch windows represent a range of possible launch times. Where these are used, the ANSP should ensure the appropriate protections are within the LOA for long-haul flights which may be airborne hours before changes are made.

3.3.4 Air Traffic Flow Management (ATFM) Support

To maintain orderly flow in the surrounding airspace, the ANSP should consider applying ATFM policies or procedures if they are capable.⁴ For some ANSPs, this will be limited to simple demand monitoring. This allows the ANSP to identify exactly which aircraft might be affected by the space operations danger area and when they might arrive there. Other ANSPs who can reroute or delay aircraft bound for the affected airspace might consider implementing ATFM measures (also known as ATFM initiatives), which include ground stops, ground delay programmes, airspace flow programs, and rerouting programmes. If the ANSP has the capability, they can construct and implement a flow constrained area (FCA) around the danger area(s) to keep aircraft out of the FCA in specific time periods. This provides a precise and efficient way to identify and manage affected aircraft. Notification should be issued to all stakeholders when ATFM measures are cancelled or extended.

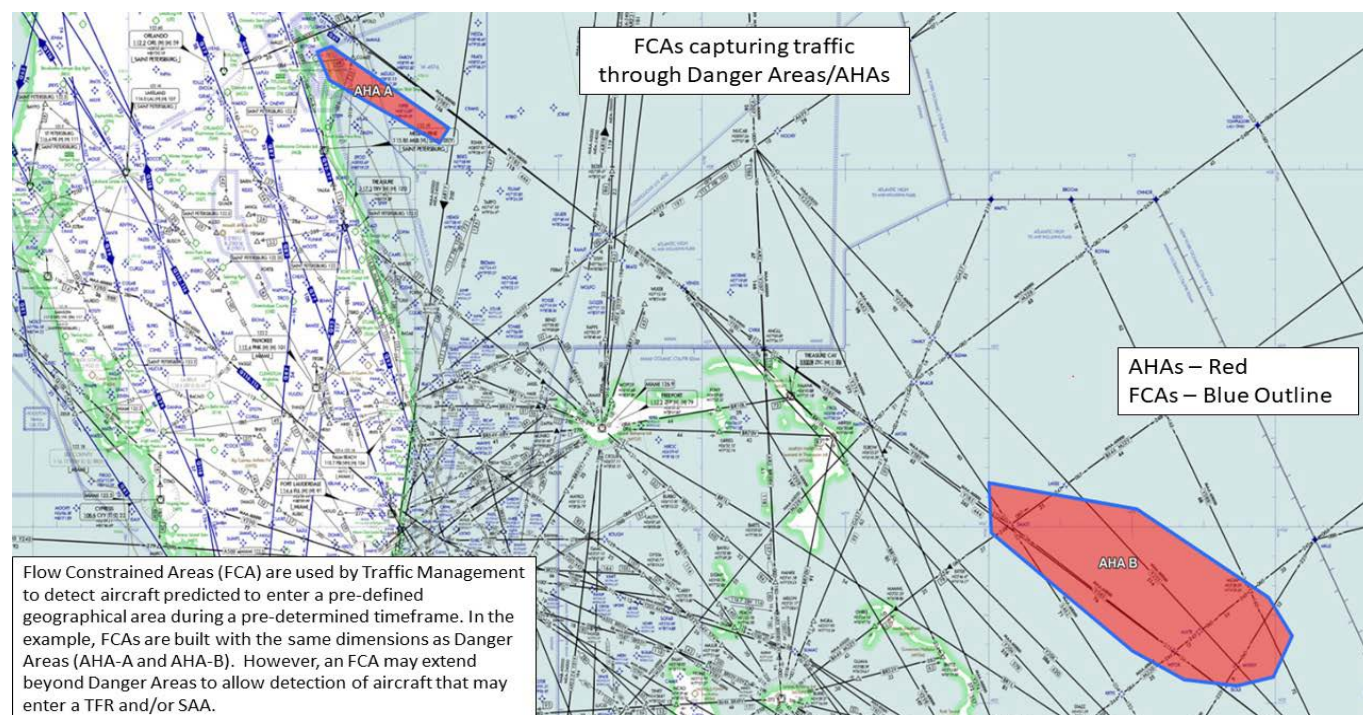


Figure 7 – Traffic managers create a flow constrained area (FCA, blue border) that captures two danger areas, also known as aircraft hazard areas.

⁴ ICAO Document 9971, “Manual on Collaborative Air Traffic Flow Management”

3. Integration Considerations

3.3.5 Contingency Plan Enactment

As warranted, contingency plans may be implemented for irregular, unexpected or unplanned events. ANSPs should develop and disseminate contingency plans (usually in the LOAs) with appropriate stakeholders in advance of the day of operations. After the day of operations, SSRs should investigate incidents or accidents related to a space operation as necessary. Incidents involving aircraft should also be investigated pursuant to the requirements of ICAO Annex 13 (Aircraft Accident and Incident Investigation) and Annex 19 (Safety Management).

At this time, there are no internationally recognised standards specifying unique details of L/R contingency plans; ANSPs can implement their own versions of contingency plans. For example, the FAA in the U.S.A employs Debris Recovery Areas (DRAs).

A DRA is a contingency area activated only in the event of a launch malfunction leading to falling debris. During a L/R operation, civil air traffic can operate within the DRA, but if the launch fails, the integrating ANSP is notified so they can move and keep aircraft out of the DRA until it is clear of debris. Each DRA

has a time limit of potential activation relative to the launch. For instance, suppose a rocket launch has a DRA with a time limit of \ nine \ minutes. This means if the rocket launches successfully and shows no signs of malfunction nine minutes after launch, then the DRA is no longer be activated, because the rocket has passed the geographical area specified by the DRA.

3.4 Post Operations Analysis

Events and lessons learned should be documented on the day of operations, or shortly thereafter. Ideally, an examination with internal stakeholders would be held to review how well the operations went and how processes or procedures might be improved. This may also involve external stakeholders. This is a consideration for Coordinating ANSPs and Integrating ANSPs.



Figure 8 – Activities within Post Operations Analysis Phase.

3. Integration Considerations

3.5 Overall Workflow

In this chapter, we summarised the ANSP considerations for integrating L/R operations into airspace systems. The considerations were broken down into four key phases for a L/R operation: Notification for Airspace, Airspace Planning, Day-of Activities, and Post Operations Analysis. Figure 9 summarises the overall workflow for the ANSP.

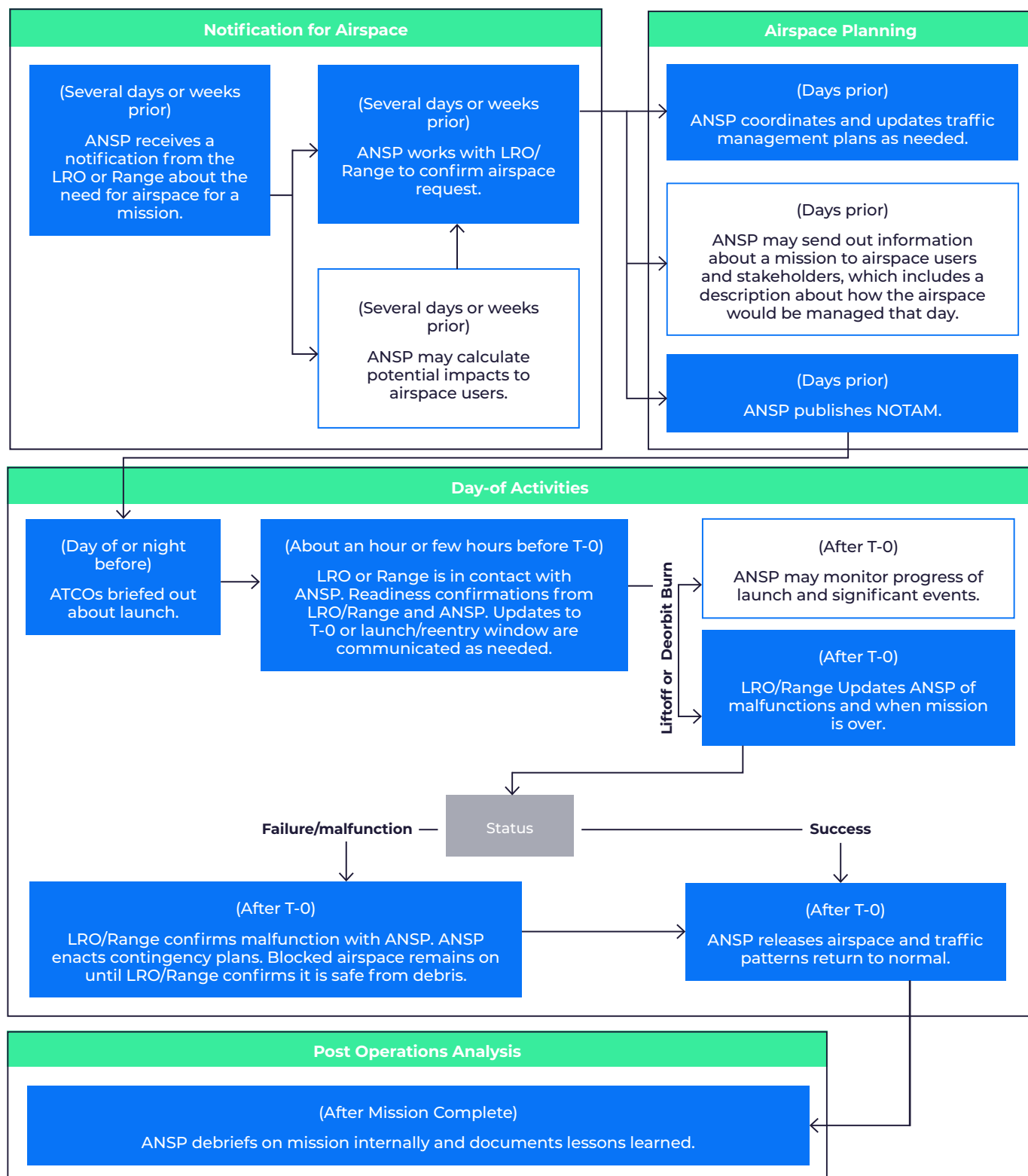


Figure 9 – Overall Workflow with Activities. White Boxes indicate Optional Activities.

4. Other Considerations

4.1 International Standards and Recommended Practices (SARPs)

ANSPs should be aware of some key differences in standards and recommended practices (SARPs) for civil aviation versus space operations.

In 1944, the Convention on International Civil Aviation, also known as the Chicago Convention, created the International Civil Aviation Organization (ICAO) to harmonise civil aviation around the world. Since that time, ICAO has played an active role in issuing standards and practices for its 193 member states. ICAO's authority is limited to only civil aircraft.⁵ Since space operations are not civil aviation operations and space vehicles are not aircraft, ICAO authority does not address space operations. However, ICAO's purview does extend to management of civil operations potentially impacted by space operations, and ICAO standards are binding upon ANSPs from its member states.⁶

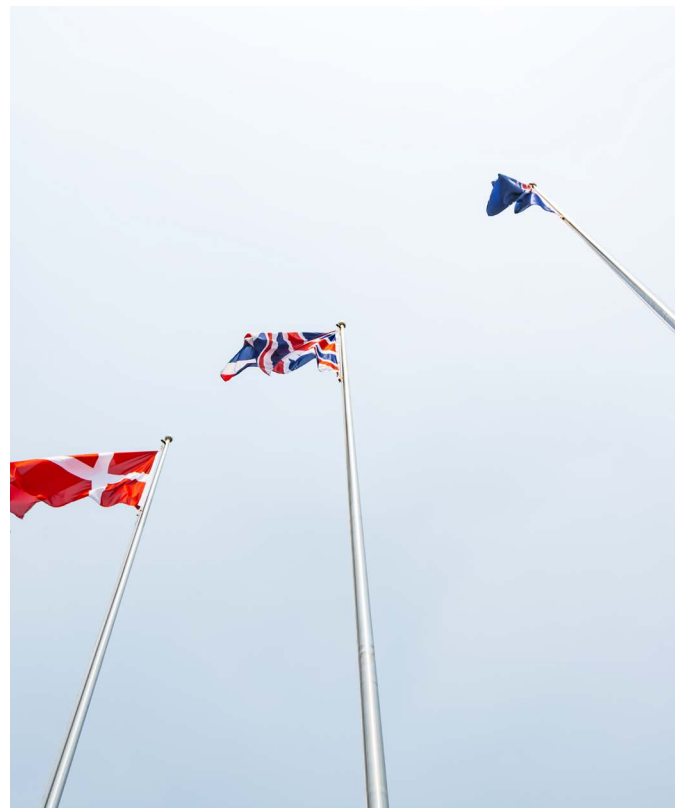
Currently, there is no body or authority to regulate or develop standards or practices for operations taking place in space. Instead, space operations are governed by several international treaties. The Committee on the Peaceful Uses of Outer Space (COPUOS) was established by the United Nations in 1959 to govern the exploration and use of space for the benefit of humanity. COPUOS has formed five treaties including the Outer Space Treaty, the Liability Convention, and the Registration Convention.⁷

The Inter-Agency Space Debris Coordination Committee (IADC) is an international governmental forum for the worldwide coordination of activities related to the issues of man-made and natural debris in space. IADC promotes international cooperation in the peaceful use of outer space and facilitates multilateral treaties. For example, IADC develops technical recommendations for all space operations. These forums provide recommendations recognised by most state space oversight bodies as starting

points for national legal and regulatory frameworks to govern space activities.

ANSPs should limit scope of their actions to airspace management related to space transportation

activities, which generally includes NOTAM coordination and air traffic control procedures. Issues regarding regulation of space operations should be deferred to the SSR. SSRs are charged with oversight of public safety for commercial space operations and the operation of spaceports. ANSPs correspondingly play a fundamental role in ensuring the safety and security of the airspace system. Therefore, the implementation of SSR-defined hazard areas, or danger areas, is an essential role of an ANSP during space transportation operations.



⁵ See ICAO Doc 7300: <https://www.icao.int/publications/pages/doc7300.aspx>

⁶ Though binding, all States file differences to the SARPs for their airspace volumes.

⁷ See UN web page: <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html>

4. Other Considerations

4.2 Collaboration

Successful implementation of space transportation operations into airspace systems requires collaboration from all stakeholders.

ANSPs should establish collaborative partnerships and coordination mechanisms with spaceports, LROs, air traffic facilities, regulatory authorities, industry associations, and other relevant stakeholders (e.g., military and local public safety) involved in space transportation operations. Regular communication and coordination are crucial for information sharing. ANSPs should consider engaging in relevant forums and cooperation initiatives to share best practices and harmonise standards for integrating space operations into airspace systems.

In coordination with the appropriate SSR(s), ANSPs should review information provided by LROs to:

- Establish formal agreements on how to notify, plan, coordinate, and execute these operations with necessary stakeholders within the LOA;
- Communicate with LRO on upcoming space transportation operations;
- Participate in opportunities such as licensing reviews, operator announcements, conferences, site visits, etc;
- Determine ANSP and ATSU support needs for each mission as soon as practicable;
- ANSP or ATSU management may direct assignments earlier based on mission requirements and pre-mission coordination needs.

The ANSP should consider establishing an official communication mechanism. For instance, some ANSPs have established a 'space mailbox'. The space mailbox is an email address that can be used as a recognised contact point for pre-launch coordination issues. However, to be effective, its existence needs to be known in advance by relevant stakeholders, including potentially affected ANSPs and ATSUs. A key benefit of the group mailbox model is to avoid connecting pre-launch coordination communications to a specific individual (e.g. by using a personal email address), who might leave the organisation or move

to another role. The idea is that the space mailbox should be checked daily by all identified ANSP team members. Also, messages can be appropriately labelled and archived.

Before establishing such mechanisms however, the ANSP should consider existing mechanisms that can be used to accomplish their goals.

When information arrives by individual emails, phone calls, or other sources, it should be appropriately documented and shared with appropriate stakeholders.

4.3 Risk Hazard Analysis

The SSR (or its equivalent) should oversee a risk hazard analysis for each L/R operation and any connected return during the licensing and permitting process to ensure they meet applicable safety criteria. This might not apply to military operations. The ANSP uses the risk hazard analysis to determine the appropriate geographical dimensions that should be used to define danger area(s) suitable to ensure the safety of their ATM operations and to determine the geographical definition of the danger area(s) that will be included in the NOTAM and PIB.

ANSPs should consider who has the authority to request a NOTAM in support of a space transportation operation. Examples may include: SSR, space agencies, military entities, LROs, spaceports, and ANSPs coordinating on behalf of LROs.

5. Summary of Considerations

In this section, we summarise the considerations for ANSPs. These are captured in four tables as follows:

- **Table 1** – Considerations for notification and negotiation;
- **Table 2** – Considerations for airspace planning and coordination;;
- **Table 3** – Considerations for the day of operations;
- **Table 4** – Considerations for post operations.

In each table, considerations are broken down by the coordinating ANSP and integrating ANSP.

Table 1: Notification/Negotiation Considerations

Subject	Coordinating ANSP	Integrating ANSP
Regulation and Policy	ANSP should consider division of roles and responsibilities between the SSR and the ANSP. For instance, regulations and policies for space operations are usually set by a state regulator outside the ANSP.	Same.
LRO Request for Airspace	Consider what the process will be for the LRO to submit a request for airspace (e.g., ANSP, CAA, or SSR).	Receive and implement requests, in accordance with ICAO Document 10066, Annexes 11 and 15.
Airspace Impact Assessment	ANSP may wish to conduct, or may be asked to conduct (by the SSR), an airspace impact assessment for the L/R based on the initial request.	None.
Collaboration	ANSPs should consider how they will coordinate with spaceports, LROs, air traffic facilities, regulatory authorities, and other relevant stakeholders (e.g., military and local public safety) involved in space transportation operations.	Consider best practices for coordinating NOTAMs for space operations.

5. Summary of Considerations

Table 2: Airspace Planning Considerations

Subject	Coordinating ANSP	Integrating ANSP
Airspace Management	Form a plan for how the airspace is to be managed.	Consider which aspects of the AMP depend on or affect their operations.
NOTAM Formation	Form a NOTAM for dissemination in accordance with ICAO guidance.	Ingest or process NOTAM information as received, in accordance with ICAO Documents 10066, 8126, 8400 and Annexes 11 and 15.
Disseminate Information to stakeholders	Prior to day of operations, ANSP should disseminate relevant information to stakeholders via a NOTAM (at a minimum). The NOTAM however can be accompanied by an AMP or other relevant information about the L/R.	Inform airspace stakeholders of potentially hazardous activities, in accordance with ICAO Documents 10066, 8126, 8400 and Annexes 11 and 15.

Table 3: Day of Operations Considerations

Subject	Coordinating ANSP	Integrating ANSP
Technology and Systems Readiness	Consider forming a technology and systems readiness checklist for the day of operations.	Receive necessary information and disseminate appropriately.
Situational Awareness	Consider how awareness will be maintained for (1) airspace management plan execution, (2) space operation mission awareness (e.g., status, go/no-go), (3) weather effects that could impact non-participating aircraft (e.g., planned reroutes).	Same.
NOTAMs Management	Consider how/if airspace can be released early.	Consider real-time communication mechanisms with coordinating ANSPs to ensure the safe use of airspace after an operation.
Time-based Airspace Management	Consider the benefits of implementing dynamic launch windows.	None.
Contingency Plan Enactment	Consider what type of contingency plans may need to be executed or created during an operation.	Same.
ATFM Support	Consider how air traffic flow management activities (if in place) can provide support.	Same.

5. Summary of Considerations

Table 4: Post-Operations Considerations

Subject	Coordinating ANSP	Integrating ANSP
Post-Mortems	Consider conducting post-operations reviews internally or with stakeholders to gather lessons learned.	Same.
Documentation	Consider capturing lessons learned or proposed future improvements in documents.	Same.
Future Improvements	Consider modifications to practices and procedures for future improvement.	Same.

