SP-1 Airspace Change Manager

Room 113 AT Building
QinetiQ Malvern Technology Centre
St Andrews Road
Malvern
Worcestershire
WR14 3PS

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ACP-2021-12 – Spaceport 1 North Uist Stage 2 Step 2A Airspace Design Options – Stakeholder Engagement

1 Introduction

1.1 Purpose

This document forms part of the airspace change process as defined in Civil Airspace Publication (CAP) 1616. ACP-2021-12 was commenced in 2021 to enable the launch of both sub-orbital sounding rockets and orbital small satellite rockets from the Spaceport 1 (SP-1) site at Scolpaig, North Uist on the Outer Hebrides. However, the planning application for the SP-1 site only includes sub-orbital rocket launches and therefore orbital small satellite rocket launches have since been removed from this ACP. The airspace change Sponsor is QinetiQ Ltd who form part of the SP-1 consortium led by the local council, Comhairle nan Eilean Siar, and comprising Highlands & Islands Enterprises (HIE) as well as private investors.

It is evident that vertical launch rockets will pose a risk to other airspace users and, as for other such hazardous activities, there is a requirement for segregation. This can be achieved through a number of different airspace classifications and airspace design options, which are presented in this letter.

The purpose of this letter is to enable all stakeholders the opportunity to comment on the design options presented, help shape the design and inform the airspace classification discussion. You or your organisation have been identified as a stakeholder in the ACP process and as Sponsor for the airspace change, we would very much like your feedback on the design options presented.

It should be noted that this engagement request is concerned purely with the final permanent airspace solution for SP-1 under ACP-2021-12. This should not be confused with the engagement process regarding a Temporary Danger Area (TDA) for sub-orbital rocket operations from the same site; ACP-2021-37 refers.

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3 Statement of Need (SoN)

3.1 To help understand the requirement the original SoN is reproduced:

Since the SoN was written orbital rocket launch airspace requirements have been removed from this ACP.

> *"A consortium led by the local council (Comhairle nan Eilean Siar), comprising Highlands & Islands Enterprise, private investors and QinetiQ, are developing a vertical launch spaceport site, herein known as 'Spaceport 1', at Scolpaig, North Uist on the Western Isles. This site is being developed as an opportunity in support of the UK government's spaceflight programme, 'LaunchUK', which aspires to grow the UK's global market share of the space sector to 10% by 2030 and be at the forefront of small satellite launch.*
>
> *Spaceport 1 has been the recipient of local government investment to construct a vertical launch spaceport that will enable small satellite launch. Development of the site and future use by operators will generate much needed revenue for local communities. It is envisaged that significant economic return will result from the creation of high quality job opportunities for local residents, direct and indirect financial income and an increase in personnel residing and visiting the area.*

The location has been carefully selected in order to minimise disruption to the public and airspace users, the latter through the exploitation of the existing Ministry of Defence (MOD) managed Danger Areas known as the Hebrides Range; the EG D701 complex. Using irreducible spare capacity of the existing Danger Area complex will enable safe testing of suborbital 'sounding rockets' and future small satellite launch rockets[1]. The existing Danger Areas are fully integrated into systems and processes employed by the UK Airspace Management Cell (AMC) and the Eurocontrol Network Manager enabling harmonised and dynamic planning of the Air Traffic Management (ATM) network. Moreover, it is envisaged that QinetiQ will manage any 'new' airspace created under the ACP in exactly the same fashion the Hebrides Range airspace is managed, thereby utilising existing airspace management processes and procedures enabling efficient use of airspace under the Flexible Use of Airspace (FUA) concept. Furthermore, this will facilitate expedient transfer of airspace use from MOD activity to Spaceport operations as well as accommodating short notice changes and, where appropriate, coincident operations.

The Spaceport 1 site at Scolpaig currently lies beneath Class G unregulated airspace but is only a few miles from the EG D701 complex. As rocket launch will pose a risk to other airspace users, there is a requirement to safely segregate such activity to minimise risk. Segregation is normally achieved through the promulgation of temporary reserved airspace activated by a Notice to Airmen[2] (NOTAM). However as the airspace is likely to be needed on a regular basis, the promulgation of a NOTAM detailing the coordinates and control procedures for every launch is probably not appropriate as a long term solution. Furthermore, such temporary airspace is not fully integrated into the airspace management systems and has to be created on a case by case basis thereby increasing workload and by necessity, the notification periods for activation.

It is therefore considered an ACP is required to provide a small fillet of segregated airspace that provides both adequate protection for the spaceport activities and connects the spaceport with the Hebrides Range Danger Areas. It should be noted that the MOD have developed an agreed process for non-MOD activities to be conducted in MOD sponsored Danger Areas such as the Hebrides Range. This formalised process is an enabler that should allow Spaceport 1 to operate, under certain conditions, in the Hebrides Danger Areas. The small fillet of airspace required under the ACP effectively joins the most easterly boundary point of D701E with D701Y, where the latter adjoins D704.

The ACP will enable both sounding rockets to be tested (nominally on a westerly bearing) and small satellite rocket launch to the North[3]; both trajectories maximising the use of the D701 complex."

[1] The requirement for orbital launch options is no longer included in this ACP

[2] Since the SoN was produced the CAA have changed the terminology to be gender neutral and should now read: 'Notice to Aviation'

[3] Although the requirement for orbital 'launch to the North' has been removed, there remains a requirement to be able to conduct certain sub-orbital launches to the North where they can be wholly contained within D701

4 Airspace Design Principles (DPs)

4.1 Airspace Options – Relationship to Design Principles

In accordance with CAP 1616 the airspace options should be aligned with the DPs. For ACP-2021-12 the DPs were first circulated for comment in June 2021 and were later revised following engagement feedback and the CAA Define Gateway Assessment in September that year. As part of your input, please consider these DPs against the proposed airspace designs and highlight on the feedback form where you believe the airspace design option does not meet one or more of the DPs. To assist in this evaluation, the revised DPs (as published on the CAA airspace portal), are detailed below.

It should be noted that the expanded explanation of DP2 and DP3 make reference to orbital rockets, which have since been removed from this ACP. While the CAP 1616 process does not allow for subsequent modification of the DPs' descriptions, the orbital rockets element should be discounted in making your feedback. Furthermore, DP9 is no longer relevant as this relates solely to orbital rocket launch and is therefore Not Applicable (NA).

DP1	**Safety**	**The safety of all airspace users is the paramount factor in the airspace design**
Safety is the single most important factor and DP1 establishes the need to design airspace that provides adequate protection from any hazards associated with rocket launch from SP-1 to other airspace users. Note: safety of third parties on the ground or seaspace is detailed in separate but parallel work packages associated with the planning consent regulations.		
DP2	**Safety**	**The airspace design will be of the smallest volume to safely segregate Spaceport rocket launches from other airspace users thereby minimising the impact on other airspace users**
In ensuring safety of other airspace users the airspace design should consider the potential failure of the spacecraft both at the launch site, immediately after launch and when in flight. The airspace design must be of sufficient volume to contain all credible risks associated with rocket malfunction for both orbital and sub-orbital sounding rockets. The former have trajectories predominantly to the North of the launch site and despite EG D701 complex containing a significant portion of the hazard, the airspace design may need to consider airspace outside the EG D701 boundaries. This may, in the interests of minimising the volume of airspace required, call for a bespoke modular airspace design within EG D701 complex as well as beyond.		
DP3	**Operational**	**Minimise the impact (on other aviation stakeholders) of activating specific EG D701 Danger Areas in support of SP-1 operations**
When considering the impact on other airspace users the new airspace should not be considered in isolation but must also take into account the consequential impact of activating numerous EG D701 areas for SP-1 operations (if this is deemed appropriate) at times when the Danger Areas may not normally be activated. This design principle includes consideration of which EG D701 areas need to be activated and their impact on other stakeholders in particular where these necessitate the closure of Oceanic Entry Points (OEPs) for the North Atlantic (NAT) tracks. It may prove beneficial to utilise		

D701 for sub-orbital sounding rocket activities where these can be contained wholly within the D701 complex. This DP may not be relevant if a bespoke modular design is preferred for orbital launches.		
DP4	**Operational**	**Use Flexible Use of Airspace (FUA) principles by integrating the airspace design into the extant Airspace Management (ASM) procedures operated within the EG D701 complex**
This design principles should include integration of the new airspace into the ASM processes of the existing EG D701 complex thereby minimising the need for new multifaceted standalone procedures and exploiting current Standard Operating Procedures (SOPs). This will enable timely notification of operations and swift cancellation of NOTAMs thereby freeing up airspace efficiently. Furthermore, expanding extant EG D701 procedures to include the new SP-1 airspace (both around the launch site, beyond D701 boundary or, for a bespoke solution), will enable safe access for other airspace users when deemed necessary, in particular emergency services.		
DP5	**Operational**	**Integrating/deconflicting SP-1 activity safely with MOD activity in EG D701 is a vital element of the operational use of the airspace design**
It is recognised that use of the EG D701 areas will be subject to MOD activities and priorities therefore an important design principle will be the operational integration of SP-1 activities in and around MOD use. By managing both programmes, QinetiQ expects to be able to facilitate the most efficient use of airspace especially where it is proven safe to conduct simultaneous operations.		
DP6	**Operational**	**The airspace design shall take into account Free Route Airspace (FRA) and Flight Planning Buffer Zones (FBZs) remaining cognisant of CAA Buffer Policy**
It is recognised that any new Danger Area airspace will have to comply with the CAA Buffer policy and ANSPs may be required to apply FBZs. The design principles will have to take into consideration both these requirements. Furthermore, the advent of FRA in the Scottish Flight Information Region (FIR) will need to be considered.		
DP7	**Environmental**	**The airspace design and associated activation of EG D701 need to consider the environmental impact of aircraft being re-routed around the airspace in addition to considering the noise, emissions and light pollution in the local area**
It is likely that the new airspace around the launch site and beyond the boundaries of EG D701 will be relatively small in volume (due to rocket launch profiles), and therefore current traffic patterns should be unaffected. However, a holistic approach is required to consider the wider impact that subsequent activation of the EG D701 Danger Areas, (and any additional airspace requirements beyond EG D701, including a bespoke modular design) will have, in particular on the NAT tracks. Any deviation caused by unavailability of OEPs will have to be carefully considered in the airspace design to understand the environmental impact of additional miles flown by aircraft forced to deviate from route. It is further acknowledged that rocket launch from the site at Scolpaig will create noise and light pollution; and these elements will need to be considered in the airspace design especially where they are traded off against minimising disruption to Commercial Air Transport (CAT). Many of these environmental issues are being considered within the planning application and associated Environmental Impact Assessment (EIA); the latter will help inform part of the ACP process.		

DP8	**Regulatory**	**The airspace design will need to consider any emerging regulations pertaining to spaceports and Ranges under the Space Industry Act 2018**
It is recognised that the airspace design might be influenced by the secondary legislation to the Space Industry Act (SIA) 2018. The design principles will take account for any additional legislative requirements, in particular where these are linked to the Spaceport operator licence and Range operator licence.		
DP9	**Operational**	**Rocket stage drop zones may be required outside the EG D701 Areas and will need to be considered**
For orbital rocket launch, it is expected that one or more rocket stages may be required that will separate after launch. Where separation and return to earth occurs outside the EG D701 complex, additional segregated airspace will be required – The design principle should include the most efficient use of airspace to accommodate this requirement.		

5 Local and Adjacent Airspace Overview

5.1 Local Airspace

The SP-1 launch site at Scolpaig, North Uist, lies beneath Class G airspace and has Benbecula Airport approximately 10NM to the south, the small beach landing strip at Sollas approximately 5.5NM to the east and Stornoway Airport approximately 58NM to the north east. The launch site is located between the MoD Hebrides Range Danger Areas EG D701 and EG D704 (see *Figure 1*). There is limited General Aviation (GA) activity in the local area with this mainly concentrated during the Sollas annual fly-in event during the summer. Other aviation activity is minimal, comprising prominently of scheduled flights to/from Benbecula (circa 6 flights per day during the busier summer months), occasional helicopter activity, and coastguard, medical and lighthouse support aircraft as well as military aircraft either conducting trials on the Hebrides Range or training in the local area (these flights increase significantly during the bi-annual exercise Joint Warrior).

Information gained during the TDA (ACP-2021-37) engagement process has indicated that the proposed segregated airspace around the SP-1 site will not impact on flights operating to/from Benbecula, Barra or Stornoway Airports.

The airspace to be utilised under this ACP is largely over the ocean with very few land areas other than in the immediate vicinity of the launch site and a number of small generally uninhabited islands.

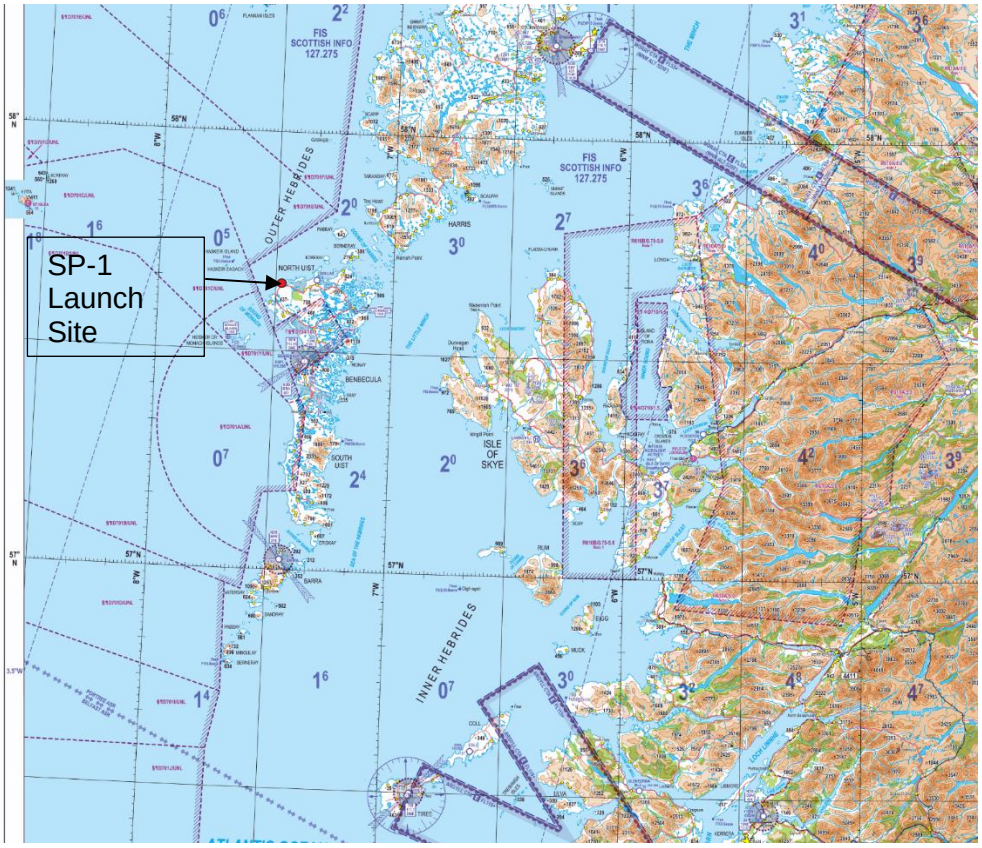

Figure 1: Local area airspace in the vicinity of SP-1 site

5.2 Affected Adjacent Airspace

Considering the airspace further afield, it can be seen that this ACP will mostly affect CAT routing on the NAT oceanic tracks through the OEPs at 10° west and potentially, MOD activity. There are also a number of other military sponsored Danger Areas over the North of Scotland that if active at the same time as SP-1 could have a blocking effect on CAT over Scotland. This is potentially further exacerbated by the development of other vertical launch Spaceport sites at Sutherland and Shetland (see *Figure 2*). These issues will need to be addressed later in the ACP process.

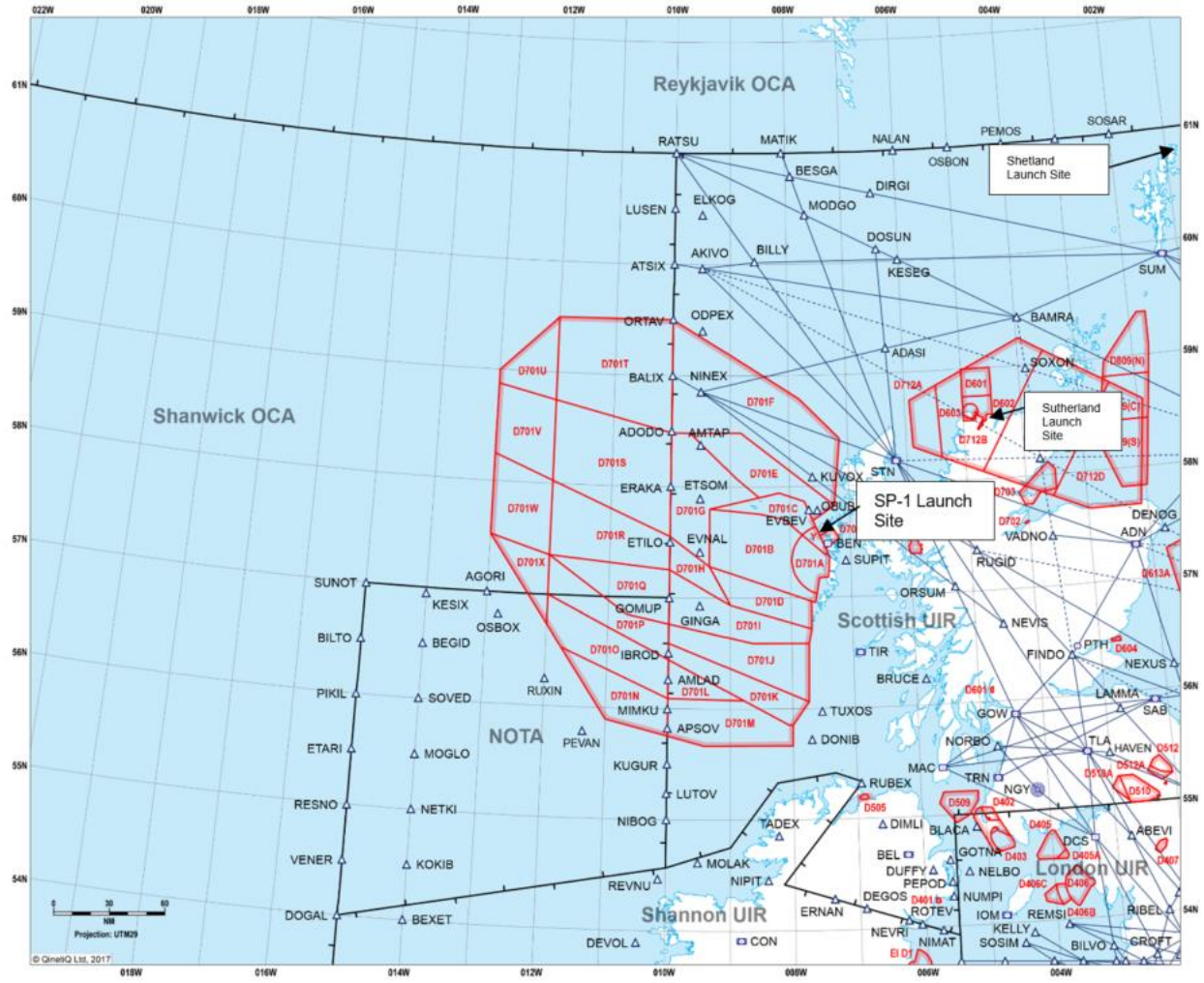

Figure 2: Adjacent airspace in relation to SP-1 launch site including other planned vertical launch spaceports

6 Design Options - Considerations

6.1 Introduction

QinetiQ, in developing the temporary airspace for SP-1 (ACP-2021-37), gained a significant amount of important information on the concerns of local airspace users, Air Navigation Service Providers (ANSPs) and the Ministry of Defence (MOD). This information has informed the airspace options process and will be used in the options appraisal during Step 2B of Stage 2.

6.2 Important Background Information

6.2.1 Airspace Change – Vertical Launch Spaceport Differences

Unlike 'normal' airspace changes associated with accommodating aircraft with established safety pedigree and the ability to easily manoeuvre, where it is possible to modify flight profiles (and thus airspace design) to meet stakeholders' needs; the airspace change process is not as straightforward in the case for vertical launch spaceports. Here the options for airspace design are limited as they are driven by the required trajectory of the rocket system (with limited pedigree) and the associated safety trace[4] that determines the boundary of the airspace either side of the trajectory track. This boundary has to be sufficient distance from trajectory track to ensure all credible hazards associated with a malfunction or catastrophic failure of the rocket are contained therein. The safety trace around the trajectory track encompasses the worst case scenario events that could occur on the launch pad, in the minutes after launch and at any time during the rocket flight until it no longer poses a threat/hazard (i.e. once it splashes down in the ocean). The safety trace and debris field (following explosion) generally 'fans out' from the launch site as the vehicle increases velocity and gains altitude, thereby increasing the size of any debris field following failure. Therefore, catastrophic failure on the launch pad or immediately[5] after launch, means the debris field is contained in a relatively small area; it is only once the vehicle is climbing and rapidly accelerating that the hazard area and debris field increases and more airspace is needed. This expansion of hazardous area/debris field continues to fan out until it reaches a point where it will not have any further increase in the lateral plane, only in the direction of travel along the line of trajectory post failure until 'splash down'. For these reasons the airspace design options show a comparatively small safety trace area around the launch site, thereafter fanning out until splash down.

6.2.2 Spaceport Airspace Challenges

A further challenge to the airspace design is the fact each different rocket type will have a different safety trace. Furthermore, not only does the safety trace change between different rocket types but also between the same rockets where the payloads are of different mass. Where the acceleration of the rocket is reduced due to high mass payload, this results in the rocket travelling a greater distance along the trajectory track before splashing down. This information is only fully understood during the planning stage for each individual launch where the safety traces are calculated along with the corresponding airspace requirements. Only when the airspace requirements are known can the airspace design be developed. This means it is extremely difficult to predict at this juncture what the exact airspace dimensions are likely to be for each launch other than in the immediate vicinity of the launch site (paragraph 7.2 refers). To address this, the Sponsor proposes a modular block design extending from the launch site that can accommodate a number of trajectories[6] and worst case scenarios; different blocks of airspace can then be activated to meet the safety trace of the rocket being launched once these are known. Furthermore, this method enables the launch of rockets with limited pedigree to be safely operated.

[4] Safety trace is the term given to the volume of airspace needed to contain all credible hazards, including the debris field created by any failure or subsequent destruction of the rocket that may pose a risk to third parties. This includes the failure of any of the vehicles' systems or components, as well as catastrophic system failure planned (in the case of a flight termination system) or unplanned.

[5] Within a few seconds after launch.

[6] Different trajectories are necessary to meet varying characteristics of different rocket types and may be influenced by environmental and other airspace considerations.

This challenge is no different to the testing of MOD systems on the MOD Hebrides Range. This is why the D701 Danger Area complex is made up of a number of different airspace blocks (26) that extend out from the Range Head incrementally. When a system is going to be tested on the Range all the relevant data is examined and the appropriate safety trace designed for that system. The safety trace is then overlaid onto the D701 areas to determine what areas need to be activated in order to wholly contain the hazard. The trajectory or firing line can often be adjusted to minimise the number of D701 areas needed. The Sponsor is proposing exactly the same methodology is used for sub-orbital rocket launch by either utilising the existing D701 complex or designing a new bespoke airspace structure originating at the SP-1 site.

6.2.1 Other Considerations

It was identified during Stage 1 of this ACP, and during the TDA engagement process, that the airspace design options will need to consider the most efficient use of airspace. Where existing airspace structures are contemplated for ease of use, flexibility to operators and utilisation of tried and tested processes and procedures, these considerations need to be carefully balanced against the cost and impact on other stakeholders. This will form part of the engagement process during this step and will be a critical element of Step 2B, 'options appraisal'.

The impact that closing large areas of oceanic airspace has on the ATM network is well documented and understood by the Sponsor. Careful consideration of how to minimise the impact remains a key element in the airspace design and subsequent operating procedures. Furthermore, it is recognised that any such closures should not be measured in isolation and the cumulative effect of segregated activities across the UK FIR will need to be reflected through the development of agreed airspace protocols between all main parties (MOD, Spaceport operators, ANSPs, aviation stakeholders and Regulator).

The Sponsor is cognisant that FBZs will be required around those areas of new segregated airspace that are developed and these FBZs may differ in size depending upon the location of the segregated airspace. Furthermore, it is understood that additional airspace reporting points might need to be established to enable General Air Traffic (GAT) to safely route around the segregated airspace when active. These aspects will be explored during this engagement period.

7 Airspace Options

7.1 Airspace Around Launch Site – Background

With the need to segregate the airspace around the launch site, QinetiQ staff undertook safety analysis work to determine if a straight line drawn between two exiting Aeronautical Data Quality (ADQ) points, connecting D701F and D704 (see *Figure 3*), would contain all credible hazards associated with rocket launch. It was determined that this area, herein referred to as the 'fillet', was more than adequate to contain the hazards. Moreover, by using two existing ADQ points this would simplify the airspace

change process and be easier to understand in particular for the TDA that was needed ahead[7] of the permanent airspace solution.

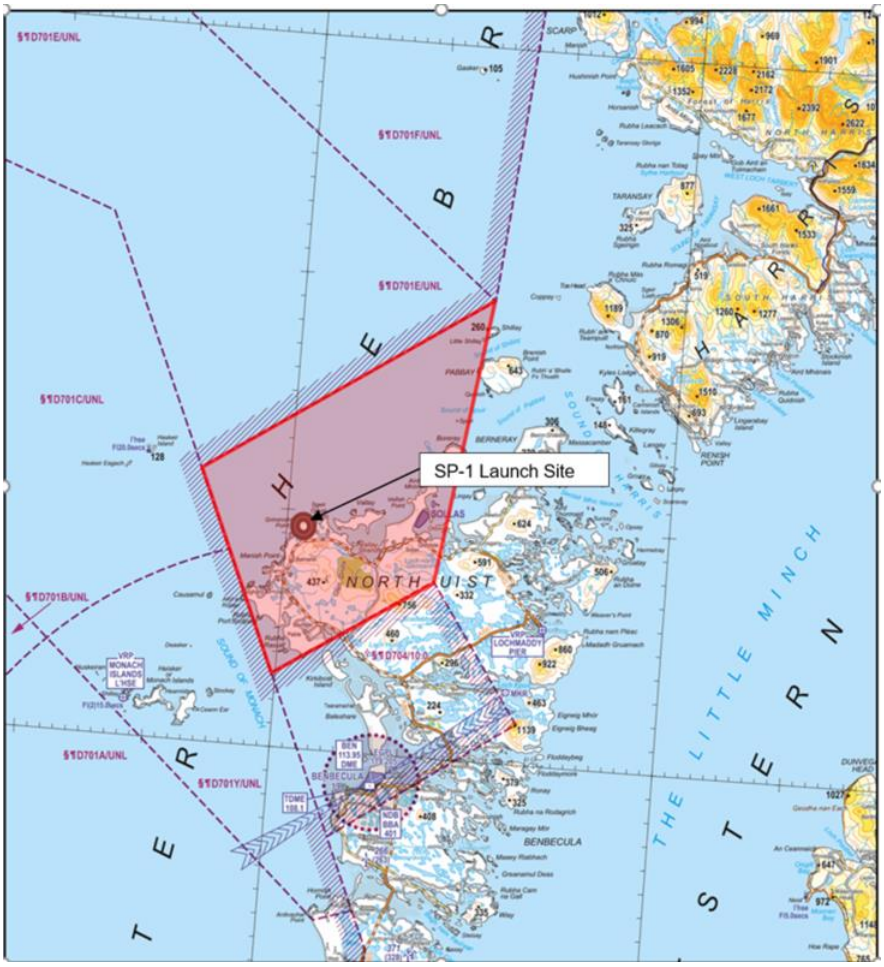

Figure 3: Diagram depicting the original proposed airspace 'Fillet' design over SP-1 launch site

However, it was documented during the TDA proposal development that this design had the potential to impact on the beach landing strip at Sollas. Following the concerns of Sollas stakeholders and subsequent delay of the TDA, further in depth safety analysis was conducted the results of which demonstrated the eastern boundary of the fillet of airspace could be safely re-profiled so as not to affect the landing site at Sollas. The original airspace fillet design is therefore discounted as an option. The new proposed design is shown at *Figure 4*.

[7] At the time the TDA had a compressed timeline and this 'more than safe' option was considered appropriate given the very limited time available to conduct additional safety analysis.

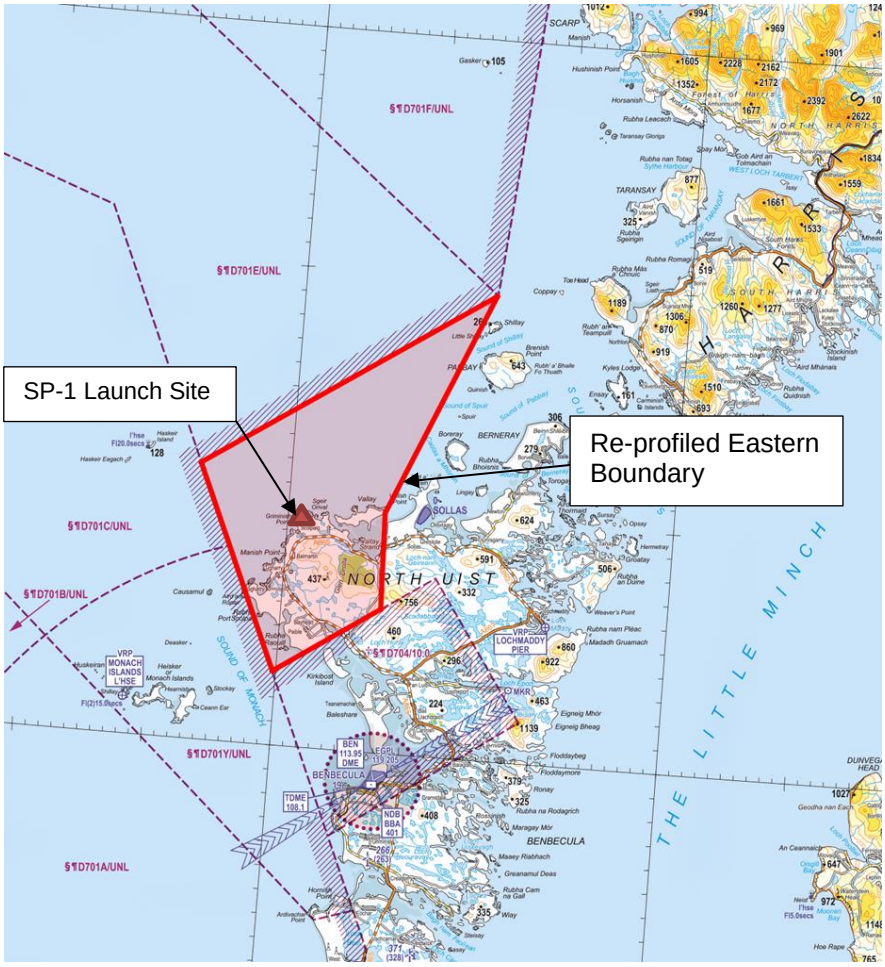

Figure 4: New proposed small 'Fillet' of segregated airspace around the SP-1 launch site

7.2 Safety Analysis

Due to the lack of pedigree of sub-orbital rockets, QinetiQ Range and safety staff have conducted a generic safety analysis approach using key US military and Federal Aviation Authority (FAA) reference documentation as well as experience gained from launching ballistic missile target rockets from the Hebrides Range since 2015. The analysis, conducted through a risk management process, includes but is not limited to: launch risk analysis and hazard identification, risk criteria, probability of failure, hazard thresholds, casualty areas, debris risk assessment, vehicle and debris dispersion modelling, risk uncertainties and assessment of other related risks. The outcome of the analysis provides evidence to the CAA that the boundaries of the proposed segregated airspace fillet at *Figure 4* present the maximum reasonable geographic extent of the region within which credible hazards could occur due to rocket launch and flight activities. It should be noted that the ground safety footprint may preclude rockets being launched in certain wind conditions where this causes debris to fall over the land areas.

It was further identified, from experience gained launching ballistic missile targets from the MOD Hebrides Range during the Formidable Shield (FS) Exercises that there is likely to be a requirement to

safeguard personnel (working at the launch site) from the hazard created by low flying aircraft. It is determined that these spaceport personnel may be at risk of harm while engaged in pre-launch preparation such as refuelling and arming phases of the rockets, if they are suddenly alarmed by the appearance and noise from a low flying aircraft; in particular fast jets. Because these refuelling/arming activities may occur several hours or even days before the intended rocket launch, it was determined, in the interests of Flexible Use of Airspace (FUA) that it would be inappropriate to have the whole segregated airspace fillet activated for the purpose of protecting ground personnel. It is proposed that a small inner circular area around the launch pad, as depicted in *Figure 5*, is made available. This can activated for longer periods of time without adversely impacting on other aviation stakeholders. This additional volume of airspace extends 1000m laterally from the launch pad, extending to 3000ft above ground level (AGL) and sits within the larger airspace fillet. The primary use of this small area of segregated airspace is to protect SP-1 personnel on the ground from the sudden appearance and noise from a low flying aircraft. It may further be of use (should it be deemed necessary by the rocket providers) to provide the rocket systems with Radio Frequency (RF) interference protection from low flying aircraft during the same critical stages of preparation.

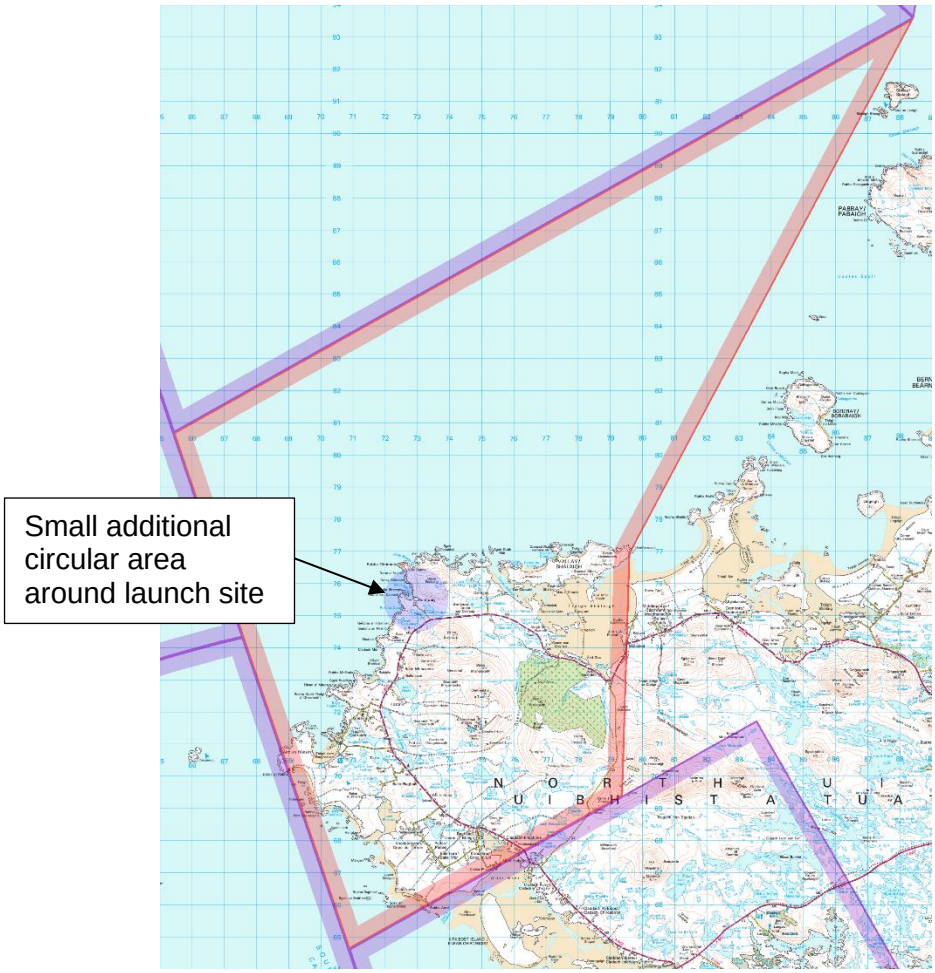

Figure 5: Proposed airspace 'Fillet' with additional circular segregated airspace area around launch site

7.3 Airspace Options for Sub-orbital

7.3.1 Option 0 - Do Nothing

This option leaves the airspace as it currently exists (depicted in *Figure 1* and *Figure 2* above). Although utilisation of D701 Danger Area could provide segregation for a portion of the rocket trajectory (where this is permitted), the area around the launch site would remain unsegregated. Without segregation, it is considered that rocket launch could not occur due to the risk to other airspace as rockets will have no means of complying with the Rules of The Air (RoTA). This option is therefore considered unviable.

7.3.2 Option 1 – Do Minimum

This option would necessitate bespoke airspace designs for each individual launch following the safety assessment and safety trace analysis. NOTAMs and associated Aeronautical Information Publication (AIP) Supplement (SUPP) information would have to be created and published for each launch to enable segregation. Such one-off NOTAMs would not be fully integrated into the UK AMC or Eurocontrol Network Manager (NM) ASM systems that enable the harmonised and dynamic planning of the ATM network. An exemplar NOTAM is depicted at *Figure 6.*

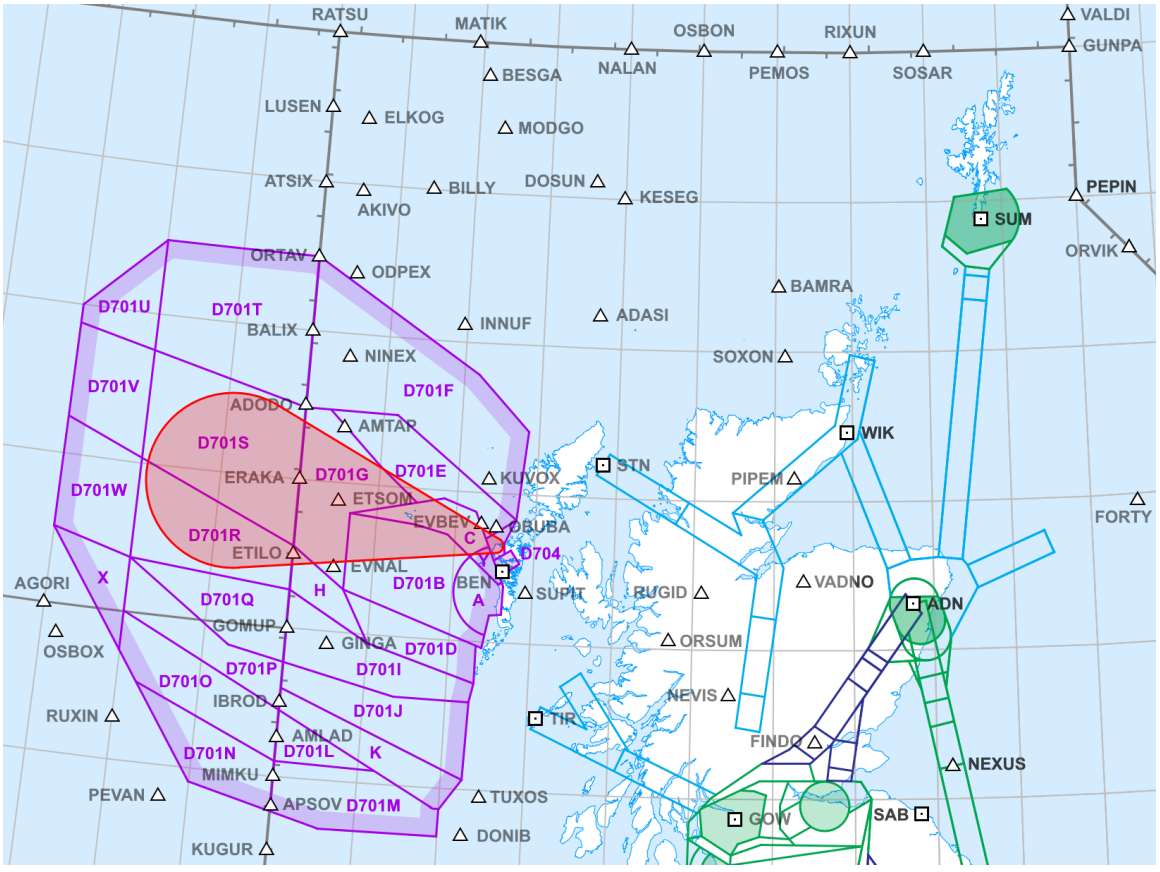

Figure 6: Option 1 - Do Minimum: Diagram showing an exemplar NOTAM area for single rocket launch

7.3.3 Option 2 – Do Minimum and Utilise D701

This option would still necessitate an individual NOTAM and associated AIP SUPP information prescribed for the fillet of airspace around the launch site for each individual launch. Such one off NOTAMs would not be fully integrated into the UK AMC or Eurocontrol NM ASM systems that enable the harmonised and dynamic planning of the ATM network. The D701 areas could be activated in the normal manner using only those areas necessary to contain the safety trace of the rocket being launched. An example of the areas required for a sub-orbital rocket launch similar to that shown in Option 1 is depicted below in *Figure 7*

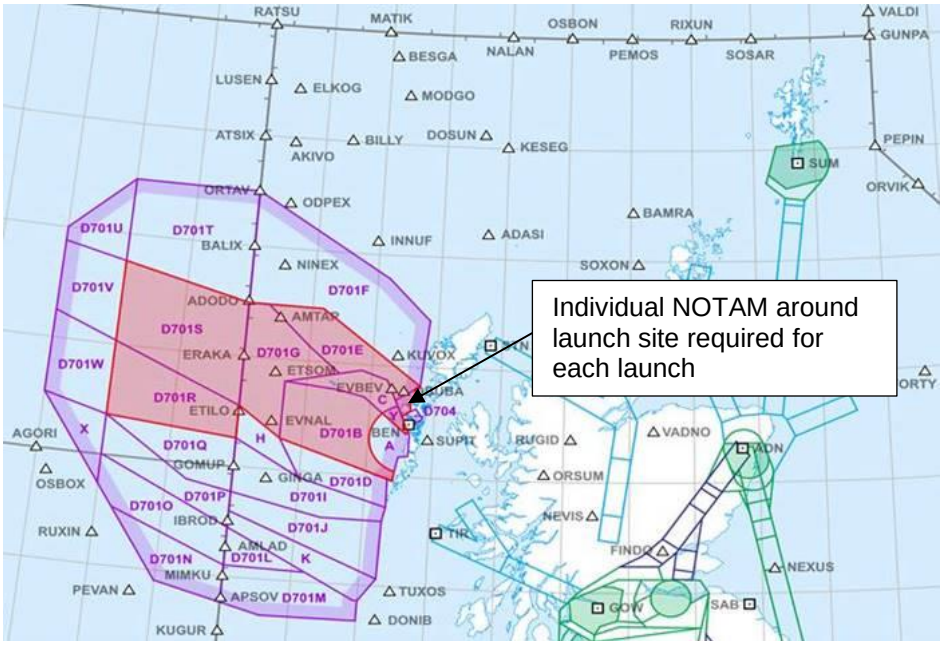

Figure 7: Option 2 - Do Minimum & Utilise D701: Diagram showing an example of D701 areas activated

7.3.4 Option 3 – New Fillet of Segregated Airspace around Launch Site and Utilise D701

This option includes the use of a new fillet of airspace around the launch site between D701 and D704 that could be activated by NOTAM in the same manner as D701. This would provide a permanent airspace solution over the launch site and provide connectivity to the D701 Danger Areas. The D701 areas could be activated in the normal manner using only those areas necessary to contain the safety trace of the rocket being launched. Both the fillet of airspace and D701 would be fully integrated into the systems and processes employed by the UK AMC and the Eurocontrol NM, enabling the harmonised and dynamic planning of the ATM network. Furthermore, this option provides the most straightforward operation for Range staff as each different sounding rocket launch would be treated in exactly the same manner as any MOD weapon firing or test and evaluation event. The new fillet of airspace would be treated as an extension of D701 for ASM purposes and the associated D701 areas would be activated accordingly to meet the safety trace requirements of the vehicle being launched. Notification, activation and deactivation would follow existing procedures and Letters of Agreement (LoAs).

7.3.5 Option 4 - Construct New Bespoke Segregated Airspace Blocks From Launch Site

As many of the sounding rockets have very limited pedigree, endeavouring to accurately predict the launch profiles, and critically the safety traces, is not feasible at this stage (so far in advance of the launch). Therefore, any attempt to design new airspace blocks introduces risk unless a large bespoke modular design is used. Any such large bespoke modular design for sounding rockets would have to extend in excess of 250km west north-west from the launch site and be constructed of several different airspace blocks to enable a process of tailored activation (similar to that currently used for D701) to be adopted. With experience gained from the ACP pertaining to the redesign of the D701 areas in 2014, it is expected any such modular design would have to be largely aligned to the existing boundaries of D701 to enable minimum disruption to traffic routing to/from the OEPs at 10° west. The modular design and alignment of the D701 Danger Areas may not always occupy the absolute minimum volume of airspace (with more airspace sometimes being activated than is absolutely necessary) however its alignment enables CAT to fly the shortest routes to/from the OEPs. Therefore, any additional unused airspace becomes largely irrelevant especially as this airspace is rarely used by anything other than CAT. For this reason, it is considered that any modular bespoke design would have to follow similar alignments to that of D701. The airspace would be fully integrated the systems and processes employed by the UK AMC and the Eurocontrol NM enabling the harmonised and dynamic planning of the ATM network.

The new airspace blocks would overlay a significant part of the existing D701 areas (see *Figure 8*) and would require careful delineation to prevent confusion; this would be particularly important when simultaneous activities were occurring (MOD use of D701 and SP-1 use of new areas). New ASM process and procedures would be required for this option.

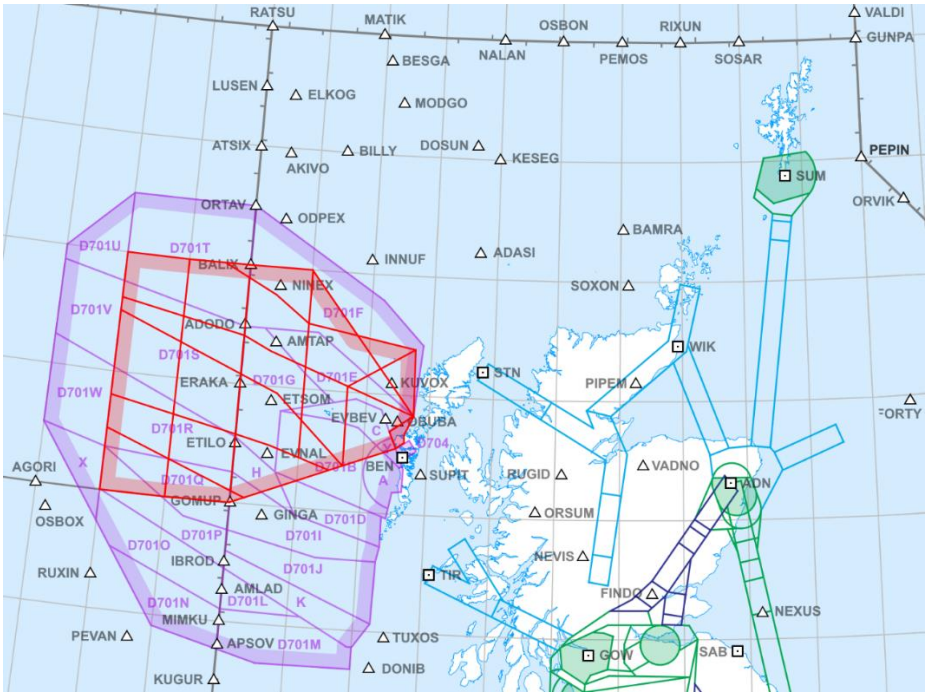

Figure 8: Option 4 – Example of what a new bespoke airspace design might look like

7.3.6 Option 5 – Use in Conjunction With Option 2 or 3 Adding Sub-division of D701B, C, D, E, & F

This option introduces a series of sub-divisions of the existing D701 areas in order to reduce the overall volume of airspace unavailable to other airspace users. The exact positions of these sub-divisions would require further work to conclude the optimum location; however, an example of what this might look like is depicted at *Figure 9.*

Whether the additional airspace made available by this option would be of benefit to other airspace users will form part of the analysis in Stage 2B of this ACP. This option would need MOD support and agreement, and further investigation to establish if any changes to the D701 construct would be permitted as part of the present ACP. If this is not the case and an additional ACP is required to modify D701, then the cost benefit analysis of this option would have to be carefully considered during Step 2B of Stage 2 to ensure the airspace gains[8] were cost-effective against any additional ACP costs, especially when balanced against the limited usage (probably only once or twice a month).

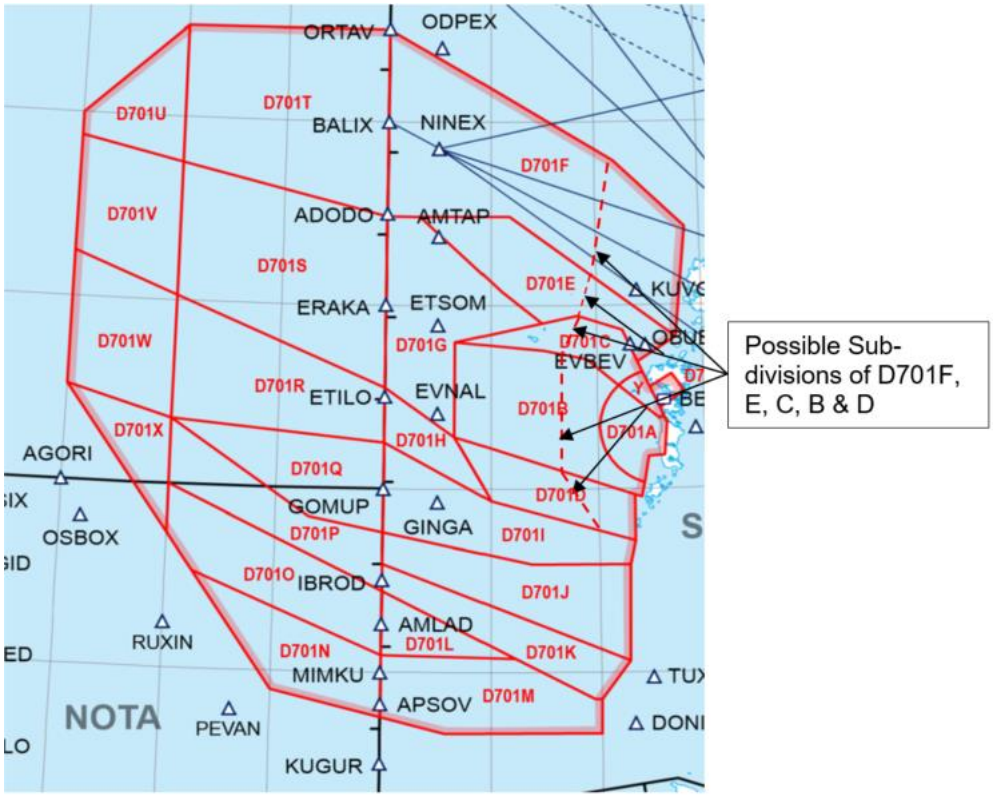

Figure 9: Option 5 – Exemplar sub-divisions of D701

Note: Options 3 to 5 include the small additional circular area of airspace around the launch site as described in paragraph 7.2

[8] The use of any additional airspace availed through these sub-divisions is likely to be limited to GAT and might not provide sufficient benefit to be cost effective.

7.4 Options Summary

The following table provides a summary of proposed options:

Option	Description	Notes
0 - Do nothing	No change to current airspace	Not viable for rocket launch.
1 - Do Minimum	Design and publish unique airspace design NOTAM & AIP SUPP information for every individual launch	Temporary NOTAMs not integrated into ASM systems.
2 - Do Minimum & Utilise D701	Design and publish unique airspace design NOTAM & AIP SUPP information for airspace around launch site.	Temporary NOTAMs not integrated into ASM systems.
3 - New Fillet of Segregated Airspace around Launch Site and Utilise D701	New Fillet would be an extension of D701 and activated in a similar fashion	Fully integrated into ASM systems; Utilise existing ASM processes and procedures.
4 - Construct New Bespoke Segregated Airspace Blocks From Launch Site	Design a new bespoke airspace complex from the launch site extending out over D701	Require new ASM processes and procedures; Area delineation may be an issue.
5 – Adding Sub-division of D701B, C, D, E, & F	Use in Conjunction With Either Options 2 & 3 – Sub-divisions reduce the overall airspace volume in use within D701	May need additional ACP to make changes to D701; Additional airspace made available would have limited use.

Table 1: Summary of airspace options

8 Airspace Classification Options

8.1 Types of Airspace to Accommodate Vertical Spaceport Launches

Rocket launches and flights pose a risk to other aviation users either through mid-air collision or, following catastrophic failure of the rocket (explosion), debris impacting other aircraft. To safeguard airspace users from these risks there is a requirement to segregate the activity accordingly. This is achieved through establishing segregated airspace in one form or other.

The SP-1 launch site at Scolpaig on North Uist currently sits beneath Class G ‘uncontrolled’ airspace. This means anyone is entitled to operate in this airspace without any specific equipment, training or air traffic control. Therefore, there is no method to safeguard them from SP-1 rocket launches. In the UK there are five classifications of airspace which can all provide a method of segregation. These are detailed and assessed for suitability by the Sponsor in the table below.

8.2 Classification of Airspace Comparison A, C, D, E & G

Type of segregated airspace	Suitability for Rocket Launch	Sponsor Comment
Class A	No	- IFR flight is mandatory in class A airspace, rockets will be largely 'uncontrolled' after launch so will be unable to comply with ATC instructions applicable in Class A or comply with RoTA - Rockets will not be equipped with the necessary CNS equipment for flights in controlled airspace - Controlled airspace is currently permanently on/active, therefore in the spirit of FUA it is not practicable to have Class A for the relatively few launches - Too restrictive on other airspace users (inability to access Class due to aircraft equipment and pilot limitations)
Class C	No	- ATC instructions mandatory in class C airspace, rockets will be largely 'uncontrolled' after launch so will be unable to comply with ATC instructions applicable in Class C or comply with RoTA - Rockets will not be equipped with the necessary CNS equipment for flights in controlled airspace - Controlled airspace is currently permanently on/active, therefore in the spirit of FUA it is not practicable to have Class A for the relatively few launches - Too restrictive on other airspace users (inability to access Class due to aircraft equipment and pilot limitations)
Class D	No	- Rockets unable to comply with ATC instructions that are mandatory in class D airspace or comply with RoTA - Inability to operate under either IFR or VFR as rockets will be largely 'uncontrolled' after launch - Controlled airspace is currently permanently on/active, therefore in the spirit of FUA it is not practicable to have Class D for the relatively few launches
Class E	No	- Rockets cannot comply with IFR or VFR, or RoTA - Controlled airspace is currently permanently on/active, therefore in the spirit of FUA it is not practicable to have Class E for the relatively few launches
Class G Danger Area	Yes	- Less impact on other airspace users since it can be tactically managed (does not have notified hours of activation in UK AIP) – only activated by NOTAM when needed

Type of segregated airspace	Suitability for Rocket Launch	Sponsor Comment
TMZ/RMZ	No	- Rockets may not be transponder equipped - Airspace would need to be controlled by approved ATC not Range controllers – resourcing issue - TMZ/RMZ would preclude many of the aircraft using the beach landing site at Sollas during periods when the Spaceport is not active

Table 2: Proposed Airspace Types for Consideration with Sponsor Comment

9 Measures to Minimise Impact on Other Airspace Users

9.1 Classification of Airspace

Airspace with the least restrictions to other airspace users is uncontrolled Class G. This airspace still has the option to 'segregate' activity through the establishment of a Danger Area; such Danger Areas can be activated by NOTAM when needed. The Sponsor therefore proposes that the airspace classification around the launch site remains Class G.

9.2 Activation Procedures and Access to Active Danger Area

MOD Hebrides Range will manage the fillet of airspace in the vicinity of the launch site in exactly the same way as the airspace within D701 is managed when active. In essence, the new fillet of segregated airspace (and additional small circular area around the launch site) being proposed, will be treated as an extension of the D701 complex. Here MOD Hebrides Range have developed robust procedures to enable Search and Rescue (SAR) aircraft, Air Ambulance, Coastguard and other emergency services aircraft access when safe to do so. As MOD Hebrides Range manage the activity in D701, they can manage rocket launch from D701 such that the launch can be delayed in an emergency or where national security must take priority. MOD Hebrides Range will also work with local airspace users to enable admittance into the new fillet of airspace when it is safe to do so. As the airspace is likely to be activated for a period before launch, MOD Hebrides Range control staff will advise airspace users when it is safe to cross prior to and immediately after launch. For radio equipped aircraft it is anticipated that the fillet of airspace will only prohibit access for a short period, probably less than an hour prior to launch to a few minutes after launch.

For a bespoke airspace solution for each launch (Option 2) that is independent to D701 (where this is the preferred option), access to this airspace may take longer to arrange given the volume of airspace being NOTAMed; however, like the small fillet of airspace around the launch site, the airspace will be released (NOTAM cancelled) almost immediately after launch as it is anticipated the rocket will only be utilising the airspace for a matter of minutes – this will only change should the rocket have a catastrophic failure or need to be destroyed, then there will be a more protracted period for the airspace to be active to enable the debris field to clear. This will be evaluated for each launch and shared with airspace managers and ANSPs in advance.

10 Utilisation of Airspace

10.1 Anticipated Rocket Launch Schedule

It is currently not possible to predict the actual usage of the SP-1 facility for sub-orbital rocket launches; however, under the conditions of the proposed planning application, the number of launches will be limited to 10 per year. It is expected that some months may have two or three launches and other months, particularly in the winter, will see only a single or no launch.

It is anticipated that the small Danger Area (1000m radius surface to 3000ft agl) will be needed on one or two occasions per launch up to 3 weeks in advance of any proposed launch window and for periods of several hours for 'wet rehearsal' days. The main fillet of segregated airspace will be required for a period of approximately 2-3 hours for each launch (this is necessary to enable sufficient time to clear the 'sea-space' prior to any launch). It is probable that one or two spare days will be required for each launch to mitigate against technical, weather or Foul Range[9] issues. Where practicable, a decision whether to activate the airspace will be made the day before at D minus 1 (D-1). This way the airspace can be fully utilised in the event of launch cancellation. Worst case scenario is the rocket launch is cancelled on the day in which case the NOTAM might already be active and airspace restrictions in place; this could occur on the spare days as well. In order to minimise the impact on the ATM network, SP-1 will consider developing protocols that could include a day break between preferred launch day and any spare days to enable the ATM network to recover and reset.

Other such initiatives and protocols will also be developed, such as launch timings to help minimise the impact on the ATM network.

11 How to Provide Feedback

QinetiQ welcomes comments and feedback from all interested parties. All comments received regarding this proposal will be taken into consideration before taking our designs through to CAP1616 Stage 2 Step 2B Options Appraisal. All the details of this airspace change proposal are available on the CAA's Airspace Change Portal. The ACP identification number is ACP-2021-12. Feedback on the proposed change and what is important to you should be sent by email to the airspace change manager at: SP1ACP@QinetiQ.com.

To assist in formulating feedback, a feedback form is provided at the Annex to this letter. If you believe any additional stakeholders should be included, please inform the airspace change manager accordingly.

You are politely requested to provide any response regarding the airspace design options no later than Wednesday 09th November 2022.

[9] Foul Range may be caused by non-participants entering the Range safety trace area; this could include personnel or vehicles on the land area, sea-space or airspace.

12 Distribution:

2Excel Aviation
Babcock Aviation
Bristow Helicopters
CnES Planning
Comhairle nan Eilean Siar
Fisheries Management Scotland
Gamma Aviation
HIAL
Highlands & Islands Strut of LAA
Historic Environment Scotland
IAA
LAA
Loganair
Marine Scotland Compliance (local fisheries office)
Marine Scotland MSLOT
MCA
Met Office
MOD DAAM (for MOD DE&S)
MOD DAATM
NATMAC
NATS
NLB
North Uist Community Council
Outer Hebrides IFG
Programme Manager General Aviation Alliance
Reykjavik Area Control Centre
RSPB Scotland
RYA
SATCO Benbecula (and Barra)
SATCO Stornoway
Scottish Creel Fishermen's Federation
Scottish Fishermen's Federation
Scottish Water
SEPA
Sollas Fly-in Coordinator
UK AMC
UK Chamber of Shipping
UK Search and Rescue
UKHO
Western Isles Fishermen's Association

13 Glossary

Acronym	Meaning
ACP	Airspace Change Proposal
AIP	Aeronautical Information Publication
AMC	Airspace Management Cell
ANSP	Air Navigation Service Provider
ASM	Airspace Management
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAT	Commercial Air Transport
DA	Danger Area
DAATM	Defence Airspace & Airspace Traffic Management
DP	Design Principle
EG D	UK Segregated Airspace Designator and Danger Area
EIA	Environmental Impact Assessment
FBZ	Flight planning Buffer Zone
FIR	Flight Information Region
FRA	Free Route Airspace
FUA	Flexible Use of Airspace
GAT	General Air Traffic
HIAL	Highlands & Islands Airports Ltd
HIE	Highlands & Islands Enterprises
IAA	Irish Aviation Authority
ICAO	International Civil Aviation Organisation
LoA	Letter of Agreement
MCA	Maritime Coastguard Agency
MOD	Ministry of Defence
NA	Not Applicable
NAT	North Atlantic
NATMAC	National Air Traffic Management Advisory Committee
NLB	Northern Lighthouse Board
NOTAM	Notice To Aviation
OEPs	Oceanic Entry Points
RoTA	Rules of The Air
SAR	Search And Rescue
SIA	Space Industry Act
SOPs	Standard Operating Procedures
SP-1	Spaceport 1
SUPP	Supplement
UKHO	United Kingdom Hydrographic Office
US	United States

A Stakeholder Feedback Form – ACP-2021-12

A.1 **Do you assess that the presented design options achieve the Design Principles (DPs); please complete the Proforma below accordingly and consider if they are 'Met', 'Partially Met' or 'Not met' in your opinion. Add your rationale in free text as appropriate.**

Name:
Representing:
Address:

Design Principle		Option 0	Option 1	Option 2	Option 3	Option 4	Option 5
1	The safety of all airspace users is the paramount factor in the airspace design						
2	The airspace design will be of the smallest volume to safely segregate Spaceport activities from other airspace users thereby minimising the impact on other airspace users						
3	Minimise the impact (on other aviation stakeholders) of activating specific EG D701 Danger Areas in support of SP-1 operations						
4	Use Flexible Use of Airspace (FUA) principles by integrating the airspace design into the extant Airspace Management (ASM) procedures operated within the EG D701 complex						
5	Integrating/deconflicting SP-1 activity safely with MOD activity in EG D701 is a vital element of the operational use of the airspace design						
6	The airspace design shall take into account Free Route Airspace (FRA) and Flight Planning Buffer Zones (FBZs) remaining cognisant of CAA Buffer Policy						

Design Principle		Option 0	Option 1	Option 2	Option 3	Option 4	Option 5
7	The airspace design and associated activation of EG D701 need to consider the environmental impact of aircraft being re-routed around the Danger Areas due to SP-1 activities						
8	The airspace design will need to consider any emerging regulations pertaining to spaceports and Ranges under the Space Industry Act 2018						
9	Rocket stage drop zones may be required outside EG D701 and will need to be considered	NA	NA	NA	NA	NA	NA

Which design option do you believe best delivers the DPs?

A.2 Feedback on preferred type(s) of segregated airspace to be implemented (including order of preference and rationale, if appropriate).

A.3 **Would this proposal impact you (or members of your organisation) and, if so, are there any changes you would like to put forward for consideration?**

A.4 **What is your biggest concern regarding this airspace change?**

A.5 **Do you have any other feedback for the Sponsor?**