ACP-2021-12

Enabling Sounding Rocket Launch from Spaceport - 1

Stage 3 – CONSULT
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3	12th January 2024	Updated to address CAA comments
4	5th March 2024	Environmental section and consultation period updated

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1. Introduction

1.1 Background

1.1.1 The report is compiled as part of the Airspace Change Proposal (ACP) process prescribed in Civil Aviation Publication (CAP) 1616 for a permanent airspace change. ACP-2021-12[1] has been commenced in order to establish a safe volume of 'segregated' airspace around the Spaceport 1 (SP-1) launch site on the Outer Hebrides (as shown in Figure 1), to facilitate sub-orbital rocket launch, by late 2024. Additionally, the SP-1 project board have been pursuing a temporary airspace change to facilitate a limited number of sub-orbital rocket launches prior to the permanent airspace solution being in place. The Temporary ACP (ACP-2021-37) is currently 'paused' and is a separate activity to this ACP and consultation process.

Figure 1: SP-1 Launch site location and adjacent existing Danger Areas of the Ministry of Defence (MOD) Hebrides Range EG[2] D701 and EG D704. (Source: CAA 1:500000 Chart)

[1] Each new ACP is issued a reference number by the Civil Aviation Authority (CAA) in a 'year' and 'sequence' order; thus SP-1 ACP was established in 2021 and was the twelfth ACP of 2021

[2] EG is the International Civil Aviation Organisation (ICAO) designator for the UK and 'D' is the designator, in aeronautical publications, for a Danger Area. All Danger Areas in the UK are numbered sequentially starting with D001 in the South with numbers increasing the further North. Many Danger Area complexes are subdivided into small areas and these have an additional letter designator, for example D701A and D701Y.

1.1.2 The SP-1 project[3], led by the local council, Comhairle nan Eilean Siar (CnES), seeks to develop a vertical launch spaceport at Scolpaig, North Uist. The project is being pursued in support of key local economic development priorities and is strategically aligned with the UK Government's National Space Strategy which seeks to capture a greater share of the growing global space market and create additional jobs in the sector over the next decade. The provision of sub-orbital launch capability is a key component. QinetiQ is the airspace change Sponsor for this proposal, which seeks to secure suitable airspace for the safe operation (from launch to splashdown) of sub-orbital sounding rockets operating from the SP-1 launch site at Scolpaig, North Uist.

1.1.3 This document provides a simple but comprehensive explanation of the airspace change proposal that is considered necessary to enable the safe operation of sub-orbital rocket launch from the SP-1 launch site at Scolpaig, North Uist. In studying this document, the reader should be able to gain an understanding of the purpose of the airspace change and how it may affect them. The document describes how the airspace will be operated, including measures to minimise the impact on other airspace users, and how stakeholders can comment on the proposal.

1.1.4 As rocket launch poses a risk to other aviation participants, it is considered necessary to separate (segregate) this activity from all other aviation. This can be achieved through the establishment of a volume of airspace of pre-defined dimensions, known as a Danger Area[4], that is periodically activated and notified accordingly (through the Notice to Aviation (NOTAM) process) to warn other airspace users of the hazardous activity (in this case rocket launch) occurring within, and the need for them to remain clear for their own safety and the safety of third parties. To propose any change to the airspace in the UK, including the establishment of a new Danger Area, an airspace change Sponsor needs to be identified who will manage the ACP by following the Civil Aviation Authority (CAA) airspace change process detailed in CAP 1616. QinetiQ Ltd are acting as the airspace change Sponsor for the SP-1 Project Board.

1.1.5 CAP 1616 details the 7 Stage ACP process that is made up of a number of steps in each stage. This is an iterative process with each step of each stage followed consecutively. The ACP for SP-1 (ACP-2021-12) has successfully passed through Stages 1 & 2 and now enters Stage 3, the formal consultation stage of the process. Although a number of key affected stakeholders have been engaged during the first two stages of the process, reviewing the airspace Design Principles (DPs) and providing feedback on the airspace options presented, it is only at Stage 3 that the wider Consulation takes place. At this stage of the process, as with previous stages, nothing is yet fixed or approved therefore the wider community now has the opportunity to engage with the Sponsor and provide feedback (ask questions, raise concerns, objections or suggest modifications) to the airspace change. Only when all feedback has been recorded and acted upon as appropriate, can the ACP move to the next stage of the process, Stage 4, where the Sponsor submits the final airspace proposal. The Sponsor has to demonstrate that feedback has been addressed and if appropriate, how the airspace design has changed as a result of that feedback.

[3] A recent review of governance saw the establishment of the SP-1 Project Board and the SP-1 Delivery Team. The Project Board is led by Comhairle nan Eilean Siar and provides strategic oversight for the project and directs the work of the Delivery Team (formerly SP-1 Consortium). QinetiQ, together with other specialists in the space sector, is a member of the SP-1 Delivery Team.

[4] A Danger Area is often referred to as 'segregated airspace' in aviation terms as their purpose is to segregate hazardous activities from other airspace users.

1.1.6 This document will demonstrate how the Sponsor has arrived at the final proposed airspace solution and how the environmental impact (noise, air pollution, CO_2 emissions and biodiversity) has been considered during the final full options appraisal.

1.1.7 The formal consultation process for the airspace change is separate to that for the planning application for the SP-1 site; both have distinctly different regulator regimes and requirements. It is recognised that a number of the stakeholders will be the same for both processes however, the comments should be kept separate and for this ACP comments and concerns should only focus on the proposed airspace change. Certain documents[5] and evidence associated with the planning process are used in supporting the ACP, these include but are not limited to:

- Environmental Impact Assessment (EIA) by Aquatera Ltd and Western Isles Marine and Environment Ltd on behalf of the SP-1 consortium led by Comhairle nan Eilean Siar (CnES); and,
- Supplementary Environmental Information (SEI) SEI Addendum Report dated January 2023.

As part of the Stage 3 consultation process the Sponsor has to provide the CAA with the following:

- a draft Consultation Strategy detailing the scale, nature and timescales of the proposed consultation;
- a draft Consultation Document (this document) that allows stakeholders – including those with no technical expertise – to understand the potential impact of the proposed changes; and,
- an Options Appraisal (Phase II – Full) identifying potential impacts and mapping potentially affected stakeholders.

This document addresses the second requirement: the consultation document.

1.2 Statement of Need (SoN) – Extract

1.2.1 The following paragraphs in italics are extracted from the original SoN and are provided to assist the reader in understanding the requirement for the airspace change.

"Spaceport 1 has been the recipient of local government investment to construct a vertical launch spaceport. 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) QinetiQ managed Danger Areas known as the Hebrides Range; the EG D701 complex. Using the existing Danger Area complex will enable safe testing of suborbital 'sounding rockets'. The existing Danger Areas are fully integrated into systems and processes employed by the UK Airspace Management Cell (AMC) and the

[5] https://cne-siar.gov.uk/home/busines/spaceport-1/

EUROCONTROL[6] 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[7] 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. This can be achieved through the provision of 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.

1.2.2 QinetiQ Ltd manages the MOD Hebrides Range under a contract called the Long Term Partnering Agreement (LTPA) with the MOD. Within this contract, QinetiQ may undertake non-MOD, commercial activities on the range when suitably approved by the MOD under Other Works Approvals (OWAs) process. This process ensures that there is no adverse impact on MOD operations. Although the intent is to use the existing MOD Hebrides Range airspace, equipment and personnel to support SP-1 rocket launches; these launches cannot be conducted from the MOD 'Range Head Facility[8]' due to MOD limitations. Therefore, a separate commercially run Spaceport launch site is required and the site at Scolpaig has been selected. Any questions regarding the use of the 'Range Head Facility' for commercial rocket launch should be directed to the MOD.

1.2.3 It should be noted that the main business demand for the SP-1 facility is for the operation of sub-orbital sounding rockets. It was initially envisaged that orbital launches would be facilitated sometime in the future and in the interests of economies and future proofing the launch site, this ACP originally covered both sub-orbital and orbital airspace needs despite the requirements[9] being significantly different. The planning application for the SP-1 launch site is however limited to sub-orbital launch only and to avoid confusion and possible misinterpretation of intent, it was decided that the ACP must focus solely on sub-orbital rocket launch.

[6] EUROCONTROL is a pan-European, civil-military organisation supporting European aviation.

[7] Class C airspace exists above Class G, this is explained further in paragraph 2.1.1

[8] Range Head Facility is the MOD owned land area on South Uist where different MOD systems are operated from.

[9] Orbital launches require more airspace, trajectories are fixed to meet specific orbits and are generally of a northerly orientation such that only the first part of the flight would be contained within the existing MOD Hebrides Range D701 Danger Areas.

2. Context

2.1 Local Area and Other Aviation Activities

2.1.1 **Understanding Airspace** - The airspace in the UK is split into two distinct different categories: firstly 'controlled airspace' where Air Traffic Control (ATC) separate and sequence aircraft; and secondly 'uncontrolled airspace' where aircraft have the freedom to operate and manoeuvre unrestricted where the pilots are responsible for maintaining separation from other users of the airspace. Airspace is further classified by letters A-G with Class A-D[10] being 'controlled airspace' (with Class A and C the most restrictive in terms of ATC instruction compliance, aircraft equipment standards and aircrew qualifications). Class C generally exists above Flight Level (FL) 195 (approximately 19,000 feet (ft) above mean sea level (AMSL)) in the UK with either Class A or D around the majority of airports (other than those with low numbers of aircraft movements). Controlled airspace corridors often connect airports with Class C. Class G 'uncontrolled airspace' enables full freedom to operate with minimum rules (other than the air equivalent of the Highway Code[11]). There are no restrictions on who can enter Class G airspace or what equipment they must carry, or route they must take.

2.1.2 **Danger Areas and other Special Use Airspace** – Special Use Airspace (SUA) is airspace designated for air activities of a nature such that limitations on airspace access may be imposed on other aircraft not participating in those operations, for safety reasons. Often these operations are of a military nature. The designation of SUA identifies to other users the areas where such activity occurs, provides for segregation of that activity from other users where appropriate, and allows charting to keep airspace users informed of potential hazards. SUA usually takes the form of Danger Areas established to provide protection to other airspace users from activities that may not be conducted in accordance with the Rules of The Air (RoTA) and may be hazardous to other aircraft. Danger Areas are often considered the most efficient use of airspace where hazardous activity is not continuous; this way the airspace is only 'restricted' when in use and reverts to its normal status and airspace classification when not active. The use of Danger Areas averts the need to establish the more restrictive permanent controlled airspace.

2.1.3 **SP-1 Airspace Requirement** - This airspace change proposal is looking to establish SUA in the form of a Danger Area in the vicinity of the SP-1 launch site, herein referred to as the 'airspace fillet'; this Danger Area will only be activated when needed for rocket launch. SUA is necessary as the SP-1 launch site and its immediate surroundings resides wholly within Class G 'uncontrolled airspace' that sits beneath Class C controlled airspace[12]. As rockets are unable to comply with the RoTA (airspace highway code), they pose a hazard to other airspace users therefore segregation through the use of SUA is deemed necessary. This new 'airspace fillet' of SUA will provide connectivity to the

[10] Class B and Class F is not used in the UK.

[11] These are referred to as Rules of The Air (RoTA) in aviation regulation, where priorities of right of way, lookout and direction of manoeuver to maintain safe separation are defined.

[12] The Class G airspace in the vicinity of SP-1 extends from surface level to FL195 with Class C extending above from FL195 to FL660. Most commercial airlines operate in Class C which offers them the greatest protection and control.

existing QinetiQ-managed MOD Hebrides Range[13] Danger Areas. Elements of the Hebrides Range (the number will depend upon the individual capability of the rocket being launched) will be activated in conjunction with the SP-1 airspace fillet for the duration of the launch period that is expected to be in the region of 2-3 hours. In addition, there is a requirement for a small Danger Area centred on the launch pad extending 1000m laterally from surface level to 3000ft above ground level (agl) Figure 2. This Danger Area will be activated independently from the airspace fillet as it is necessary to protect SP-1 personnel on the ground from the sudden appearance and noise from low flying aircraft that may cause a distraction during pre-launch activities such as refuelling and arming phases of the rocket. Furthermore, this area will prevent any unwanted high frequency radio transmissions from low flying aircraft inadvertently interfering with the rocket systems. This small Danger Area is likely to be activated for longer periods than the airspace fillet, this could be several days prior to the rocket launch to enable ground personnel to conduct 'dry' launch runs. The area may also need to be activated for extended time periods (several hours) before launch. However, its small volume is not expected to impact on any other airspace user.

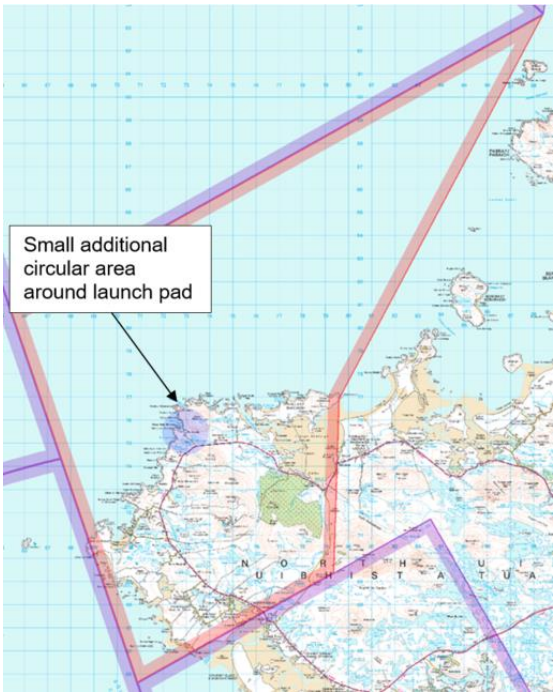

Figure 2: Small additional Danger Area around the launch pad to protect SP-1 personnel on the ground from the hazards caused by low flying aircraft. (Source: Ordnance Survey 1:50000 Map)

2.1.4 **Local Area** - The SP-1 launch site at Scolpaig, North Uist has Benbecula Airport approximately 10 Nautical Miles (NM) to the south, Barra beach landing strip 38NM south, the small beach landing strip at Sollas approximately 5.5NM to the east and Stornoway Airport approximately 58NM to the north east. All these airports and landing strips sit within Class G airspace although there

[13] Hebrides Range EG D701 is further sub-divided into many smaller components that can be activated sequentially depending upon the size of the area needed to contain the hazardous activity. These sub-areas are still numbered D701 but with the addition of a single letter designator (A-Y). It should be noted that D704 also forms part of the Hebrides Range although it is not envisaged it will be used for SP-1 launches.

is a controlled airspace corridor extending from Inverness to overhead Stornoway airport. The launch site is located between the MoD Hebrides Range Danger Areas D701 and D704 (see Figure 3).

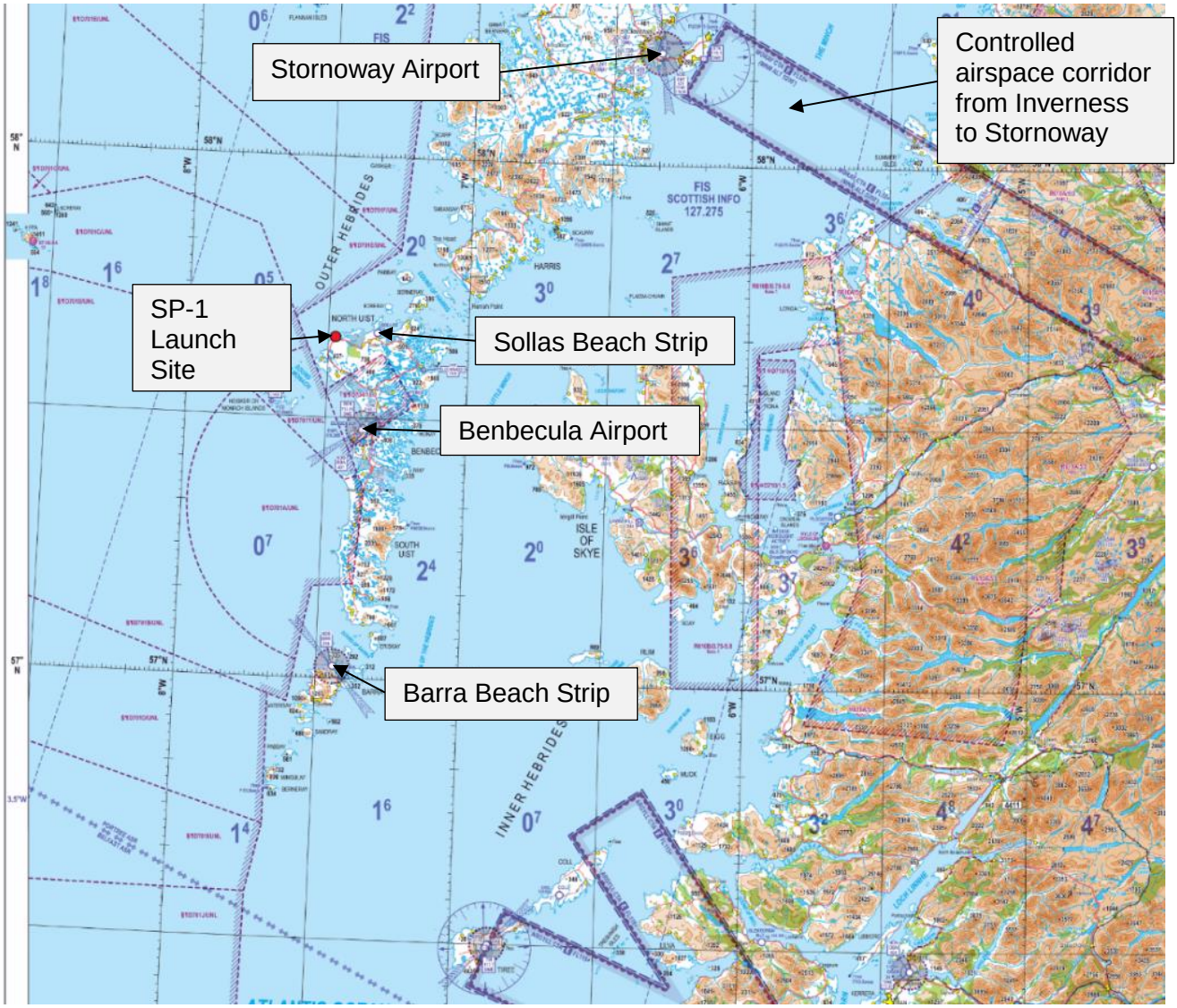

Figure 3: SP-1 launch site in relation to adjacent airspace structures and airports. (Source: CAA 1:500000 Chart)

2.1.5 It was identified during the early stages of the ACP process that the location of the proposed new airspace fillet of SUA around the SP-1 launch site (Figure 4) at Scolpaig could potentially impact on the beach landing site at Sollas and flights to/from Benbecula airport from the north. However, following engagement with Sollas users and both the Benbecula airport operator (Highlands and islands Airports Ltd (HIAL)) and its only scheduled operator, Loganair, it has been ascertained that the location of new Danger Area fillet of airspace is unlikely to affect either (see paragraph 3.3). It is acknowledged that when the D701A and Y areas are activated in support of SP-1 rocket launch then these can affect the instrument approach to the north easterly runway (Runway 06) at Benbecula. This is mitigated by existing operating procedures between the MOD Hebrides Range and the airport controllers where scheduled flights (and emergency flights) are afforded access where safe to do so.

Launch windows may also be designed to deconflict with most scheduled flights where practicable. The main routes flown by aircraft operating on the scheduled flights to/from Benbecula are shown at Figure 4 together with the location of the proposed new airspace fillet.

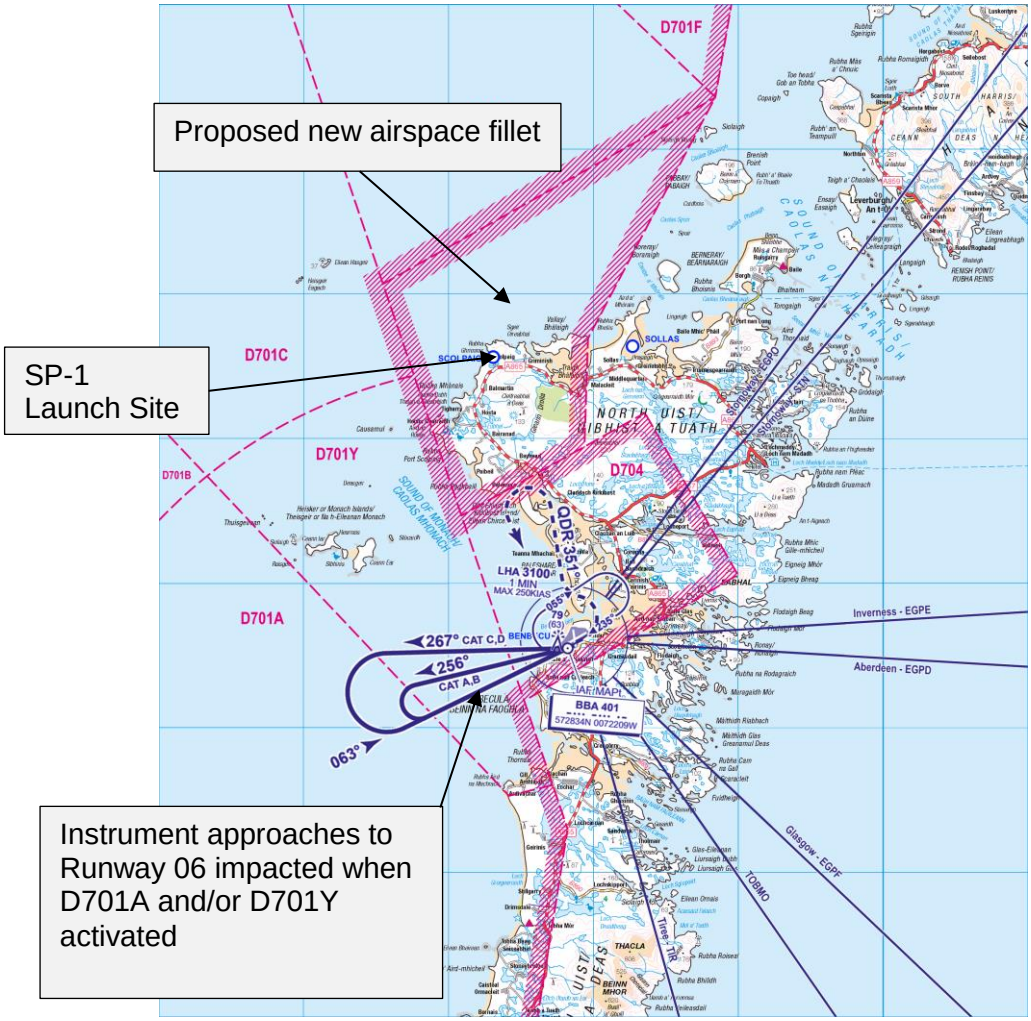

Figure 4: Loganair provided routes transposed in blue onto current CAA 1:250000 chart with instrument approach chart overlay for runway 06 at Benbecula and SP-1 site at Scolpaig.

2.1.6 **Main Local Aviation Stakeholders in Class G** - The main local airspace users include aircraft operators supporting UK fisheries protection, Search & Rescue (SAR), coastguard, air ambulance & police, air taxi, Northern Lighthouse Board (NLB) support aircraft, military operators, commercial scheduled operators and recreational General Aviation (GA) flying. All have been engaged previously (during Stage 1 and 2 of the ACP process) and invited to comment on the airspace design principles, airspace options and likely impact on their operations. Furthermore, information was gained from these stakeholders to ascertain their monthly average number of flights in the region. Full details of the analysis and feedback can be found in the 'Step 2B options appraisal (phase I) initial report (version 3)' on the CAA airspace portal at: Airspace change proposal public view (caa.co.uk); a summary table showing the average flight numbers can be found below.

Operator – Provider of Statistical Evidence	Approximate annual flights in region	Monthly Average	Comments
2Excel Aviation	30	<3	Fisheries protection & UK SAR
Northern Lighthouse Board	24	2	Conducted exclusively by PDG Aviation; figures include short transits to and from support ships operating in close proximity to 2 lighthouse stations (Haskeir & Ushenish).
Bristow Helicopters	60	5	Coastguard Stornoway – Difficult to predict but stated nil flights some months with up to 10 in a busy month; numbers include all flights both tasking & training flights
PDG Aviation	20	<2	Figure includes all NLB support flights.
Sollas beach site	>24	<2	Annual figure based on busiest year annual fly-in event. Monthly figure based on general enquires to use landing site as provided by Sollas Fly-In coordinator.
Babcock Aviation	104	<9	Operating Air Ambulance and Police helicopters; the former averaging 8 flights per month in the local area and the latter one flight every 6 months.
Gamma Aviation	>24	>2	Survey and air ambulance flights considered to be less frequent than SAR flights, estimated to be circa >2 per month – no formal response received, estimate based on local knowledge from MOD Hebrides Range staff.
Loganair	2256	188	CAT cargo & passenger operator to Benbecula.
Military – Low Flying Booking	24	>2	Assumed to be less than 2 per month based on night flying statistics and infringement data.
Danger Area Infringements (NATS)	1	>0.1	Data obtained from QinetiQ contracted civil air traffic Range controllers (NATS)
AIRPROX Reports	0	0	UK AIRPROX board data
Total Number	2546	212	
Total Number Excluding Scheduled Flights	290	24	Circa 24 'other[14]' flights per month

Table 1: Summary table of local area aviation operators - annual and average monthly flights.

[14] Where 'other' flights include SAR, Air Ambulance, Air Taxi, NLB support, military, GA and any non-commercial aircraft flights.

2.1.7 **Summary of Local Aviation Activity** - It is evident from the data gathered and presented in 'Step 2B options appraisal (phase I) initial report (version 3)' report[15] and as summarised in Table 1, that there is very limited aviation activity in the vicinity of North Uist operating in Class G airspace:

- Benbecula airport total aircraft movements are amongst the lowest (bottom 10%) of all UK airports; and,
- other aviation activity evidenced by responses from local operators also suggests very light activity in the SP-1 local area, circa 24 flights per month – this is strongly supported by the infrequent Danger Area Infringement data[16].

2.1.8 Air Proximity (AIRPROX)[17] data provides a useful UK-wide comparison. The fact that there have not been any recorded AIRPROX in the vicinity of the Outer Hebrides in the past 21 years is in itself a reliable indicator that traffic levels are extremely low.

2.2 Wider Affected Area

2.2.1 Having established that it is unlikely this airspace change will have any negative impact on the relatively low levels of local traffic, it is necessary to look further afield to understand the influence the change may have on aircraft overflying the region at high level. Predominantly, the aircraft overflying the Outer Hebrides at high level are large commercial civilian air transport aircraft (often referred to as Commercial Air Transport (CAT))18 transiting between Europe and Middle East to the Americas and Canada over the North Atlantic (NAT) on routes known as the NAT tracks; a typical NAT track structure is shown in Figure 5. All these aircraft entering the Oceanic[19] Airspace to the west of the Hebrides are sequenced and separated by the UK air traffic service provider NATS (a key stakeholder in this ACP process). Although the new small fillet of airspace proposed in this ACP is likely to have minimal bearing on these NAT tracks, it is the subsequent activation of the larger D701 Danger Areas that will. It is here our main focus has been with regard to the potential indirect environmental impact caused by deviating commercial aircraft from their optimum routes while avoiding the active D701 areas (see Section 6). Any number of D701 areas may be required depending on the range, velocity and payload of the rocket being launched; a typical long range rocket could for example require the areas shown in Figure 6. The method of area selection is dealt with later on in this document.

[15] The report containing the detailed analysis can be found at: Airspace change proposal public view (caa.co.uk) under 'documents' and 'Version 3 Stage 2B Options Appraisal (Phase I) Initial'.

[16] A comparison was made with another similar UK Danger Area (Aberporth in South Wales) over a 10 year period. Aberporth recorded 116 infringements while the Hebrides Range recorded only 10.

[17] Commonly referred to as 'air miss' and is: "a situation in which, in the opinion of a pilot or ATC personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised" (Source: International Civil Aviation Organisation (ICAO)).

[18] CAT, for the purposes of this document, also includes military aircraft flying under the control of and in accordance with civil air traffic procedures.

[19] Oceanic airspace commences at 10° west from FL55 (circa 5,500ft AMSL) to unlimited and is Class A controlled airspace.

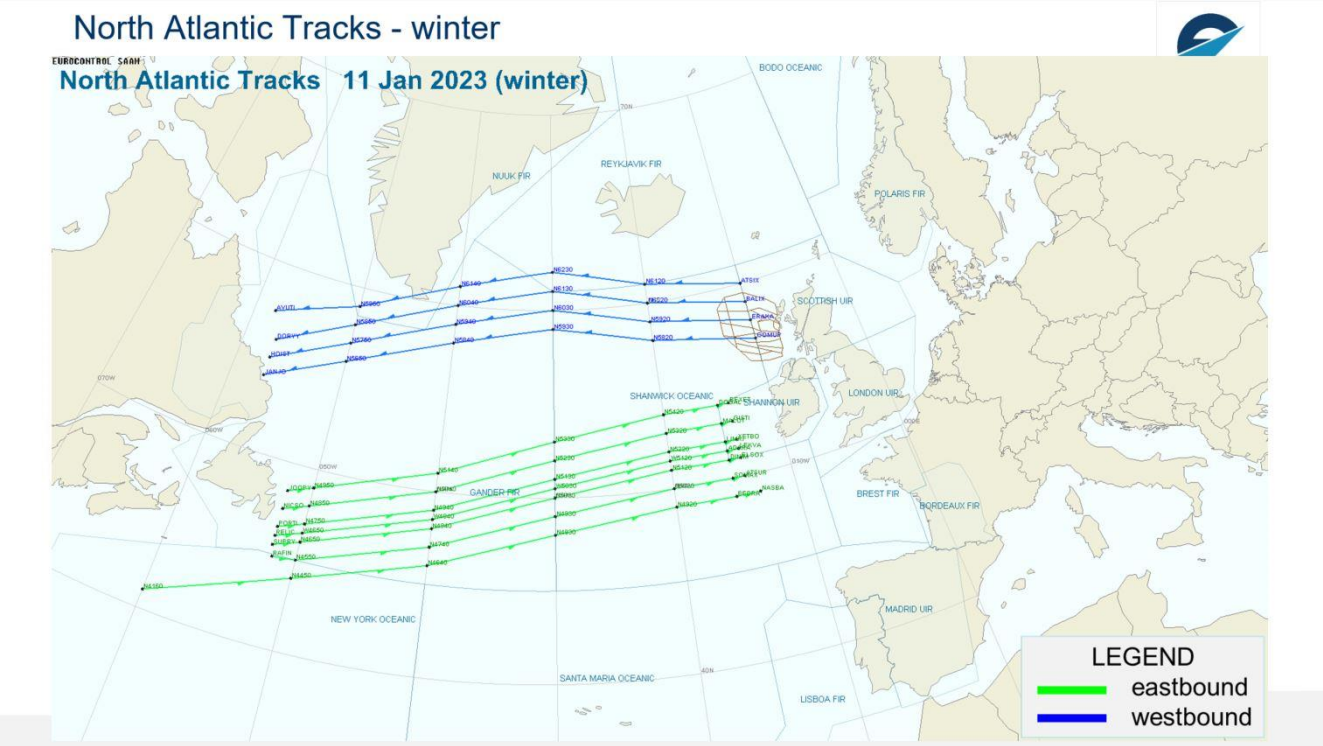

Figure 5: Typical NAT track structure showing the tracks available for both east and westbound flights routing to/from the Americas and Canada. (Source: EUROCONTROL)

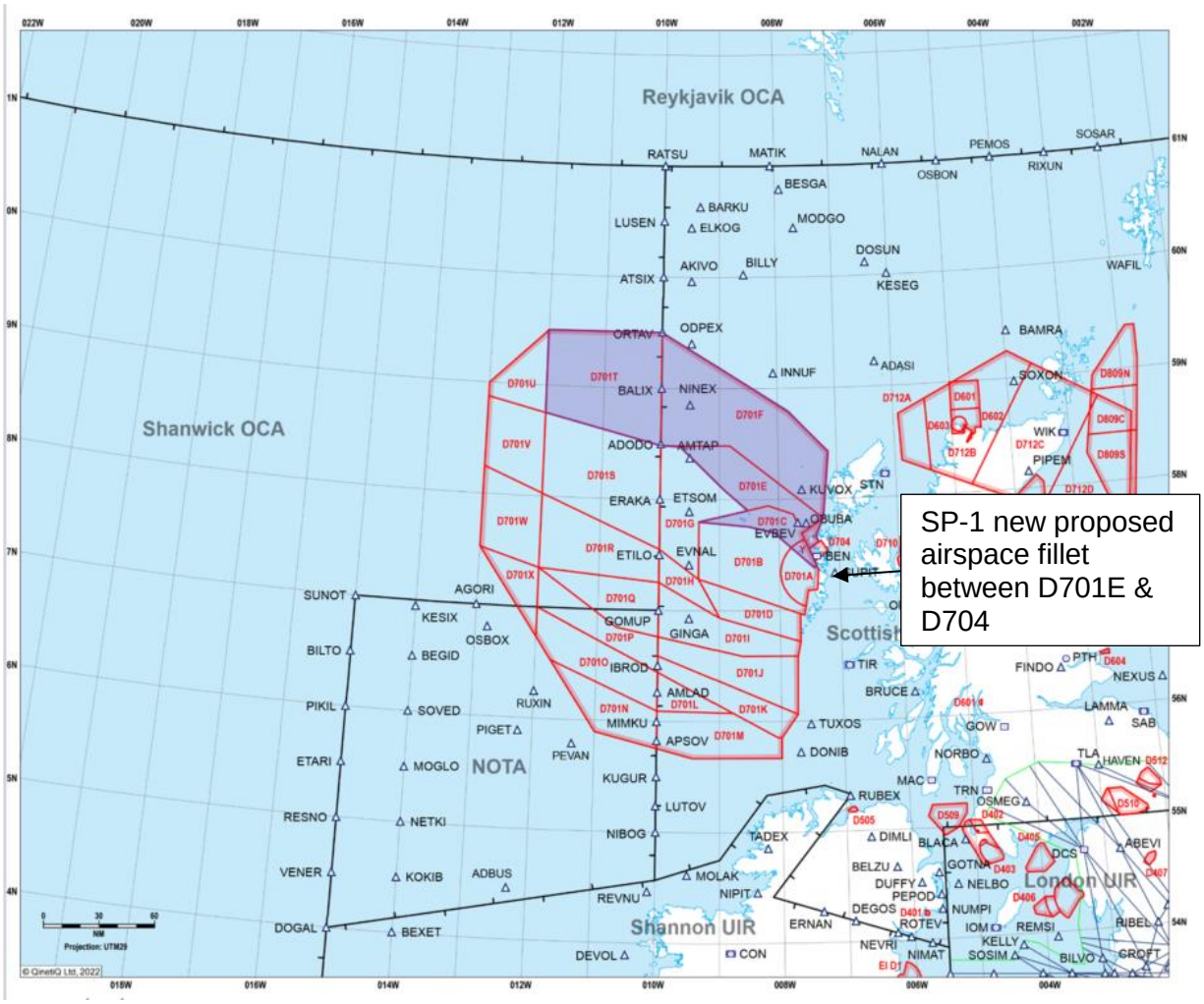

Figure 6: MOD Hebrides Range D701 and D704 Danger Area complex with new proposed airspace fillet around SP-1 launch site and possible D701 areas activated (shaded areas) for an exemplar long range sounding rocket. (Source: QinetiQ)

2.2.2 It should be noted that the airspace fillet and associated D701 areas will only be activated during planned launch windows in the region of 2-3 hours each time with a maximum of 10 launches[20] per year, plus a maximum[21] of two contingency days per launch. This equates to a worst case activation of the airspace for a total of 90 hours per year (less than 2% of the year), for SP-1 launches. When this airspace is not activated, it remains in its existing status (Class A, C & G) with no restrictions[22].

[20] SP-1 is limited to 10 launches per year as part of the conditions associated with planning approval.

[21] It is unlikely that more than two contingency days will be factored in per launch due to availability of the MOD Hebrides Range; it is also unlikely that all contingency days will be required for all launches and an assumption of one contingency day for every launch has been made based on experience of launching similar rockets from the MOD Hebrides Range.

[22] It should be noted that the D701 airspace will still be activated for MOD use in addition to SP-1 use.

3. Summary of Airspace Design Development

3.1 Design Principles

3.1.1 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. Stakeholders were requested to consider the DPs against the proposed airspace designs and highlight their view on the feedback form.

3.1.2 The DPs for ACP-2021-12 are shown below in Table 2. It should be noted that in late 2021 the requirement for orbital launch was removed from this ACP. This placed far less demand on the airspace requirements and elements of the DPs became irrelevant; these elements are still shown for completeness but have been struck through for clarity. 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 ASM procedures operated within the EG D701 complex**
This design principles should include integration of the new airspace into the Airspace Management (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 Air Navigation Service Providers (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 (North Atlantic) 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 these elements will need to be considered in the airspace design especially where they are traded off against minimising disruption to CAT. Many of these environmental issues were 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 & Range operator licences.		
~~**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.~~		

Table 2: Airspace Design Principles submitted during Stage 2.

3.2 Initial Airspace Fillet Design

3.2.1 It was envisaged from the outset that the most straightforward and sensible option for SP-1 operations was to use an existing Danger Area airspace structure, namely the EG D701 MOD Hebrides Range complex. By using the existing Danger Areas, it was considered that the same processes and procedures for safety and airspace management, as in everyday use by QinetiQ who manage this MOD Range, could be used for SP-1 rocket launch. The MOD agreed that, under certain conditions prescribed in a letter of agreement between the MOD, QinetiQ and SP-1 project board, the D701 areas could be used for sounding rocket launch. This was the first step in developing the airspace for SP-1. What followed was detailed safety analysis of similar rocket systems that had already been used at the Range, recognising that the SP-1 launch site was outside the existing Range and as such, a new fillet

of airspace would be required. At first, while the safety data was being evaluated and worst case scenarios developed, it was proposed that a simple line drawn from the bottom corner of D701F (where it joined D701E), to intersect the top right hand corner of D704 would be more than adequate to contain the 'air safety hazards' (see Figure 7). This line also conveniently shared coordinates that had already been validated by the CAA, this validation means the points are defined to Aeronautical Data Quality (ADQ) standard.

3.3 Refined Airspace Fillet Design

3.3.1 Following early engagement, it was identified that the initial airspace design would impact on the beach landing site at Sollas, albeit only very occasionally, so it was initially decided that the activation of the airspace fillet would not occur during the annual Sollas fly-in event held in the summer once a year. However, once more detailed safety analysis had been concluded, it was evident that the eastern edge of the airspace fillet could be safely re-profiled such that it no longer encompassed the immediate area around Sollas and the design at Figure 7 (right) was established. The airspace extends from surface level to unlimited altitude.

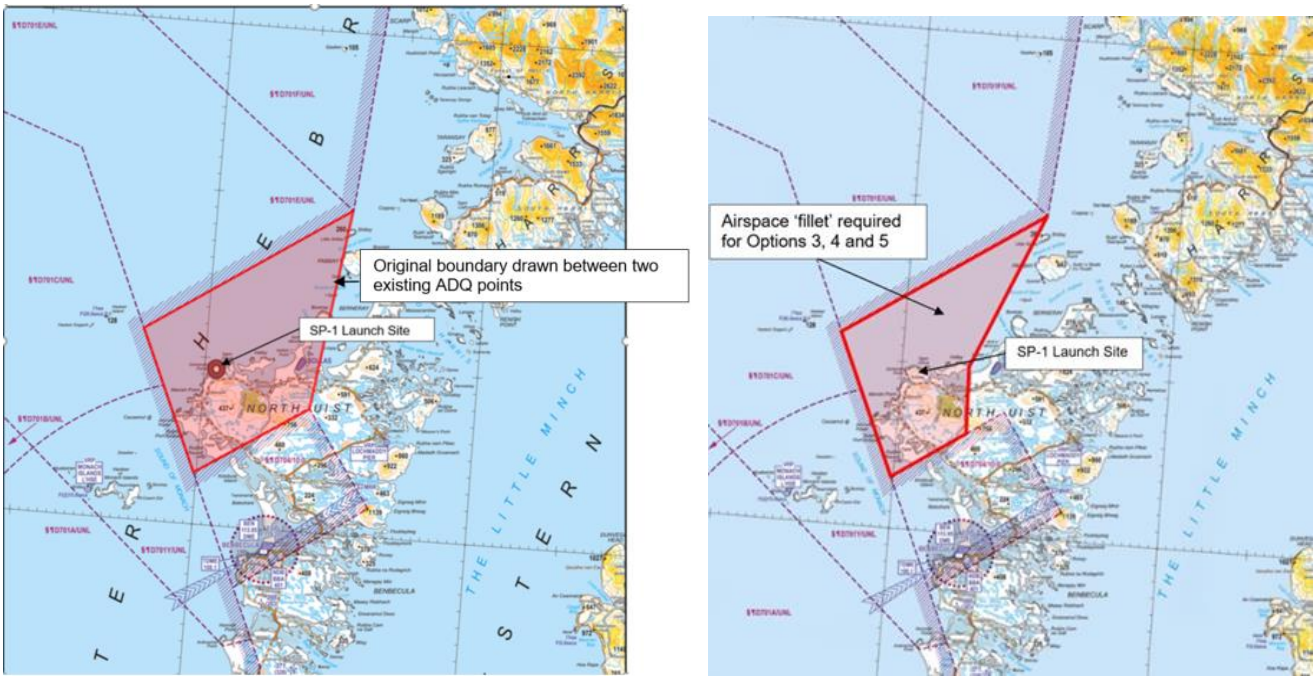

Figure 7: Original airspace fillet design (left) and revised airspace fillet design (right) modified following detailed safety analysis that enabled the eastern boundary to be re-profiled. (Source: CAA 1:250000 chart)

3.4 Safety Analysis

3.4.1 Due to the immaturity of many modern sub-orbital rockets, QinetiQ MOD Hebrides Range and suitably qualified 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 MOD Hebrides Range since 2015. The analysis, conducted through a MOD Hebrides Range risk management process, includes but is not limited to:

- ascertaining launch risk through hazard identification and risk analysis processes;
- development of risk criteria and hazard thresholds then applying these to the probability of failure;
- analysis of catastrophic failures and debris dispersion modelling and risk assessments; 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 7 present the maximum reasonable geographic extent of the region within which credible hazards could occur due to rocket launch and flight activities.

3.4.2 It is important to note that the process to determine the size of airspace necessary to ensure no additional risk to other airspace users is different to that regarding the 'land safety footprint' and risk to 3rd parties on the ground, and to the process used to establish the risk to maritime 3rd parties. The airspace safety requirements consider a large aircraft with a high number of passengers travelling at high speed therefore, to reach an acceptable level of risk, the segregated airspace area has to be significantly bigger than the land or sea space safety areas. The airspace area therefore does not denote an area of risk to personnel on the ground; there are many UK Danger Areas over land that are there to safeguard aviation and do not indicate that a threat to personnel on the ground exists. EG D704 over Benbecula airport is a good local example. This airspace is activated when there is a risk to other airspace users; the risk to 3rd parties on the ground is evaluated differently and restrictions/warnings are put in place accordingly. In effect any additional risk caused by SP-1 activities to 3rd parties on the ground has to be contained well within the SP-1 site area as shown in Figure 8.

3.4.3 It should be further noted that the ground safety footprint (and that over the sea space) is not evaluated under the ACP process; this is addressed separately by the CAA through the Spaceport and Rocket/Launch Operators licences and approvals. Here both the Spaceport operator and the rocket launch provider will need to satisfactorily demonstrate to the CAA that they have a robust safety case, safety management processes and evidence to show the operation is safe and risk to 3rd Parties on the surface is tolerable and within the regulated safety margins – the CAA will only issue the respective licences when these strict safety criteria are met.

3.4.4 Further reading on the safety analysis can be found in the Airspace Options Appraisal Report Phase II (Full) Section 4; the document also forms part of the consultation documentation and is available at: Airspace change proposal public view (caa.co.uk).

3.4.5 Beyond the new airspace fillet, safety will be assured through the utilisation of the D701 areas and associated safety processes and procedures. Sub-orbital sounding rockets will be treated in exactly the same manner as any rocket or weapon fired on the MOD Hebrides Range; in essence the small airspace fillet will become an extension of the D701 Danger Area complex with regard to safety processes pertaining to aviation activities.

3.4.6 Greater detail on the safety analysis used to determine the size of the 'airspace fillet' will be contained in the formal proposal submission during Stage 4 of the ACP process.

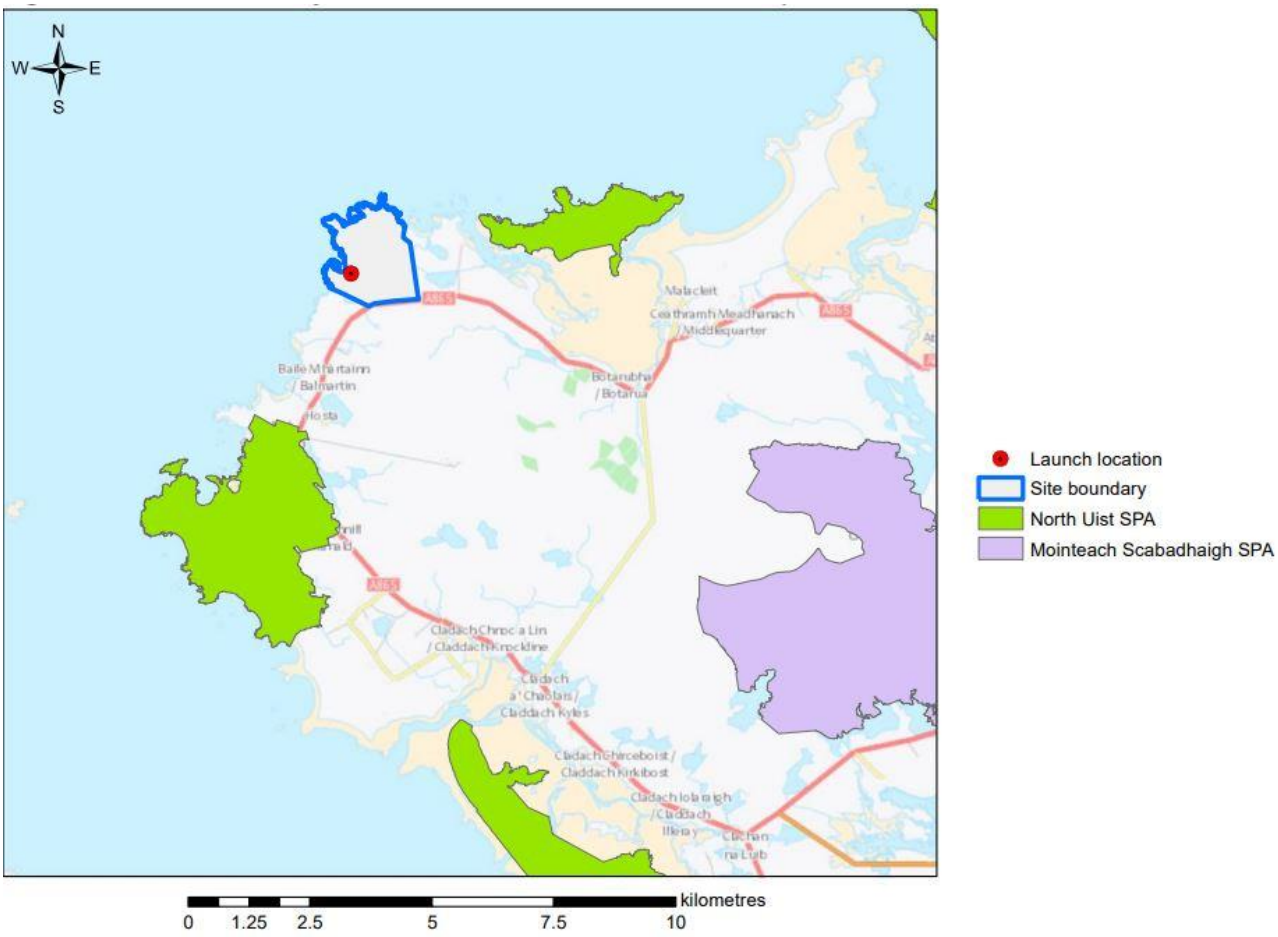

Figure 8: Extract from the EIA showing the approximate SP-1 site boundary in blue outline (and location of Special Protection Areas (SPAs))

4. Airspace Design Options

4.1 Six Initial Options

4.1.1 There were six initial airspace options tabled for comment and feedback, including the 'do nothing option' which has acted as a baseline during the appraisal process. However, three of the options were discounted by the main stakeholders and QinetiQ on the grounds that they did not meet the SoN or the airspace DPs. Full details of the airspace options and design principle evaluation can be found in the 'SP-1 Airspace Designs & Design Principles Evaluation Report version 2' on the CAA airspace portal at: Airspace change proposal public view (caa.co.uk). The airspace options are summarised in Table 3 below; these are expanded in paragraph 4.1.2 to paragraph 4.1.9. Note: All six airspace options will require the small additional volume of airspace around the launch pad as described in paragraph 2.1.3 and shown in Figure 2 above.

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 & Aeronautical Information Publication (AIP) Supplement (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 airspace 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 change D701; Additional airspace made available would have limited use.

Table 3: Airspace options summary table

4.1.2 **Option 0 - Do Nothing Baseline** - This option leaves the airspace as it currently exists (depicted in Figure 9 below) with the SP-1 launch site sitting within Class G airspace. 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 users as rockets will have no means of complying with the RoTA appropriate to the class of airspace. This option is therefore considered unviable.

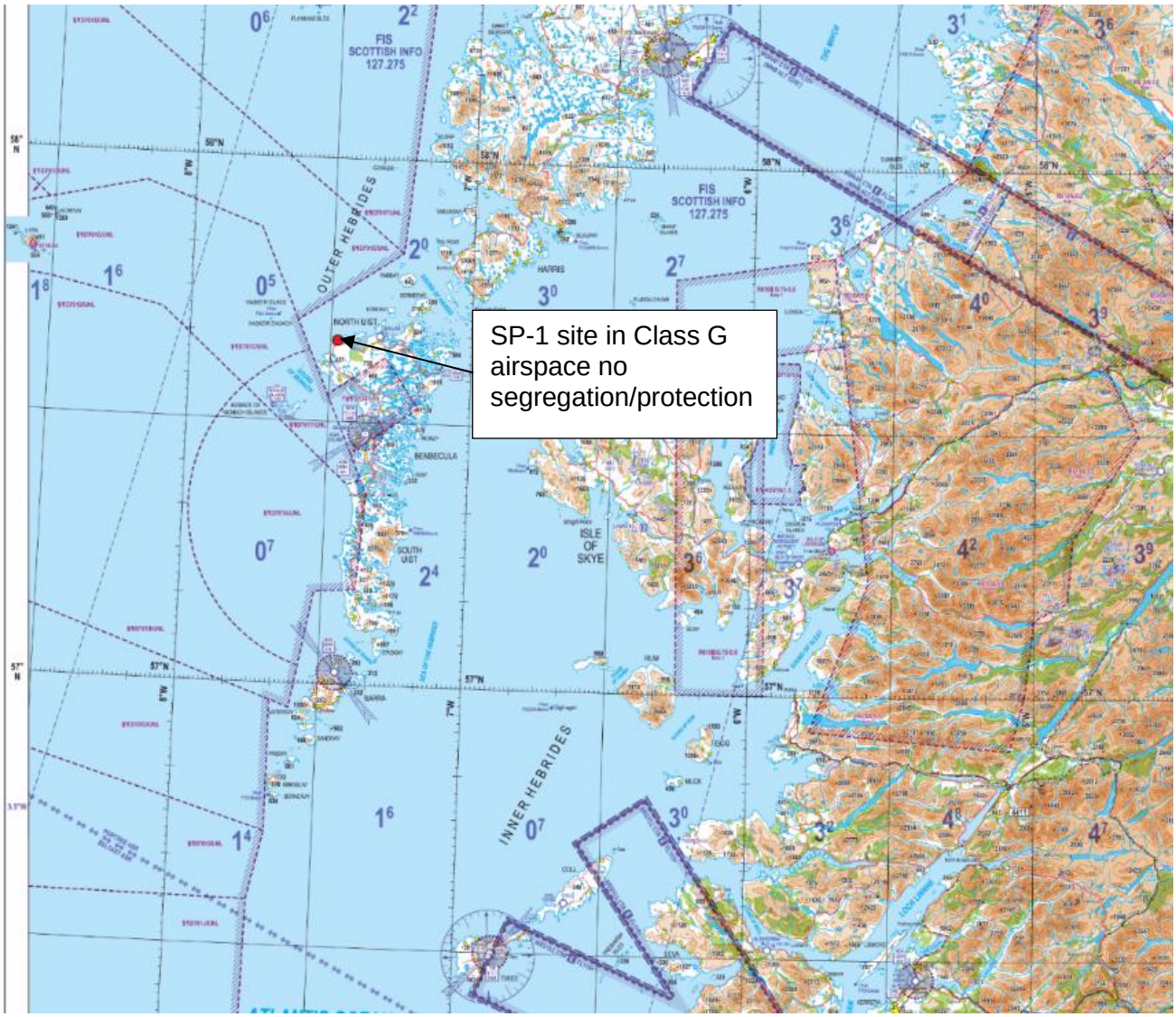

Figure 9: Option 0 - Do nothing (Source CAA 1:500000 Chart)

4.1.3 **Option 1 – Do Minimum** - This option would necessitate bespoke airspace designs for each individual launch following the safety assessment and safety trace[23] analysis. NOTAMs and associated AIP 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 (ENM) ASM systems that enable the harmonised and dynamic planning of the ATM network[24]. An exemplar NOTAM area is depicted at Figure 10.

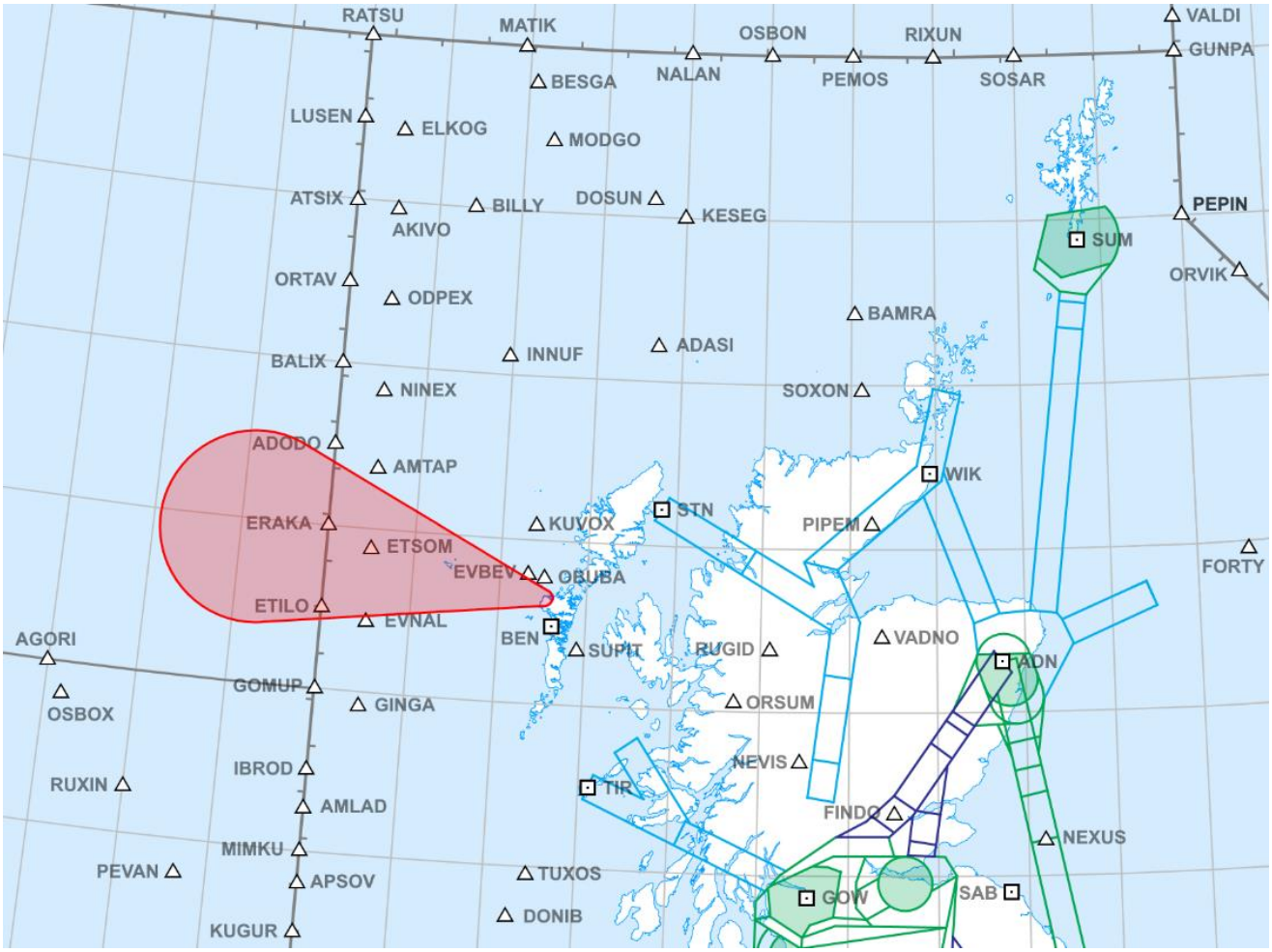

Figure 10: Option 1 - Do minimum: Diagram showing an exemplar NOTAM area for single rocket launch. (Source: QinetiQ)

[23] 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 3rd 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.

[24] Permanent airspace solutions have defined coordinates that are built into the electronic flight planning systems and when activated create automated flight planning restrictions (this ensures the aircraft are automatically routed around the active SUA). This enables far greater efficiency in the planning of flights and enhances safety. Moreover, permanent solutions are marked on aviation charts and activation details are contained within aeronautical publications.

4.1.4 **Option 2 – Do Minimum and Utilise D701** - This option would still necessitate an individual NOTAM and associated AIP SUPP information for the airspace fillet around the launch site for each individual launch. Such one-off NOTAMs would not be fully integrated into the UK AMC or ENM 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 11.

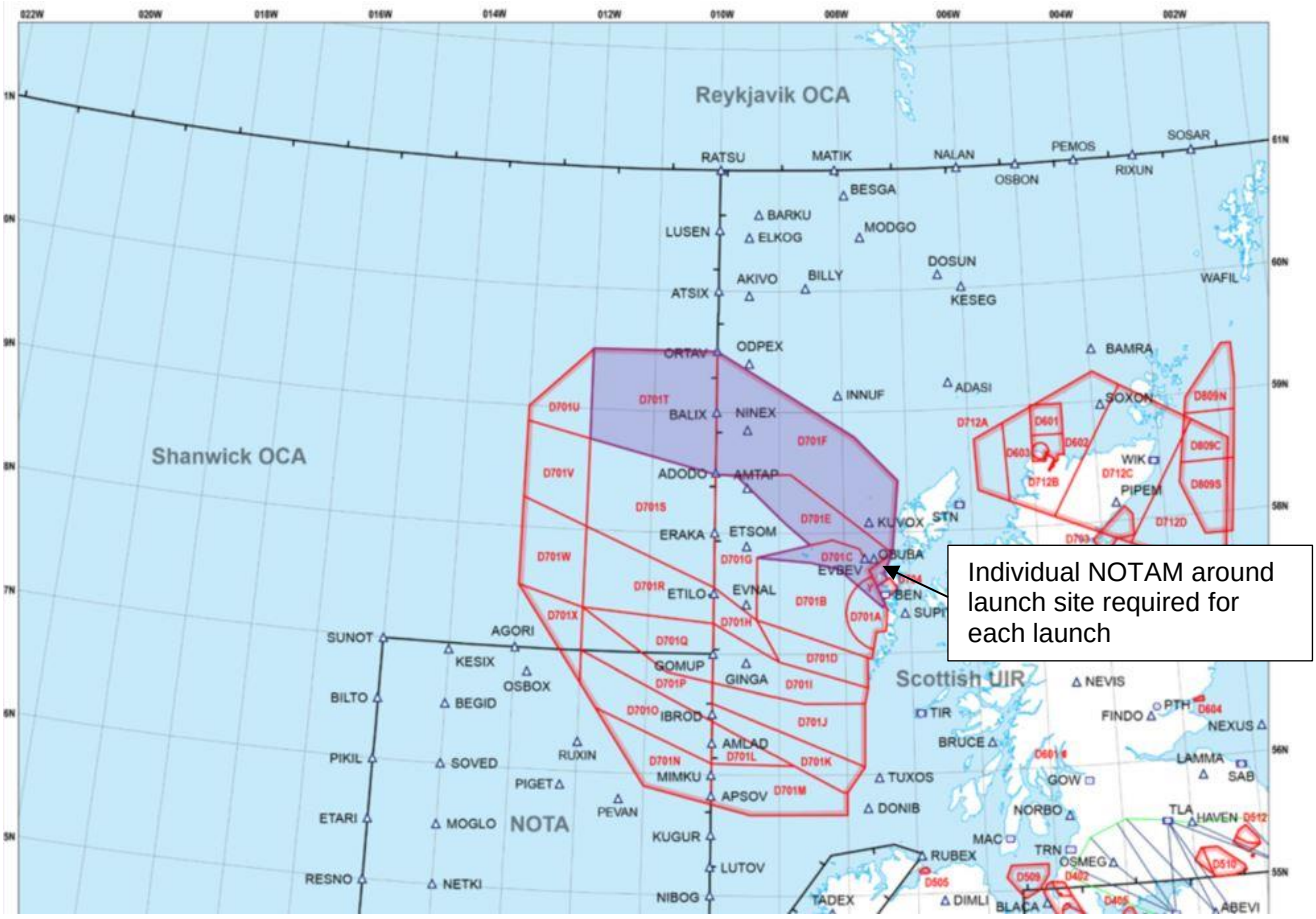

Figure 11: Option 2 - Do minimum & utilise D701 (diagram showing an example of D701 shaded areas activated for a long range sounding rocket). (Source: QinetiQ)

4.1.5 **Option 3 – New fillet of Segregated Airspace Around Launch Site and Utilise D701** - This option includes the use of a new airspace fillet 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[25] 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 airspace fillet and D701 would be fully integrated into the systems and processes employed by the UK AMC and the ENM, 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 airspace fillet would be treated as an extension of D701 for ASM purposes, and the associated D701 areas would be activated as needed to meet the safety trace requirements of the vehicle being launched. Notification, activation and deactivation would follow existing procedures and Letters of Agreement (LoAs).

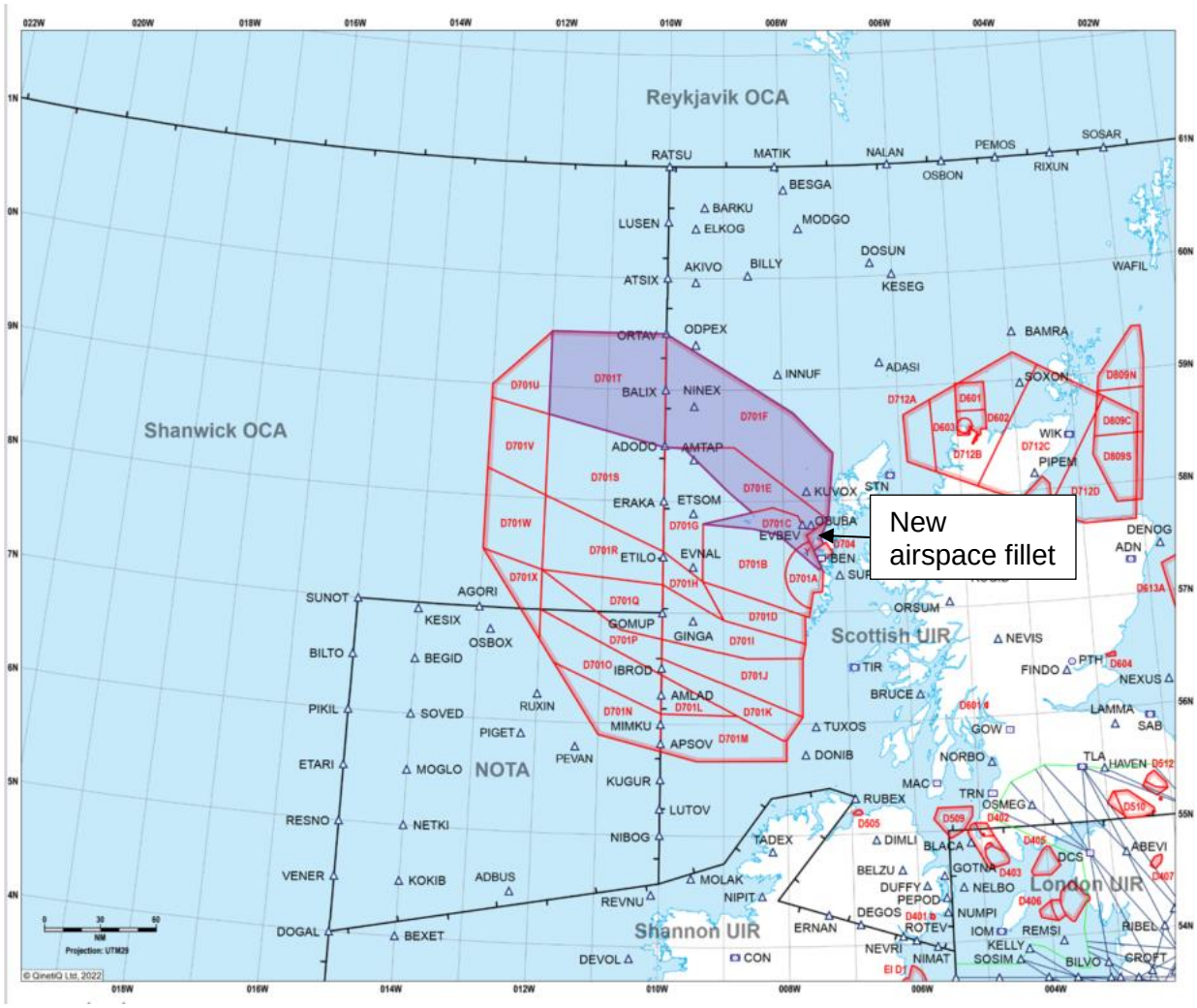

Figure 12: Option 3 - New airspace fillet around launch site and utilise existing D701 areas – diagram shows the typical areas activated (shaded) for a long range rocket. (Source: QinetiQ)

[25] Activated by NOTAM when needed.

4.1.6 **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 created. Any such large bespoke modular design for sounding rockets would have to extend in excess of 250km west north-west from the launch site (to contain the long range sounding rockets) 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 10º 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 into the systems and processes employed by the UK AMC and the ENM enabling the harmonised and dynamic planning of the ATM network.

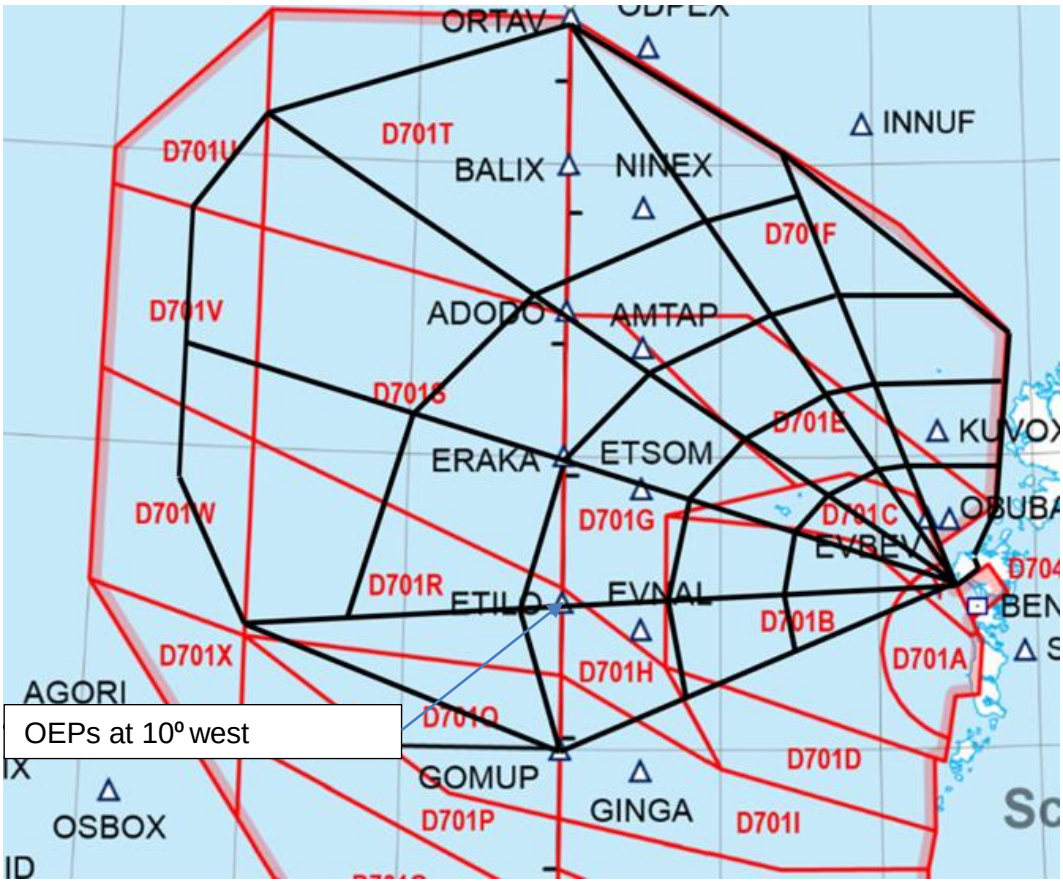

Figure 13: Option 4 – New airspace fillet around launch site and whole new bespoke modular system (in black) overlaying the D701 areas (in red) and position of OEPs and other 5 letter reporting points. (Source QinetiQ).

4.1.7 Option 4 introduces an extremely complex airspace structure due to the presence of the existing D701 areas (see Figure 13) and there is concern the two could easily be confused as they are managed by the same organisations (MOD Hebrides Range staff and ANSPs). This would be particularly pertinent where new standalone ASM processes and procedures are developed and are operated in conjunction with existing procedures. Furthermore, both aeronautical and maritime charts would become complex; similarly the radar maps used by MOD Hebrides Range and ATC staff would be multifaceted and need to be capable of displaying both structures clearly.

4.1.8 Data from the pan-European civil-military organisation EUROCONTROL provides evidence that such a new design structure would not release any more airspace than if the current D701 areas are utilised (see Section 6). Therefore the impact on air traffic is very similar.

4.1.9 **Option 5 – Use in Conjunction with Option 2 or 3 Adding Sub-division to Existing D701 Areas and/or Re-profiling** - This option introduces a series of sub-divisions and/or re-profiling of the existing D701 areas in order to reduce the overall volume of airspace unavailable to other airspace users. The sub-divisions would potentially reduce the overall volume of airspace required for shorter range sub-orbital rockets; however, as the specific parameters and precise safety traces for these rockets are not yet known, it is very difficult to accurately predict where the optimum position for these sub-divisions should be. Furthermore, this information is unlikely to be forthcoming until a few months before a prospective launch. However, an example of what the sub-divisions or re-profiling might look like is depicted at Figure 14.

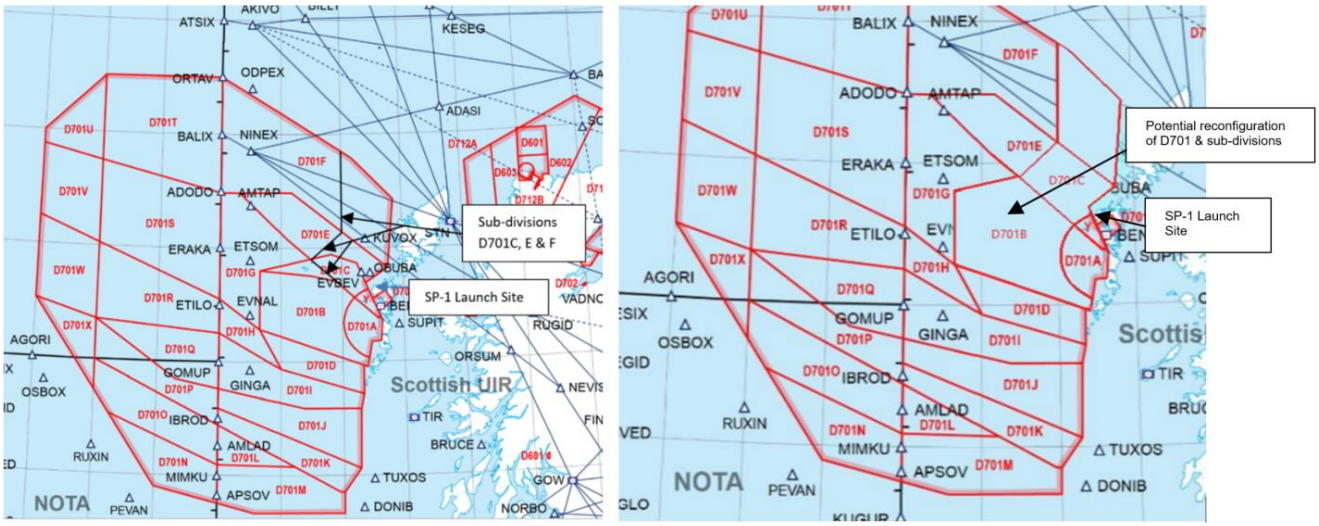

Figure 14: Option 5 in conjunction with either Option 2 or 3, new sub-divisions of existing D701 areas and/or re-profiling D701C with sub-divisions of D701E and F. (Source: QinetiQ).

4.2 Options Taken Forward into Stage 2 Step 2B Options Appraisal

4.2.1 Following the design principle evaluation and stakeholder feedback, only three options were taken forward into Stage 2 Step 2B for appraisal, namely:

- Option 3 - New Fillet of Segregated Airspace around Launch Site and Utilise D701;
- Option 4 - Construct New Bespoke Segregated Airspace Blocks From Launch Site; and,
- Option 5[26] in conjunction with Option 3 – Use in Conjunction with Option 2 or 3 adding Sub-division to existing D701 areas and/or re-profiling.

4.2.2 It was considered that only these three options met the SoN and the majority of the DPs.

5. Proposed Airspace Design Option

5.1 Preferred Option

5.1.1 The preferred airspace option is Option 3 for a number of reasons:

- it is considered the least costly to implement (minimal changes to Range and ATC equipment mapping, procedures and aeronautical charts);
- it requires minimal training for Range and NATS ATC staff (smallest change); and,
- It is considered the safest option and the least likely to confuse Range and ATC staff as well as those in the aviation community.

5.1.2 Full details supporting the justification of making Option 3 the preferred option is contained within the 'Options Appraisal (Phase II – Full)' report available at: Airspace change proposal public view (caa.co.uk).

[26] This Option is simply referred to as Option 5 in this document hereafter as Option 2 was discounted.

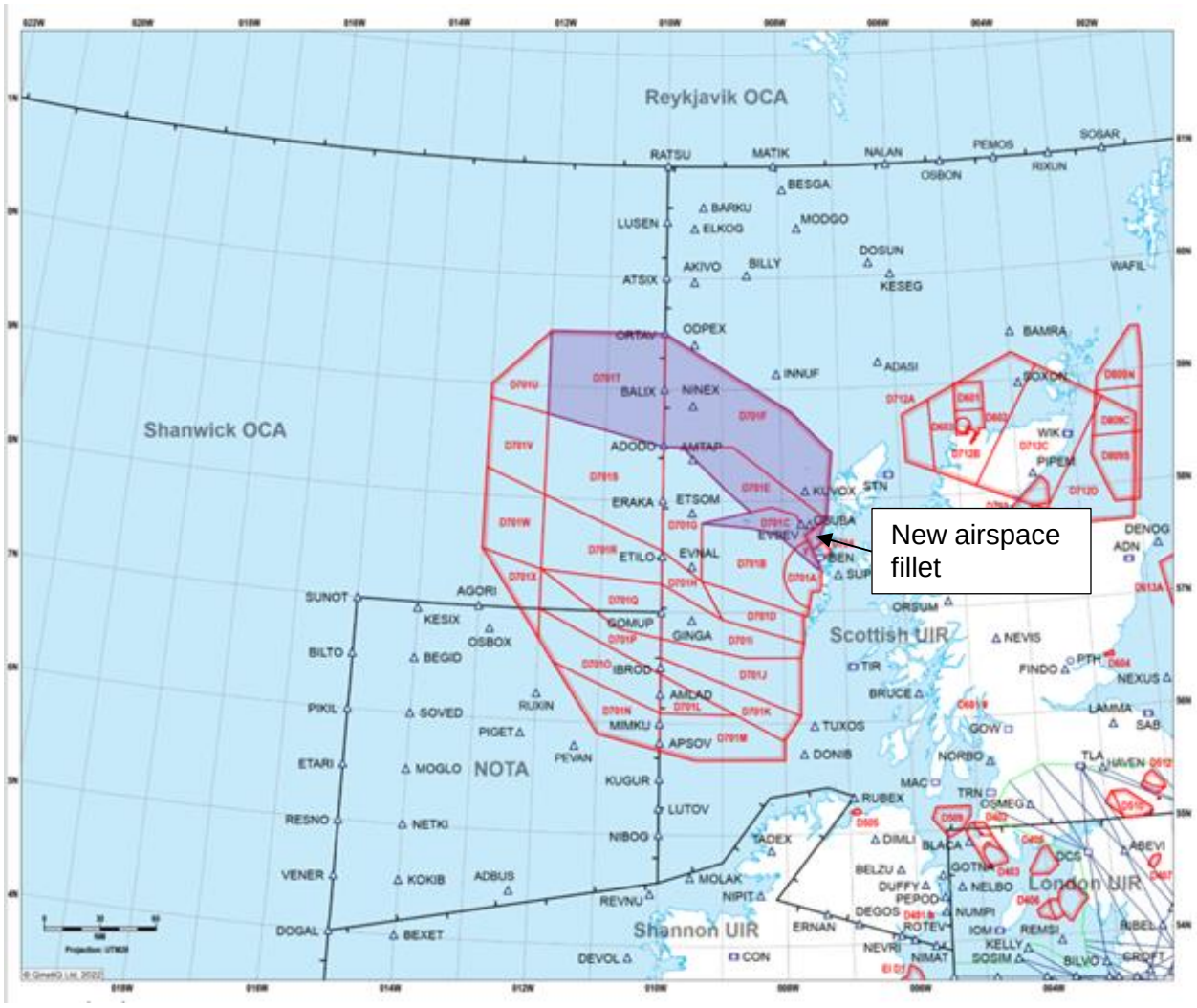

Figure 15: Preferred option (Option 3) showing new airspace fillet around launch site and utilisation of existing D701 Hebrides Range Danger Areas – Diagram shows possible D701 areas activated (shaded areas) for an exemplar long range rocket. (Source: QinetiQ).

5.2 Airspace Design Summary

5.2.1 The new proposed airspace design consists of a simple small airspace fillet shown in Figure 4 that provides a volume of segregated airspace from surface to unlimited around the launch site, and connectivity to the D701 MOD Hebrides Range Danger Areas. Within the fillet lies a small additional circular area extending 1000m radius from the launch pad from surface to 3000ft agl as depicted in Figure 2). The connectivity to the D701 areas facilitates use of an existing airspace structure meaning the size of the airspace change is kept to an absolute minimum and the impact on other airspace users is a known entity and partially mitigated through best practice and well established procedures. It is anticipated that the new airspace fillet will become an extension of the existing D701 areas regarding ASM processes and procedures and the MOD Hebrides Range staff will manage the airspace and rocket launch in exactly the same manner as MOD activities in the D701 areas. The same strict Range safety procedures and compliance with both MOD regulations and civil HSE guidelines will be utilised for SP-1 rocket launches.

6. Indirect Environmental Impact Assessment

6.1 Air Traffic Impact Assessment

6.1.1 The analysis is divided into two distinct elements using noticeably different methods of assessment, the first element: 'Options comparison' [6.2] explores the different traffic impact assessment the three options have on transatlantic air traffic. The main focus here is on the impact a short-range rocket launch may have when comparing Option 3 with Options 4 and 5, both of which use less airspace than Option 3 for short-range rocket launches. It is considered vital to understand whether the additional airspace made available by these two options actually provides any benefit in terms of reducing the additional number of track miles flown by aircraft needing to deviate off route (to avoid the activated areas), as both these options are more costly and complex to implement than Option 3. A similar comparison is made between Option 3 and Option 4[27] but with regard to a long-range rocket launch. This analysis has been conducted by EUROCONTROL using their sophisticated flight modelling and prediction tools for a single 'typical busy day' for flights[28] over Scotland. This assessment is purely used to understand if there are any differences in impact on NAT traffic between the three separate airspace options. It should be noted that the metrics used by EUROCONTROL may differ from those used by the UK CAA – the CAA prescribed metrics are used during the second element of the analysis. Furthermore, the number of D701 areas activated differs between the two elements of analysis as does the start point for any flight deviation.

6.1.2 The second element: 'Traffic analysis and indirect environmental impact caused by worst case scenario' [6.3], uses a vast amount of air traffic data where all flights crossing the AOI within specified time periods were considered over a 10 month period during 2019[29]. Using this data and averaged for a 12 month period, the extra track miles flown by aircraft affected by SP-1 operations was calculated through QinetiQ modelling. From this, using the most common single aircraft type crossing the AOI, the extra fuel burnt and associated CO_2 emissions has been calculated; this forms the indirect environmental impact assessment presented in paragraph 6.3.

6.2 Options Comparison (first element)

6.2.1 Using two different exemplar rocket profiles (short range and long range) EUROCONTROL were tasked with providing air traffic network impact data on the shortlisted options primarily to ascertain whether Option 4 (new bespoke areas) or Option 5 (sub-dividing/re-profiling existing D701 areas) had any significant benefit (less impact on NAT tracks) than using the existing D701 areas (Option 3), when considering short range rocket launch – see Figure 16.

6.2.2 EUROCONTROL considered a single day traffic sample where there was a high level of westbound transatlantic air traffic routing over the D701 areas; this constitutes a worst case scenario. The traffic for this day was modelled against 5 different scenarios; scenarios 1 to 3 compared Options

[27] Option 5 is not considered for long-range rocket launch as it provides no additional benefit.

[28] These were actual flights with realistic fuel burn for each different aircraft type on the selected day.

[29] 2019 considered the peak period for air travel.

3, 4 and 5 for a short range rocket launch; and, scenario 4 and 5 compared[30] Option 3 and 4 for long range rocket launch. The analysis (see Table 4), verifies that despite more flights being affected by utilisation of the existing D701 areas under Option 3 when compared to Option 4 and Option 5, it is evident that where flights are able to execute an early deviation in their route, this normally prevents the need to fly any additional track miles and burn extra fuel. Furthermore, the analysis determines that during the afternoon period (1300-1600 UTC), there is no difference in extra fuel burn between scenario 1b (Option 5), 2b (Option 3) or 3b (Option 4) with all necessitating the same number of flights to fly extra track miles with the same fuel burn (see Table 4). This is an important factor as the vast majority of rocket launches will occur in the afternoon period.

6.2.3 It is also evident that long range rocket launch as depicted in scenario 4 (Option 3) and scenario 5 (Option 4) that there is little difference in impact on the number of affected flights between the two Options. The data would suggest using Option 3 would have slightly less impact than using Option 4 (four less flights in the morning and 10 less flights in the afternoon).

6.2.4 It is further evident that due to the configuration of the D701 Danger Areas – the wider the north-south expansion of areas activated, the greater the impact on NAT traffic; expansion to the west has far less consequence as the vast majority of NAT traffic route in a westerly (or easterly) direction. This appears to be a significant factor as to why the three airspace options have a very similar impact on NAT traffic despite using dissimilar volumes of airspace.

[30] Option 5 was not compared for long range rocket launch as it provides no additional benefit to Option 3.

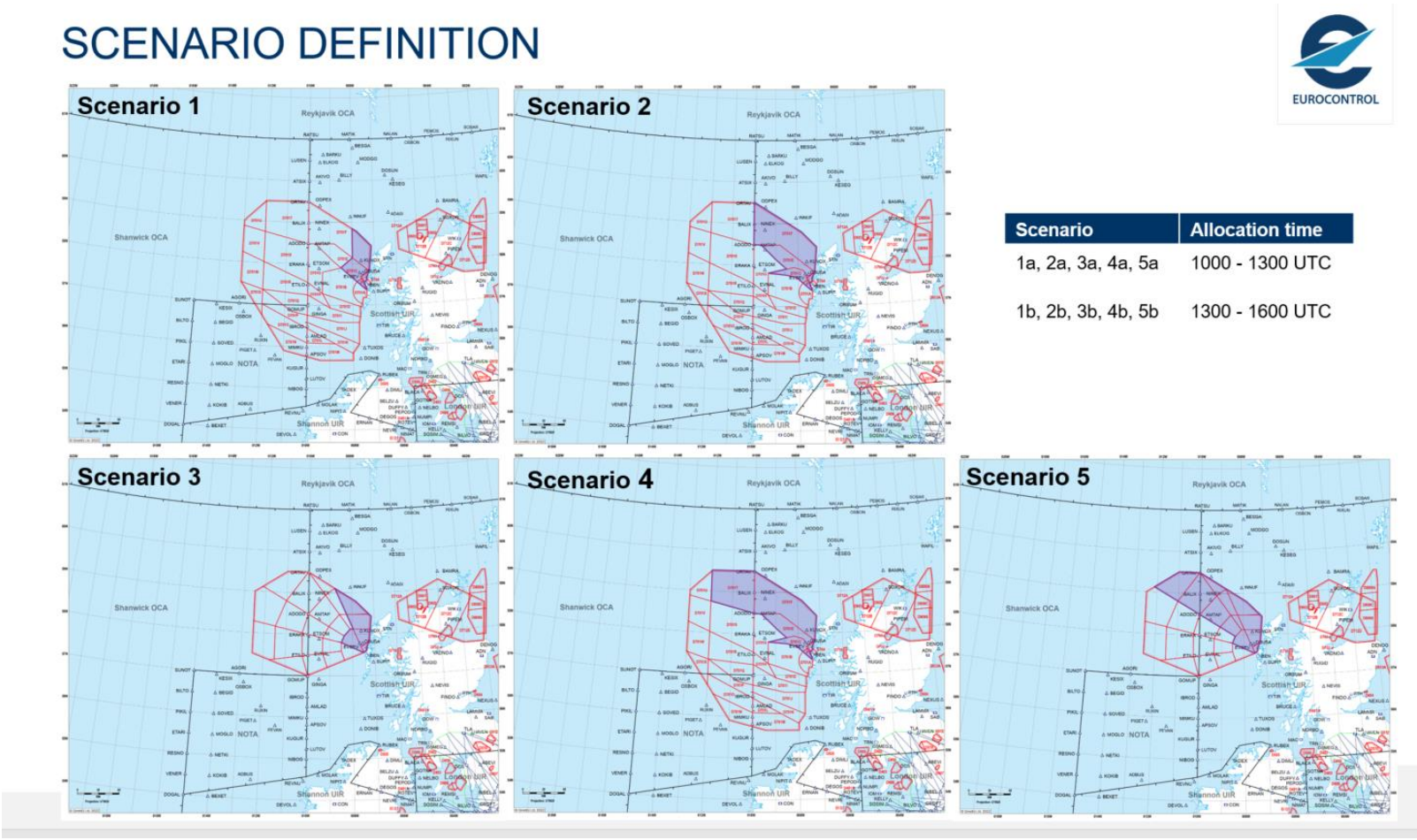

Figure 16: EUROCONTROL scenarios for each of the three proposed airspace options where scenario 1 is Option 5; scenario 2 is Option 3; and, scenario 3 is Option 4 (all show areas required for short range rocket). Scenario 4 is Option 3 & Scenario 5 is Option 4, both showing areas required for long range rocket launch. (Source: EUROCONTROL)

Scenario	Total number of flights	Length (NM)		Fuel (kg)	
		Nb flights	Total	Nb flights	Total
1a	**47**	45	1751.921	20	9992.51
1b	**47**	37	1007.908	12	6023.64
2a	**64**	45	1784.305	20	9992.51
2b	**72**	37	1007.908	12	6023.64
3a	**48**	46	1786.479	20	9992.51
3b	**48**	37	1007.908	12	6023.64
4a	**69**	45	1784.305	20	9992.51
4b	**83**	42	1435.055	16	8968.93
5a	**73**	49	2027.348	23	12401.91
5b	**89**	52	1880.241	19	11346.03

Table 4: EUROCONTROL options comparison where Scenario 1 is Option 5; Scenario 2 & 4 are Option 3 and Scenario 3 & 5 are Option 4. The 'a' against the scenario indicates time frame 1000-1300 & the 'b' indicates 1300-1600; all time UTC. (Source: EUROCONTROL)

6.2.5 The EUROCONTROL findings indicate that there would be little or no benefit of implementing Option 4 or Option 5 over Option 3 from an air traffic and environmental impact perspective. It is important to note that there is a marked difference in cost between implementing the three different options as both Options 4 and 5 require fairly significant changes to charts as well as air traffic control and MOD Hebrides Range equipment mapping. There are also increases in training costs associated with the more significant changes especially with Option 4 which also carries some potential safety concerns, (see paragraph 4.1.7).

6.3 Traffic Analysis and Indirect Environmental Impact Caused by Worst Case Scenario (second element)

6.3.1 Air traffic data for a 10 month period during 2019 (peak aviation period prior to COVID) was analysed to establish the flights patterns across the AOI[31] as shown in Figure 17 for the period 1000-2000[32] Coordinated Universal Time (UTC). This data provided evidence on the most commonly operated tracks and daily variations in traffic flows, with some days showing little or no flights, other days displaying a high numbers of flights. From this data, the impact on air traffic, over a 10 month period, has been evaluated against the activation of the D701 areas for SP-1 launches (assuming a three hour launch window).

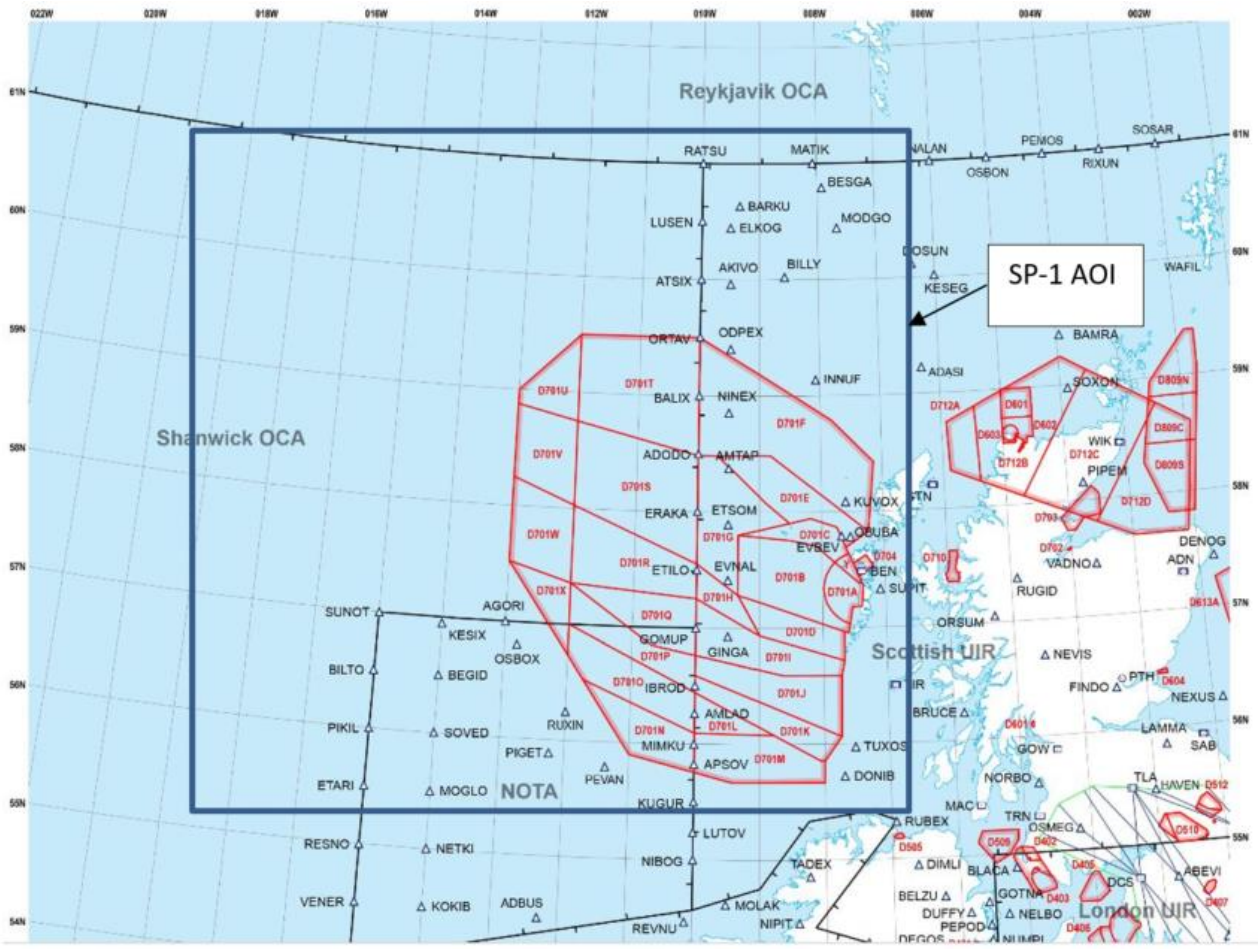

Figure 17: SP-1 AOI used for air traffic impact assessment. (Source QinetiQ).

[31] Traffic data was evaluated for the prescribed AOI however, in order to provide a quantative assessment of the impact specific D701 Danger Area activation had on flights, the AOI used for analysis was reduced – details can be found in the options appraisal phase II (full) report.

[32] The main transatlantic westbound flow of air traffic – it is anticipated the vast majority of rocket launch windows will occur post 1300 UTC.

6.3.2 Part of the analysis included an assessment of how frequently air traffic crossing the NAT route over Scotland, as this is not necessarily a daily occurrence and is dependant on the position of the Jetstream[33]. Furthermore, the vast majority of flights going westbound across the NAT occur during the day (circa 0800-2000) with eastbound flights occurring during the night (circa 0100-0700). This means rocket launch from SP-1 will generally only affect westbound flights so this is where the analysis was focused.

6.3.3 Using 10 months data of traffic crossing the NAT it is evident that there are seasonal variations. During the summer months the Jetstream favours westbound NAT traffic to route out over the southern UK and Ireland twice as often as out over Scotland. This means during the summer[34], where it is anticipated 60% of rocket launches (circa 6 launches) will take place, the air traffic impact will only be felt one day in every three days. This variation reverses during the winter[35] months meaning air traffic route out over Scotland two days out of three.

6.3.4 To understand the annual impact on the NAT air traffic the number of airspace activations need to be considered. The maximum number of launches is known to be 10 per year[36]. It is anticipated that there could be up to two contingency days for each launch required so potentially 30 airspace closures per year. However, experience of operating similar rockets on the MOD Hebrides Range strongly suggests that contingency days are not often[37] used and as such a conservative estimate would suggest one contingency day per launch as a reasonable assumption; this would mean a maximum of 20 airspace activations per year. From these 20 activations, it is anticipated that 60% (12) will occur in the summer months with the remainder (8) occurring in the winter. Using the seasonal variation data that NAT air traffic will route over Scotland one day from three, an assumption could be drawn that it is likely that the 12 airspace activations occurring in the summer will only affect the NAT air traffic on 4 occasions. Using the same process for winter then 5 activations from the 8 will impact on the NAT air traffic. Therefore, when considering the annual impact, **a total of 9 activations per year** are used in the analysis.

6.3.5 **Fuel Burn and CO_2 Emission Analysis** – During 2019 a total 8309 flights crossed the AOI during the period 1300-1600 UTC. Analysing the busiest day (29th September) for air traffic crossing the NAT and through the AOI in 2019, considered the worst case, the following detail was obtained:

- 380 flights crossed the AOI during the period 1000-2000 UTC;

[33] The jetstream are very strong upper winds that airline operators use to plan their tracks across the North Atlantic; such tracks are planned to avoid flying into the jetstream where possible, and use it in their favour to reduce fuel burn.

[34] Summer months are arbitrarily May to October.

[35] Winter months are arbitrarily November to April.

[36] As prescribed in the planning approval for the SP-1 launch site.

[37] MOD Hebrides Range experience of rocket launch suggests the majority of launches occur on the first planned day.

- 133 flights were affected by the activation of D701 for a long range rocket launch, this reduced to 71 flights for short range rocket launches; time period[38] for both was 1300-1600 UTC;
- The representative aircraft types were Boeing 777 (B777), 787, 767 and Airbus 330 (A330) all variants – the average fuel burn for the B777 (the most common aircraft type) is 9.61 kg per km flown[39]
- the average modelled deviation for all flights crossing the AOI during 2019 between 1300 and 1600 UTC was 12.3 NM or 22.8 km[40]; and,
- it is expected that circa 30% of rockets launched will be short range[41] rockets.

6.3.6 Assuming 9 activations of the airspace per year (affecting NAT air traffic), where 6 activations are expected to be for long range rockets and 3 for short range rockets, the total number of flights affected in a year is approximately: (6 x 133) + (3 x 71) = 1,011 flights. This number of affected flights equates to a total of 23,051 km flown (1011 x 22.8 km). Applying the associated average fuel burn of 9.61 kg per km flown results in an annual total of 221,518kg or 221.5 tonnes of additional fuel burnt. Using the metric[42] that 1 tonne of aviation fuel burnt produces 3.18 tonnes of CO_2, the total additional CO_2 emissions in a year are circa 704.4 tonnes.

6.3.7 While this figure may appear high, it should be read in conjunction with the fuel burnt for a 'typical' long haul transatlantic flight. Examination of a single actual flight that crossed the AOI, a B777-300ER operating as Emirates flight EK211 (Dubai to Houston) on 2nd May 2019, the flight track is circa 13,243 km. This means the flight burns 127,265.2 kg of fuel or 127.3 tonnes; this results in 404.8 tonnes of CO_2. Therefore the extra fuel burnt and CO_2 emissions caused by the flight deviating around the active D701 areas (22.8 km) equates to about 0.17% of the flight's total fuel burn and emissions.

6.3.8 It should be noted that this analysis assumes that air traffic levels are at their peak on every day when an airspace restriction occurs and it does not factor in the ability to make route adjustments several hundred miles ahead of the airspace restriction to avoid flying additional kilometres. More detailed information on this analysis can be found in the 'Options Appraisal Phase II (Full)' available at: Airspace change proposal public view (caa.co.uk)

[38] It is expected that rocket launch will occur post 1300 UTC; only those short range rockets not impacting on the NAT air traffic are likely to be launched before this time.

[39] Using the ICAO Carbon Emissions Calculator (online: ICAO Carbon Emissions Calculator (ICEC)).

[40] Using the metric that 1 NM = 1.852 km.

[41] Medium range rockets fall under long range for the purposes of this evaluation.

[42] American Society for Testing and Materials (ASTM) D1655, ASTM, 2015.

7. Operating Principles

7.1 Measures to Minimise Impact on Other Airspace Users

7.1.1 As described at paragraph 2.1.3, the change Sponsor intends to implement a fillet of segregated SUA in the form of a Danger Area around the SP-1 launch site to provide connectivity to the existing D701 areas. This airspace fillet (and associated D701 areas) will only be activated for the minimum periods necessary to enable sub-orbital rocket launch; this is expected to be in the region of an average of 60 hours per year[43] (see also paragraph 6.3.4 above). Utilising SUA enables the airspace to revert to its background classification Class G and Class C (above FL195) when not in use. This is far more efficient use of airspace than establishing permanent controlled airspace (Class A-D) around the launch site.

7.1.2 Utilising current best practice at the Range (as detailed in a number of existing LoAs) for SP-1 rocket launches will ensure the minimum impact on other airspace users. This includes optimising the timings of the launch (activation of the airspace) such that it minimises the impact on air traffic in the region, and selecting a trajectory that utilises the least number of D701 areas. Planning, notification and cancellation procedures will follow extant LoAs and use of the D701 areas will be in accordance with the QinetiQ/MOD/SP-1 LoA. The airspace (and associated D701 areas) will be activated by NOTAM using standard notification periods; in addition intended launch windows will be notified to local residents by a number of different mediums – this will be facilitated by the local council.

7.1.3 Access to the airspace fillet and D701 areas when active will be enabled, when safe to do so, in accordance with current procedures and agreements. MOD Hebrides Range will manage the SP-1 airspace fillet in exactly the same manner as the D701 areas, applying the same strict safety criteria.

7.2 Utilisation of Airspace

7.2.1 In accordance with the planning application for the SP-1 site, the number of launches will be limited to 10 per year. Each launch will require contingency (backup) days as described in paragraph 6.3.4 and it is opined that on average each launch will require one contingency day. It is therefore argued that an assumption of 20 activations of the airspace per year is considered the worst case condition.

7.2.2 The actual period from launch to splash down is only a few minutes, probably no more than 10; however, the launch could be delayed by unpredictable events such as changeable weather conditions, the Range safety area being fouled by a 3rd party, or minor technical issues. To accommodate these variable occurrences it is necessary to provide a sufficiently extensive time period within which to conduct the launch. Thus, based on experience of operating rocket launches from the MOD Hebrides Range, the launch window is likely to be in the region of 2-3 hours. Where the launch is successful in the first few minutes of the airspace activation, splash down confirmed and any potential debris field cleared (following catastrophic failure or flight termination), the airspace will be immediately cancelled and available to other airspace users.

[43] This assumes 10 launches plus 10 contingency days are used meaning 20 airspace activations per year assuming 3 hours per activation.

7.3 Typical Trajectories

7.3.1 Unlike orbital rockets that have fixed trajectories and often fixed launch windows to meet specific orbits, sub-orbital rockets are not similarly constrained and permit far greater flexibility both in trajectory choice and launch timing. The trajectories will be determined by a number of factors that may include the rocket capabilities and safety trace required, as well as any environmental considerations such as wind speed and direction. All variables will be considered when deciding which trajectory to use; where there is a choice of more than one, then the trajectory that causes the least impact on the air traffic network[44] will normally be selected. The corresponding D701 areas that are activated will be determined by the detailed safety analysis conducted for each individual launch. This safety analysis will determine worst case scenarios including rocket failure or termination[45]; the D701 areas selected will ensure containment of all hazards.

7.3.2 The Danger Area airspace fillet around the launch site, being of fixed dimensions, will be able to safely accommodate most sized sounding rockets regardless of trajectory. However, where a rocket safety trace at launch cannot be contained within this area and/or corresponding ground safety area, due to environmental conditions or other reasons, then the rocket will not be allowed to operate. Exemplar trajectories are shown at Figure 18; trajectories will be contained within the sector 215º to 315º from the SP-1 launch site. Trajectories could be on any bearing within this sector, excepting those where they pass over inhabited land mass (such as St Kilda). It is anticipated that for the long range rocket launches, a westerly or north westerly trajectory will be used where possible in order to limit the impact on the transatlantic air traffic[46]. All trajectories avoid over-flight of inhabited areas and, in the event of rocket failure or termination, any subsequent debris field will be contained within the SP-1 launch area or will occur over the sea within the designated sea hazard area[47].

[44] NAT tracks flown by CAT.

[45] Some rockets will be fitted with a flight termination system which can be activated in the event the rocket strays off the desired course.

[46] Experience gained operating the D701 areas determines that the greatest impact on the transatlantic traffic is caused where there are multiple OEP affected. See also paragraph 6.2.4.

[47] The process for safeguarding the land area and seaspace is not included in the ACP as this falls under the licensing process for rocket provider, Spaceport and Range operator.

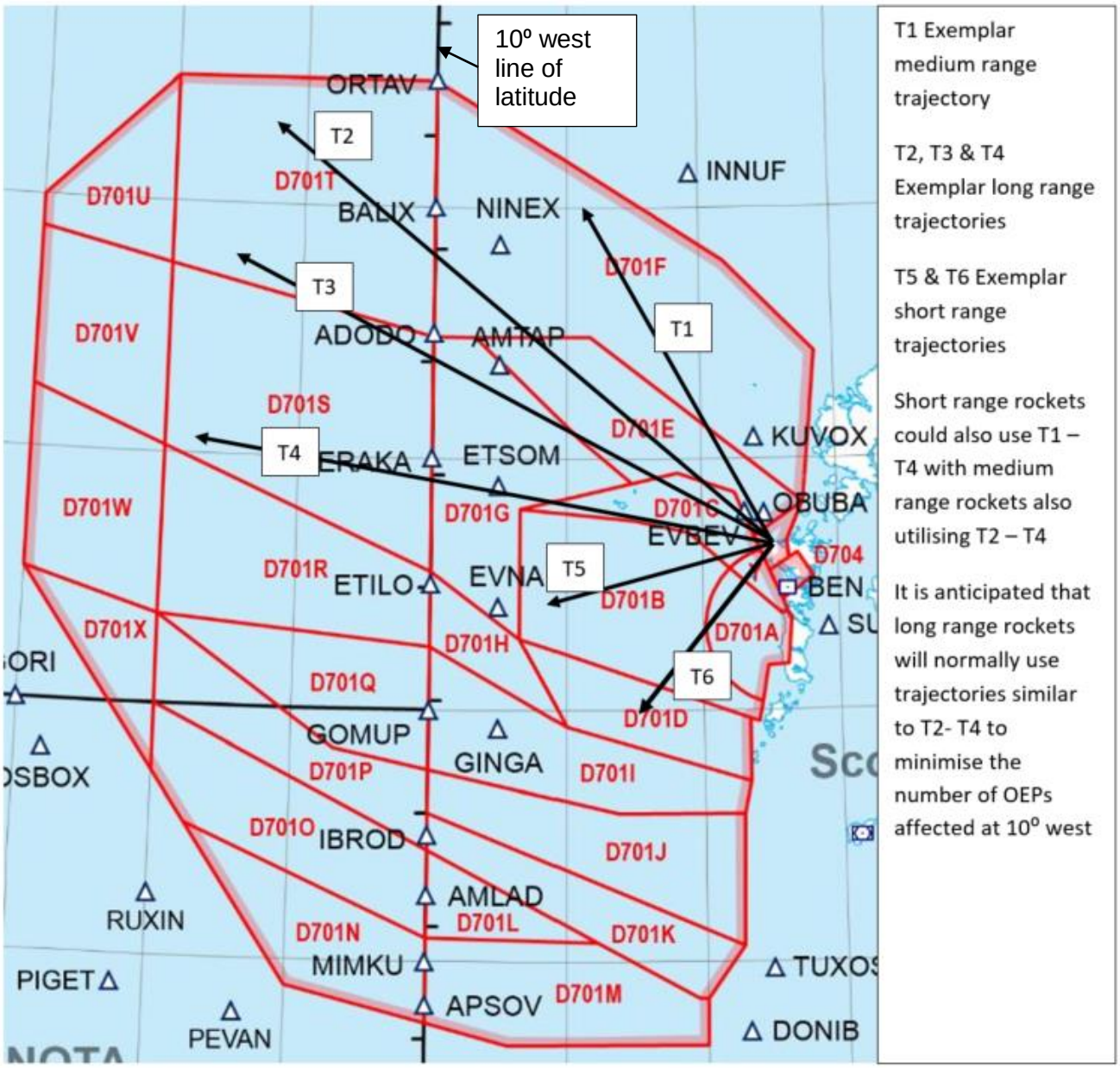

Figure 18: Six potential rocket trajectories (225° and 315° from SP-1 launch site) in relation to the D701 areas and five letter OEPs. (Source: QinetiQ)

8. Effect of Proposed Airspace Design Option

8.1 Effect on Local Communities

8.1.1 The EIA and SEI delivered as part of the planning application for SP-1 details the environmental impact on environmental receptors caused by rocket launch, this is called the 'direct impact' and is detailed below in 9.2. The airspace change does not affect the EIA analysis or results regarding increase in greenhouse gases. The ACP does, however, have to consider the wider

environmental impact (known as 'indirect impact') that activating the D701 areas may have on CAT that are required to fly additional miles around the activated areas. This indirect environmental impact is calculated for the worst case scenario where: the maximum number of D701 Areas activations are required, and the firing window is for a duration of three hours during a period where the transatlantic air traffic is at a peak (see paragraph 6.3). This wider indirect environmental impact has no direct effect on local communities. Full detailed analysis is contained within the airspace options appraisal (full) report available to view on the CAA airspace portal, a summary of which is contained at Section 6 of this document.

8.2 Effect on Aviation Stakeholders

8.2.1 During stage 2 of this ACP process and as summarised at paragraph 2.1.7, the evidence collected on aviation activity in the local area supported the statement that the new proposed airspace fillet (and small additional area around the launch pad) would have little or no impact on other aviation stakeholders. Flights below 7000ft agl within the immediate vicinity are unlikely to be affected by the activation of this additional small airspace fillet especially given the limited times when it will be active. Furthermore, the scheduled flights to and from Benbecula and Barra will be unaffected by this new airspace activation and existing procedures are in place to minimise the impact on those procedures to Benbecula affected by D701A & Y being active. Moreover, existing procedures enable access to the active airspace for essential flights where it is safe to do so. This includes medical emergency/accident and air ambulance/police helicopters that need to enter the segregated airspace when active. This is made possible by the fact the airspace may be activated but launch delayed due to unpredictable events (see paragraph 7.2.2) and as no hazard exists, access to the airspace is granted – full details will be contained within the appropriate LoAs. It should also be noted that when safe to do so, the launch may be delayed if emergency aircraft require access to the airspace.

8.2.2 It was identified that the associated activation of the D701 areas is where the greatest effect would be felt, in particular on the transatlantic air traffic (noting that activation of D701A & Y can impact on Benbecula airport). This impact will be mitigated as far as possible by use of the least disruptive trajectories, coordinating launch windows to avoid peak transatlantic traffic flows and ensuring the decision to use any spare days is made in good time to meet flight planning requirements[48].

9. Environmental Effects

9.1 Direct and Indirect Impact

9.1.1 The environmental effects are split into two distinct parts namely the 'direct impact' caused by a rocket launch from the SP-1 site at Scolpaig and 'indirect impact' caused by re-routing of air traffic around the new airspace fillet and associated D701 Danger Areas; (see Section 6 and paragraph 8.2 for indirect impact).

[48] Normally if the decision is made by 1600 UTC the day before (known a D-1) not to use the spare day, then the air traffic network (CAT flights) are unaffected. Where cancellation occurs later than 1600UTC the NOTAM will already have been issued for the following day and even when this is cancelled, some flights might still be affected.

9.2 Direct Environmental Impact

9.2.1 An EIA was undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. The findings of the EIA were compiled as an EIA Report (the 2021 EIA Report) to support a planning application for permission to construct and operate a sub-orbital sounding/research rocket launch facility in North Uist Outer Hebrides, SP-1. Following examination of the 2021 EIA Report by CnES Planning, which also considered representations by the public, statutory consultees and externally commissioned reviews, a request for supplementary information in the form of a SEI was issued to the Developer on 1 September 2022. Further information to support the planning application was submitted in January 2023. Planning permission for SP1 was issued in summer 2023. The EIA together with the SEI form the basis of the wider impact assessment, supplemented by further analysis to meet the requirements of the ACP process, e.g. detailed analysis of aviation and additional metrics relating to noise. The original EIA report and SEI can be accessed online at: https://cne-siar.gov.uk/home/busines/spaceport-1/

9.2.2 **Noise and Vibration** - Due to its rural nature, North Uist has a quiet acoustic environment dominated by natural sources including the wind and sea. Artificial acoustic sources are usually limited to low levels of road traffic, occasional aircraft, agricultural practices and shipping. The existing MOD weapons Range is present on South Uist, and the wider area is used bi-annually for Joint Warrior and other military exercises, generating noise from activities such as missile firings, ships, and aircraft, which include low-flying fast jets and helicopters. These acoustic sources are comparable in character and pattern of occurrence to those associated with the proposed airspace change.

9.2.3 Extensive modelling has been undertaken to show the predicted noise level contours from launches on human receptors, ecological receptors, and heritage receptors across the following impacts covered in further detail below (ecological receptors covered under dedicated assessment summaries):

- Launch Noise;
- Sonic Boom; and,
- Vibration.

9.2.4 **Launch Noise** – The predicted noise level contours illustrated on Figure 19 represent the worst-case scenario for launch noise. The near-circular shape of the contours and central position on the launch site indicate that the highest noise levels would occur shortly after lift-off.

9.2.5 Planning conditions limit the execution of launch activities between the hours 0700–2000 (Monday to Friday) and 0700–1800 (Saturday) with no Sunday working (Condition 15 of the CnES Decision Notice). Implementation of a community notification process will also provide advanced notice to appropriate residential properties. Noise from each rocket launch will be of very short duration, ranging from approximately 43 to 120 seconds. Launches will occur no more than 10 times per year, and during daytime hours only. The impact of the predicted launch noise is within the range of commonly experienced noise levels (LAmax[49] 110 dB) for all noise sensitive receptors and of a duration of up to 120 seconds. The impact of noise from rocket launches on human receptors has been assessed as not significant. Launch noise predictions for the worst-case scenario of launch

[49] LAmax is the maximum value sound pressure level reached during a measurement period, expressed in decibels (dB).

vehicle anticipated at the site are illustrated against human receptors in Figure 19 and against the tranquillity receptor of South Lewis Harris and North Uist National Scenic Area (NSA) in Figure 21.

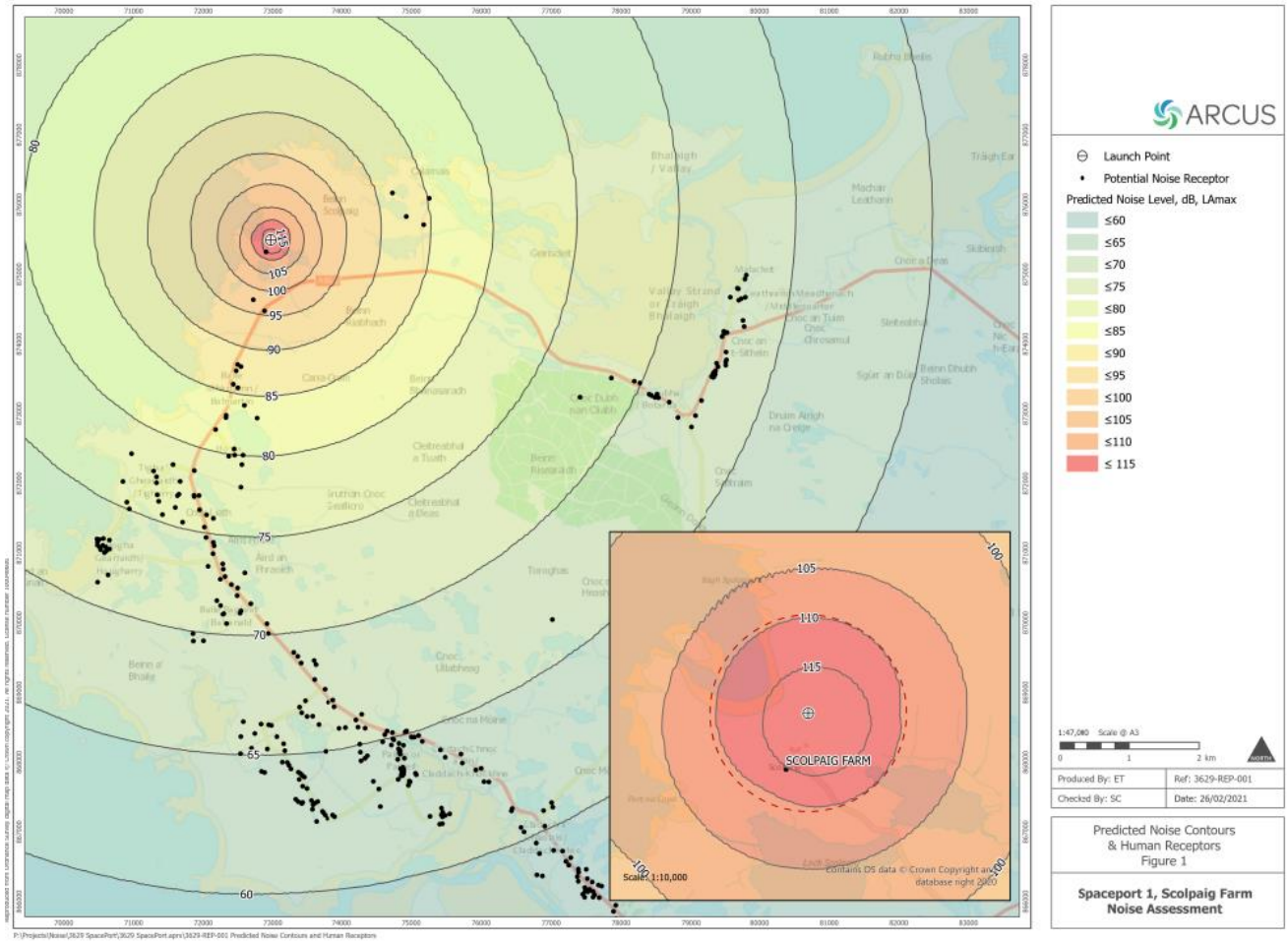

Figure 19: Predicted noise contours and human receptors (dwellings marked in black). (Source: Atlantic58 EIA)

9.2.6 It should be noted that the noise created by the largest rocket launch at the closest dwelling (for somebody standing outside) is not likely to be more than that created by a motorcycle as depicted in Figure 20 below.

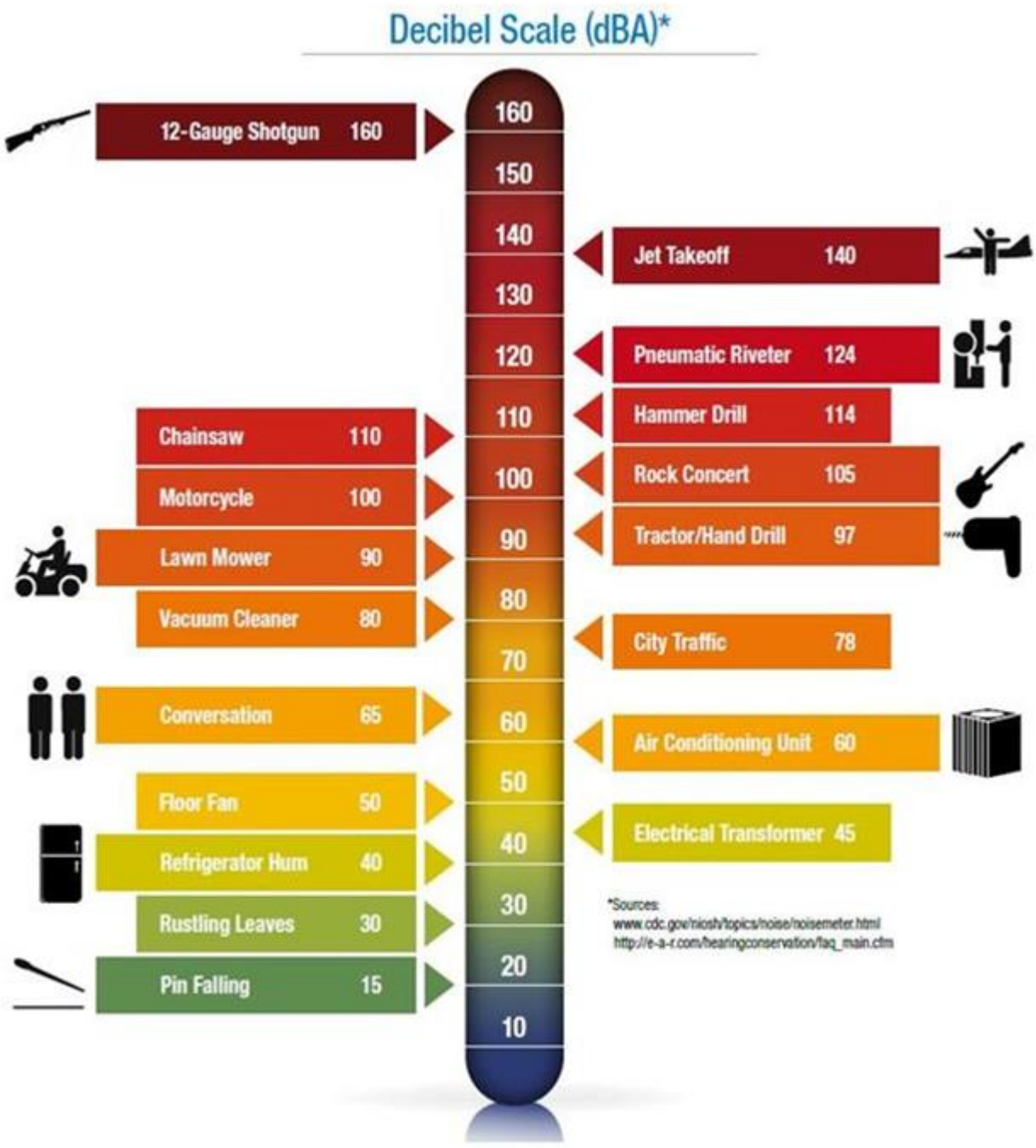

Figure 20: Chart showing noise created by different activities as measured in decibels.

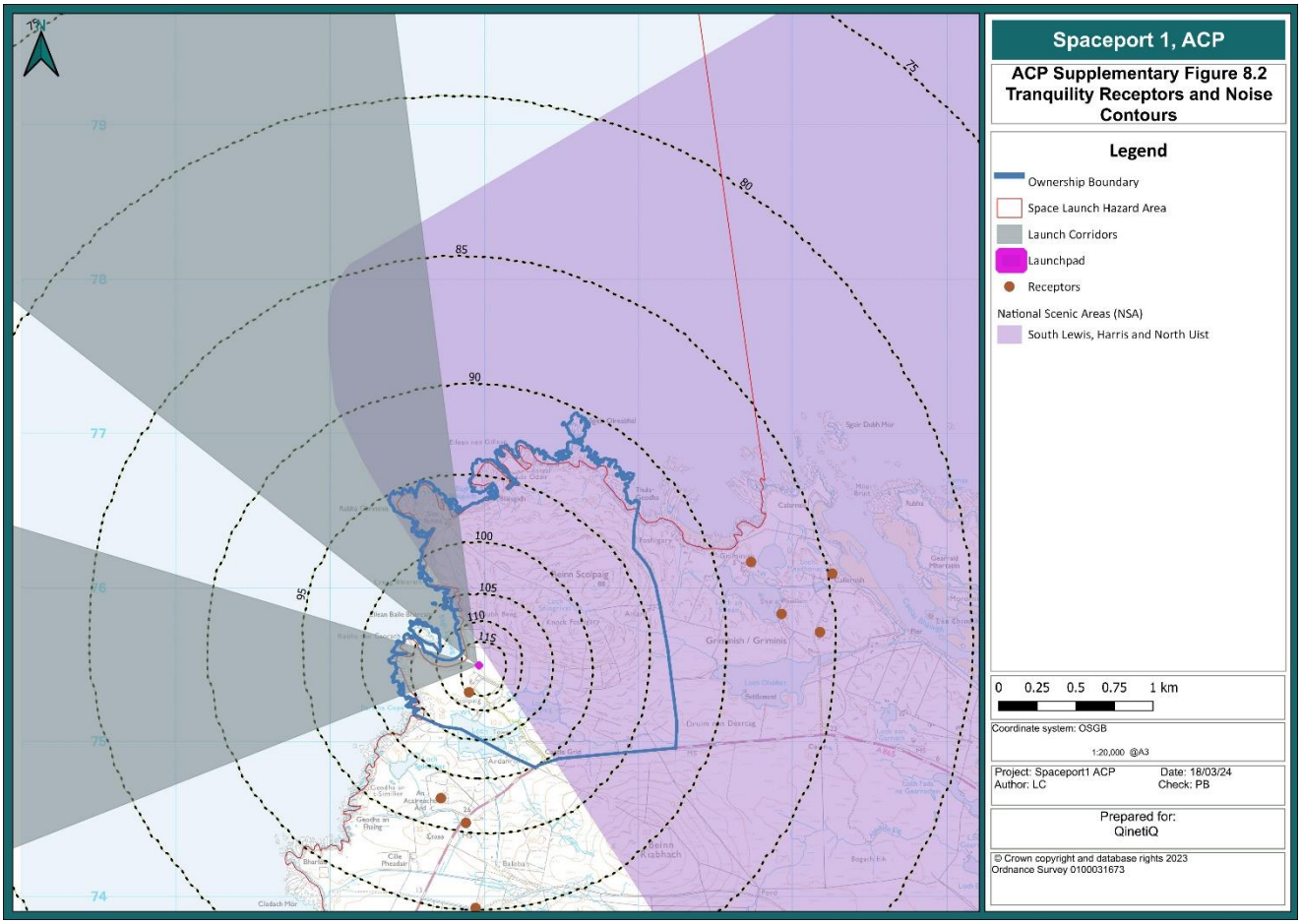

Figure 21: Diagram showing the NSA and noise contours together with expected launch corridors with trajectories between 225º and 315º. (Source: Atlantic58).

9.2.7 **Sonic Boom** – Sonic booms will occur during the descent of some rocket types, although modelling of the worst-case rocket type and proposed trajectory indicates that these are likely to predominantly affect areas at sea, with a possible effect on St Kilda (a World Heritage Site, National Scenic Area, Special Area of Conservation, Site of Special Scientific Interest and Special Protection Area). Three sonic boom profiles were modelled reflecting the northerly, southerly and mid-range trajectories. Levels predicted at St Kilda are below limits defined as acceptable by National Aeronautics and Space Administration (NASA) and at substantially lower levels than sonic booms from commercial and military aircraft. These effects will occur for less than one second up to 10 times per year and, when considering the overall negligible magnitude of change, the effects are assessed to be not significant. CAP 1616 guidance indicates that no receptor should experience a maximum overpressure above 1 pounds per square foot (psf). The maximum overpressure calculations indicates that the psf for modelled sonic boom ranges from 0.01 to 0.54 psf.

9.2.8 It is likely that other launch trajectories will be adopted when necessary, but limited to within the proposed Space Launch Hazard Area. Levels above a threshold of 75 Perceived Decibel Level (PLdB)[50] criteria are predicted on the surrounding habitable islands at the most northerly and southerly

[50] PLdB is the metric used for sonic boom noise as it more accurately describes how the human hearing system responds to noise generated by shockwaves.

extremes of the Space Launch Hazard Area. The limited duration of these effects (less than one second up to 10 times per year) suggests this is not a fundamental or material change to the baseline conditions, and results in a low magnitude of change. As such, the effects of noise at these trajectories are considered not significant for the duration of the audible sonic boom event (less than one second).

9.2.9 **Vibration** - Vibration modelling was undertaken as part of the SEI submission to assess potential impacts on heritage assets during operation. Heritage assets within 100 metres (m) of the proposed launch site could potentially be impacted by operational phase vibration during rocket launches. Slight impacts were predicted relating to Scolpaig Farmstead and cattlefold, which form part of the Scolpaig Farmstead, located within 100 m of the launch pad. Heritage assets out with 100 m of the launch pad would be unaffected by vibration during launches. The assessment set out in the SEI concluded no significant effects arising from operational effects (vibration impacts) on heritage assets.

9.2.10 Following feedback from the CAA querying the relationship between specific noise metrics and to understand the structural damage assessment, further modelling was undertaken to map all areas exposed to spaceflight noise exceeding 100, 105, 110, 115 and 120 dB LZmax[51], showing any structures in the area impacted above 100 dB LZmax. The noise model was re-run using the same input parameters as those used in the EIA; and the resulting LZmax (slow) contours are illustrated in Figure 22. The figure shows all residential dwellings and scheduled monuments predicted to experience noise levels above 100 dB, LZmax (slow). Scolpaig Farmhouse will not be reinstated as a residential dwelling, instead being integrated as part of the SP-1 development and is not a noise-sensitive receptor. Overall, there are a total of three receptors (two dwellings, and one scheduled monument) that are predicted to experience levels above 100 dB LZmax (slow), none of which are predicted to experience levels of 120 dB LZmax (slow) or above (i.e. the criterion for risk of structural damage given in the Space Industry Act 2018).

[51] LZmax is the unweighted Lmax level – for avoidance of ambiguity un-weighted levels are denoted with a Z rather than be left blank.

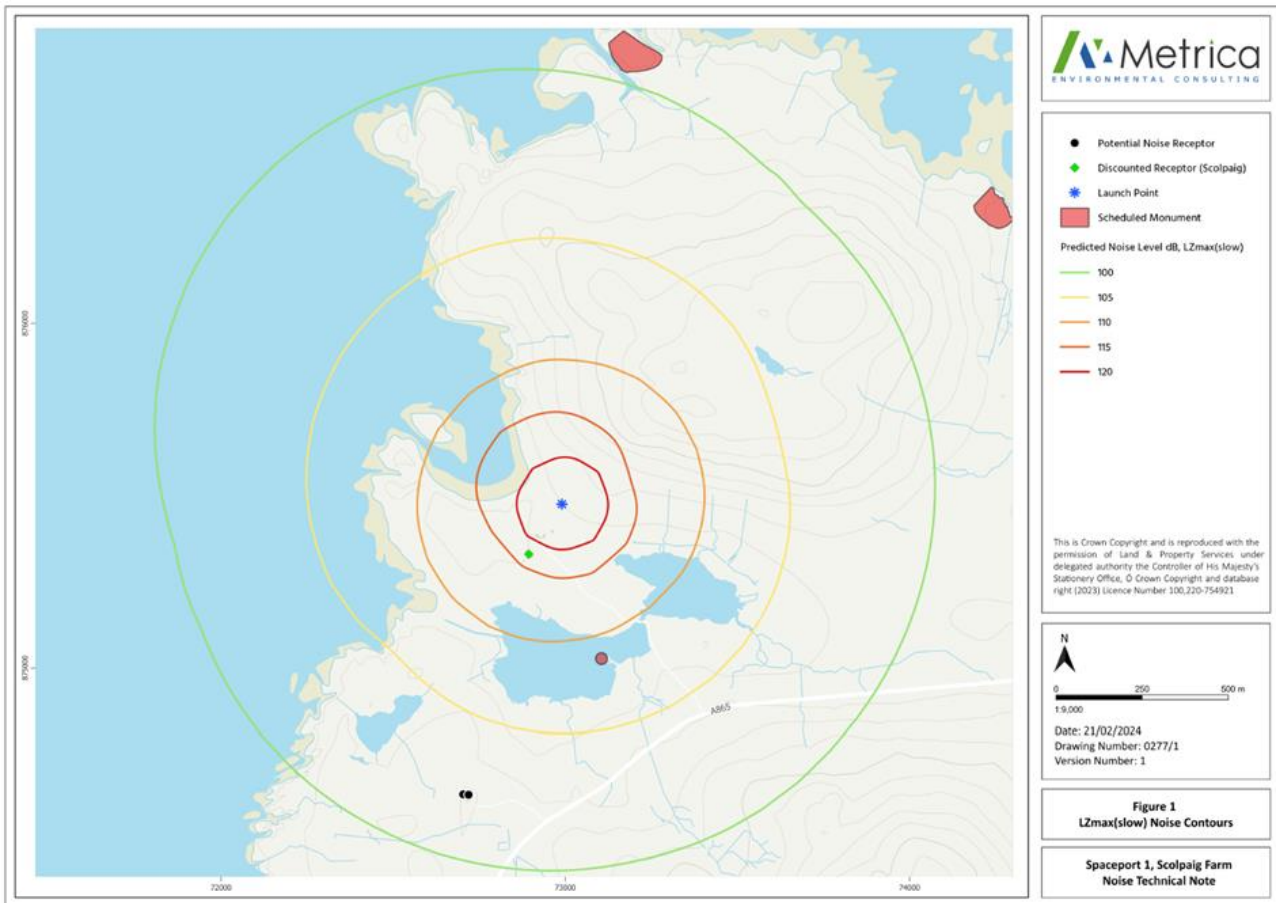

Figure 22: LZmax (slow) noise contours (modelling undertaking by Metrica Consulting, Feb 2024, to support the ACP process)

9.2.11 **Biodiversity (Ornithology)** - The 2021 EIA Report assessed impacts based on two years of baseline surveys between April 2019 and March 2021 covering two breeding seasons (2019 and 2020) and two non-breeding season periods (September to March). The aim of the surveys was to establish baseline ornithological conditions in the survey area in terms of the distribution, abundance, and status of bird species across Scolpaig Farm and the immediate surrounding area.

9.2.12 The local area is used by a wide variety of breeding and non-breeding bird species, these ornithological interests are consistent with those found more widely along the west coast of North Uist. The ornithological interests of the survey area centre on breeding birds; in particular, nine species of breeding waders, wigeon, Arctic tern, common gull and corncrake. The survey area is also used as a foraging site by a range of locally breeding bird of prey species and wintering visitors such as great northern diver, whooper swan and occasionally barnacle goose.

9.2.13 **Biodiversity (Ornithology) Impact** - Screening of bird receptors based on criteria relating to conservation importance identified 21 bird species detailed for consideration and assessment. Screening of potential impacts on bird receptors determined the following impacts: operational disturbance, acoustic disturbance from rocket launches and the risk of collision/entanglement with jettisoned launch vehicle deposits. Several other potential impacts were scoped-out including impacts from accidents (e.g., misfiring or explosion), risk of entrapment in storage tanks/buildings, ingestion of jettisoned components.

9.2.14 Screening identified potential impacts on five Special Protection Areas (SPA) (sites in the UK-wide network of European sites that are designated to protect the most important areas of bird habitat and their associated bird populations). For this reason, it was determined that the activities require a Habitats Regulations Appraisal (HRA). The five SPAs examined in the HRA are: North Uist Machair and Islands SPA, West Coast of the Outer Hebrides SPA, St Kilda SPA, Seas off St Kilda SPA and Flannan Isles SPA (see Figure 23).

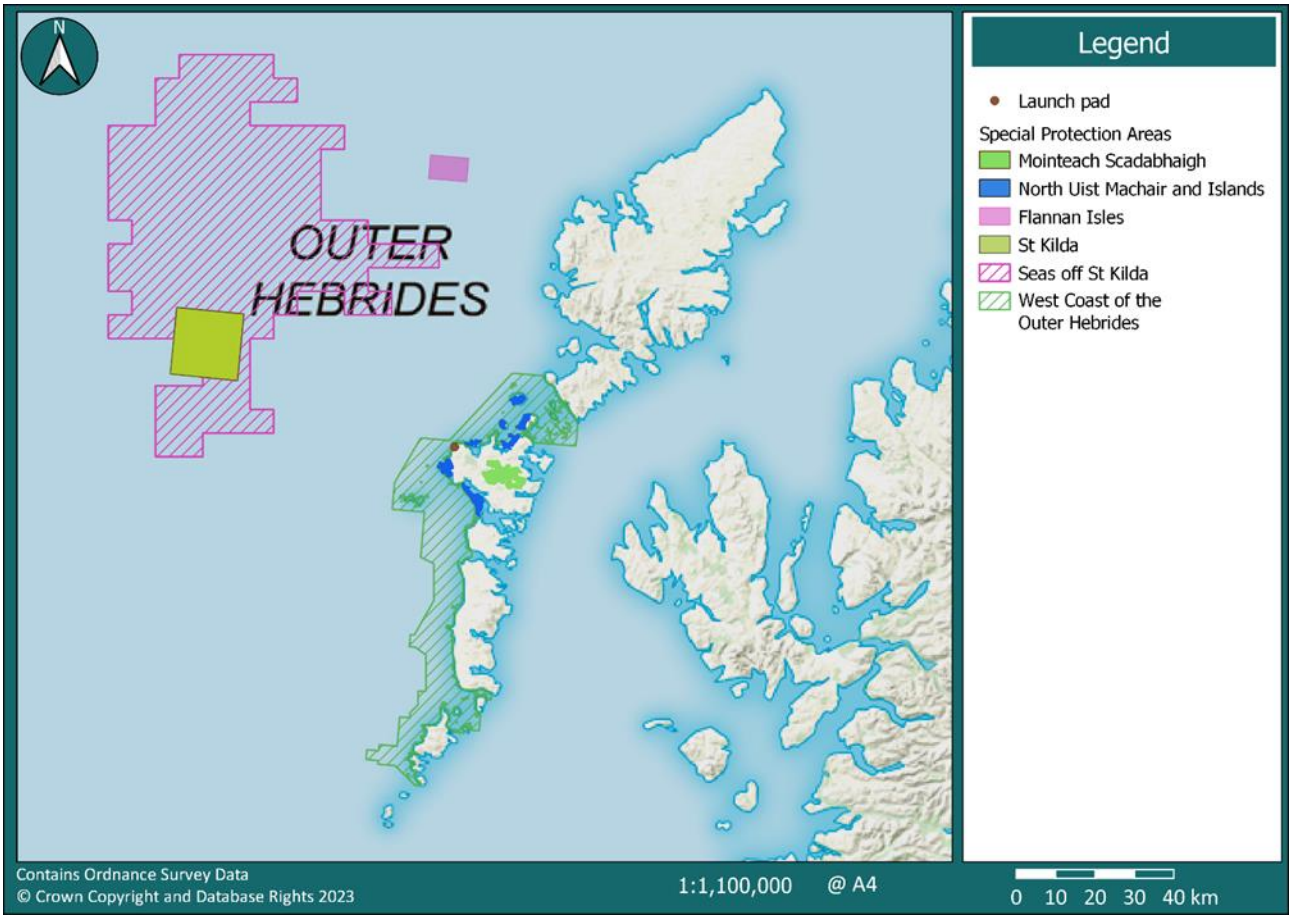

Figure 23: Special Protection Areas (extracted from SP-1 EIA Report)

9.2.15 **Biodiversity (Ornithology) Mitigation** - Several mitigation measures are designed to avoid or reduce adverse impacts on bird species. These include measures to manage disturbance and minimise the potential hazard to birds from launch vehicle deposits. Mitigations also include the development of a Habitat and Amenity Management Plan (HAMP). This sets out the key principals for the future management of Scolpaig Farm in ways that safeguard and, where appropriate, enhance its nature conservation value for birds and other wildlife, in conjunction with other uses and interests associated with the site.

9.2.16 Several of the mitigations proposed relate to corncrake, a rare breeding bird species for which North Uist has particularly high conservation importance. Through managing grass sward height, the corncrake mitigation measures are designed to deter birds from breeding in areas where they could be disturbed (e.g., the vicinity of the launch site) and encourage them to breed in other areas away from disturbance sources. The grazing and cutting regime currently incorporate habitat enhancement

measures developed in conjunction with the Royal Society for the Protection of Birds (RSPB) including species rich grassland, wader wetlands and corncrake habitat.

9.2.17 **Biodiversity (Ornithology) Assessment** - For all ornithological receptors, the potential residual impacts of disturbance caused by operation are of zero or negligible magnitude and not significant. Similarly, the potential residual impacts of acoustic disturbance caused by rocket launches and sonic booms are of zero or negligible magnitude and not significant, based on the application of targeted mitigation measures. Using cautious assumptions, it is concluded for all ornithological receptors that the potential residual impacts of bird strike and entanglement risk from rocket deposits falling into the splashdown area are of zero or negligible magnitude and not significant.

9.2.18 **Biodiversity (Terrestrial Ecology)** - Spaceport 1 is located within a low-lying area formerly used for the rough grazing of sheep and cattle and comprises predominately wet dwarf shrub heath, dune grassland and swamp habitats. A range of baseline ecological surveys were undertaken to determine the ecological character of the site. These included a Phase 1 habitat survey, National Vegetation Classification survey and Otter survey (2019 and 2021). Baseline surveys were used to inform the assessment of effects of all phases of the Project on important habitat features, protected and notable species. Baseline survey data was complimented by a desk-based assessment, and consultation also informed the baseline characterisation of the site.

9.2.19 Several Important Ecological Features (IEFs) were identified, including the following statutory designated sites: North Uist Machair Special Area of Conservation (SAC) and Vallay Site of Special Scientific Interest (SSSI); Annex 1 habitats, wet dwarf shrub heath and dune grassland; protected species, otter; and a local biodiversity priority, great yellow bumblebee, see Figure 24.

9.2.20 **Biodiversity (Terrestrial Ecology) Impacts** – Potentially significant effects on IEFs were identified, and included the degradation of habitats, including Annex 1 habitats, and those of potential value to IEF species, as well as disturbance to protected species.

9.2.21 **Biodiversity (Terrestrial Ecology) Assessment** - As operational activity will generally be very localised in extent, occasional and small in scale, and will be operated in compliance with good practice to minimise adverse impacts, all residual effects on IEFs from operational phase impacts are expected to be negligible and not significant. Although no significant effects on otter are predicted, as launches have the potential to result in disturbance to otter, an Otter Protection and Monitoring Plan has been developed to ensure the legal compliance of launches with European Protected Species legislation.

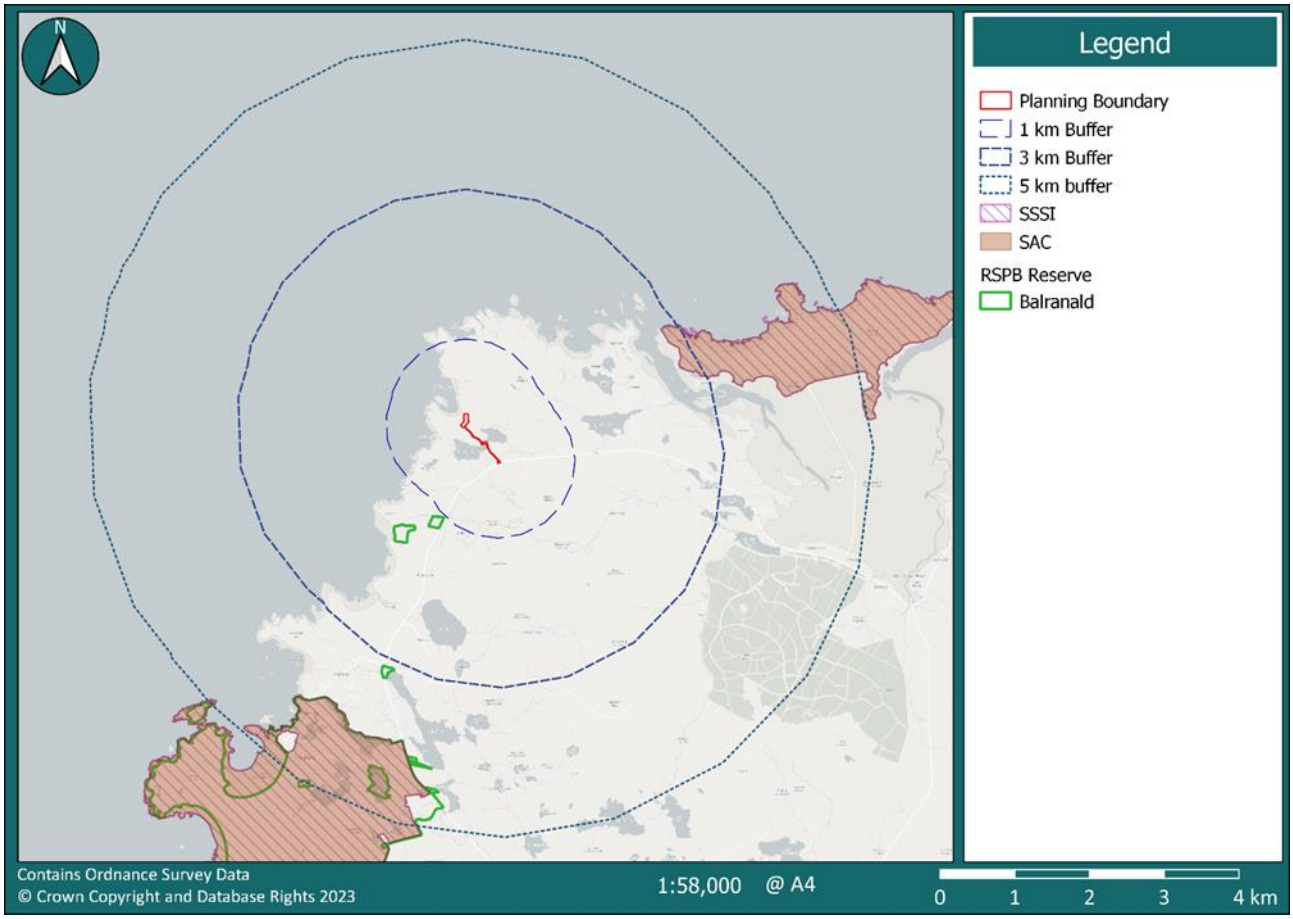

Figure 24: Terrestrial ecology study area (figure extracted from Spaceport 1 EIA)

9.2.22 **Biodiversity (Marine ecology)** - The study area includes the offshore area to the west and northwest of the launch site, within which marine ecological features may be affected by launch activities. Key operational areas for marine ecological features are the rocket trajectories and corresponding pre-designated splashdown areas where jettisoned stages of the rocket would be deposited. A detailed desk-based assessment was undertaken to inform the baseline characterisation of the study area, covering a vast marine landscape from the continental shelf edge to the deep sea and features two isolated seamounts. Several IEFs were identified including designated sites (Marine Protected Areas (MPAs), Special Areas of Conservation (SACs), SSSIs and Designated Seal Haul-out Sites), benthic habitats and species, fish (including basking shark and Atlantic bluefin tuna), cetaceans and seals.

9.2.23 **Biodiversity (Marine ecology) Impacts** - Potential impacts included acoustic disturbance to seals from launch activities and rocket flight paths passing overhead, in addition to impacts associated with jettisoned stage. These included direct strike, ingestion or absorption of component parts or released toxic contaminants, and deposition on the seabed resulting in smothering of benthic organisms and bottom-dwelling fish.

9.2.24 **Biodiversity (Marine ecology) Assessment** - Any noise and disturbance effects due to launch activities and flight paths passing overhead would be transient and, with up to 10 launches per year, spread temporally such that any adverse residual effects on seals and associated designated site IEFs will be negligible and not significant. Jettisoned stages entering the sea as deposits will be

relatively small in size, and many of the rocket stages will deploy a parachute system which will reduce the force of impact with the sea surface and facilitate their intended recovery. The area affected by a splashdown event would be very localised in extent and the likelihood of direct strike to mobile, transitory animals such as cetaceans, basking shark and Atlantic blue fin tuna, or seals given their at-sea densities, is considered very low. The safety / recovery vessel will follow good practice by adhering to the Scottish Marine Wildlife Watching Code (SMWWC) if any cetaceans or basking sharks are encountered during operations. The assessment therefore concludes that adverse residual effects on fish and marine mammals and associated designated site IEFs will be negligible and not significant.

9.2.25 Potential impacts from non-recovered rocket components that may deposit on the seabed will be highly localised and limited in scale due to the small sizes of components. Each rocket is designed for maximum and efficient fuel use; therefore, the potential loss of small amounts of residual fuel and oxidiser is not anticipated to result in toxicological effects to nearby marine receptors. Launches will be spread spatially and temporally throughout the year which will greatly reduce the likelihood of an area being repeatedly affected by rocket deposits. Therefore, the assessment concludes that any adverse residual effects from non-recovered jettisoned deposits on benthic habitats and species, fish, marine mammals and associated designated site IEFs will be negligible and not significant.

9.2.26 **Air Quality and Heat** – A detailed air quality assessment was undertaken as part of the EIA process to assess the potential impact of emissions from the launch of rockets. Detailed dispersion modelling was undertaken by Cambridge Environmental Research Centre to support the analysis. There are several designated sites within a few kilometres of the site, including SPAs, SACs and SSSIs. There is a further designated site, West Coast of the Outer Hebrides SPA, immediately adjacent to the launch site. The habitat of this site is entirely marine, with no terrestrial features, vegetation or freshwater habitats, and was not considered in the assessment. There are currently no Air Quality Management Areas (AQMAs) identified in the Western Isles and there is no Air Quality Strategy in place.

9.2.27 **Air Quality and Heat Impacts** – The potential impact on human health considered within original EIA assessment focused on identifying the maximum impact off site (i.e., out with the ownership boundary of Scolpaig Farm), and this is taken as the worst-case impact at any human health receptor.

9.2.28 **Air Quality and Heat Assessment** – Whilst the heat emission profile of vehicles launched during operation will vary between rocket specifications, they will typically exhibit heat emissions characteristic of rockets using fuel/propellant and oxidant/oxidiser mixtures. The operational schedule of 10 launches per year has been assessed and is expected to be a worst-case scenario. There are no specific criteria for the assessment of significance, conclusions are drawn based on the professional judgement, based on a review of the relevant literature and the expected heat emission profile of each launch. The significance of each potential emission release was assessed by comparing the Process Contribution (PC) to the relevant air quality objective. The maximum concentration of these emissions is predicted at the site boundary (for human health receptors) and for ecological receptors (designated sites only) and compared to applicable air quality standards to better understand the potential impact of rocket exhaust emissions.

9.2.29 Based on the assessment, most impacts considered are readily screened out as not significant based on the PC only. In some instances, the impacts could not be screened out, and further assessment was undertaken. When incorporating existing background concentrations, all Predicted Environmental Concentrations (PECs) were comfortably below relevant air quality standards. Emissions from launches do not appear to present any significant risk to local human health or the environment, and the overall impact from air quality and heat is evaluated as not significant.

9.2.30 **Greenhouse Gas Emissions** – The preparation for, and firing of, rockets from the site will have a number of associated gaseous emissions that relate to Global Warming Potential[52]. However, existing natural conditions and local community activities as well as adjacent transport sources provide an existing inventory of gases that create the current baseline conditions. Marine transport and road transport CO_2 emissions for North Uist shows that for the area under consideration for development, the main background sources of anthropogenic CO_2 arise from transport and other mobile sources of emissions. It can also be seen that the levels of direct CO_2 generated are at a 'low to typical' level in comparison to the wider area[53].

9.2.31 **Greenhouse Gas Emissions Impact** – The EIA evaluated the potential effects of the proposed SP-1 Project on climate change in terms of generating greenhouse gas emissions. A conservative assessment of the contribution of carbon dioxide from rocket launches was undertaken based on the worst-case scenario propellant mass over 10 launches. The total contribution from rocket launches was assessed as 14 tonnes CO_2.

9.2.32 **Greenhouse Gas Emissions Mitigation** – The space sector is actively developing measures to reduce its carbon footprint, and efforts to reach Net Zero by 2045 form a core part of Scottish Government's Scotland's Space Strategy.

9.2.33 **Greenhouse Gas Emissions Assessment** - A conservative assessment of the contribution of carbon dioxide from rocket launches was undertaken based on the worst-case scenario propellant mass over 10 launches. The total contribution from rocket launches was assessed as 14 tonnes CO_2, equivalent to less than the activity of eight typical cars (based on 1.7 tonnes / year / car). The majority of propellants anticipated to be used on site are relatively small due to the lower size class of sub-orbital launches proposed at the site (<100 kg). Impacts in terms of the contribution to climate change are assessed as not significant.

9.3 Indirect Environmental Impact Summary

9.3.1 **Noise and Vibration** - As previously described in paragraph 2.1.7, rocket launch and activation of the airspace fillet around the SP-1 site is highly unlikely to have an impact on local aviation activities (flights operating below 7000ft) such that their flight paths will need to be altered. The detailed analysis conducted during Stage 2 of the ACP process and contained within the Options Appraisal (Phase I) Initial[54] provides the evidence to support this statement. Therefore there is no expected change to noise levels or vibration created by local aviation activity – indirect noise. Moreover, any re-routing of high level air traffic will not influence noise levels at surface level so these are discounted.

9.3.2 **CO_2 emissions and fuel burn** – The indirect impact is the additional fuel burn and associated CO_2 emissions resulting in aircraft deviating around the new airspace fillet and the D701 areas when activated in support of SP-1 rocket launches. From the evidence gained during Stage 2 of the ACP process, the number of local (i.e. lower altitude) flights in the vicinity of the SP-1 site and the area covered by this airspace change is very low compared to most other parts of the UK (see also paragraphs 2.1.4 to 2.1.8). It has been determined that the daily scheduled flights to/from Benbecula

[52] A term used to describe the relative potency, molecule for molecule, of a greenhouse gas, taking account of how long it remains active in the atmosphere.

[53] National Atmospheric Emissions Inventory (accessed 14/12/2021).

[54] Found at: Airspace change proposal public view (caa.co.uk).

will only be impacted by the subsequent activation of the D701 areas (namely D701A and D701Y) when runway 05 is in operation. On the rare occasions where these D701 areas are activated during a scheduled flight, current procedures enable that flight to access the Danger Areas. It is therefore concluded that the airspace change will not cause any increase in fuel burn or CO_2 emissions for aircraft operating in the local area.

9.3.3 In the case of high level commercial air traffic, where they are required to deviate around the activated D701 areas, a worst case scenario analysis has been conducted; full details are contained within the Options Appraisal Phase II (full) and summarised in Section 6 of this document. It should be noted that this a worst case analysis and the actual impact and increase in CO_2 emissions is likely to be far less once mitigations are put in place as described in Section 7 above.

9.3.4 **Air quality** – Air quality must be considered by the change Sponsor if the proposed airspace change is likely to induce a change in aviation emissions (by volume or location) below 1000ft and the location of the emissions is within or close to an identified Air Quality Management Area (AQMA). It has been established[55] and summarised at paragraph 2.1.7 and 8.2 that local traffic below 7000ft will be unaffected by the airspace change. Furthermore, there are no AQMA adjacent to the SP-1 site (EIA report chapter 18.10.2 refers[56] and paragraph 9.2.28 of this document).

10. Consultation Process

10.1 Consultation Duration

10.1.1 The size of the airspace change is comparatively small and all the relevant aviation stakeholders have been fully engaged from the outset of the ACP process. Furthermore, the majority of non-aviation stakeholders have already been engaged during the planning process (although not specifically on the airspace design). Therefore, it is considered proportional to reduce the consultation period from the standard 12 weeks (as per CAP 1616) to 8 weeks as recently agreed with the CAA. However, it is recognised that the consultation period falls over the Easter holidays therefore it has been extended by a week and a half to take this into account.

10.1.2 The objectives of the consultation must consider the wider government guidance that are underpinned by the Gunning Principles[57], which set out the legal expectations surrounding formal consultation and related activities. The Gunning Principles for effective consultation are:

- consultation should occur when proposals are at a formative stage;
- the consultation should give sufficient reasons for any proposal to permit intelligent consideration;
- the consultation should allow adequate time for consideration and response; and,

[55] As evidenced in 'STEP 2B OPTIONS APPRAISAL (PHASE 1) INITIAL – VERSION 3 report' dated 11th May 2023. Airspace change proposal public view (caa.co.uk)

[56] https://cne-siar.gov.uk/home/busines/spaceport-1/

[57] The Gunning Principles set out legal expectations for what constitutes an appropriate consultation, and are named for a court case in the 1980's involving the London Borough of Brent (source: CAP 1616).

- the product of consultation must be conscientiously taken into account.

10.1.3 The consultation will commence on Wednesday 20th March 2024 and complete on Friday 24th May 2024. This will ensure sufficient time for all stakeholders to provide feedback as necessary. Stakeholders should note that this consultation process pertains solely to the ACP airspace design.

10.2 Feedback Requirements

10.2.1 Your feedback and comments really matter and are an integral part of the ACP process as they will help inform the final airspace design and associated operating procedures, therefore you are encouraged to respond using the online survey questionnaire "Airspace Change Citizen Space", that is available at:

https://consultations.airspacechange.co.uk/qinetiq-ltd/spaceport-1-acp-stage-3-consultation

10.2.2 A copy of the questionnaire can also be found at Appendix A to this document or as described in paragraph 10.3.3 below.

10.3 Meetings and Communications

10.3.1 A 'drop in' event will be facilitated by the local council and will be held at Hosta Hall, North Uist on Wednesday 17th April 2024 from 1300 to 1730. The drop in event is designed to enable the Sponsor to explain the airspace design options, how the preferred option was selected and what the airspace change means to local communities. This is the opportunity to ask questions of the Sponsor either publicly or one to one if preferred. All consultation material will be available to view on the CAA airspace portal and the council's FaceBook page. A Frequently Asked Questions (FAQs) list will be promulgated and regularly updated on the 'Citizen Space'.

10.3.2 Stakeholders may wish to contact the change Sponsor direct using the email: SP1ACP@QinetiQ.com or face to face at the drop in event. A record of discussions will be made and a confirmatory email sent to the respondent seeking acknowledgement that the email accurately reflects the conversation/discussion.

10.3.3 A paper copy of this Consultation Document including the feedback form will be available[58] on request at the address below. If stakeholders are unable to respond electronically, written responses to the hard copy form at Appendix A may be submitted to the address below including a stamped addressed envelope if a reply is required:

For the attention of:
SP-1 Airspace Change Manager
Comhairle nan Eilean Siar
Balivanich Council Offices
Isle of Benbecula
HS7 5LA

[58] A limited number of spare copies will be made available at the public drop in event on 17th April.

The deadline for response is Friday 24th May 2024. All written responses will be uploaded to the CAA airspace portal. Key dates and activities associated with the consultation stage of the ACP process are detailed in Table 5 below.

Date	Activity	Remarks
15 Mar 24	CAA CONSULT Gateway	Consultation can only commence following CAA approval at the CONSULT Gateway
20 Mar 24	Commence formal consultation	9½ week period
20 Mar – 24 May 24	FAQ updated on Citizen Space	
10 Apr 24	Sponsor send reminder to stakeholders	
17 Apr 24	Drop in Event	One day event held at Hosta Hall North Uist
7 May 24	Progress Assessment	Evaluation of responses
8 May 24	Sponsor send reminder to stakeholders	
24 May 24	Consultation ends	
27 May 24 – 21 Jun 24	Step 3D – Collect and Review Responses	Based on stakeholder responses the airspace design may need updating – Consultation Report published
8 Aug 24	Formal ACP submission to CAA	Sponsor produces the final airspace proposal report in accordance with CAP 1616

Table 5: Key dates and activities for the consultation process

10.4 Next Steps

10.4.1 Consulation responses will be collated and categorised, a consultation report will be published that will explain the categorisation process and issues raised together with the change Sponsor's response and any resolutions. The report will confirm the final airspace option to be submitted to the CAA or what additional amendments are to be made to the chosen design as a result of consultation feedback. The report will be uploaded to the CAA airspace portal once the CAA has confirmed that no further consultation is necessary.

10.4.2 Stakeholders are to note that, should the CAA decide to approve the airspace change (Stage 5, circa early December 2024) and it is implemented, the approval is still reversible if the airspace does not prove to meet the objectives, or impacts are not as predicted. The change Sponsor is required to formally assess the effectiveness and usage of the airspace during Stage 7 at the post-implementation review (12+ months post implementation expected circa April 2026). The post-implementation review is an assessment of whether the impacts and benefits of the original proposal and published decisions are as expected and, where there are differences, what steps (if any) the CAA requires to be taken. In the event that steps are necessary to modify the airspace design, once implemented this will undergo a further period of evaluation. If the modified design still does not meet the requirements then consideration will be given to retain the original design or, whether implementation of the design is reversed and a whole new ACP is required.

11. Glossary

Acronym	Meaning
5LNC	5 Letter Name Code
ACP	Airspace Change Proposal
ADQ	Aeronautical Data Quality
ADS-B	Automatic Dependent Surveillance - Broadcast
agl	Above Ground Level
AIP	Aeronautical Information Publication
AIRPROX	Air Proximity
AMC	Airspace Management Cell
AMSL	Above Mean Sea Level
ANSP	Air Navigation Service Provider
AOI	Area Of Interest
AQMA	Air Quality Management Areas
ASM	Airspace Management
ATC	Air Traffic Control
ATS	Air Traffic Service
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAT	Commercial Air Transport
CnES	Comhairle nan Eilean Siar
CNS	Communication Navigation & Surveillance
CO_2	Carbon Dioxide
dB	Decibel
DPs	Design Principles
EG D	UK Segregated Airspace Designator and Danger Area
EIA	Environmental Impact Assessment
ENM	EUROCONTROL Network Manager
FAA	Federal Aviation Authority
FBZ	Flight planning Buffer Zone
FL	Flight Level
FRA	Free Route Airspace
FUA	Flexible Use of Airspace
GA	General Aviation
HAMP	Habitat and Amenity Management Plan
HIAL	Highlands & Islands Airports Ltd
HIE	Highlands & Islands Enterprises
HRA	Habitats Regulations Approval
IAA	Irish Aviation Authority
ICAO	International Civil Aviation Organisation
IEFs	Important Ecological Features
IFR	Instrument Flight Rules
km	Kilometre
LARA	Local and sub-regional airspace management support system
LoA	Letter of Agreement
LTPA	Long Term partnering Agreement

MOD	Ministry of Defence
MPAs	Maritime Protected Areas
NASA	National Aeronautics and Space Administration
NAT	North Atlantic
NSA	National Scenic Areas
NLB	Northern Lighthouse Board
NM	Nautical Mile
NOTAM	Notice To Aviation
OEPs	Oceanic Entry Points
OWAs	Other Works Approvals
PC	Process Contribution
PECs	Protected Environmental Conditions
PIR	Post Implementation Review
psf	Pounds per Square Foot
RF	Radio Frequency
RMZ	Radio Mandatory Zone
RoTA	Rules of The Air
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SIA	Space Industry Act
SMWWC	Scottish Marine Wildlife Watching Code
SoN	Statement of Need
SOPs	Standard Operating Procedures
SP-1	Spaceport 1
SPA	Special Protection Areas
SSSI	Site of Special Scientific Interest
SUPP	Supplement
TDA	Temporary Danger Area
TMZ	Transponder Mandatory Zone
UCT	Coordinated Universal Time
US	United States
VFR	Visual Flight Rules

Appendix A – Consultation Feedback Form

This form is a print copy of the online Consultation Feedback Form that will be distributed to stakeholders on request.

Enabling Sub-orbital Sounding Rocket launch from Scolpaig

Overview

The aim of this consultation is to seek stakeholder views on the introduction of a change in designation of airspace in the vicinity of Scolpaig, North Uist.

There is a requirement to launch sub-orbital sounding rockets from Scolpaig into the adjacent MOD Hebrides Range Danger Areas from 2025. Airspace change is necessary to ensure safety of other airspace users, protecting them from the hazards associated with rocket launch operations and to protect SP-1 ground personnel.

The purpose of this consultation is for all stakeholders to respond effectively to the information provided. The questionaire will assist in gathering and considering opinions and information from relevant stakeholders regarding the potential impact of this Airspace Change Proposal (ACP).

The methodology of this consultation is summarised in the Consultation Strategy, which can be read in conjunction with the Consultation Document and the Full Options Appraisal, which assesses the costs, benefits, and potential environmental impacts of the airspace change.

The consultation period is from 20th March 2024 to 24th May 2024: Once consultation has ended, all feedback will be considered for the final design proposal. The final design proposal may evolve from that described in the Consultation Document, subject to stakeholder input.

At this stage of the airspace change process nothing is yet finalised. We would therefore like to have your feedback on this proposal (ACP-2021-12). Your feedback is a critical part of the airspace change process and is important to us as it will help inform the final airspace design and associated operating procedures.

1. What is your name? (required)

2. What is your email address (by entering your email address you will receive an acknowledgement email) (required)

3. Please enter your post code (most relevant to your response e.g. home / work / organisation etc) (required)

4. Are you responding as an individual or do you represent an organisation? (Please select one) (required)

   ☐ Individual

   ☐ Organisation

5. Name of organisation (if applicable)

6. If you are responding on behalf of an organisation, what is your position/title?

7. Do you support the proposed airspace change proposal? Please range response below (Please select only one) (required)

- ☐ Strongly support
- ☐ Support
- ☐ Neutral
- ☐ Object
- ☐ Strongly object

8. If you support this proposal, please provide any alterations that would further improve it for you.

9. If you oppose this proposal, please explain why.

10. While ensuring SP-1 has the necessary airspace to safely enable sub-orbital rocket launch the Sponsor is keen to minimise the impact on other airspace users. Can you suggest any mitigation or alterations that would resolve your opposition whilst achieving this?

11. Are there any other general considerations that you would like the Sponsor to consider in relation to this airspace change proposal?

12. In accordance with the UK Civil Aviation Authority's CAP 1616 (Airspace Design), consultation responses will be published on Citizen Space via the Airspace Change Portal. Responses will be subject to moderation by the Civil Aviation Authority (CAA). If you wish your response to be published anonymously, please indicate below and your personal details (Name, Address & Position) will be redacted and only be seen by the CAA. (Please select only one) (Required)

☐ Publish Response

☐ Publish Response Anonymously