Spaceport 1 Scolpaig North Uist (ACP-2021-012)

Stage 4 AIRSPACE CHANGE PROPOSAL FINAL SUBMISSION Version 2

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Glossary

Acronym	Meaning
5LNC	5 Letter Name Code
A330	Aircraft type - Airbus 330
ACP	Airspace Change Proposal
ADQ	Aeronautical Data Quality
ADS-B	Automatic Dependent Surveillance - Broadcast
agl	Above Ground Level
AIP	Aeronautical Information Publication. A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.
AIRAC	Aeronautical Information Regulation and Control
AIRPROX	Aircraft Proximity. A situation in which, in the opinion of a pilot or air traffic services 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.
AIS	Aeronautical Information Service
AMC	Airspace Management Cell
AMDT	AIP Amendment
AMS	Airspace Modernisation Strategy
AMSL	Above Mean Sea Level
ANSP	Air Navigation Service Provider. Any public or private entity providing ANS for general air traffic, including an organisation having applied for a certificate to provide such services
AOI	Area Of Interest
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
ASD/FS	At Sea Demonstration/EXERCISE FORMIDABLE SHIELD
ASM	Airspace Management
ASMOG	UK Irish Airspace Management Operations Group (organisation)
ASTM	American Society for Testing and Materials
AT	EXERCISE ATLANTIC THUNDER
ATC	Air Traffic Control
ATM	Ait Traffic Management. The aggregation of the airborne and ground-based functions (air traffic services, airspace management and air traffic flow management) CAP 1430 Definitions 15 June 2023 Page 10 required to ensure the safe and efficient movement of aircraft during all phases of operations.
ATS	Air Traffic Service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).
B757	Aircraft type - Boeing 757
B767	Aircraft type - Boeing 767
B777	Aircraft type - Boeing 777
CAA	Civil Aviation Authority (organisation)
CAP	Civil Aviation Publication
CAT	Commercial Air Transport

CnES	Comhairle nan Eilean Siar (organisation)
CO_2	Carbon Dioxide
CONOPS	Concept of Operations
D-1	Day minus 1
D-5	Day minus 5
D-21	Day minus 21
dB	Decibel
DE&S	Defence Equipment & Support (organisation)
DfT	Department for Transport (organisation)
DME	Distance Measuring Equipment
DoD	Department of Defence (organisation)
DP	Design Principles
EG D	UK Segregated Airspace Designator and Danger Area
EGPX	Prestwick (ICAO designator)
EIA	Environmental Impact Assessment
ENM	EUROCONTROL Network Manager
ERNIP	European Route Network Improvement Plan
FAA	Federal Aviation Authority (organisation)
FBZ	Flight plan Buffer Zone
FIR	Flight Information Region. Airspace of defined dimensions within which flight information service and alerting service are provided.
FIS	Flight Information Service(s). A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.
FISO	Flight Information Service Officer
FJ	Fast Jet
FL	Flight Level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals
FRA	Free Route Airspace. A specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) significant points, without reference to the ATS route network, subject to airspace availability.
FRZ	Flight Restriction Zone
ft	Feet
FUA	Flexible Use of Airspace
GA	General Aviation
GAT	General Air Traffic. Encompasses all flights conducted in accordance with the rules and procedures of ICAO and/or the national civil aviation regulations and legislation.
HAMP	Habitat and Amenity Management Plan
HF	High Frequency
HFD	Hazardous Fragmentation Distances
HIAL	Highlands & Islands Airports Ltd (organisation)
HIE	Highlands & Islands Enterprises (organisation)
HRA	Habitats Regulations Approval
HSE	UK Health & Safety Executive
IAA	Irish Aviation Authority (organisation)
IATA	International Air Transport Association (organisation)
ICAO	International Civil Aviation Organisation (organisation)

ICARD	International Code And Route Designators
ICEC	ICAO Carbon Emissions Calculator
IEF	Important Ecological Features
IFR	Instrument Flight Rules
km	Kilometre
LAA	Light Aircraft Association (organisation)
LARA	Local and sub-regional airspace management support system
LFA	Low Flying Area
LoA	Letter of Agreement
LTPA	Long Term Partnering Agreement
LV	Launch Vehicle
LZmax	Lmax is the highest Root Mean Squared sound pressure level within the measuring period.
MAMC	Military Airspace Management Cell
MNPS	Minimum Navigation Performance Specification
MOD	Ministry of Defence (organisation)
MPA	Marine Protected Areas
NASA	National Aeronautics and Space Administration (organisation)
NAT	North Atlantic
NATS	National Air Traffic Services (NATS)
NDB	Non-Directional Beacon
NERL	NATS (En route) PLC
NLB	Northern Lighthouse Board (organisation)
NM	Nautical Mile
NOTA	Northern Oceanic Transition Area
NOTAM	Notice To Aviation. A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.
NSA	National Scenic Areas
OAT	Operational Air Traffic. Encompasses all flights which do not comply with the provisions stated for GAT and for which rules and procedures have been specified by appropriate national authorities.
OEPs	Oceanic Entry Points
OTS	Organised Track Structure
PC	Prestwick Centre
PC	Process Contribution
PEC	Predicted Environmental Concentrations
PLdB	Perceived Decibel Level
psf	Pounds per Square Foot
RF	Radio Frequency
ROM	Rough Order of Magnitude
RoTA	Rules of The Air
RPAS	Remotely Piloted Aircraft Systems
RSPB	Royal Society for the Protection of Birds (organisation)
SAC	Special Areas of Conservation
SAR	Search And Rescue
SARG	CAA Safety and Regulation Group
SEI	Supplementary Environmental Information

SFC	Surface Level
SIA	Space Industry Act
SMWWC	Scottish Marine Wildlife Watching Code
SoN	Statement of Need
SoS	Secretary of State
SP-1	Spaceport 1
SPA	Special Protection Areas
SSP	State Safety Programme
SSSI	Site of Special Scientific Interest
SUA	Special Use Airspace. A generic term used for airspace volumes designated for specific operations, such as military training, exercises and operations, of a nature such that required limitations on airspace access may be imposed on other aircraft not participating in those activities. These may include, but are not limited to, restricted, danger and prohibited areas or temporary segregated areas (TSA) and temporary reserved areas (TRA).
SUAAIS	Special Use Airspace Activity Information Service
SUPP	Supplement
TAG	Transport Analysis Guidance
TDA	Temporary Danger Area
UNL	Unlimited
US	United States
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-Directional Range

1 Introduction

This document forms Stage 4 Step 4B of the Airspace Change Proposal (ACP) 2021-012 and has been prepared in accordance with Civil Aviation Publication (CAP) 1616 Ed 5 [F] by QinetiQ Ltd, the airspace Change Sponsor on behalf of Spaceport-1 (SP-1). The purpose of this document is to provide an overview of the proposed ACP that is designed to enable sub-orbital rocket launch from the SP-1 site at Scolpaig North Uist. This document is a culmination of key components from earlier stages of the ACP process, concluding in the final airspace design where both the positive and negative impacts of ACP are highlighted.

This ACP seeks to establish permanent airspace (activated by Notice to Aviation (NOTAM)) of sufficient dimension around the SP-1 site to facilitate the safe operation of sub-orbital rocket launches, and provide connectivity to the existing Hebrides Range Danger Area (DA) complex.

The ACP was commenced in May 2021 and followed the ACP process CAP 1616 Ed 4 until completion of Stage 3 (Consultation), thereafter the ACP shall follow CAP 1616 Ed 5.

2 Executive Summary

2.1 Drivers for Change

ACP-2021-012 has been commenced in order to establish a safe volume of 'Special Use Airspace' (SUA) around the SP-1 launch site on the Outer Hebrides (as shown in *Figure 1*), to facilitate sub-orbital rocket launch, by mid-2025. Sub-orbital rocket launch, flight and splashdown poses a risk to other aviation uses as unlike manned aircraft, rockets cannot comply with the 'rules of the air' (RoTA) to prevent mid-air collision with other air vehicles. These RoTA necessitate either compliance with Air Traffic Control (ATC) instructions to maintain safe separation or, rely on the pilot seeing and avoiding other air vehicles. As the SP-1 launch site is located within unregulated airspace[1] where separation between aircraft relies on pilots 'seeing and avoiding' other aircraft, it is necessary to safely 'segregate' rocket activities[2] from other airspace uses. The most efficient method of achieving this is to establish a volume of SUA[3] that contains all credible[4] hazards associated with rocket activities and notifying when this airspace volume is active so other airspace users can avoid it – the SUA proposed is a DA. DAs are promulgated on navigational charts and maps and are detailed in the National and

[1] Unregulated airspace is classified as 'Class G' by the International Civil Aviation Organisation (ICAO); in the vicinity of SP-1 Class G extends from surface level to Flight Level (FL) 195 (approximately 19,500ft above surface level) above which Class C 'controlled airspace' exists where special rules apply to flights and ATC services may be mandated.

[2] Rocket activities include the launch, flight and splashdown of the Launch vehicle (LV).

[3] SUA is defined by the CAA [D] and can be in several forms such as: Restricted airspace, Prohibited airspace, DAs and other types; the SUA being proposed in this ACP is a DA.

[4] In safety regulatory terms, credible hazards are those that are reasonably foreseeable and pose a safety risk. Hazards that create a risk that are assessed as 'incredibly low' are not considered 'credible' as the probability of such an occurrence happening is so small that it is considered acceptable by International safety bodies and the UK Health & Safety Executive (HSE).

International aeronautical publications; they are only normally activated when needed for the specific purpose detailed, at all other times the airspace is available for other airspace users. Such activations are notified in NOTAM, well in advance to enable other airspace users and Air Navigation Service Providers[5] (ANSPs) to plan accordingly.

The proposed new airspace around the SP-1 launch site, herein referred to as the 'airspace fillet', is of sufficient volume to contain all associated hazards rocket launch poses to other aircraft during the launch phase[6]. Within the airspace fillet there is an additional small area of SUA required around the launch pad to protect SP-1 ground personnel from the sudden distraction caused by low flying aircraft, or any potential Radio Frequency (RF) interference low flying aircraft may cause. It can be seen from *Figure 2* that the new proposed airspace fillet (extending surface level (SFC) to unlimited (UNL) height), adjoins the existing Ministry of Defence (MOD) Hebrides Range DA complex (designated EGD701[7]) whereby it will provide uninterrupted connectivity to the existing DAs. The inflight and splashdown elements have to be contained in a much larger area and this ACP proposes that instead of designing a vast new area of SUA over the sea, SP-1 launches should/could utilise the current D701[8] complex[9]. Utilising existing airspace structure has numerous advantages, not least the application of current airspace management processes and procedures, familiarity by operators and other airspace users, as well as being the most cost effective solution; this is expanded in more detail at paragraph 3.2 below.

In accordance with The Air Navigation (Amendment) Order article 94 2021[10], a Flight Restriction Zone (FRZ) around the spaceport is necessary to prevent the unauthorised flight of certain unmanned aircraft in the vicinity of the protected space site (SP-1).

All D701 DAs extend from SFC to UNL, only D704 is different, extending SFC to 10,000 feet (ft) above mean sea level (AMSL).

[5] Nominally ATC.

[6] The launch phase is from ignition, lift off and the initial part of the flight trajectory.

[7] EG is the ICAO designator for the UK and 'D' is the designator, in aeronautical publications, for a DA. All DAs in the UK are numbered sequentially starting with EGD001 in the South with numbers increasing the further North. Many DA complexes are subdivided into small areas and these have an additional letter designator, for example EGD701A and EGD701Y.

[8] For the purposes of this document the 'EG' designator is dropped and DAs are referred to as simply 'D' with their corresponding number; for example D701.

[9] D704 (originally D701Z) remains part of the D701 'complex' it was renamed when the regulatory authorities removed the Z designator for individual SUA; (Z is now used for all SUA where an additional safety buffer zone is added for flight planning purposes – see Appendix E – Draft AIP Entry).

[10] The Air Navigation (Amendment) Order 2021 refers.

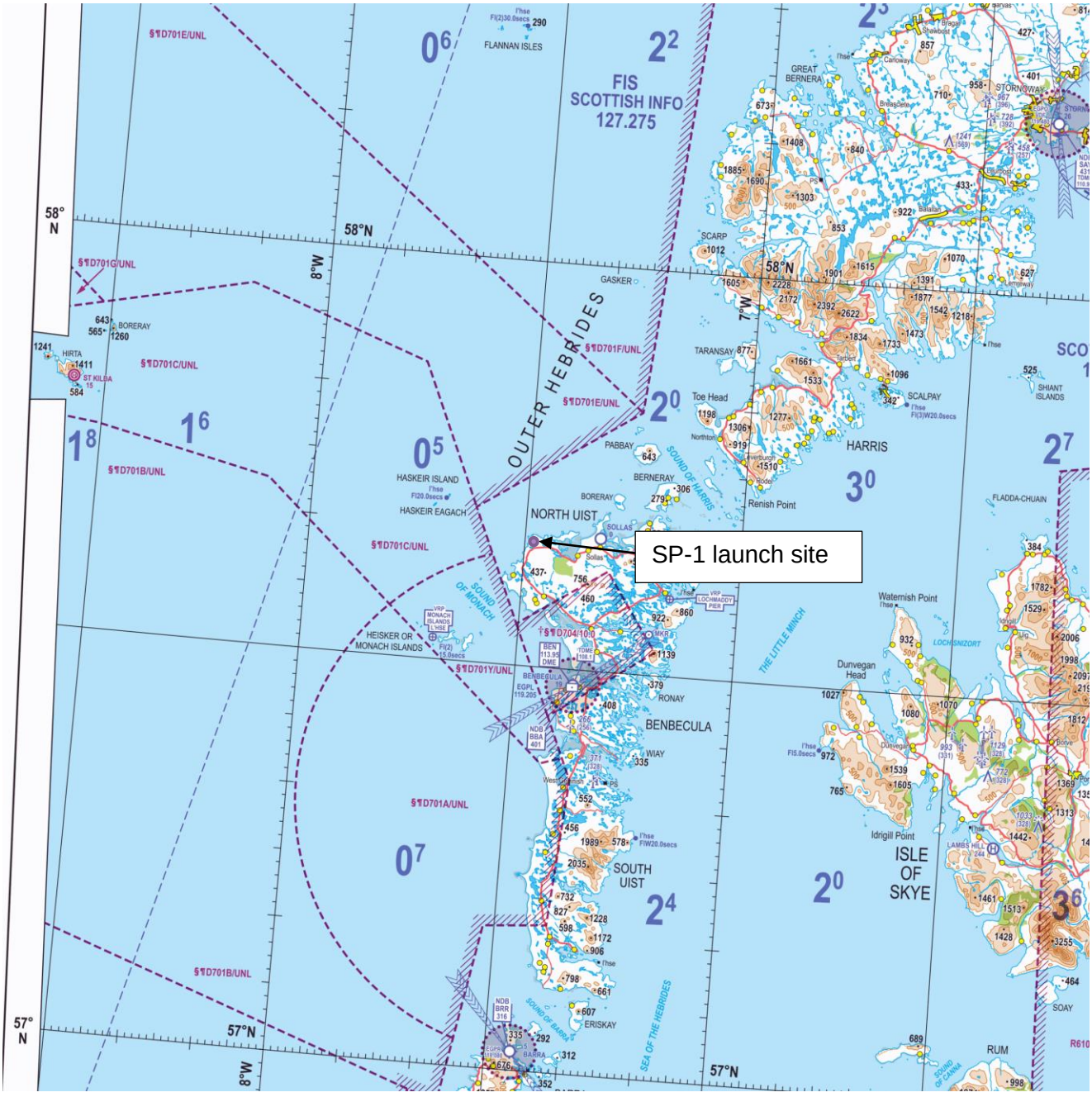

Figure 1: SP-1 Launch site location and adjacent existing DAs of the MOD Hebrides Range D701 and D704 (Source: CAA 1:500000 Chart Sheet 2150ABCD Scotland Edition 36 (2023)).

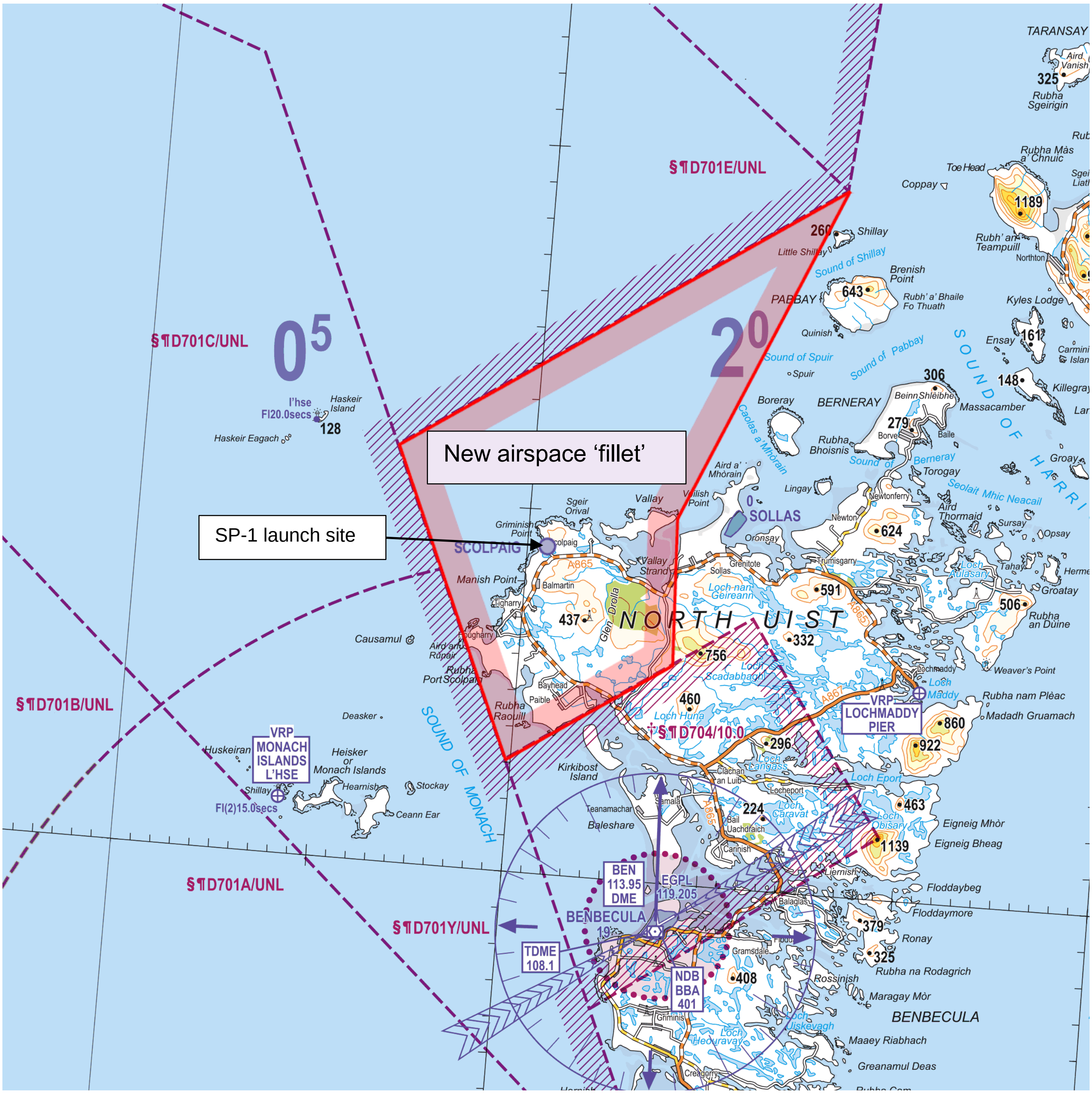

Figure 2: New proposed airspace 'fillet' (red outline) extending SFC to UNL and connecting the airspace to the D701 DA complex (Source: CAA, Topographical Air Chart of the United Kingdom 1:250,000, Sheet 1 Northern Scotland West Edition 13 (2024)).

2.2 Statement of Need (SoN)

The original Statement of Need is as follows:

> *"A consortium[11] led by the local council (Comhairle nan Eilean Siar), comprising Highlands & Islands Enterprise, private investors and QinetiQ, is developing a vertical launch spaceport site, herein known as 'Spaceport 1', at Scolpaig, North Uist on the Western Isles. This site is being developed[12] as an opportunity in support of the UK government's spaceflight programme, 'LaunchUK', which aspires to grow the UK's global market share of the space sector to 10% by 2030 and be at the forefront of small satellite launch.*
>
> *Spaceport 1 has been the recipient of local government investment to construct a vertical launch spaceport that will enable small satellite launch. Development of the site and future use by operators will generate much needed revenue for local communities. It is envisaged that significant economic return will result from the creation of high quality job opportunities for local residents, direct and indirect financial income and an increase in personnel residing and visiting the area.*
>
> *The location has been carefully selected in order to minimise disruption to the public and airspace users, the latter through the exploitation of the existing Ministry of Defence (MOD) managed DAs known as the Hebrides Range; the EG D701 complex. Using irreducible[13] spare capacity of the existing Danger Area complex will enable safe testing of suborbital 'sounding rockets' and future small satellite launch rockets[14]. The existing DAs are fully integrated into systems and processes employed by the UK Airspace Management Cell (AMC) and the Eurocontrol Network Manager enabling harmonised and dynamic planning of the Air Traffic Management (ATM) network. Moreover, it is envisaged that QinetiQ will manage any 'new' airspace created under the ACP in exactly the same fashion the Hebrides Range airspace is managed, thereby utilising existing airspace management processes and procedures enabling efficient use of airspace under the Flexible Use of Airspace (FUA) concept. Furthermore, this will facilitate expedient transfer of airspace use from MOD activity to Spaceport operations as well as accommodating short notice changes and, where appropriate, coincident operations.*
>
> *The Spaceport 1 site at Scolpaig currently lies beneath Class G unregulated airspace but is only a few miles from the EG D701 complex. As rocket launch will pose a risk to other airspace users, there is a requirement to safely segregate such activity to minimise risk. Segregation is*

[11] A 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 (CnES) 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.

[12] 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.

[13] This refers to the capacity of operation for EGD701 not the airspace per se.

[14] The requirement for orbital launch options is no longer included in this ACP – this requirement was removed in September 2022.

normally achieved through the promulgation of temporary reserved airspace activated by a Notice to Airmen[15] (NOTAM). However, as the airspace is likely to be needed on a regular basis, the promulgation of a NOTAM detailing the coordinates and control procedures for every launch is probably not appropriate as a long term solution. Furthermore, such temporary airspace is not fully integrated into the airspace management systems and has to be created on a case by case basis thereby increasing workload and by necessity, the notification periods for activation.

It is therefore considered an ACP is required to provide a small fillet of segregated airspace that provides both adequate protection for the spaceport activities and connects the spaceport with the Hebrides Range DAs. It should be noted that the MOD have developed an agreed process for non-MOD activities to be conducted in MOD sponsored DAs such as the Hebrides Range. This formalised process is an enabler that should allow Spaceport 1 to operate, under certain conditions, in the Hebrides DAs. The small fillet of airspace required under the ACP effectively joins the most easterly boundary point of D701E with D701Y, where the latter adjoins D704[16].

The ACP will enable both sounding rockets[17] to be tested (nominally on a westerly bearing) and small satellite rocket launch to the North[18]; both trajectories maximising the use of the D701 complex."

Although this airspace change does not form part of the plan for delivering the airspace modernisation strategy[19] it is nonetheless consistent with that strategy to enable 'new entrants', in this case rocket launch, access to UK airspace.

2.3 Aims of the Proposal

The aim of this ACP is to facilitate the safe launch, flight and splashdown of sub-orbital rockets operating from the SP-1 launch facility at Scolpaig North Uist such that these activities pose no additional risk[20] to other airspace users. While achieving the aim the objective is to minimise disruption to other airspace users through the most efficient use of the airspace.

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

[16] D704 is considered part of the D701 'complex'.

[17] Sounding rockets are research sub-orbital rockets that are designed to take measurements and perform scientific experiments.

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

[19] As detailed at Reference [E].

[20] Any additional risk is managed to as low as reasonably acceptable in accordance with current Health and Safety (H&S) legislation and other Range regulatory requirements.

It can be demonstrated[21] that the new airspace fillet and contained small additional SUA area around the launch pad, will have little or no impact on other airspace users. The size of the fillet was adjusted during Stage 2 of the ACP process so as not to impinge on flights operating to/from the beach landing site at Sollas located approximately 5.5 NM to the east of Scolpaig (see paragraph 2.8 and *Figure 2*).

It is the activation of the D701 areas in support of SP-1 that causes the most significant disruption with this being felt by aircraft operating on the North Atlantic (NAT) routes across Scotland, in particular the daytime, mostly westbound, routes. The procedures associated with this ACP aim to address and minimise this impact as detailed in paragraph 3.2.1 below.

It is concluded that the ACP meets fully the aims and objectives that fulfil both the requirements of the SoN and the airspace Design Principles (DPs), see paragraph 2.7.

2.4 Assumptions and Constraints

The main assumptions and constraints that have been highlighted during the previous Stages of the ACP process, in particular Stage 3 - Consult, are as follows:

Assumptions:

- a Spaceport operator for the SP-1 site will be contracted in the near future and said operator will commence the process to obtain a Spaceport Operator Licence;
- the Launch Vehicle (LV) provider will be appropriately licenced/approved by the Civil Aviation Authority (CAA) to operate from the SP-1 site;
- SP-1 operations will not impact on the UK AMC such that additional resource is needed by the AMC;
- National Air Traffic Services (NATS) and CAA agree as to how any increased 3Di[22] scores or attributable delays (as a result of SP-1 activities) will be applied against the already agreed NATS Enroute PLC (NERL) performance targets;
- Tactical management review of time and lateral separation buffers applied to SUA is undertaken by NATS in collaboration with the MOD and QinetiQ, with a view to enabling more efficient use of the airspace; and,
- the appropriate Letters of Agreement (LoAs) will be agreed and in place to enable sub-orbital rocket launch.

Constraints:

- The CAA has yet to determine the prioritisation of Spaceflight, therefore, prioritisation of sub-orbital rocket launch v Commercial Air Transport (CAT) has not been determined. These protocols will need to be agreed before the first launch can occur.

[21] As detailed in Sec 3 para 3.2 of Reference [C] and available at: Airspace change proposal public view (caa.co.uk)

[22] 3Di is the CAA measurement of NATS environmental performance.

- The AMC UK is a Joint and Integrated (NATS and MOD) function and does not currently cater for 'new entrants' such as commercial rocket launch. New entrants will need AMC UK access to enable airspace reservations to be put in place necessary for rocket launch.

2.5 Summary Description of the Current Airspace and Operation

2.5.1 Controlled airspace and Air Traffic Services (ATS) routes

There is no controlled airspace in the immediate vicinity of SP-1; the closest is the airway that ends at nearby Stornoway to the north, and two similar airways that end at the Inner Hebrides to the south-east of the launch site (see *Figure 3*). Controlled airspace starts at FL195 (approximately 19,500ft above sea level) over the entire area and is declared as free route airspace where instead of aircraft flying along specific corridors they fly the most efficient route point to point. Beyond this to the west, where Oceanic airspace starts (at 10º west), controlled airspace starts at FL55 and aircraft are routed via Oceanic Entry Points (OEPs), they then normally follow specific NAT routes promulgated as the NAT Organised Track Structure (NAT OTS), see *Figure 10*. The OTS varies depending upon the position of the Jetstream[23].

[23] The Jetstream are strong upper winds blowing from west to east that airline operators use to their advantage by flying along the direction of the Jetstream eastbound and avoiding flying onto the Jetstream when flying westbound. The NAT OTS is positioned to maximise the benefits and minimise the impact of the Jetstream.

Figure 3: Chart extract showing the location of SP-1 and adjacent controlled airspace and SUA (namely elements of the D701 complex); (Source: CAA 1:500000 Chart Sheet 2150ABCD Scotland Edition 36 (2023)).

2.5.2 **SUA**

SUA, predominantly D701, is in close vicinity of the SP-1 launch site with other SUAs to the east and north as shown in *Figure 4*. D713 extends over the SP-1 site and partially into D701 however this SUA is activated infrequently (see paragraph 3.1.2).

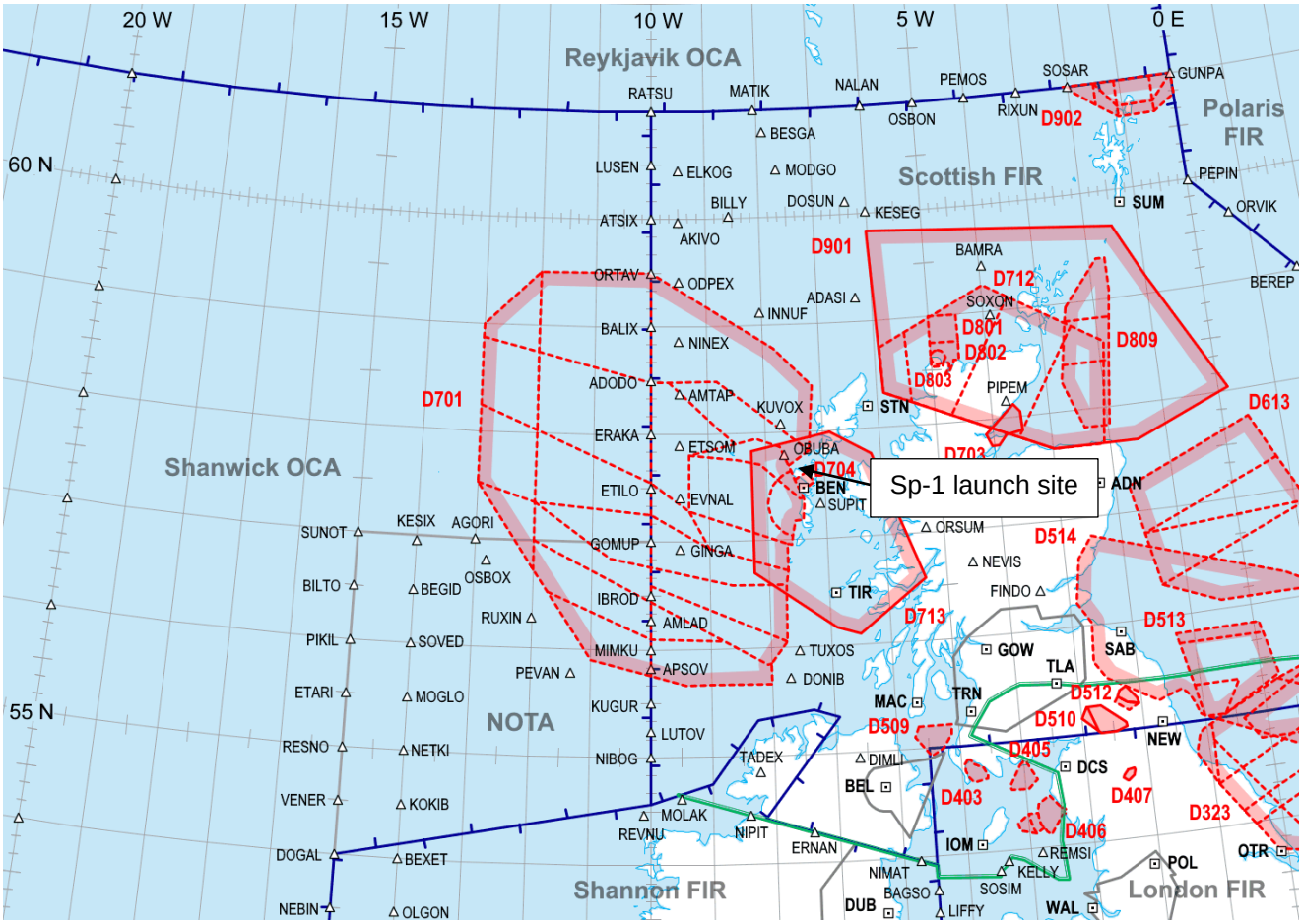

Figure 4: Diagram showing the SUA (outline in RED) in relation to the SP-1 launch site with the main area being the D701 complex (Source: QinetiQ 2024).

2.5.3 **Instrument flight procedures**

There are a number of instrument flight procedures in operation at Benbecula airport and some of these, in particular to the north-easterly runway (runway 06) can be affected by activation of certain D701 areas. A LoA between the MOD Hebrides Range and Highlands and Islands Airports Ltd (HIAL) determines the procedures in place between Benbecula, Barra[24], and Stornoway airports and the MOD Hebrides Range that help mitigate the impact Range activation can have on these instrument flight procedures.

[24] Barra Airport is located approximately 27 NM south of Benbecula.

2.5.4 **Navigation aids and waypoints**

Non-Directional Beacons (NDB) are fitted at Barra, Benbecula and Stornoway airports with Very high frequency Omni-directional Range (VOR)s and Distance Measuring Equipment (DME) navigation aids fitted at Benbecula and Stornoway. Only Stornoway's VOR/DME is used for Enroute[25] air navigation in the region, with similar systems fitted at Tiree.

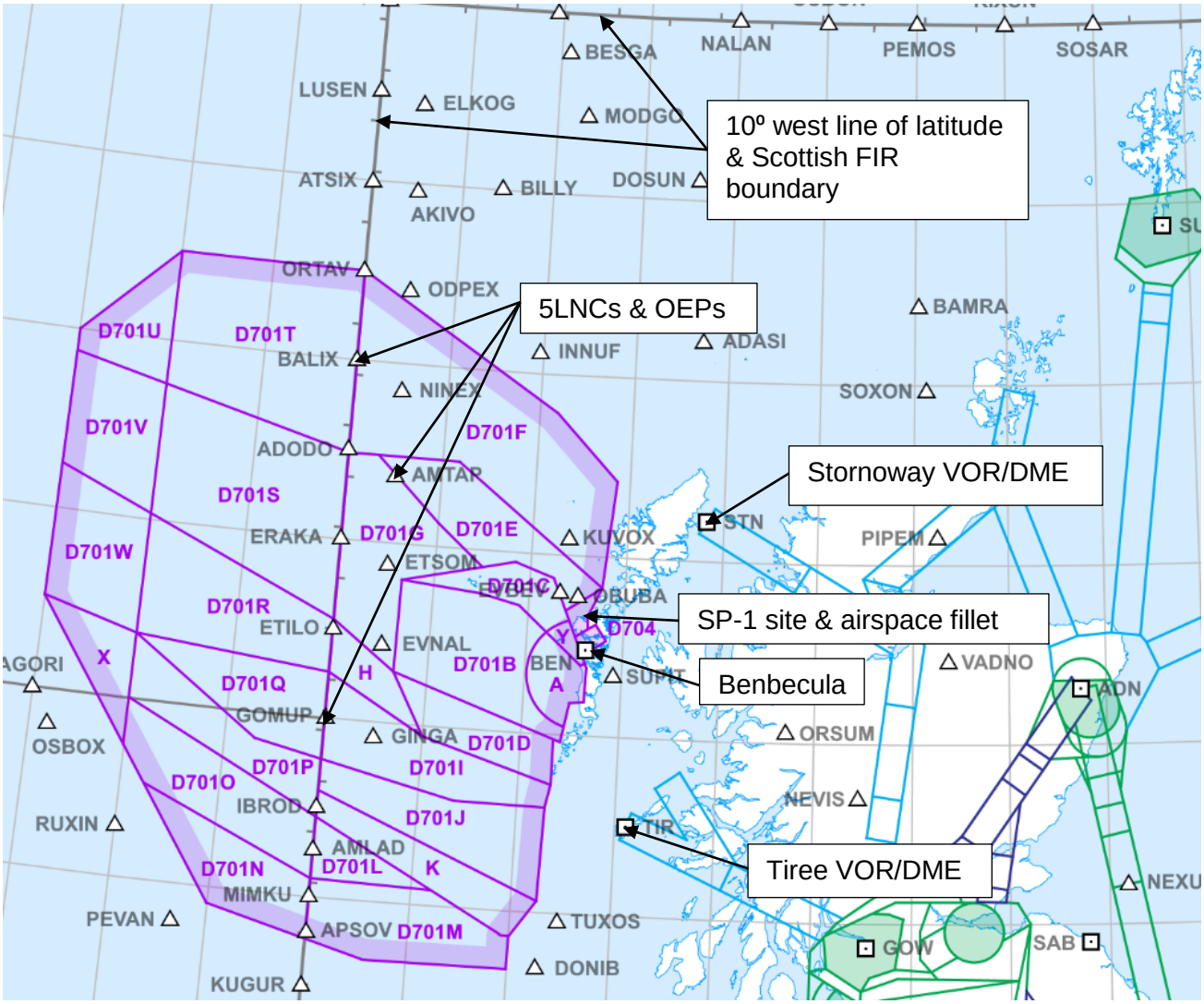

Figure 5: Depicting the location of 5LNCS & OEPs, Stornoway & Tiree VOR/DME and SP-1 site with proposed airspace fillet (Source: QinetiQ 2023).

The main waypoints in the region are the 5 Letter Number Codes (5LNCs) that are mainly used for air traffic operating in the upper airspace and in particular those routing across the NAT. Probably the most significant are those that lie on the 10º west line of latitude as this is the demarcation line for

[25] Enroute traffic is nominally air traffic routing between different way points overflying the vicinity of the airport/navigation aid.

where Oceanic airspace starts in the Scottish Flight Information Region (FIR). The 5LNCs over the sea are also referred to as OEPs (see *Figure 5*).

2.5.5 **Airspace usage**

Lower airspace - Airport movements at Benbecula for 2022[26] show that the average number of scheduled movements per month is circa 231, (Barra average is 106 per month). In addition to this, the average number of military movements is <2 per month, with General Aviation (GA) <4 movements per month. Other movements, including positioning flights, air taxi and Search and Rescue (SAR) make up < 16% of total movements per month. From over 60 airports featuring in the CAA's statistical analysis, Benbecula features in the bottom seven airports for the number of movements, with Barra generally in the bottom two. It is considered that these figures provide a good indicator regarding levels of traffic in the local area and it is determined that the numbers of aircraft operating in the local area below 7000ft is extremely low compared with most other parts of the UK. It should be noted that Stornoway airport is unaffected by this ACP.

Other aircraft movements in the local area are also extremely low, consisting mainly of helicopter support aircraft (lighthouse, air taxi and fisheries), with little GA traffic (most occurring during the annual Sollas fly in weekend in the summer).

Upper airspace - The airspace above FL195, in particular above FL290 can be very busy, especially during the peak NAT traffic flows when aircraft are transiting across the NAT to/from the US and Canada. These peak periods are generally during the day namely: late morning to early afternoon for the majority of west-bound flights; and, after mid-night to early morning for the mainly east-bound flights. The peak traffic flows do not always route over Scotland however, as the NAT OTS is determined by the position of the Jetstream (see paragraph 3.1.5). There are fewer flights crossing the Scottish region in the summer in comparison to the winter months.

2.5.6 **Navigation specification**

There is no navigation specification for flights in the lower Class G airspace; however, there are minimum equipment and performance requirements pertaining to flights in Class C airspace (above FL195) and further specific requirements for aircraft operating in the NAT oceanic regions.

2.5.7 **Provision of ATS**

The upper air and NAT traffic is controlled by NATS and AirNav Ireland, who closely coordinate airspace closures with the MOD Hebrides Range authority when any of the D701 DAs are active.

ATS are provided to aircraft in the local area in the vicinity of the Outer Hebrides by HIAL with air traffic controllers at both Stornoway and Benbecula airports and a Flight Information Services Officer (FISO). At Barra. Occasionally civil licenced air traffic controllers are utilised at MOD Hebrides Range for specific trials.

A SUA Activity Information Service (SUAAIS) is proved by NATS through 'Scottish Information' (a Very High Frequency (VHF)) information service that is provided to any aircraft on request; this service provides details of the D701 complex activity status as promulgated by NOTAMs. Pre-flight information

[26] With a 9% decrease in 2023.

on the activity status of D701 complex may also be obtained from the MOD Hebrides Range control on the published telephone number (see Appendix E – Draft AIP Entry).

2.5.8 **Operational efficiency, complexity, delays and choke points**

At the local level, slight delays to aircraft arriving into Benbecula airport might be experienced on the rare occasions when access to D701A or D701Y is not available due to imminent or actual Range activity. Activation of D704 has the biggest impact on Benbecula operations and for this reason special procedures and agreements apply however, D704 is rarely activated.

Choke points can occur for high level NAT traffic when D701 and other adjacent SUA are activated simultaneously, in particular D712, D713 and D901; this is mitigated through existing airspace protocols contained in the necessary LoAs (see also paragraph 3.1.2). Occasionally, usually no more than once a year, the MOD Hebrides Range is extensively extended to the west to accommodate large scale military exercises which necessitate the closure of large swathes of the NAT. This can induce delays to NAT traffic (in particular west-bound) and also choke points at some of the OEPs. Furthermore, if other Nations such as France block off similar large areas of the NAT airspace to the south, the cumulative impact on the NAT air traffic network can be severe. This is normally mitigated through International negotiations.

2.5.9 **Flight planning and air traffic flow and capacity management**

Airspace restrictions for the NAT region have to be agreed at D-1 in order that the airspace management system across Europe can publish the available routes to the airlines to enable them to finalise their flight plans for the following day. The UK AMC produces the airspace plan for EUROCONTROL who in turn publish the Europe wide route availability plan and details of airspace restrictions such as the D701 areas. Once this is published at D-1, the airlines file their flight plans for the following day. The main issue with this process is that if the DA activity finishes ahead of schedule, or is cancelled on the day, although the airspace restrictions can be removed, it is often too late for the airlines to respond and resubmit their flight plans. Because of the sheer number of aircraft involved, it is not possible to safely dynamically re-route aircraft back onto the most efficient track. ANSPs are sometimes able to tactically re-route a small number of aircraft but this is limited depending upon controller workload at the time.

2.5.10 **Airspace management**

Airspace management in the vicinity of the proposed airspace fillet and D701 areas is coordinated by the UK AMC. This is where priorities are set between civil and military activities. Feeding into the AMC, the ANSPs and MOD Hebrides Range carefully coordinate their activity following the agreements stipulated in the relevant LoAs. These LoAs also contain the airspace protocols where priorities are listed. For the large scale exercises where the D701 DAs are vastly expanded, more organisations become necessarily involved in the airspace management processes; these include EUROCONTROL, Reykjavik, Canadian and US airspace authorities.

2.5.11 **Safety**

Within the boundaries of the MOD Hebrides Range and other SUA managed by the MOD, safety for the activity within these areas sits with the MOD who also ensure the hazardous activities do not go beyond the confines of the proscribed DAs. For some types of activity, the MOD is required to have additional safety buffers applied to the inside of the DAs. The ANSPs also have a safety responsibility

by ensuring aircraft under their control do not encroach active DAs. Furthermore, they also apply separation criteria against the boundary[27], the size of which is determined by a number of variables.

Benbecula and Barra airports carefully coordinate their flights with the MOD Hebrides Range when the D701 DAs are active. This is aimed at preventing aircraft inadvertently entering active DAs as well as enabling safe access for emergency flights. Furthermore, this close coordination helps facilitate other flights entering the active DAs when it is safe to do so (see paragraph 3.1.7).

2.6 Summary Description of the Changes to Airspace Design and Operation

Airspace design - This ACP calls for a minor change to the airspace structure in the vicinity of the launch site around Scolpaig. The change necessitates two additional SUAs as described at paragraph 2.1 above. The first SUA is a fillet of airspace that sits between the existing D701 and D704 DAs thereby forming uninterrupted connectivity to the D701 DA complex (see *Figure 2*). This is considered critical as the fillet of airspace only provides the necessary protection to other airspace users during the launch phase of the rockets. Once in flight and on a trajectory (predominantly to the west), the LV require an ever expanding 'safety area' as they gain speed and altitude (in order to contain all hazards should a catastrophic failure of the LV occur at any time during its flight profile, see paragraph 3.6). The D701 areas are ideally suited and positioned to provide this additional SUA and can be activated incrementally to meet the safety needs of the particular LV being operated.

Within the fillet of airspace, there is a requirement for an additional small circular volume of SUA around the launch pad; this is there to protect SP-1 ground personnel from the sudden distraction caused by low flying aircraft while they are engaged in critical pre-flight activities such as arming or re-fuelling. Furthermore, this SUA also prevents any potential RF interference low flying aircraft may cause on the LV systems. Moreover, there is a requirement to establish a FRZ around the launch site to prevent unauthorised flights of certain unmanned[28] aircraft.

Airspace operation – The airspace fillet will be managed and operated in exactly the same manner as the D701 DAs by utilising the same aviation notification procedures. The airspace will be activated in conjunction with the necessary D701 areas required for rocket launch; this is likely to be for a three hour period no more than 20 times a year (allowing one spare airspace notification per launch). It is anticipated that the vast majority of launches will occur in the afternoon to minimise the disruption to the air traffic network and it is likely there will be more launches in the summer months than in the winter. Current local aviation activity is unlikely to be affected by the airspace activation and extant procedures and coordination process already in place with MOD Hebrides Range will be expanded to include SP-1 operations thereby mitigating any potential impact the airspace activation may have. The FRZ however, will be permanently active.

The proposed design option will not require any changes to be made to current air traffic procedures, the surrounding airspace, navigational aids, reporting points or the provision of air traffic control services. Any impact on upper air traffic will be as a result of activation of the existing D701 DAs, this will be managed through the current processes and procedures, and still to be agreed, airspace protocols (see paragraph 2.4).

[27] These may be lateral and/or vertical separation distances (or buffers) and/or time buffers.

[28] Also referred to as Drones or Remotely Piloted Aircraft Systems (RPAS).

2.7 Summary of Options Analysis

In developing the airspace options the Change Sponsor first produced a Statement of Need (SoN) that captured the requirements for the airspace change. Subsequently, a set of DPs that encompassed the safety, environmental and operational criteria and the strategic policy objectives that the Change Sponsor sought to archive in developing the ACP, were developed. These DPs were shared with aviation stakeholders who were given the opportunity to comment and suggest changes. Following engagement and feedback, the DPs were finalised and sent to the CAA for acceptance. Subsequently, the Change Sponsor was required to develop a number of potential airspace solutions for sub-orbital[29] rockets (design options), each one was tested and evaluated against the DPs to establish if they met the DP and SoN requirements. Again, aviation stakeholders were invited to participate in the DP evaluation and provide the Change Sponsor with feedback. The Change Sponsor provided six potential airspace options that included the 'do nothing' option. During DP evaluation three of the options were discounted as either not meeting the requirements of the SoN (this included the 'do nothing' option as safety could not be assured), or not sufficiently meeting the DPs.

The three remaining design options were taken forward to the next stage of the ACP process where they were further refined and an 'Initial Options Appraisal' conducted; each option was tested against specific criteria in order to demonstrate their individual merits and shortcomings. Simplified these three options were:

- Option 3 - Create a small fillet of airspace between D701 and D704 to provide SUA connectivity from the launch site to the D701 areas and use the latter in their current capacity;
- Option 4 - Design a bespoke volume of airspace consisting of a number of expanding areas similar to the D701 areas but centred on the SP-1 launch site (this would still necessitate the small fillet of airspace); and,
- Option 5 - Create a small fillet of airspace between D701 and D704 to provide SUA connectivity from the launch site to the D701 areas but reconfigure a number of the D701 areas with sub-divisions such that less airspace would be used when short range rockets are launched.

Note: all three options included the small additional circular SUA around the launch pad.

The initial Options Appraisal concluded that Option 3 was the preferred option for a number of reasons, not least the fact it required the smallest change to the current airspace structure, was considered the most cost-effective (when training, mapping and system changes were considered) and was likely the safest because of the familiarity of operating this airspace from both a Range and ANSP perspective. The three airspace options were presented, during the formal consultation stage with the rationale behind the Change Sponsor's preferred option (Option 3) being explained.

The consultation documentation included the second phase of the Options Appraisal (Options Appraisal (full)), where the Change Sponsor was required to conduct detailed analysis of the impact each option could have on other airspace users, local communities and the environment. The Options Appraisal (full) included quantitative assessments of the various impacts and evidence to support the

[29] The requirement for orbital launch (utilising significantly more airspace than sub-orbital) was removed from this ACP in September 2022.

preferred option. EUROCONTROL[30] were tasked to conduct analysis on the traffic impact of the three options and to ascertain which, if any, produced the most benefits/least impact on the air traffic network. EUROCONTROL were also tasked with the following:

- to ascertain whether Option 5 (sub-dividing/re-profiling existing D701 areas) had any significant benefit (i.e. lower impact on NAT tracks) than using the existing D701 areas for short-range rocket launch (as for Option 3). For completeness, Option 4 (bespoke new areas) was also tested; and,
- to ascertain whether there was any difference in the impact on NAT tracks when using Option 3 when compared with Option 4 (for long-range rocket launch).

It was concluded that, when comparing the scenarios for afternoon short-range rocket launches it was evident that there was no difference in impact of the three options. This 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, the extra track miles flown by those additional affected flights is insignificant in terms of extra fuel burn (in particular for the afternoon time period). It became evident that due to the configuration of the D701 DAs – the wider the north-south expansion of areas activated, the greater the impact on NAT traffic; expansion to the west has far less consequence. This appears to be a significant factor as to why the three airspace options had a very similar impact on NAT traffic despite using dissimilar volumes of airspace with Option 3 using the most (for short range rocket launches). Furthermore, analysis of the three options when used for long range rocket launch again demonstrated there was little or no difference in the impact on air traffic.

The consultation stage of the ACP process necessitated the inclusion of a wide range of other (non-aviation) interested parties; all were invited to provide feedback on the airspace options via a questionnaire on the CAA 'Citizen Space' platform.

The Change Sponsor collated feedback and categorised each one by deciding whether the feedback constituted a change to the preferred airspace design, affected it in any way or did not impact on the final design. Although a few points were raised regarding operational processes and airspace protocols, there were no suggested changes to the airspace design and it was concluded that none of the feedback impacted detrimentally on the preferred airspace design option. The Change Sponsor therefore, deems that the final options appraisal is de facto the same as the Options Appraisal (full) as presented in the consultation documentation.

It is concluded, from the analysis and feedback, that the preferred option (Option 3) is the most appropriate option to take forward. This option necessitates a new, small airspace fillet that joins D701 and D704 to provide connectivity to the D701 MOD Hebrides Range DAs, (and an additional small circular area around the launch pad), that can be activated in conjunction with the existing D701 areas. Together, these SUA fully meet the SoN and DPs as set out earlier in the process. It is also considered that this is the simplest option and likely the safest given the lack of change and familiarity operators have with the current D701 processes, as well as being the most cost effective option. Furthermore, it can be demonstrated that no single option lessons the environmental impact or impact on other airspace users, or local communities.

[30] EUROCONTROL is a pan-European civil-military organisation dedicated to supporting European aviation; more information can be found at: EUROCONTROL | Supporting European Aviation | EUROCONTROL.

2.8 Summary of Engagement and Consultation

The first engagement regarding airspace requirements occurred with NATS in 2019 where the concept of SP-1 on North Uist was shared. Subsequently, initial discussions were held with the MOD as it was recognised that their approval to use the D701 complex and MOD assets (namely the Range capabilities such as radars, communications and other sensors) for commercial rocket launch was critical in advancing the ACP. Once provisional approval was gained, the first key aviation stakeholders were formally engaged in early 2021 namely, NATS, HIAL and Loganair. This was then broadened in May 2021 to include a wide cross section of aviation stakeholders, in particular local aviation operators, all of whom were invited to comment on the nine airspace DPs. The stakeholder list was further expanded in August 2021 to include a wide cross section of non-aviation stakeholders, including environmental groups, Local Authorities/Councils and other potentially affected organisations. Feedback received did not suggest any changes to the DPs although it was noted that the expanded explanatory notes for those DPs pertinent to D701 did need refining to capture other potential airspace design options. The DPs and Engagement Report at Reference [A] captured the relevant feedback and updated DPs; this was uploaded to the CAA airspace portal in August 2021.

At a similar time, a separate ACP (ACP-2021-037)[31] was proposed for SP-1. This ACP was for a Temporary Danger Area (TDA) around the launch site to enable a limited number of launches ahead of the permanent airspace solution (ACP-2021-012) being delivered. Distinct engagement was conducted with a very similar stakeholder list as used for the DP engagement, only this time the Change Sponsor was asking for feedback on the 'airspace fillet' design that would enable sub-orbital rockets to be launched from SP-1 into the D701 DA complex. The TDA engagement commenced with a few key stakeholders in March 2021 before broadening to the wider stakeholder list in May 2021, concluding in February 2022. The TDA implementation date was subject to numerous delays and was eventually 'Paused' in Aug 2023 largely due to the delays in 'potential' LV operators in obtaining their necessary approvals/licences in sufficient time. The TDA ACP remains 'Paused' at Step 5 of the process.

Although the two ACP processes were kept separate it became evident that, once the permanent ACP was de-scoped in 2022 to only include sub-orbital launch, many elements of discussion and feedback from the TDA process were relevant to the permanent ACP. This included discussions and concerns raised by Sollas beach landing site users, where it was identified that the original design of the airspace fillet would impact on the Sollas landing site to the east of Scolpaig. Working with users of the site, namely the Light Aircraft Association (LAA) Highlands Strut, a better understanding of the typical flight profiles in use at Sollas was gained. Using this information the MOD Hebrides Range safety experts reviewed the minimum airspace requirements for generic sub-orbital rockets (and those previously launched from the MOD Hebrides Range) and rather than drawing a 'convenient line' between two existing points, it was identified that the eastern boundary of the airspace fillet could be re-profiled, (see paragraph 3.6). The re-profiled eastern boundary no longer encompassed Sollas but remained of sufficient size to still contain all credible hazards to aviation that rocket activities may pose. Similar relevant detail from the TDA process was subsequently mapped across to the permanent ACP during Stage 2 and were recorded/referenced in the ACP-2021-012 documentation accordingly.

[31] Details can be found at: Airspace change proposal public view (caa.co.uk)

In September 2022, the decision was made to de-scope the ACP to support sub-orbital rocket only[32]. Stakeholders were notified of this change in October 2022 and were invited to comment on the initial six sub-orbital airspace options[33] with a request to evaluate each option against the DPs (a feedback DP evaluation form was included).

Despite contacting 88 stakeholders feedback was extremely limited with only nine responses and from these nine[34] just three offered any feedback on the airspace design and DP evaluation; these were MOD, HIAL and NATS. All three provided comprehensive feedback that helped inform which airspace options to take forward and importantly, the operating procedures. The consensus was that three options (3, 4 & 5) could be taken forward to the next stage of the process as they largely met the DPs. Option 3, the Change Sponsor's preferred option, was the preference of MOD and HIAL. The 'Airspace Options and Design Principle Evaluation Report V2' was made available to all stakeholders once uploaded to the CAA airspace portal in March 2023. The Change Sponsor then produced an 'Airspace Options Appraisal (Phase I) Initial' report that was made available to Stakeholders on the CAA airspace portal in May 2023.

The main consultation period (Stage 3 Step 3C), was commenced late March 2024 and lasted for nine and a half weeks, concluding late May 2024. This was a slightly reduced period from the CAA recommended 12 weeks as the airspace change was considered small in comparison to other ACPs (the reduction in consultation period was approved by the CAA). All existing[35] stakeholders were again contacted along with numerous additional organisations, interested groups, politicians and local authorities. Feedback was requested on the preferred airspace design, Option 3. To assist in understanding the airspace, the options and previous stages of the ACP process, a comprehensive set of consultation documents were produced as per CAP 1616 and made available on a number of platforms as well as hard copies on request:

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

Additionally, a set of frequently Asked Questions (FAQs) was produced and made available on the CAA Citizen Space platform, together with the consultation documentation and the stakeholder 'feedback form'. The consultation was promoted widely using social media, local flyers and a number of TV, radio and newspaper outlets. Furthermore, a single day 'public drop in event' was organised and held on North Uist in the vicinity of the Scolpaig site, during which a presentation was provided

[32] Removing orbital launches significantly reduced the size of the airspace requirements

[33] This included Option 0 'do nothing option'.

[34] It is thought that the lack of responses were largely due to the fact the airspace change is relatively small and has little or no impact on other airspace users other than NATS, MOD and HIAL.

[35] Stakeholder list was reviewed to account for any changes in personnel and additional interested parties.

and feedback from attendees recorded. Individuals and organisations were encouraged to provide feedback through the questionnaire hosted on the CAA Citizen Space platform.

All feedback received was recorded and categorised by the Change Sponsor, along with a response to any comments provided; full details are articulated in the consultation response report that was uploaded to the CAA airspace portal[36] in July 2024. Furthermore, the Change Sponsor sent a detailed email response to individuals and organisations that had provided any comments on the airspace change questionnaire; these responses are reflected in the consultation response report.

The Change Sponsor advocates that the Consultation period was a success and met the objectives it aimed to achieve by reaching a broad range of stakeholders and enabling timely feedback on the airspace change proposal. Feedback was received from 31 different individuals/organisations with representation from a diverse number of stakeholder groups demonstrating that the media launch and public drop in event were a success with the consultation material providing the necessary information to enable all stakeholders to understand the process and why the airspace change is needed.

Despite nearly 55% of respondents providing negative feedback to the ACP, the majority of feedback comments were related to the perceived environmental impact of rocket launch and associated safety concerns; none of the objections were specifically related to the airspace construct. It is evident that most of those objecting to the airspace change are from the local community and strongly object to the Spaceport project in its entirety. Responses from aviation groups either supported, or were neutral towards the airspace change and most of the issues raised have already been addressed within the consultation material and through ongoing engagement. However, several wider concerns were raised (not related to the airspace design) and, although acknowledged by the Change Sponsor, they are largely out with the Change Sponsor's remit, as they cover all 'New Entrants' access to airspace and necessitate governmental decisions and CAA/Department for Transport (Dft) input.

After the consultation period concluded it was identified that there were three key actions to take forward in Stage 4:

- addressing the LoAs with NATS, HIAL and MOD (2 LoAs);
- formalising use of D701 with MOD under the Long Term Partnering Agreement (LTPA)[37]; and,
- working collaboratively with ANSPs, UK AMC, MOD and CAA to establish airspace protocols.

Draft LOAs have been agreed in principle and are at Appendix B – Draft Letter of Agreement (2) and Appendix C – Draft Letter of Agreement (3) of this document, along with the LoA formalising use of D701 under the LTPA (Appendix A – Draft Letters of Agreement (1)); work remains ongoing to establish the airspace protocols.

A chronology of engagement activity is contained in Table 1 below:

[36] Available at: Airspace change proposal public view (caa.co.uk).

[37] LTPA is the Defence contract between MOD and QinetiQ

Chronology of Engagement and Consultation Activity			
Date	**Stakeholder**	**Activity**	**Remarks**
Apr 2019	NATS	Presentation	SP-1 Concept & potential airspace requirements
Nov 2020	MOD	Presentation	Discussions on use of MOD DAs for commercial rocket launch
Mar 2021	Benbecula and Barra Airport (HIAL) Logan Air	Presentation	
Apr 2021	NATS	Emails	Initial contact regarding ACP
May 2021	CAA	Commencement of ACP-2021-12	CAA confirms ACP for permanent airspace change appropriate
May 2021	Main Aviation Stakeholders	Letter detailing DPs	Request for feedback on DPs
May 2021	*TDA Aviation Stakeholders*	*TDA Presentation*	*Initial engagement for proposed TDA*
Aug 2021	Main Aviation Stakeholders	Letter detailing DPs	Request for feedback on DPs
Aug 2021	*TDA Aviation Stakeholders*	*Letter detailing TDA Design update*	*TDA update in design*
Oct 2021	Wider stakeholder group including non-aviation	Letter detailing CAA Define gateway outcome	Confirmation of Gateway pass and approval to move to Stage 2
Nov 2021	*TDA Aviation Stakeholders*	*Emails*	*TDA delay and timeline update*
Feb 2022	*Sollas Users (LAA) & Coordinator*	*Emails*	*Re-profiling of eastern boundary of airspace fillet*
Apr 2022	*TDA Aviation Stakeholders*	*Letter detailing delay*	*Stakeholders notified that earliest launch circa Nov 2022*
Oct 2022	Wider stakeholder group including non-aviation	Email containing letter regarding airspace options	Details of the 6 airspace options for sub-orbital launch only (statement that orbital had been removed from ACP), with request to provide feedback on airspace options including DP evaluation
Oct 2022	UK Irish Airspace Management Operations Group (ASMOG)	Presentation	Presentation of airspace options and discussions on potential way forward
Nov 2022	Available to the general public	Airspace options and DP evaluation report	Uploaded to CAA airspace portal
Feb 2023	Local Aviation Operators	Email request for information	Change Sponsor request for information on local aircraft movements to inform options appraisal
Feb 2023	AMSOG	Email exchanges	Request that AMSOG discussions are not made public
Mar 2023	Available to the general public and all stakeholders	CAA airspace portal	Design options and DP evaluation report V2

Chronology of Engagement and Consultation Activity			
Date	**Stakeholder**	**Activity**	**Remarks**
May 2023	Available to the general public and all stakeholders	CAA airspace portal	Options Appraisal (Phase I) Initial V3
Aug 2023	*Available to the general public and all stakeholders*	*CAA airspace portal*	*TDA Paused (Update provided on airspace portal Nov 24)*
Mar 2024	Wider stakeholder group including non-aviation and media outlets	Commence formal consultation	CAA Citizen Space platform hosting feedback questionnaire, FAQs, consultation strategy, consultation document and options appraisal (full). Consultation documents also available on CAA airspace portal
Apr 2024	Wider stakeholder group including non-aviation and media outlets	Email reminder	Details of consultation period, public drop in event and how to provide feedback
Apr 2024	Available to the general public and all stakeholders	Public Drop in Event	Held at Hosta Hall North Uist, presentation and Q&A
May 2024	Wider stakeholder group including non-aviation and media outlets	Email reminder	Details of consultation period and how to provide feedback
Jul 2024	Available to the general public and all stakeholders	CAA airspace portal	Consultation response report V2
Jul 2024	Stakeholders whom provided feedback	Email response	Change Sponsor sent an email response to all stakeholders whom had provided comments on the airspace questionnaire

Table 1: Chronology of ACP-2021-12 Engagement and Consultation activity with TDA (ACP-2021-37) engagement highlighted in grey and in italics.

2.9 Summary of Anticipated Impacts

2.9.1 Airspace users/ANSPs

It is determined that this airspace change will have little or no impact on local airspace users. It is the subsequent activation of the D701 DAs for SP-1 operations that causes the greatest impact mainly affecting the high level transatlantic air traffic on occasions where they need to deviate around active D701 DAs.

NATS ANSP is impacted, not by the airspace change but by the subsequent activation of D701 DAs for SP-1 operations. The impact on NATS includes an increase in workload for some staff and the potential for lost revenue where aircraft are re-routed through the Irish or Icelandic flight regions. Furthermore, NATS may be impacted on their environmental performance targets as a result of necessarily re-routing aircraft on longer tracks to avoid active DAs.

HIAL, incorporating Benbecula and Barra airports, should not be impacted by the ACP other than a minimal increase in workload notifying aircraft under their control of the status of the airspace fillet and associated D701 areas. Benbecula ATC may also see a slight increase in workload where the activation of D701 for SP-1 launches impacts on approaches to runway 06 and additional coordination is necessary. Stornoway airport will not be impacted by the ACP.

2.9.2 **Safety & airspace modernisation objective on safety**

The CAA's State Safety Programme (SSP) aims to enable UK industry to safely develop innovative technologies such as spaceflight. It is considered that this ACP provides a safe solution to enabling sub-orbital rocket launch. It fulfils the requirements of CAP 1711[38] by enabling 'new entrants' (rocket launch) to safely integrate into the existing airspace structure in the UK. Furthermore the ACP, by providing a segregated airspace environment, minimises the risk to other airspace users and *"people on the ground in the UK as a result of an aviation incident"*, thereby effectively contributing to State Safety Objectives.

2.9.3 **Efficient use of airspace & expeditious flow of air traffic**

As detailed in paragraph 3.1.1, the NAT route structure is impacted when the D701 DAs are activated; the more areas activated the greater the impact in particular where activation includes a large volume of airspace orientated north/south; activations to the west have less impact. The impact activation of D701 has on the NAT air traffic is mitigated through agreed complex notification and operating procedures as prescribed in LoAs. The LoAs enable the most expeditious safe routing of traffic and the most efficient use of airspace.

2.9.4 **Matters relating to spaceflight activities**

There is potential for a wider impact on the air traffic network when more than one Spaceport necessitates the closure of airspace at overlapping times. This could result in bottlenecks in the air traffic system in the UK and may induce delays should the ANSPs need to invoke any type of air traffic flow control/regulation measures. This is not unique to SP-1 but is the same for all Spaceport Operators. This can be mitigated through the appropriate airspace protocols however these need developing at governmental level as they cannot be decided by the individual Spaceports.

2.9.5 **Environmental**

The environmental impact is effectively two elements, direct and indirect. The direct environmental impact is caused by the actual LV and this mostly affects the local area through a slight increase in CO_2 emissions, noise and vibration during the initial launch period. These direct impacts are captured in detail in the Environmental Impact Assessment (EIA) [G] and Supplementary Environmental Information (SEI) [J] commissioned by SP-1 as required under the local planning regulations for the site[39]. It is evident from these reports that the direct environmental impact should be minimal due to the limited number of launches (maximum of 10 per year), the short duration of any associated noise (under two minutes and decreasing immediately after launch), and the relatively[40] small sub-orbital rockets (with the largest being in the region of 11 metres).

The indirect environmental impact is where air traffic is required to fly additional track miles to avoid any airspace closures associated with SP-1 operations. It is anticipated that there will be an increase

[38] CAP1711: Airspace Modernisation Strategy 2023–2040 Part 1: Strategic objectives and enablers V2 dated 22 Feb 2024.

[39] All supporting documents are available at: https://cne-siar.gov.uk/home/busines/spaceport-1/.

[40] When compared to orbital rockets.

in CO_2 emissions from high level air traffic operating on the NAT routes whenever the D701 areas are activated in support of SP-1 operations. This increase in CO_2 emissions is not considered significant when balanced against a typical long haul flight overall emissions, but nonetheless it is recognised that there will be an unavoidable increase. Notwithstanding, operational procedures and Airspace Management (ASM) protocols will help mitigate this increase by minimising the impact on air traffic by de-conflicting launch times at the most busy periods.

2.9.6 National security

Aircraft operating on National security will always be afforded the highest priority to access any active DAs when safe to do so. If necessary, SP-1 launches will be delayed to enable such state aircraft freedom to operate, and in the case of post rocket launch, state aircraft will be allowed access to any active DAs once the hazard (LV) is known to have splashed down; normally a matter of minutes after launch or, any debris field has cleared.

2.9.7 International obligations

All rocket activities from SP-1 should be contained within the D701 complex and the agreements associated with D701 will apply. In exception, should the requirement to operate beyond the boundaries of D701 ever occur, then the relevant International bodies would be consulted and an airspace management plan specific to that launch would need to be developed with the airspace managers from those countries affected. Such ASM procedures would be similar to those adopted by the MOD Hebrides Range for major exercises such as those listed in paragraph 3.1.4.

2.10 Assessment Criteria for the Secretary of State (SoS) for Transport's Call-in Process

Due to the anticipated relatively low noise levels of sub-orbital rocket launch (about the same as a motor bike) for the nearest noise receptor to the launch site, and the fact that the noise will dissipate very quickly (less than two minutes), it is highly unlikely this ACP will meet the call-in criteria for the SoS for Transport's call-in process. Furthermore, launches will not occur at night or on Sundays with launches being limited to 0700-2000 (Mon-Fri) and 0700-1800 (Sat). Moreover, SP-1 does not meet the terms of the guidance on strategic national importance because SP-1 is not the first vertical launch site for sub-orbital use.

2.11 Timeline for Implementation

The main activities to be completed prior to the airspace implementation are contained in Table 2 below:

Activity	Date to be Completed	Remarks
CAA Decide Gateway	4 Apr 2025	CAA approval required before commencing Stage 6 Implementation
Stakeholder Notification of CAA Decision	Prior to 11 Apr 2025	Change Sponsor email to stakeholder group list and media outlets as used during Stage 3
Finalising LoAs	Prior to 4 Apr 2025	LoAs will need to be fully agreed and ready for sign off by the appropriate authorities

Activity	Date to be Completed	Remarks
Sign off of LoAs	Prior to 11 Apr 2025	Sign-off is required prior to submission of documents to Aeronautical Information Services (AIS)
Change Sponsor Change Request Cut -off	11 Apr 2025	Submit appropriate aeronautical information changes to NATS AIS to meet Aeronautical Information Regulation and Control (AIRAC) 07/2025
ATC and Range Control Display Update	Prior to 10 Jul 2025	The process for updating equipment will commence as determined by the appropriate authority in time to meet implementation date
Aeronautical Information Publication (AIP) Amendment (AMDT) Published	29 May 2025	AIRAC 07/2025
Staff Training Completed	Prior to 10 Jul 2025	Minimal staff training will be required due to the small size of the airspace change – this can commence post 4 Apr 2025 but will be complete prior to implementation 11 Jul 2025
AIRAC Effective Date	10 Jul 2025	AIRAC 07/2025
Airspace Implementation	11 Jul 2025	Airspace available post AIRAC effective date

Table 2: List of main activities to be completed prior to implementation

3 Detailed Description of the Proposal and Impacts

3.1 Detailed Description of the Current Airspace and Operations

3.1.1 Controlled airspace

There is no controlled airspace in the immediate vicinity of SP-1 site, the closest is the airway that ends at Stornoway to the north, and two similar airways that end at the Inner Hebrides to the south-east. The proposed launch site is currently located within Class G uncontrolled airspace where pilots remain responsible for collision avoidance through lookout[41] and complying with the RoTA. Controlled airspace starts at FL195 above the proposed airspace fillet and D701 DA complex, except for those D701 areas that are to the west of 10º West. Here controlled airspace starts at FL55. The main use of this controlled airspace (over the NAT) is for transatlantic air traffic. The original design of the D701 DA complex was driven by the need to have a flexible, modular airspace structure extending outwards from the MOD Hebrides Range facility (target and ordinance launch pads) that could be activated area by area to accommodate the vast array of different systems being tested and trialled on the MOD Hebrides Range. This design further evolved to replicate the main upper air, ATS routes from the UK and Ireland, where these joined the OEPs at 10° west (see *Figure 5*). This alignment of the area boundaries to the ATS routes accounts for the unusual shape of several of the D701 areas. This

[41] Often referred to as 'see and avoid'

alignment enables the most efficient use of the airspace by minimising the number of routes and OEPs that would be unavailable when specific D701 areas are activated. This does have the consequential impact of occasionally having greater volumes of airspace segregated than is necessary to contain the 'Safety Trace'[42] of the systems being operated. It was considered the benefits of the alignment far outweighed the loss of usable airspace.

Since the D701 areas were re-designed (2014), the ATS routes have been discontinued and the upper airspace is now Free Route Airspace (FRA) where aircraft are permitted to fly more direct routes rather than navigating via numerous different way points. Although this means the criticality of having the boundaries of D701 aligned to air routes has been removed, the need to minimise impact on the OEPs remains. In essence, FRA still requires aircraft to route through the OEPs for their oceanic track and as such the routes flown under FRA are similar to the old ATS routes. It is understood that at some stage in the future, FRA will be introduced to the NAT thereby removing the need for OEPs.

The existing D701 Areas lie within Shanwick Oceanic Area and the Northern Oceanic Transition Area (NOTA). Here the ANSPs, NATS and AirNav Ireland, apply flight planning separation criteria to the boundary of the respective D701 Areas when active. The separation criteria applied east of 10° west is the standard 5NM radar separation criteria but once west of 10° west, NATS apply non-radar procedural separation of 30NM or 60NM for aircraft that cannot comply with the NAT Minimum Navigation Performance Specification (MNPS). AirNav Ireland apply standard radar separation criteria for the NOTA. It is noted that the procedural separation criteria are being reduced with the advent of Automatic Dependant Surveillance–Broadcast (ADS-B) capability in the NAT. This work continues to evolve within the ICAO working groups.

3.1.2 **SUA**

The main SUA adjacent to the proposed airspace fillet is the MOD Hebrides Range DA D701 complex that will in part be activated for SP-1 use; the size and shape of these areas remain unchanged. Other adjacent SUA can be seen in *Figure 6*, the nearest large construct being D713 and D901 (new MOD Fast Jet (FJ) areas), and D712 complex. It has been identified that, where these areas are activated at the same time as the D701 complex, this creates a 'choke point' for air traffic routing to the north. To mitigate this risk, existing airspace protocols are provided to prevent simultaneous activation. By using the same airspace protocols for D701 when active for SP-1 use, the same mitigations are implemented.

MOD FJ Area D713 sits over the eastern D701 DAs and the proposed SP-1 airspace fillet. However, this area is only activated during the MOD's biannual two-week exercise 'JOINT WARRIOR'. It is extremely unlikely that SP-1 rocket launches will occur during these periods of intense military flying activity largely due to lack of availability of the D701 areas and other restrictions. It should be noted that the CAA 1:500000 charts used in this document only show SUA below FL195; D713 for example, has a base level of FL245 and it therefore not depicted.

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

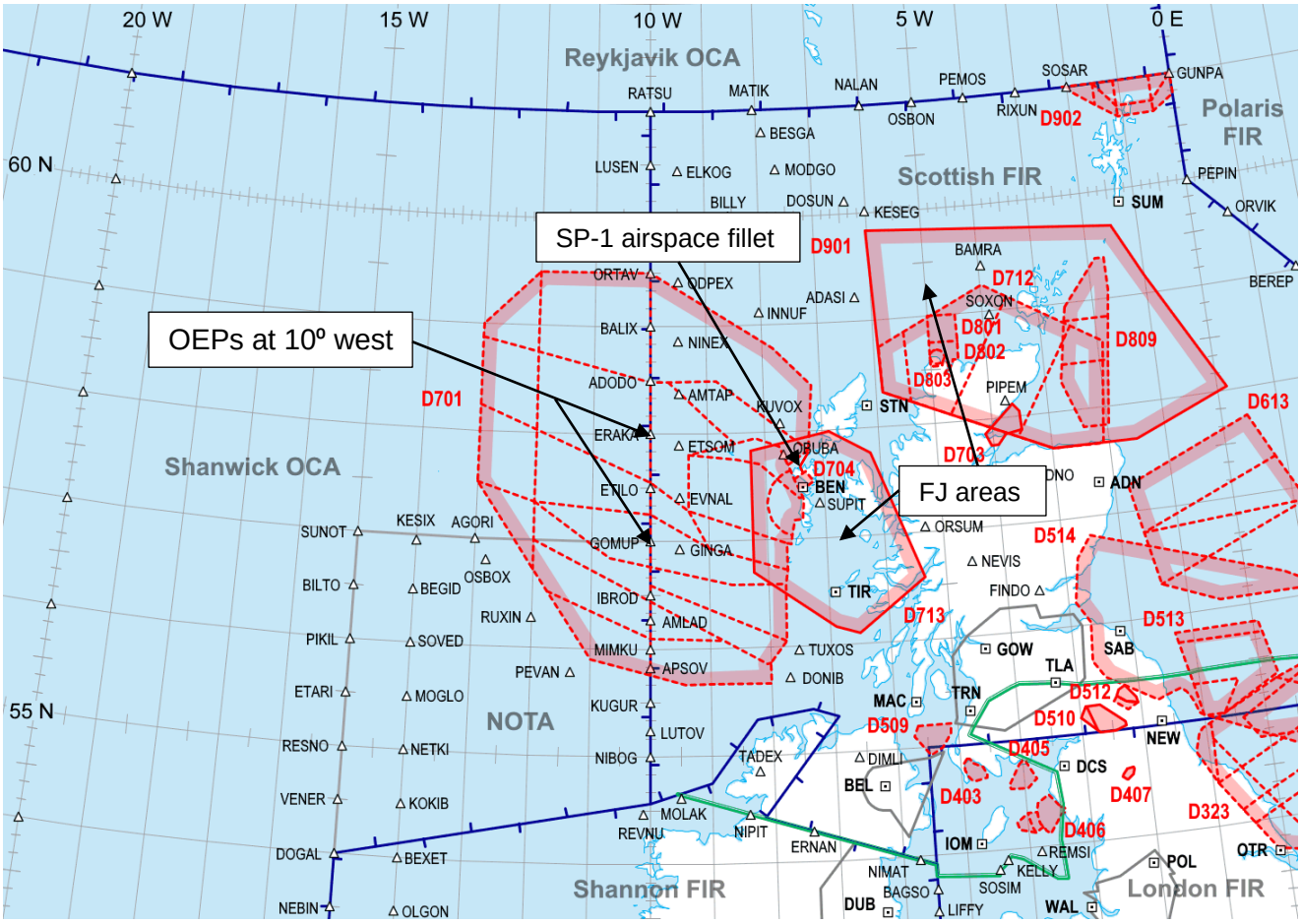

Figure 6: Diagram showing the position of SUA above 5000ft AMSL (in red outline) including the proposed airspace fillet around SP-1 and the 5LNCs OEPs at 10º west along with FJ areas D713 & D901 (Source: QinetiQ 2024).

3.1.3 **Instrument flight procedures**

Benbecula airport operates instrument approaches to two main runways namely runway 06 and 24; an extract of the approach charts for each runway contained within the AIP is shown at *Figure 7*. It can be seen that the activation of D701A and D701Y could impact on approaches to runway 06 however, runway 06 is used far less frequently than runway 24[43], the more favoured runway due to the prevailing winds from the south-west. Any disruption to instrument approaches is carefully managed to minimise the impact through existing coordination procedures between MOD Hebrides Range and Benbecula Airport ATC. By including SP-1 operations into the existing agreements and procedures for the MOD Hebrides Range D701 complex, enables exactly the same procedures to be applied when D701 is activated for SP-1 launches. These are contained within the LoA at Appendix B – Draft Letter of Agreement (2).

[43] Runway 06 is used approximately 33% of the year with runway 24 used 67% of the year (Source: Benbecula ATC).

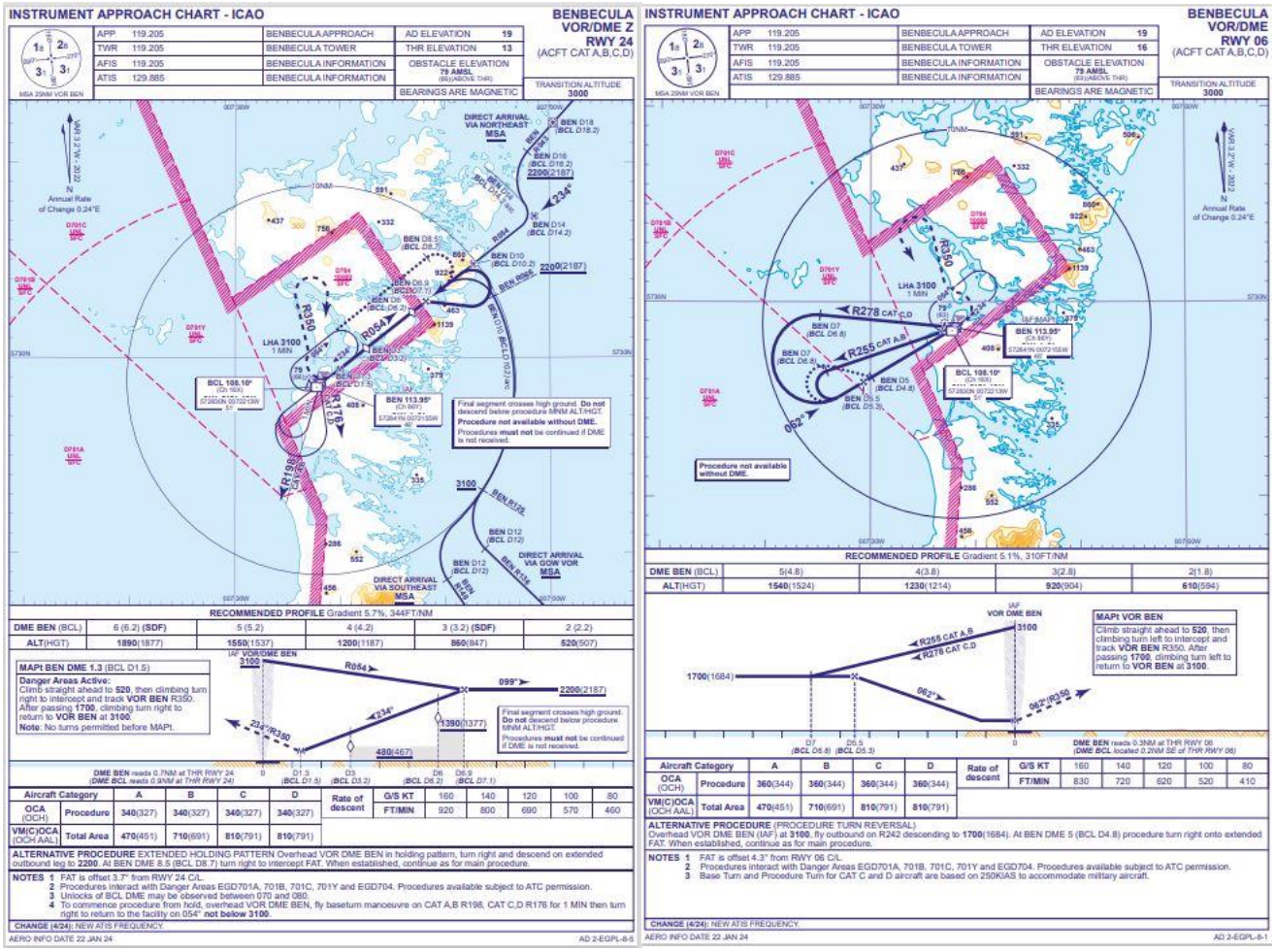

Figure 7: Extract from NATS AIP part 3 aerodromes depicting an instrument approach to both runway 25 and runway 06 (Source: NATS AIS change 4/24 dated 22 Jan 24).

3.1.4 **Airspace usage - Lower**

The SP-1 launch site at Scolpaig, North Uist has Benbecula Airport approximately 11 Nautical Miles (NM) to the south, Barra Airport 38NM south, the small beach landing strip at Sollas approximately 5.5NM to the east and Stornoway Airport approximately 58NM to the north east. The launch site is located between the MOD Hebrides Range SUA (DAs) D701 and D704 (see *Figure 11*). There is limited GA activity in the local area with this mainly concentrated during the Sollas annual fly-in event during the summer. Other aviation activity is minimal, comprising prominently of scheduled flights to/from Benbecula (circa average of 7[44] flights per day during the busier summer months), occasional helicopter activity supporting local hotels, fish farms and coastguard, plus medical and lighthouse support aircraft. Military aviation activity in the local area is primarily focused on trials and testing of systems on the MOD Hebrides Range D701 and training flights. The latter increase significantly twice a year for two weeks during the 'JOINT WARRIOR' Exercises and again for the biennial 'AT SEA DEMONSTRATION (ASD)/FORMIDABLE SHIELD (FS)' and 'ATLANTIC THUNDER (AT)' Exercises

[44] Details obtained from the main commercial carrier Logan Air and Hebridean Air Services, the latter fly to Benbecula twice daily three times a week.

(that each occur alternate years). This increase in military activity slightly escalates the use of Benbecula airport with military support aircraft. However, it is extremely unlikely that SP-1 launches will occur during these major exercise periods. A full breakdown of local aircraft movements is contained at Table 3 below. The evidence supporting the figures shown in Table 3 is contained at Reference [B].

Operator – Provider of Statistical Evidence	Approximate annual flights in region	Monthly Average	Comments
2Excel Aviation	30	<3	Fisheries protection & UK SAR
Northern Lighthouse Board (NLB)	24	2	Conducted inclusively 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, tasking & training flights
PDG Aviation	20	<2	Figure includes all NLB support flights therefore excluded from total.
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 provide 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.
Hebridean Air Services	312	26	2 daily flights between Stornoway and Benbecula 3 days per week.

Operator – Provider of Statistical Evidence	Approximate annual flights in region	Monthly Average	Comments
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	>1	Data obtained from QinetiQ contracted civil air traffic Range controllers (NATS)
AIRPROX Reports	0	0	UK AIRPROX board data
Total Number	2858	238	Excludes DA infringements and PGA Avn (latter included in NLB figure)
Total Number Excluding Scheduled Flights	290	24	Circa 24 'other[45]' flights per month

Table 3: Summary table of local area aviation operators - annual and average monthly flights (Source: Reference [B]).

It is evident from the data gathered and presented during Stage 2 of the ACP process that the assumption of 'limited GA activity in the local area' and 'low concentrations of air traffic, including GA, operating below 7000ft in the vicinity of the Outer Hebrides', is valid. This is substantiated by the fact Benbecula airport total aircraft movements are amongst the lowest of (bottom 10%) all UK airports. Moreover, there has been a steady decline in aircraft movements' year on year with 2023 recording 247 less movements than for 2022 about a 9% reduction, see *Figure 8* and *Figure 9*. Furthermore, 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 DA infringement data[46] and Air Proximity (AIRPROX[47]) data where the latter 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 22 years is in itself a reliable indicator that traffic levels are extremely low.

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

[46] This is where a DA operator reports an unauthorised air vehicle entering an active DA. MOD Aberporth Range recorded 116 infringements between 2012 and 2022 whereas MOD Hebrides Range recoded only 10 infringements for the same period. From these infringements the majority (circa 90%) for both Ranges, were aircraft operating below 7000ft. There were no GA infringements at the MOD Hebrides Range during this period; this compares to 32 infringements involving GA at MOD Aberporth Range.

[47] AIRPROX is the term used for airborne near misses where the safety of aircraft was compromised or not assured. AIRPROX data is gathered from pilots and/or controller's reports which is investigated by the UK AIRPROX board.

Aircraft Movements 2022

Table 3.1

	Total	<---------Commercial Movements--------->				<----------Non Commercial Movements---------->						
		Air Transport Total	Of Which Air Taxi	Positioning Flights	Local Movements	Test and Training	Other Flights by Air Transport Operators	Aero Club	Private	Official	Military	Business Aviation
London Area Airports												
GATWICK	217,622	214,034	16	2,799	4	129	183	-	-	28	1	444
HEATHROW	380,305	377,241	418	2,626	-	36	41	-	339	22	-	-
LONDON CITY	49,937	49,432	6,500	440	-	54	8	-	1	-	2	-
LUTON	118,063	86,592	-	405	8	33	1,042	-	110	36	-	29,837
SOUTHEND	26,624	1,478	420	201	805	1,601	63	10,742	10,495	331	129	779
STANSTED	176,914	159,531	777	4,635	1	66	861	-	-	146	73	11,601
Total London Area Airports	969,465	888,308	8,131	11,106	818	1,919	2,198	10,742	10,945	563	205	42,661
EDMISTON LONDON HELIPORT	9,012	2,847	2,847	2,220	273	-	872	-	2,475	30	78	217
Other UK Airports												
ABERDEEN	74,098	61,298	5,477	3,938	51	2,661	2,930	2,661	-	2	119	438
BARRA	1,274	1,238	2	2	-	6	-	-	26	-	2	-
BELFAST CITY (GEORGE BEST)	25,368	24,660	299	338	12	99	3	-	229	23	-	4
BELFAST INTERNATIONAL	49,942	38,634	411	577	-	164	4,419	-	-	862	5,275	11
BENBECULA	2,772	2,254	328	189	65	5	167	1	47	22	16	6

Figure 8: Airport movement statistics 2022 (Source: CAA).

Aircraft Movements 2023

Table 3.1

	Total	<---------Commercial Movements--------->				<----------Non Commercial Movements---------->						
		Air Transport Total	Of Which Air Taxi	Positioning Flights	Local Movements	Test and Training	Other Flights by Air Transport Operators	Aero Club	Private	Official	Military	Business Aviation
London Area Airports												
GATWICK	256,893	253,047	36	2,943	9	168	253	-	-	47	5	421
HEATHROW	456,600	454,374	309	1,881	-	15	86	-	228	9	7	-
LONDON CITY	52,101	51,561	3,072	411	4	124	1	-	-	-	-	-
LUTON	128,430	99,323	-	726	53	1	747	-	92	1	3	27,484
SOUTHEND	31,546	1,378	407	156	437	2,009	84	13,403	13,061	119	146	753
STANSTED	195,438	179,135	1,086	4,688	-	54	838	-	-	75	315	10,333
Total London Area Airports	1,121,008	1,038,818	4,910	10,805	503	2,371	2,009	13,403	13,381	251	476	38,991
EDMISTON LONDON HELIPORT	8,602	2,770	2,770	2,033	14	-	1,450	-	1,905	24	142	264
Other UK Airports												
ABERDEEN	73,442	62,480	5,984	3,253	174	2,713	2,683	1,923	-	6	78	132
BARRA	1,250	1,199	4	1	-	6	-	-	40	-	4	-
BELFAST CITY (GEORGE BEST)	29,282	28,683	366	341	4	22	10	-	208	4	4	6
BELFAST INTERNATIONAL	57,761	47,598	313	682	4	127	4,277	-	-	907	4,158	8
BENBECULA	2,525	1,918	17	74	28	-	331	2	73	-	47	52

Figure 9: Airport movement statistics 2023 with Benbecula showing a decline in numbers from 2022 (source: CAA).

3.1.5 **Airspace Usage – Upper**

The upper airspace (considered to be above FL195) in the vicinity of the airspace fillet and D701 DA complex east of 10º west, is almost exclusively used by aircraft transiting the NAT. This traffic generally falls into two main traffic flows that occur at different times of the day: namely; westbound flights (from circa 0900-1600) and eastbound flights (circa 0100-0800). These times are when the majority of aircraft transit the NAT. It should be noted that this is not a constant every day of the year as the

decision whether to route in/out of the UK airspace into the NAT across Scotland, Ireland or Cornwall depends very much on the position of the Jetstream. Analysis from 12 months NAT OTS data suggests that the Jetstream favours westbound traffic to route over Cornwall and Ireland during the summer months for two out of every three days (circa 66%); this is reversed in the winter months by a similar factor – the Jetstream favours westbound tracks over Scotland. An example of these routes in the summer can be seen in *Figure 10*. Evidence supporting this analysis can be found at Reference [C] paragraph 3.4.

The current use of the upper airspace is similar to 2019 pre-COVID levels therefore the analysis conducted during Stage 3 as part of the Options Appraisal (Phase II) (Full), using 2019 data remains extant. This data showed that 8309 flights crossed the SP-1 Area of Interest (AOI)[48] during 2019 with the busiest day recording 380 flights during a 10 hour period.

Figure 10: NAT OTS where the Jetstream favours a westbound flow out over southern UK and Ireland (Source: EUROCONTROL).

3.1.6 **Provision of air ATS**

As described above at paragraph 2.5.7, the upper air and NAT traffic is controlled by NATS and AirNav Ireland whom closely coordinate airspace closures with the MOD Hebrides Range when any of the D701 DAs are active. Planning and booking of the D701 areas is done many days in advance and usually firmed up and agreed the day before the activity starts, this is known as Day minus One (D-1). This enables the ATM and airline flight planning systems to react to the airspace restrictions such that flights are routed around the active DAs.

[48] AOI was defined (bounded by 56º north, 60.5º north, 14º west and 6.5º west) and a time window of 1000–2000 UTC was imposed on each day.

ATS are provided to aircraft in the vicinity of the Outer Hebrides by HIAL with air traffic controllers at both Stornoway and Benbecula airports – these services are non-radar services and only procedural separation is provide to aircraft flying under Instrument Flight Rules (IFR). Barra Airport does not have ATC available but advisory information is provided by a FISO. All three units coordinate their activity closely with the MOD Hebrides Range staff when the Range is active. For certain trials on the Range civil licenced air traffic controllers are utilised although they are only permitted to provide ATS to aircraft operating within the boundaries of the D701 complex.

3.1.7 Operational efficiency, complexity, delays and choke points

At the local level delays to aircraft arriving into Benbecula airport might be experienced on the rare occasions when access to D701A or D701Y is not available due imminent or actual Range activity. Activation of D704 (which is considered part of the D701 complex) has the biggest impact on Benbecula operations and for this reason special procedures and agreements apply – D704 is rarely activated and will not be used for SP-1 operations.

Occasionally, activation of the D701 DAs results in delays to fisheries protection and lighthouse support aircraft. However, these flights are normally coordinated to deconflict with Range activity and where this is not the case the Range can sometimes facilitate access to the active DAs where safe to do so (for example when a trial or test firing is temporarily suspended, delayed or the safety area does not extend to the full extent of the active DA).

For the upper air NAT traffic, activation of the D701 areas, especially where a large number of the areas are activated, can result in some delays or extended flight times for transatlantic air traffic. Where a large number of OEPs are made unavailable due to Range activity this can cause choke points through other OEPs and may cause a restriction on the number of flights that can pass through the remaining available OEPs. For the large scale military exercises where all the D701 areas are active and the Range is extended beyond the current boundaries, sometimes as far as 30º west, significant delays can be experienced by NAT traffic with many having to reroute through Icelandic airspace where air traffic capacity may be limited. This may also induce choke points to the North of Scotland during the busy westbound periods when the Jetstream favours routing to the North of the UK.

This ACP does not invoke any changes to navigational aids or waypoints. It is considered that the existing 5LNCs will be sufficient for SP-1 operations and use of D701. Furthermore, the small size of the new airspace fillet does not warrant the need for any additional 5LNCs.

3.2 Detailed Description of the Changes to Airspace Design and Operation

The ACP is for a fairly small ‘fillet’ of airspace that sits between two existing SUA DAs, namely D701 and D704 to the south. For convenience, the initial airspace ‘fillet’ design (extending SFC to UNL) was a straight line between to Aeronautical Data Quality (ADQ) points connecting D701E with D704. However, during engagement with local operators it was evident that this convenient line (providing more than sufficient airspace to contain the hazards to aviation associated with rocket launch), had the potential to impact on the beach landing site at Sollas (see paragraph 2.8). Following extensive safety analysis and modelling of worst case scenarios, it was established that the eastern boundary of the proposed airspace fillet could be safely re-profiled and the design as shown in *Figure 11* was taken forward.

Additionally, it was identified that there could be a risk to SP-1 ground personnel conducting critical pre-launch activities, (such as arming/refuelling) from the sudden appearance of low flying aircraft, overhead. To prevent an unexpected distraction to such ground personnel, or potential High Frequency (HF) radio interference from low flying aircraft on the rocket systems, it is deemed necessary to have a small protection zone around the launch pad in the form of a DA. This small additional DA is centred on the launch pad and extends 1000m laterally from surface level to 3000ft above ground level (agl), (see *Figure 12*). This small DA may be activated several days prior to the rocket launch to enable ground personnel to conduct 'dry' launch runs. The area may also need to be active for extended time periods (several hours) before launch.

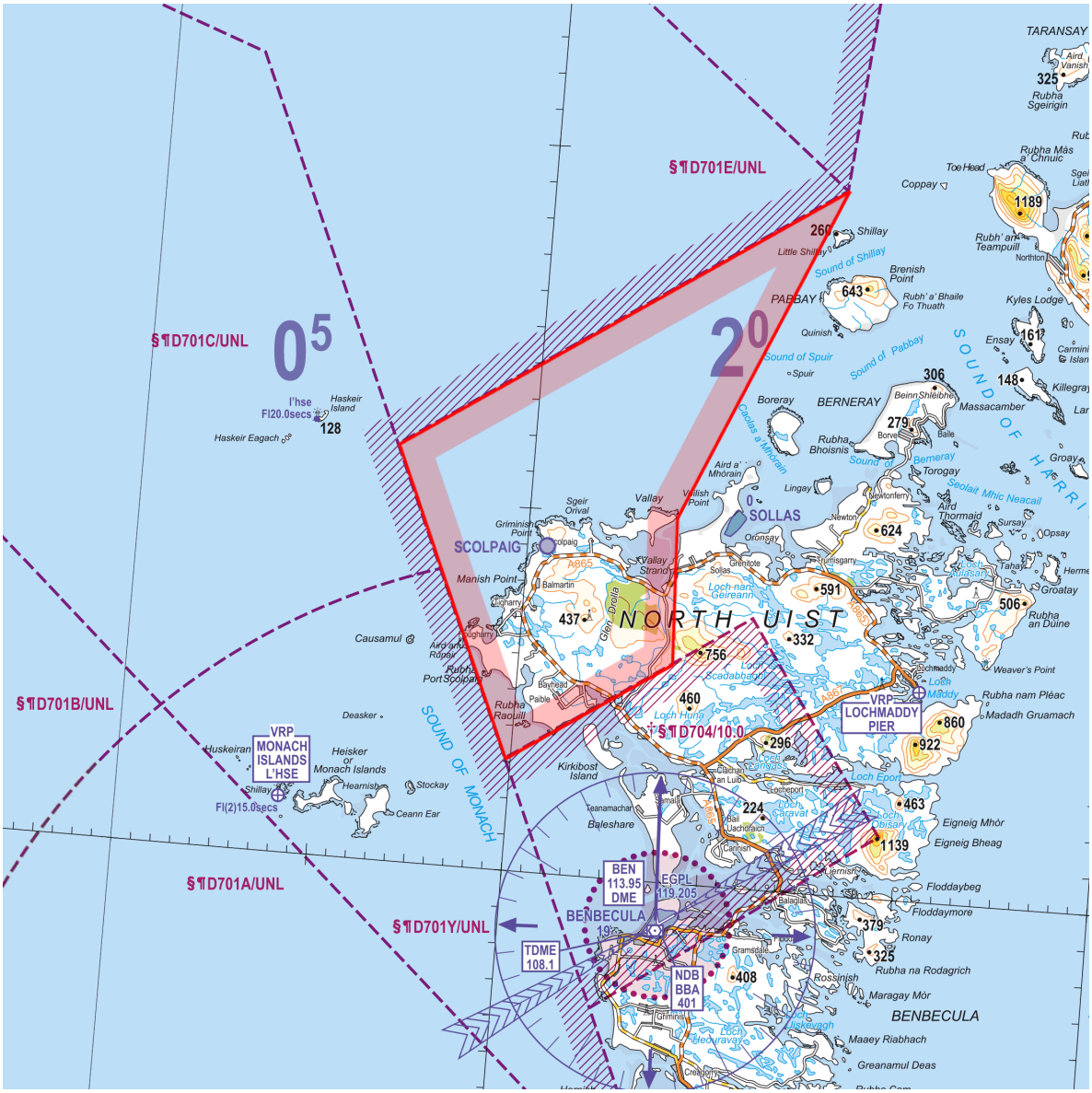

Figure 11: Airspace 'fillet' in red adjoining D701E, C & Y with D704 to the south; the launch site at Scolpaig and beach landing site at Sollas are marked in lavender with Benbecula airport circa 11 miles to the south (Source: CAA, Topographical Air Chart of the United Kingdom 1:250,000, Sheet 1 Northern Scotland West Edition 13 (2024)).

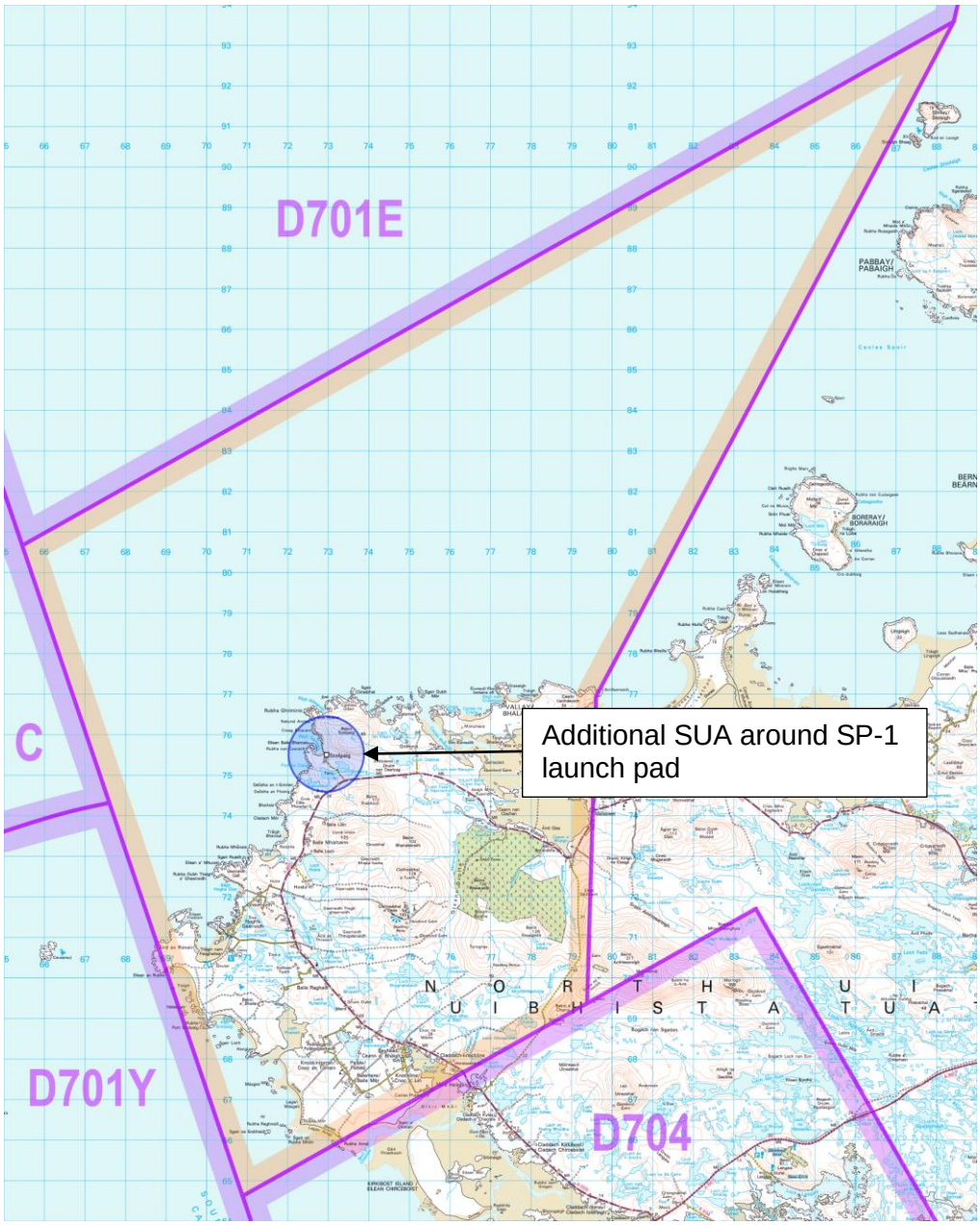

Figure 12: Additional area of SUA within the airspace fillet centred on the launch pad with a radius of 1000m extending from surface to 3000ft agl (Source: Ordnance Survey 1:50000 Landranger 18 Mapping Scotland 2024).

Furthermore, in accordance with the Air navigation (Amendment) Order 2021, there is a requirement to establish a FRZ around the launch pad of the Spaceport. This FRZ aims to prevent the unauthorised flights of unmanned aircraft in the vicinity of the Spaceport. It consists of a volume of airspace extending from SFC to a height of 2000 ft above the level of the Spaceport within the area bounded by a circle centred on the mid-point of the launch pad which has a radius of five kilometres (2.7 NM) as shown in Figure 13. The FRZ is permanently active.

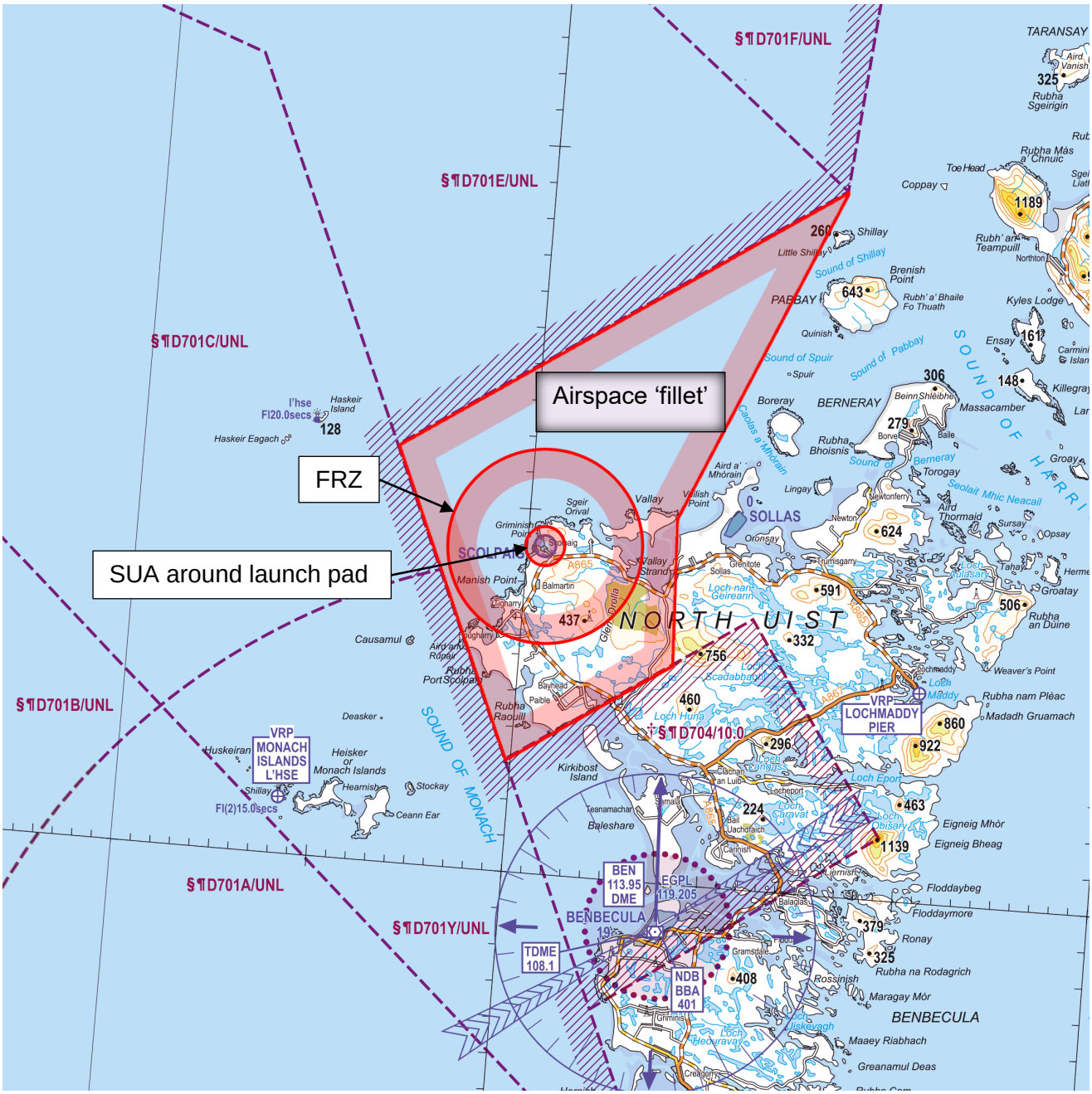

Figure 13: Airspace fillet with small additional SUA and FRZ shown in red outline (Source CAA, Topographical Air Chart of the United Kingdom 1:250,000, Sheet 1 Northern Scotland West Edition 13 (2024)).

3.2.1 **Hours of operation and seasonal variations**

Due to the limitations applied during the planning process for the launch site, it has been determined that launches will not happen at night or on Sundays. Planning restrictions limit the times of operation to: 0700-2000 Mon to Fri; and, 0700-1800 Sat. The DA will only be activated when required and the

airspace reverts to its normal background classification at all other times[49] (Class G and Class C). Planning conditions further limits the number of rocket launches to a maximum of 10 per year and it is anticipated that each launch could have a maximum of two spare days however, experience of operating similar systems on the MOD Hebrides Range would suggest that on average a maximum of one spare day is normally required therefore, the expectation is 20 airspace activations per year of approximately two to three hours in duration. This equates to circa 60 hours of airspace activation per year where the airspace may not be available to other users; this is less than 1% of the year.

The weather is likely to play a significant role in when launches can/cannot occur and it is anticipated that LV operators will opt to launch more frequently in the summer months than in the winter months, especially given the restriction on night launches. Although it is not possible to determine at this stage the frequency of launches, a seasonal variation is expected with circa 60% of launches in the summer (nominally Apr-Sep) with 40% occurring during the winter months (Oct-Mar).

It is intended that the airspace will be activated by NOTAM using existing notification procedures as used for the MOD Hebrides Range D701 DAs. This means the timings of the airspace activation and the exact D701 requirements will be determined at least 21 days in advance (referred to as D-21); this notification will be submitted as an airspace booking request to Prestwick Centre (PC) reservations cell who in turn may negotiate changes with MOD Hebrides Range to minimise the impact on civil operations. At D-5, the final agreed airspace request will be submitted and if the request has an adverse impact on the UK and Irish air traffic network, AMC UK will negotiate a solution with MOD Hebrides Range – any subsequent approval will be issued at D-5. NOTAMs are then published by the responsible agencies at D-1.

It is not predicted that the NOTAM period will exceed three hours and, the launch times are expected to occur after 1400 Universal Time Coordinated (UTC) (one hour earlier in the summer) so that the agreed (Reference [H] refers at paragraph C.2.2) maximum number of OEP closures in a year is not affected. Launches prior to 1400 UTC (one hour earlier in the summer) will normally be contained within the D701 areas that do not impact on OEPs. The small DA around the launch pad may be activated several days prior to the rocket launch to enable ground personnel to conduct ‘dry’ launch runs. The area may also need to be active for extended time periods (several hours) before launch – these timings will be largely driven by the LV provider and determined by their safety requirements.

Planned SP-1 launch activities will also be promulgated using ‘notices to mariners’ and notification processes used by the local Council as further detailed in Appendix 13.1 of the 2021 EIA report at Reference [G]. Additionally, the status of airspace activations may be obtained from the MOD Hebrides Range using the promulgated means of contact or through Scottish Information[50] on the published VHF frequency.

By restricting the majority[51] of rocket launches until the afternoon after 1400 UTC, minimising the launch window period and, where approved, conducting simultaneous activities alongside MOD use, the impact on the air traffic network can be minimised. The aim and objectives of the ACP can be measured against the DPs where the ACP meets the DP1 & 2 safety requirements by minimising the airspace necessary to safely launch rockets and have procedures in place to ensure safe operation.

[49] Note: The FRZ is permanently active.

[50] Scottish Information provide the SUAAIS.

[51] In particular those that may impact/close OEPs.

Furthermore, DP3 (minimising the impact on other aviation stakeholders) and DP4 (use Flexible Use of Airspace (FUA) principles) are fully met by the utilisation of D701 and extant safety planning processes in addition to existing procedures (expanded to include SP-1 operations) that are fully in the spirit of FUA. These extant processes and procedures also meet the requirements of DP6 (Flight Planning Buffer Zones (FBZs)) and DP7 the environmental impact of aircraft being re-routed around the airspace. As QinetiQ already manages and activates the airspace management at the MOD Hebrides Range (D701 complex), integration with MOD activity may be possible at times thereby minimising the overall airspace requirement and enabling efficient and swift transition from MOD use to commercial rocket use thereby fulfilling the requirements of DP5 integration/de-conflicting SP-1 activity with MOD activity in D701.

3.2.2 **Details of new, or modified, draft LoAs**

There are two aviation LoAs that describe the airspace management procedures and where applicable, the airspace protocols, for the MOD Hebrides Range. The Change Sponsor has proposed that SP-1 operations and use of D701 in this capacity, is included in these extant LoAs. This means SP-1 operations will be constrained to the same D701 airspace protocols[52] as the MOD, and all notification/booking procedures will remain the same, thereby significantly reducing the risk of error by operators. Signatories have agreed to changes that integrate SP-1 operations into both these existing LoAs. However, there remain outstanding actions that can only be resolved by the CAA (such as airspace protocols for space launch) and these are included in the LoA as assumptions that they will be completed ahead of the first launch. These LoAs are titled:

- Draft LoA between NATS (en route) plc – Scottish Control (Prestwick) And Shanwick Oceanic Area Control (Prestwick), MOD Defence Equipment & Support (DE&S), Civil Airspace Manager AMC UK Military Airspace Manager, Civil Aviation Authority (CAA) Safety & Airspace Regulation Group, Irish Aviation Authority (IAA) Director Safety Regulation, The Irish Air Navigation Service trading as AirNav Ireland (ANI) General manager Shannon ACC, QinetiQ Ltd (MOD Hebrides Range), and Comhairle nan Eilean Siar (CnES) – Developer of/on behalf of Spaceport-1.
- Draft Letter of Agreement Between Highlands & Islands Airports Ltd (HIAL), the MOD Defence Equipment & Support (DE&S) on behalf of MOD Hebrides and Comhairle nan Eilean Siar on behalf of Spaceport-1.

Draft updates to both these LoAs are contained at Appendix B – Draft Letter of Agreement (2) and Appendix C – Draft Letter of Agreement (3) to this document. A new LoA that enables commercial use of D701 for rocket launch has been developed and agreed by signatories:

- Letter of Agreement (LOA) Between MOD Hebrides Range, MOD Defence Equipment & Support (DE&S) And Comhairle Nan Eilean Siar (CnES) on behalf of Spaceport-1 (Sp-1) Concerning Activation, Usage and Operational Management of DAs.

This LoA is also contained at Appendix A – Draft Letters of Agreement (1).

[52] It is recognised that the current D701 ASM protocols are predicated on existing national priorities (specifically that the MoD is normally afforded priority), these are to be modified for SP-1 use of D701 accordingly.

3.2.3 Evidence that airspace design is compliant with ICAO standards and UK policies

As this ACP does not involve a change to controlled airspace, instrument approach procedures or the background classification of the airspace, it is considered that the ACP is compliant with ICAO standards and recommended practices. Furthermore, the ACP enables rocket launch and meets CAP 1711 (Airspace Modernisation Strategy (AMS)) objective of *"integration of diverse users"*; this includes rocket launch. Moreover, the AMS recognises that *"operators of commercial spacecraft and larger remotely piloted aircraft systems that require access to airspace will also gain that access through a reservation system, with separation managed in the same way as conventional piloted aircraft. The airspace requirements for the operation of spacecraft will be large, in order to provide suitable protection for the operation. This is likely to place restrictions on other airspace users, albeit for relatively short periods of time."* The SP-1 ACP aligns to the AMS with 'separation' being afforded through an airspace reservation system' by utilising the existing D701 DAs in conjunction with the new airspace fillet. Moreover, the SUA will only be activated for very limited periods throughout the year and those activations will, where at all possible, minimise the impact on the air traffic network thereby fulfilling the requirements of FUA.

3.3 Detailed Description of Anticipated Operational Impacts

3.3.1 Impact on the flow of IFR traffic (General Air Traffic (GAT) and Operational Air Traffic (OAT))

The activation of the small airspace 'fillet' and additional circular SUA around the launch pad are unlikely to have impact on IFR traffic as evidenced in Step 3A Options Appraisal (Phase II - Full) report [C]. Activation of D701 in support of SP-1 launches will impact mostly on GAT on the NAT OTS and those military aircraft operating at OAT in the NAT. Such flights will only be impacted when the D701 areas are active (for SP-1) and this is likely to be no more than 20 occasions per year for about three hours at a time. The impact on both GAT and OAT will be further mitigated through the airspace management protocols and LoAs that determine when rocket launches can/cannot occur.

3.3.2 Impact on VFR Ops

The small proposed airspace fillet is unlikely to impact on VFR traffic given the very light traffic levels in the region (see Table 3) and the limited activation of the airspace, approximately three hour windows circa 20 times per year. VFR traffic joining Benbecula airport from the north for runway 06 may need to make a slight deviation in their track when the airspace fillet is active however, this deviation is considered to be insignificant.

3.3.3 Impact on existing procedures and airspace/airport capacity

There is the potential for certain procedures at Benbecula airport to be impacted when the D701 DAs are activated in support of SP-1 operations. The impact could potentially affect instrument approaches to runway 06 and missed approach procedures to runway 24. As runway 06 is used less frequently than runway 24 (see paragraph 3.1.3), this impact is considered minimal. Furthermore, this slight impact can be mitigated through current Concept of Operations (CONOPS) contained in the LoAs. The CONOPS, which will be used for SP-1 activities, facilitates minor delays to either Range activities or

commercial flights depending upon the circumstances at the time. Furthermore, access to the active DAs is often accommodated[53] by the Range when it is safe to do so.

There are no expected impacts on airport capacity or need to change existing airport procedures.

3.3.4 Impact on aerodrome and other aviation activities within or adjacent to the area of the proposed change

As detailed in the previous two paragraphs, it is highly unlikely 'other aviation activities' will be impacted by the activation of the proposed airspace fillet[54]. Furthermore, the impact on Benbecula and Barra Airports is minimal and mitigated through existing procedures and CONOPS contained in the relevant LoAs (see Appendix B – Draft Letter of Agreement (2)).

3.3.5 Flight planning or navigational requirements

The NOTAMs issued for activation of the new SUAs and that of D701, will initiate flight planning restrictions for NAT air traffic when any OEP is unavailable (closed). FBZs will also be applied to ensure safe separation of such flights from the boundaries of the active DAs. These processes already exist in the flight planning systems and these will need a minor update to include the addition of the new airspace fillet.

3.3.6 Details of any changes to the provision of ATS

There should not be any changes to the provision of ATS as a result of this ACP.

3.3.7 Impact of traffic mix and workload of operations

There is likely to be a slight increase in workload for NATS controllers when D701 is activated in support of SP-1 operations, however this should not be significant given the limited number of airspace activations expected per year (max of 20). Moreover, the processes and procedures pertaining to the airspace closures are well understood and regularly practiced by both Range and ATC staff – one of the significant advantages of utilising an existing airspace structure for SP-1 rocket activities.

3.3.8 Consideration of access requirements of other airspace users in accordance with the type and classification of the airspace structure, including details on the ability to support the provision of ATS in accordance with the nature of the operation and classification of the airspace

Airspace access will be afforded when safe to do so – this is a standard operating procedure for the MOD Hebrides Range as described above in paragraph 3.3.3. The fact the airspace retains its background classification, Class G and Class C above FL195, means airspace access is only limited

[53] Such instances could be where the launch is delayed due to a technical issue, weather limitations or the Range area (nominally over the sea) is fouled by third party activity. Although the airspace remains 'activated' as promulgated, as no actual hazard exists, aircraft are often 'cleared' into the Range for a specified period.

[54] It is noted that the FRZ will impact on certain unmanned aircraft operating in the immediate vicinity of the Spaceport.

when it would be unsafe for other airspace users to enter. For the vast majority of the time (99% of the year) access to the airspace fillet and associated D701[55] areas activated for SP-1 operations, is unrestricted. This was the main driver for using SUA over any other airspace classification. A full breakdown of the proposed airspace types that were considered together with the rationale for SUA is contained within Section 3 paragraph 3.14 of Reference [B].

3.3.9 Consideration on connectivity to the ATM network

This airspace does not need to be connected to the ATM network – connectivity to the D701 DA complex is however essential.

3.4 Supporting Infrastructure and Resilience

The current infrastructure at MOD Hebrides Range provides the supporting infrastructure for SP-1 in addition to the Spaceport site infrastructure. New communications links between the Spaceport and the Range are under development and resilience will be part of this programme. The Range infrastructure already has resilience built into its surveillance, tracking and communications systems several of which are designed, operated and maintained to both civil and military air traffic control standards.

3.4.1 Communications equipment and services including operational coverage and frequencies

MOD Hebrides Range already has the necessary communications and tracking systems to support rocket launch from SP-1 and coverage over the SP-1 airspace fillet and D701 DA complex. Work is being undertaken to include new links to the SP-1 site – these works will need to be completed prior to the first launch.

3.4.2 Matters relating to conventional navigation equipment and services

The ACP and associated use of D701 DA complex should not have any impact to existing navigational equipment or services.

3.4.3 Matters relating to satellite-based navigation equipment and service

The ACP and associated use of D701 DA complex should not have any impact to existing satellite-based navigation equipment or services.

3.4.4 Matters relating to surveillance equipment and services

MOD Hebrides Range has the necessary surveillance equipment in place to support SP-1 rocket launches. The new airspace fillet will need to be included in the surveillance systems mapping updates prior to the airspace being available next year. Range control at the MOD Hebrides Range will be extended to cover the SP-1 airspace fillet when active.

[55] It should be noted that although the airspace fillet may only be active for 1% of the year, the D701 areas are frequently activated for MOD use in addition to any SP-1 use.

3.5 Regulations, Policies and Harmonisation

The airspace design, being SUA and only being activated when needed, meets with the FUA concept as described by ICAO and developed by EUROCONTROL thereby meeting one of the key AMS objectives. The airspace design follows the CAA Safety and Airspace Regulation Group (SARG) policy statement for the establishment and operation of SUA dated 12 February 2024 [D]. The MOD remains the SUA 'authority' for the D701 DA complex and use of the airspace by SP-1 requires SUA authority approval. QinetiQ will be the SUA authority for the new proposed airspace fillet and additional small SUA around the launch pad. QinetiQ MOD Hebrides Range staff already meet the requirements of CAP740 Chapter 9 'FUA Oversight' through the application of the following:

- QinetiQ's robust safety management framework, occurrence reporting, evaluation and validation of all new SUA activities;
- efficiency of the D701 airspace design and activation process to minimise impact on the air traffic network through careful selection of activated areas and only using the minimum required to assure safety;
- activating airspace only when needed through the NOTAM process and cancelling NOTAMs as soon as safe to do so when SUA is no longer required;
- providing the appropriate notification and FUA procedures in accordance with extant LoAs;
- utilising ASM processes and procedures that are fully integrated with the systems and processes employed by the UK AMC and the EUROCONTROL Network Manager (ENM) enabling the harmonised and dynamic planning of the ATM network; and,
- provision of a SUA activity information service through NATS SUAAIS.

These procedures will be extended to include the two new proposed SUA areas around the SP-1 launch site such that they too will be 'AMC Manageable'. Furthermore, the CAA have confirmed that QinetiQ is considered an 'approved Agency' authorised[56] by the state to deal with an AMC for airspace allocation and utilisation matters as prescribed in the EUROCONTROL European Route Network Improvement Plan (ERNIP) Part 3.

Sub-orbital rocket launch falls under the CAA descriptor for Other Munitions and Explosives (OME) with regard to the safety buffer policy. This means the ANSPs are required to apply a 1NM safety buffer to the edge of the SUA. The appropriate safety buffers through the provision of FBZs and/or ATS route procedures are already in place for the D701 complex but will need to be added for the new proposed airspace fillet (see Appendix E – Draft AIP Entry).

3.6 Safety Analysis[57] – Factors Affecting Determination of Airspace Fillet Parameters

The safety assessment for this ACP focusses on the operation of sub-orbital rockets launching from the SP-1 site into the existing D701 DA complex and the defining of the airspace fillet boundaries.

[56] Although an approved agency, it remains unclear if this encompasses commercial rocket launch.

[57] Note: This safety analysis section is supported by a detailed document that is contained at Appendix D – Additional Safety Information. This supporting document contains commercially sensitive information that cannot be contained in the main body of the report but provides the regulators with supplementary information to verify the safety arguments and statements made herein.

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 11* present the maximum reasonable geographic extent of the region within which credible hazards to aviation could occur due to rocket launch and flight activities.

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 SUA volume 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 DAs over land that are there to safeguard aviation and do not indicate that a threat to personnel on the ground exists. D704 over Benbecula airport is a good local example. This airspace is activated when there is a risk to other airspace users; the metrics used to consider 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 defined SP-1 site land area.

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 LV 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/approvals when these strict safety criteria are met.

3.6.1 **Generic risk to other airspace users**

There are two generic risks to other airspace users from launch activities:

- collision with a sounding rocket during a nominal flight profile – this is where the sounding rocket flight is following the intended path; and,
- collision with all or parts of a sounding rocket that has failed – this is where a sounding rocket fails to follow the intended flight path and/or fails explosively on the launch pad or in flight.

In both cases, it is vital that risk is managed such that other airspace users are not exposed to additional hazards associated with the activities, and the most effective way to achieve this is to segregate the sounding rockets from other airspace users through the establishment of SUA.

When designing the dimensions of the SUA (airspace fillet), both generic risks are considered. The shape of the fillet is determined by these risks but also by the proximity of the existing DAs, D701 and D704. The aim of the fillet is to provide segregated airspace connectivity to the D701 complex to the north and west. Any hazards existing beyond the western or northern boundary of the fillet can be safely segregated by activating the appropriate D701 areas. It is not intended to use D704 to the south but the boundary of D704 provides a convenient demarcation line for the southern boundary of the fillet; this boundary line is more than adequate to contain all credible hazards as depicted in Figure 11. Therefore, the line of most significant interest is the eastern boundary of the fillet.

The following safety analysis is based upon the experience of QinetiQ in supporting numerous large area weapons firings on the MOD Hebrides Range, including the 16 suborbital rocket launches conducted there since 2015. This allows an assessment of what safety areas are achievable in practice. For the purpose of this assessment, QinetiQ are considering the maximum fillet that might reasonably be required for a launch.

Collision with a sounding rocket during a nominal flight profile – Nominal flight profiles include all of the numerous possible minor variations to the intended flight profile, all of which would be considered to meet the mission parameters:

- Unguided Sounding Rockets - Unguided sounding rockets adopt an initial flight path determined by the launch tower arrangement. In all cases, the launch tower will have an elevation (from horizontal) of 88° or less. Depending on the sounding rocket boost phase characteristics, it may remain essentially on the initial elevation angle for a short period of time but will be progressively and increasingly affected by gravity, having the effect of continuously reducing the elevation angle during the flight. Therefore, as all launch azimuths are west or northwest, no point on a nominal flight path can be further east than the position of the launch pad.
- Guided Sounding Rockets – For a guided sounding rocket, the launch may be canted to the west as for the unguided rockets; however, it is expected that in the majority of cases, the sounding rocket will be launched vertically (e.g. an elevation from horizontal of 90°).

The guided sounding rocket will assess its current flight parameters, compare these to the planned flight parameters and apply corrections in order to achieve the planned flight profile.

Wind drift effects for nominal launch flight profiles – During flight of non-exo-atmospheric projectiles, both powered and unpowered, it is possible for the trajectory to be affected by the presence of wind. A controlled projectile will be designed to compensate for deviations in planned trajectories caused by external influences, but it would be possible for wind effects to cause an uncontrolled projectile to exit from the airspace fillet in certain wind conditions.

The effect of wind on projectile trajectories is likely to be most significant when its forward speed is at its lowest, such as at ballistic apogee with a broadside wind, or during a near vertical launch. The amount of deviation caused will be dependent on, amongst other things:

- the projectile's incident airflow direction and speed (a combination of projectile airspeed and direction and wind speed and direction);
- air pressure; and,

- a coefficient, or aerodynamic derivative, known as the Longitudinal Moment (also known as Yaw Moment), which depends on the projectile's physical configuration.

Furthermore, if the speed of final descent is controlled by parachute, then once again the trajectory of that descent will be significantly affected by wind speed and direction.

The effects of wind on all phases of flight will be considered during the mission safety analysis for each launch. The analysis may show that under certain wind conditions, there will be an unacceptable probability of the projectile exiting the airspace fillet. Wind conditions would be assessed on the day of launch and the launch delayed or aborted if the calculated safety limits were exceeded. Therefore, for any launch, the probability of wind related excursion from the airspace fillet will be reduced to be as low as reasonably practicable to ensure that airspace users outside the airspace fillet will not be exposed to any unacceptable risk.

Conclusion for nominal launches – The main risk to other airspace users is therefore determined to be downrange, which is a sector from the southwest to the northwest of the launch pad location. The airspace fillet, by connecting to the D701 DAs, ensures adequate segregated airspace to contain all credible hazards. As the trajectory of the rockets will always be in this westerly sector, the airspace to the east of the launch pad does not need to be as big and only needs to be of sufficient volume to contain a rocket vehicle failure as described in scenario 2 and 3 below.

Collision with all or parts of a sounding rocket that has failed – A failed or "off-nominal" sounding rocket is any one where the rocket fails to complete a full nominal flight profile. There are several possible failure scenarios, each of which could cause a hazard to airspace users. Considering these in turn we have:

- a sounding rocket exploding on the launch pad;
- a sounding rocket exploding during an otherwise nominal flight;
- a sounding rocket deviating from the nominal flightpath and exploding; and,
- a sounding rocket deviating from the nominal flightpath and remaining in one piece.

Explosions may be due to a failure or due to flight termination; however, the cause is not critical to this assessment.

Scenario 1: Sounding rocket exploding on the launch pad – To examine the risk associated with a sounding rocket exploding on the launch pad, the largest sounding rocket anticipated to be launched from SP-1 may be considered as the worst case. This rocket is an 11 metre guided vehicle with a propellant mass of circa 1.5 tons. Utilising the United States (US) FAA and US Department of Defence (DoD) methodologies for calculating Hazardous Fragment Distances (HFD), this sounding rocket attracts a safety zone of approximately 426m radius from the pad as depicted in *Figure 14*.

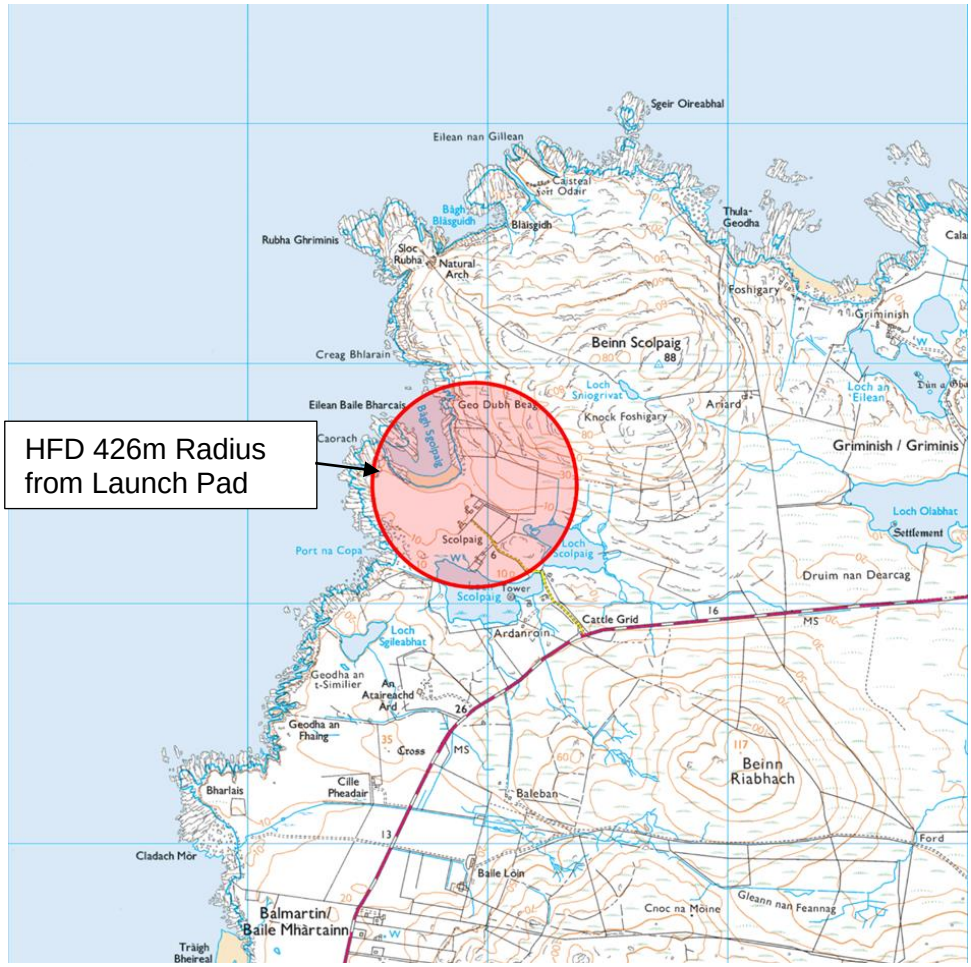

Figure 14: Diagram Depicting Indicative HFD Following Catastrophic Sounding Rocket Failure on the Launch Pad (Source: OS 1:250000 Map Explorer 454 Mapping Scotland 2023).

Scenario 2: Sounding rocket exploding during the ascent phase – When considering a sounding rocket exploding during the ascent phase the normal safety approach is to model the dispersion of fragments for a rocket exploding at a series of points during the boost phase, for a variety of wind/atmospheric conditions. The analysis used for this scenario is the same worst case rocket identified above, on the planned flightpath, which has been modelled for explosive failure at 10, 20 and 30 seconds after launch during the 'worst case wind conditions' (considered to be the maximum wind velocity that any rocket can be launched in). This debris field analysis was then cross referenced with the sounding rocket safety data provided for use on the MOD Hebrides Range; both were similar. The comparison of data provided confidence that the maximum dispersion of debris following catastrophic failure after launch would be wholly contained within the airspace fillet. It should be noted that the ground safety footprint might preclude rockets being launched in certain wind conditions where this causes debris to fall over the land areas outside the boundary of the SP-1 site.

Scenario 3: Sounding rocket deviating from the planned flightpath due to a failure, and exploding either due to a failure or due to flight termination - This situation combines two types of failure, namely the sounding rocket deviating from its nominal flightpath and either breaking up (due to a sudden dynamic deviation causing structural failure), or being flight terminated (explosively) having deviated from the planned flight path by a predetermined distance and/or for a predetermined time.

These distances and times will be launcher specific and all the relevant data will be evaluated for each launch on a case-by-case basis. However, discussions with operators and the experience gathered on the MOD Hebrides Range supports using a time of 5 seconds between deviation beginning and the initiation of flight termination.

Due to the nature of sub-orbital launches, the rockets used are either unguided or, for guided systems, are capable of course correction but should not be considered manoeuvrable. The effect is that while the deviation flightpath may, over time, result in a significant positional change from that planned, in 5 seconds the deviation from the nominal flightpath will be relatively small.

Sounding rockets, even guided versions, are designed to withstand thrust along the axis of the rocket. Note that: despite the name, guided sounding rockets are only capable of gentle course correction (low g manoeuvers). While there is some inherent capability to withstand off-axis thrust, the drive to minimise vehicle weight and their pencil-like shape makes manoeuvrability very limited. Sudden changes of direction will therefore cause structural failure of the vehicle and it will break up rather than achieving a significant deviation.

Low g deviations at very low speed, close to launch, may result in a more significant change of direction in a short time; however, the distance travelled will be small due to the low speed. As the speed rises, low g manoeuvers will inherently move the rocket less and less distance off its flightpath within the flight termination time allowed. This is one reason why unguided sounding rockets use launch rails – lateral deviation is constrained until speed has risen significantly.

The result is that this scenario does not change the proposed airspace fillet as the debris would still be contained within the same area from the launch pad or, will be sufficient distance down range from the launch pad that the debris will be contained in the D701 DAs (over the sea).

Scenario 4: Sounding rocket deviating from the planned flightpath, due to a failure, and remaining unitary – Unguided sounding rockets all launch from rails pointing downrange. Barring catastrophic failure early in flight, covered in scenarios 1 and 2, all of their hazards are inherently constrained to a downrange footprint. Even in failure cases such as the loss of a fin, the rocket will break up downrange. There is therefore, no credible risk from an unguided sounding rocket to airspace users outside the airspace fillet and associated D701 areas.

It is expected that guided rockets will always be fitted with flight termination systems to mitigate the hazard created by their inherent capability to achieve a slow and steady deviation from their nominal trajectory (given that they enter an appropriate failure mode). Therefore, the flight termination system becomes an integral part of the overall safety analysis process associated with guided rockets. Each guided rocket system will also be extensively tested before use and will need to meet specific legislative requirements associated with the rocket operator's licence so the risk of failure is reduced. Similarly, the flight termination system will undergo extensive testing and pre-flight checks; based on experience of utilising such systems at QinetiQ managed Ranges, failure of these systems is considered a low probability event. The flight termination system may be initiated by the guidance system and/or by personnel controlling the rocket system. While there might be a trigger from the flight control computer to the flight termination system, these are required to be separate systems and therefore the failure of both will require independent simultaneous failures to prevent operation. The chance of these failures

occurring at the same time reduces the probability of an unterminated deviating rocket leaving segregated airspace, to 'incredibly low[58]'.

3.6.2 Additional SUA around launch pad

The safety assessment to establish the size of the additional small SUA around the launch pad (to protect SP-1 ground personnel – see *Figure 12*) is based on experience gained at the MOD Hebrides Range launching similar (albeit older sub-orbital rocket systems) to those that can be expected to be launched from the SP-1 site. At the MOD Hebrides Range a ground safety hazard was identified for personnel working during the pre-launch preparation phase of LVs. It was recognised that the old technology being used in these LVs was susceptible, (at certain stages of set-up), to RF interference from low overflying aircraft that could create a harmful incident to ground personnel. Furthermore, the sudden appearance of a low flying fast jet and associated noise, could be a distraction that, if occurring during a critical stage of operation such as refuelling or arming, might induce a safety risk resulting in serious injury or death. The solution to minimising the risk to ground personnel posed by low flying aircraft, is to establish a small area of SUA around the launch pad of sufficient dimensions to reduce the risk. Using the examples of similar airspace designs in use at the MOD Hebrides Range a SUA of 1000m radius extending from SFC to 3000ft agl was considered appropriate.

3.7 Environmental Assessment

Introduction - The environmental effects associated with this airspace change comprises of two elements namely the 'direct impact' caused by a rocket launch from the SP-1 site at Scolpaig and the 'indirect impact' caused by re-routing of air traffic around the new airspace fillet and associated D701 DAs activated in support of SP-1. It is important to note that the direct environmental impact is the same for all proposed airspace options – the shape and size of the airspace design does not alter this impact. Furthermore, evidence from the EUROCONTROL modelling comparing the three options taken forward from Stage 2, strongly suggests the indirect environmental impact is no different between the three options; this is evidenced in the Step 3A Options Appraisal (Phase II – Full) report at Reference [C]. The environmental impacts and assessments have not changed from those detailed in the Step 3A Options Appraisal (Phase II – Full).

3.7.1 Baseline scenarios and traffic forecasts – 1 year and 10 year

10-Year Forecast Traffic Levels – CAT - This forecast is based on the EUROCONTROL traffic forecast update for Europe 2023-2029, as shown in *Figure 15*, and extrapolating the 'Base scenario' shown in blue out to 2035 (10 years post expected airspace implementation). On that basis, it is forecast that the percentage growth in traffic is circa +2% until 2027, thereafter it reduces to +1% annually; this is considered to be the most accurate assessment of future traffic levels available.

[58] Incredibly low is a safety term used where the probability of such an occurrence happening is so small that it is considered acceptable by International safety bodies and the UK Health & Safety Executive (HSE).

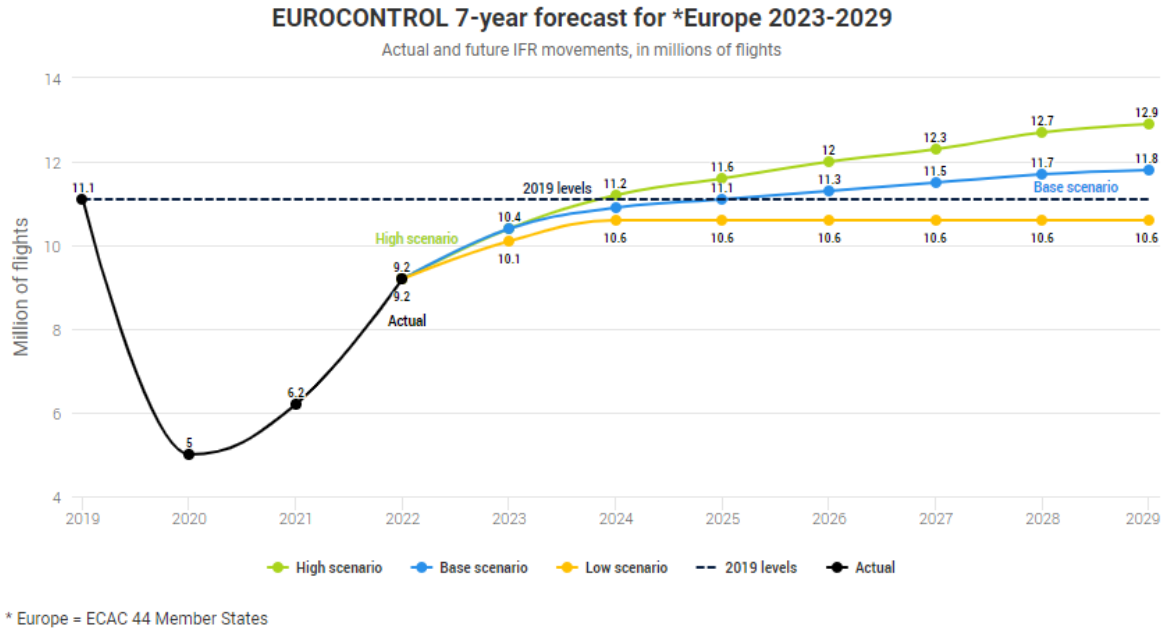

Figure 15: EUROCONTROL 7-year forecast for traffic levels. (Source: EUROCONTROL 2023).

Using the EUROCONTROL predictions, it is reasonable to assume that the number of affected flights as a result of this airspace change could increase from 1011 (as derived in paragraph 3.7.6 below) to 1152 flights (using the above growth rate) in 10 years' time[59]. Assuming a proportionate increase in fuel burn and CO_2 emissions, this suggests that the additional annual CO_2 emissions arising from this ACP would have risen to 802.7 tonnes[60] by 2035. However, this does not take into account the development and introduction of more environmentally friendly aero engines and the use of bio-fuels, both of which will reduce the carbon footprint for aviation.

3.7.2 **Estimated impact on flights below 7000ft**

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. It has been determined that the daily scheduled flights to/from Benbecula (not normally more than three to four arrivals per day) will only be impacted by the subsequent activation of the D701 areas (namely D701A and D701Y) when runway 06 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 DAs, when safe to do so, even when active. Experience launching similar rockets from the MOD Hebrides Range has shown that the launch can 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 (circa 2-3 hours). Therefore,

[59] Assuming ACP implemented in 2025.

[60] In 10 years' number of flights increased to 1152, (1152–1011) = 141 additional aircraft/flights affected
Extra distance is 141 × 22.8 km = 3,215 km
Extra fuel burnt is 3215 km x 9.61kg/km = 30,896 kg (circa 30.9 tonnes)
CO_2 emissions is 30.9 tonnes x 3.18 = 98.3 tonnes of CO_2. 98.3 + 704.4 = 802.7 tonnes CO_2 by 2035.

during these delayed launch periods it is possible to allow aircraft safe access to the DAs, in particular any scheduled flights. Furthermore, immediately after launch when the rocket has cleared the airspace fillet and D701A and Y areas, access may again be permitted as the rocket will no longer pose a hazard to aircraft in those areas. In all cases, the airspace will be de-activated as soon as 'splash down' has been confirmed and/or all hazards, including debris hazards, are known to have ceased. It is concluded that the commercial flights operating to/from Benbecula and Barra will rarely have to fly any additional track miles due to the airspace activations in support of SP-1. This means there will be little or no increase in CO_2 emissions or changes to normal noise patterns created by these flights[61].

Other flights potentially affected by activation of the airspace fillet and associated D701 areas are primarily: helicopters supporting the local lighthouses, fisheries protection aircraft and those supporting the emergency services – see Table 3. All will receive prior notification of the airspace activations (as is current practice for the D701 areas); this will enable them to plan and coordinate their sorties in advance, thus avoiding any additional fuel burn due to the airspace restrictions being in place. Emergency flights[62] will normally be afforded priority to enter the active airspace where it is safe to do so; this could mean delaying the rocket launch until the emergency aircraft are clear.

It is therefore concluded that the airspace fillet, small DA around the launch pad and any associated activation of D701 areas will not alter the current baseline environmental impact or noise created by flights in the local area operating below 7000ft. More detailed evidence to support this conclusion is contained in 'Version 3 Stage 2B Options Appraisal (Phase I) Initial' at Reference [B].

10-year local traffic forecast - It is thought that demand for passengers and cargo flying to Benbecula may increase slightly with the advent of the Spaceport, as personnel transit to/from the mainland and rocket equipment/support items are brought in. Local businesses (hotels and shops) should also benefit from the increase in personnel living on the islands, this will also increase supply chains. There may be a slight increase in helicopter support traffic where these are needed to recover any elements of the sounding rockets, although the details remain imprecise at this stage and it is too early to monetise any of these effects. Furthermore, there is insufficient data available to predict what if any increase there will be in commercial flights or other helicopter support flights. It is considered that it is likely the aircraft flights in the local area (below 7000ft) will remain largely unchanged from those detailed in paragraph 3.1.4 above. Scrutiny of the CAA published aircraft movement figures for Benbecula Airport over the past 10 years would indicate a steady decline in aircraft movements from a peak in 2018 of 3650 movements to a trough in 2022 of 2772 movements. It is evident that from 2012 to 2019 annual aircraft movements were averaging at circa 3500 movements per annum, with a steady decline thereafter. It is therefore determined that even with a slight increase in aircraft movement as a result of the SP-1 facility, it is unlikely these will surpass the 2012-1019 annual average as there is no evidence to suggest any increase in aircraft movements over the next 10-11 years.

3.7.3 **Noise**

An EIA was undertaken in accordance with the Town and Country Planning EIA (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

[61] Traffic patterns for Benbecula airport and the beach landing site at Sollas are reproduced in the Stage 2B initial Options Appraisal (Phase I) at Reference [B].

[62] These are often referred to as Category A flights.

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 References [G] and [J].

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 for 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.

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.

Launch noise – The predicted noise level contours illustrated on *Figure 16* 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.

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[63] 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 vehicle anticipated at the site are illustrated against human receptors in *Figure 16* and against the tranquillity receptor of South Lewis Harris and North Uist National Scenic Area (NSA) in *Figure 18*.

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

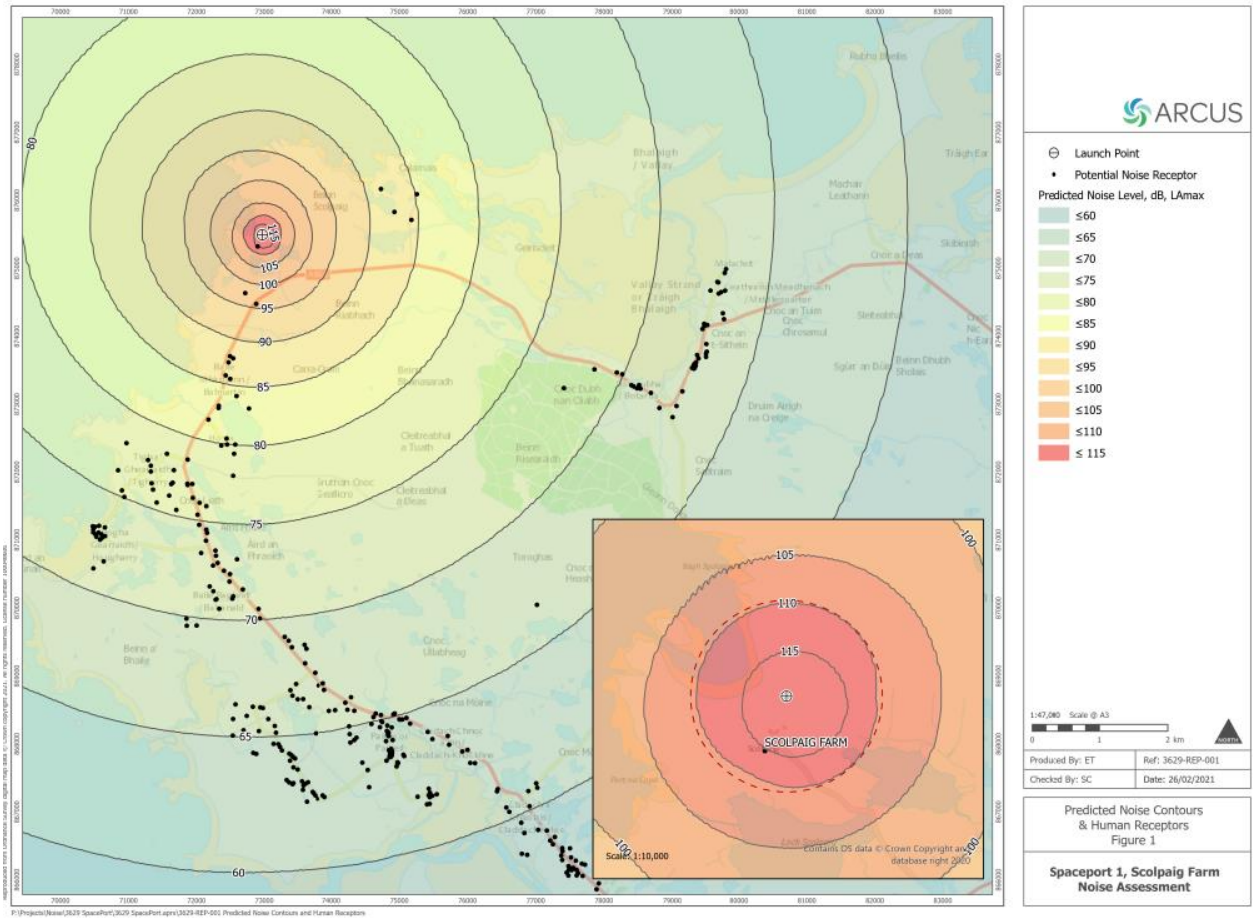

Figure 16: Predicted noise contours and human receptors (dwellings marked in black). (Source: Atlantic58 EIA).

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 17* below.

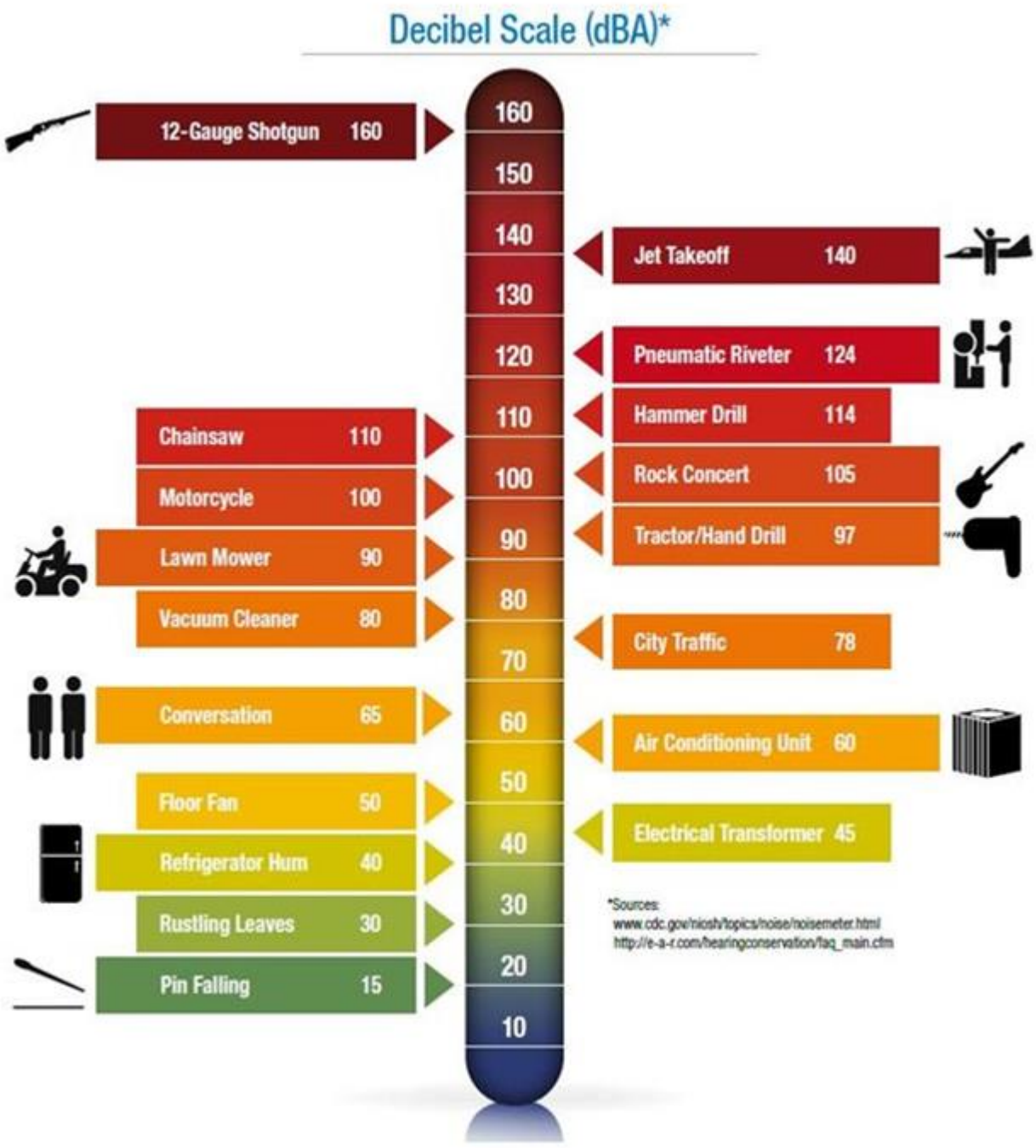

Figure 17: Chart showing noise created by different activities as measured in decibels (Source: US centers for disease control and prevention).

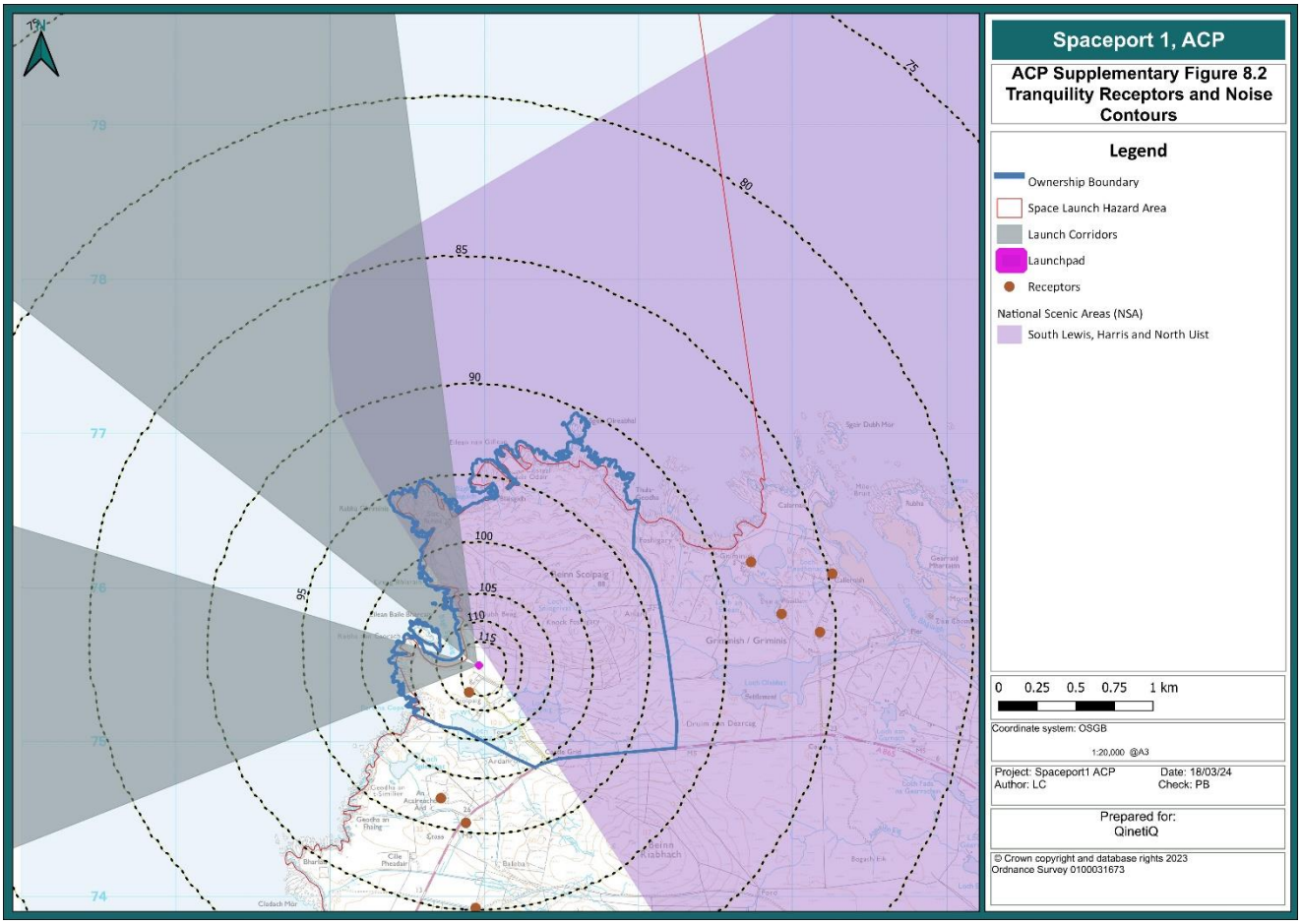

Figure 18: Diagram showing the NSA and noise contours together with expected launch corridors with trajectories between 225º and 315º (Source: Atlantic58).

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 indicate that the psf for modelled sonic boom ranges from 0.01 to 0.54 psf.

It is likely that other launch trajectories will be adopted when necessary, but limited to within the proposed Space Launch Hazard Area[64]. Levels above a threshold of 75 Perceived Decibel Level

[64] Area contained within bearing lines 225º to 315º from the launch site origin point.

(PLdB)[65] criteria are predicted on the surrounding habitable islands at the most northerly and southerly 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).

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.

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[66], 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 19*. 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).

3.7.4 **Assessment of noise impact – call in by Secretary of State**

This ACP will facilitate the launching of sub-orbital rockets from the SP-1 site at Scolpaig. It is apparent, from the evidence presented in the EIA, SEI and additional noise modelling for the ACP that the noise associated with sub-orbital rockets will not meet the criteria for a proposal to be called-in by the Secretary of State. This is further substantiated by the fact that the maximum noise level received by a person standing outside, at the SP-1 boundary, will be no louder than a motorbike; moreover, the noise will only exist for a very short period (circa 43 - 120 seconds), will dissipate quickly and will only be experienced during the day for a maximum of 10 times per year. Furthermore, in accordance with CAP 1616i paragraph 10.8; *"change Sponsors of ACPs to facilitate spaceflight activities are not required to monetise noise impacts"*.

[65] 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.

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

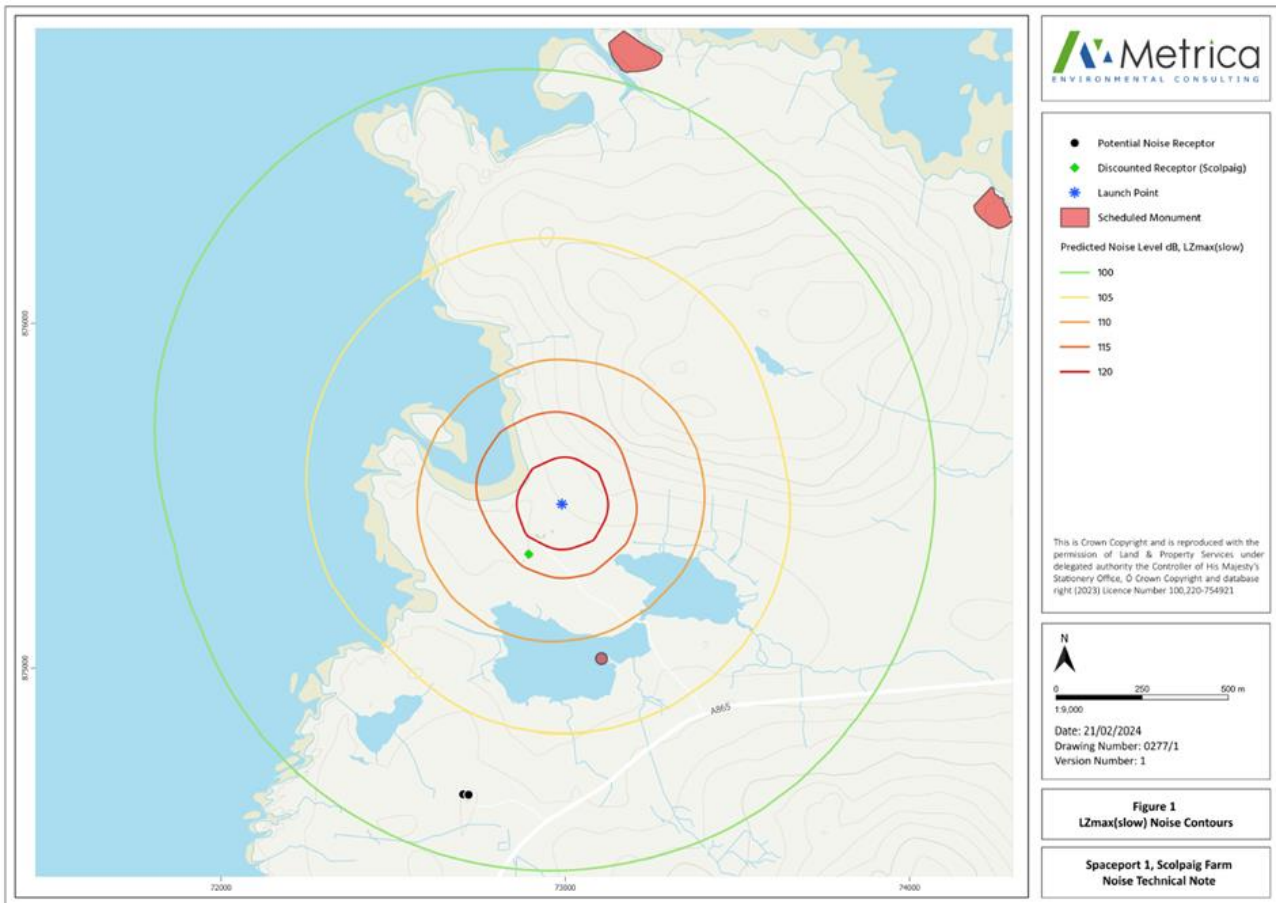

Figure 19: LZmax (slow) noise contours (modelling undertaking by Metrica Consulting, Feb 2024, to support the ACP process).

3.7.5 **Greenhouse gas emissions (Direct)**

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[67]. 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[68].

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

[67] 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.

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

worst-case scenario propellant mass over 10 launches. The total contribution from rocket launches was assessed as 14 tonnes CO_2.

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.

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.

Fuel burn and CO_2 emissions – EIA Chapter 20: 'Climate Change', provides a basic analysis of the potential contribution of the project to climate change which does not consider the indirect impact such as the rerouting of flights; this is covered at paragraph 3.7.6 below. It is considered that the CO_2 emissions from 10 rocket launches equates to approximately 10 tonnes over the year.

3.7.6 Greenhouse gas emissions (Indirect)

Impact of rerouting flights – The indirect impact is considered to be two main elements, namely SP-1 affecting local area flights nominally below 7000ft, and upper air aircraft transiting over the northern UK into Oceanic airspace of the NAT.

Local area flights - As evidenced in the 'Step 2B Options Appraisal V3' report [B], detailed traffic analysis was conducted to ascertain local traffic levels, in particular the number of flights below 7000ft and the potential impact the ACP might have on them. It was determined that there would not be any noteworthy increase in fuel burn and associated CO_2 emissions caused by the activation of the airspace fillet or associated D701 areas on local flights. Although it is acknowledged that some approaches to runway 06 at Benbecula could be impacted by D701 being activated, the likelihood of this is remote given the following:

- mitigations applied through the LoA and local procedures;
- 50% of flights are in the morning and are unlikely to be affected (most rocket launches and D701 activations will occur in the afternoon);
- the frequency of airspace activations and duration (circa 20 for a maximum of three hours); and,
- the periods when runway 06 is in use circa 33% of the time with runway 24 the more favoured runway in operation around 67% of the time[69] due to the prevailing winds from the south-west.

Any increase in CO_2 emissions by local flights as a result of SP-1 airspace activations is therefore considered inconsequential.

[69] Data obtained from Benbecula Airport ATC (October 2024).

Annual CO_2 totals associated with upper air traffic re-routing around D701 - The Department for Transport's Transport Analysis Guidance (TAG) was identified in the Stage 2 'Initial Options Appraisal' as evidence to be collected for the 'Full Options Appraisal' at Stage 3. However, the Change Sponsor elected to use the detailed analysis obtained from QinetiQ modelling to establish the potential extra fuel burn and expected additional CO_2 emissions for a 12-month period. It is considered that this analysis provides sufficient detail to satisfy the CAP 1616 requirements and the use of TAG was therefore not considered necessary. Full details of the analysis can be found in the 'Options Appraisal Phase II (Full) available at Reference [C].

Assessment of 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[70] as shown in *Figure 20* for the period 1000-2000[71] 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).

[70] Traffic data was evaluated for the prescribed AOI however, in order to provide a quantitative assessment of the impact specific D701 DA activation had on flights, the AOI used for analysis was reduced – details can be found in the Options Appraisal Phase II (Full) report.

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

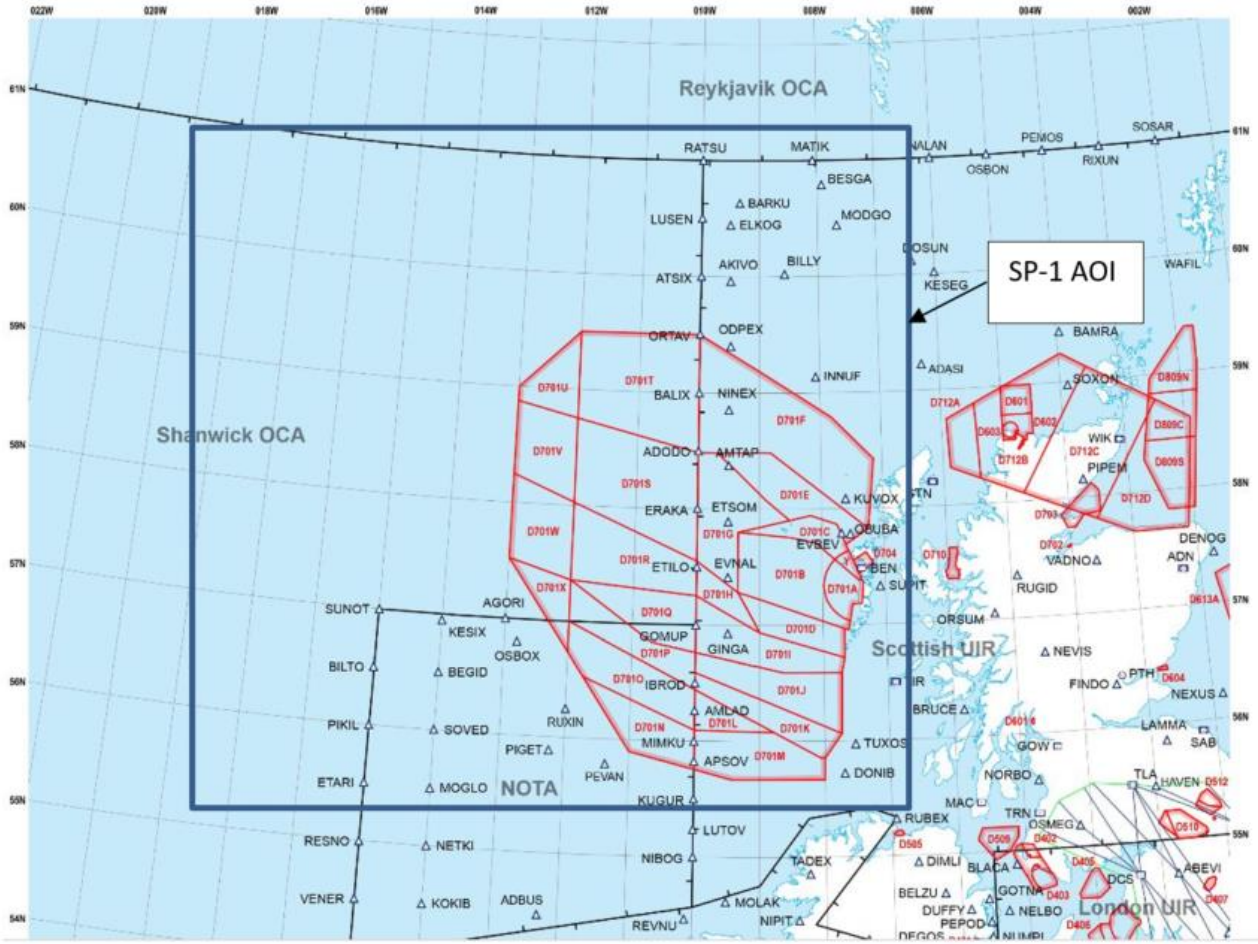

Figure 20: SP-1 AOI used for air traffic impact assessment. (Source QinetiQ 2023).

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 dependent on the position of the Jetstream. 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.

Using 10-months data of traffic crossing the NAT it is evident[72] 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[73], where it is anticipated 60% of rocket launches (circa 6 launches) will take place, the air traffic impact will only be

[72] Full details containing in Options Appraisal Phase I (Full) available at Reference [C].

[73] Summer months are arbitrarily May to October.

felt one day in every three days. This variation reverses during the winter[74] months meaning air traffic route out over Scotland two days out of three.

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[75]. 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[76] 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 peak[77] 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** were used in the analysis.

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;
- 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[78] 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[79]
- 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[80]; and,

[74] Winter months are arbitrarily November to April.

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

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

[77] It is recognised that some flights will still be impacted on every launch day however, by assuming the 9 airspace activations will always be at peak times (the busiest day of the year using a worst case) these numbers are likely to balance out.

[78] 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.

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

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

- it is expected that circa 30% of rockets launched will be short range[81] rockets.

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[82] 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[83].

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.

It is acknowledged that since this analysis was conducted using the core OTS for 2019 some flight profiles have changed with more flights operating random routes. However, it should be noted that this 2019 analysis assumes that air traffic levels are at their peak on every day when an airspace restriction occurs and it is highly unlikely that this will be the case. Furthermore, the 2019 analysis does not factor in the ability to make route adjustments several hundred miles ahead of the airspace restriction to avoid flying additional kilometres (therefore less CO_2 emissions). Moreover, it takes no account of concurrent operations where the D701 areas are already activated for MOD purposes and SP-1 launches are conducted at the same time thereby causing no additional impact to the air traffic network. Therefore, it is concluded that any missed flights (those operating on random tracks) are more than compensated for through the use of peak air traffic values and the other factors omitted in the analysis. More detailed information on this analysis can be found in the 'Options Appraisal Phase II (Full)' at Reference [C].

3.7.7 **Local air quality**

Statuary air quality limits, designated air quality area and national objectives for pollutants – EIA Chapter 18: 'Air Quality and Heat', describes the potential impacts that may arise from changes in air quality and heat emissions associated with up to 10 sub-orbital launch events introduced as a result of the Project. The assessment includes a summary of relevant air quality legislation and policy drivers, baseline air quality conditions, and the potential impact from foreseeable launch scenarios. Cumulative impacts are assessed in the supporting technical appendix EIA Appendix 18.1 at Reference [G]: 'Detailed Dispersion Modelling'.

Primary pollutants - Detailed dispersion modelling was undertaken for the range of potential air emissions anticipated from an analysis of multiple launch operators, and is contained within EIA Appendix 18.1: 'Detailed Dispersion Modelling'. Indirect or secondary pollutants are considered in Section 4.7 of that Appendix. The EIA summarises that the magnitude of impact on all receptors is

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

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

[83] This equates to circa two long haul flights.

assessed to be low. Receptor sensitivity is considered to range between medium – high however, the overall potential impact is considered as not significant.

Consideration of alternative fuels - Although SP-1 will not have direct control over the fuels used by the rocket providers they will strongly encourage the providers to adopt cleaner fuels and technologies which minimise the contribution of this sector to climate change and ozone depletion. Rocket providers will be advised to ensure that any such cleaner fuels or technologies adopted, do not introduce their own significant environmental effects.

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 Special Protection Areas (SPAs), Special Area of Conservation (SAC) and Site of Special Scientific Interest (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.

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.

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.

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.

3.7.8 **Tranquillity**

Consideration of overflight of any tranquil areas – One NSA[84] is located within the overflight area (Space Launch Hazard Area). The setting (including noise) impacts on the NSA are assessed as part of the expanded SEI Submission in SEI Section 8 and supporting SEI Appendix 8.1: 'Landscape and

[84] Note: Scotland does not have Areas of Outstanding Natural Beauty (AONB), the Scottish government use the term NSAs that are broadly equivalent to AONB in England, Wales and Northern Ireland.

Visual Assessment'. *Figure 21* has been created to meet the requirements of the ACP process illustrating the Space Launch Hazard Area and the NSA.

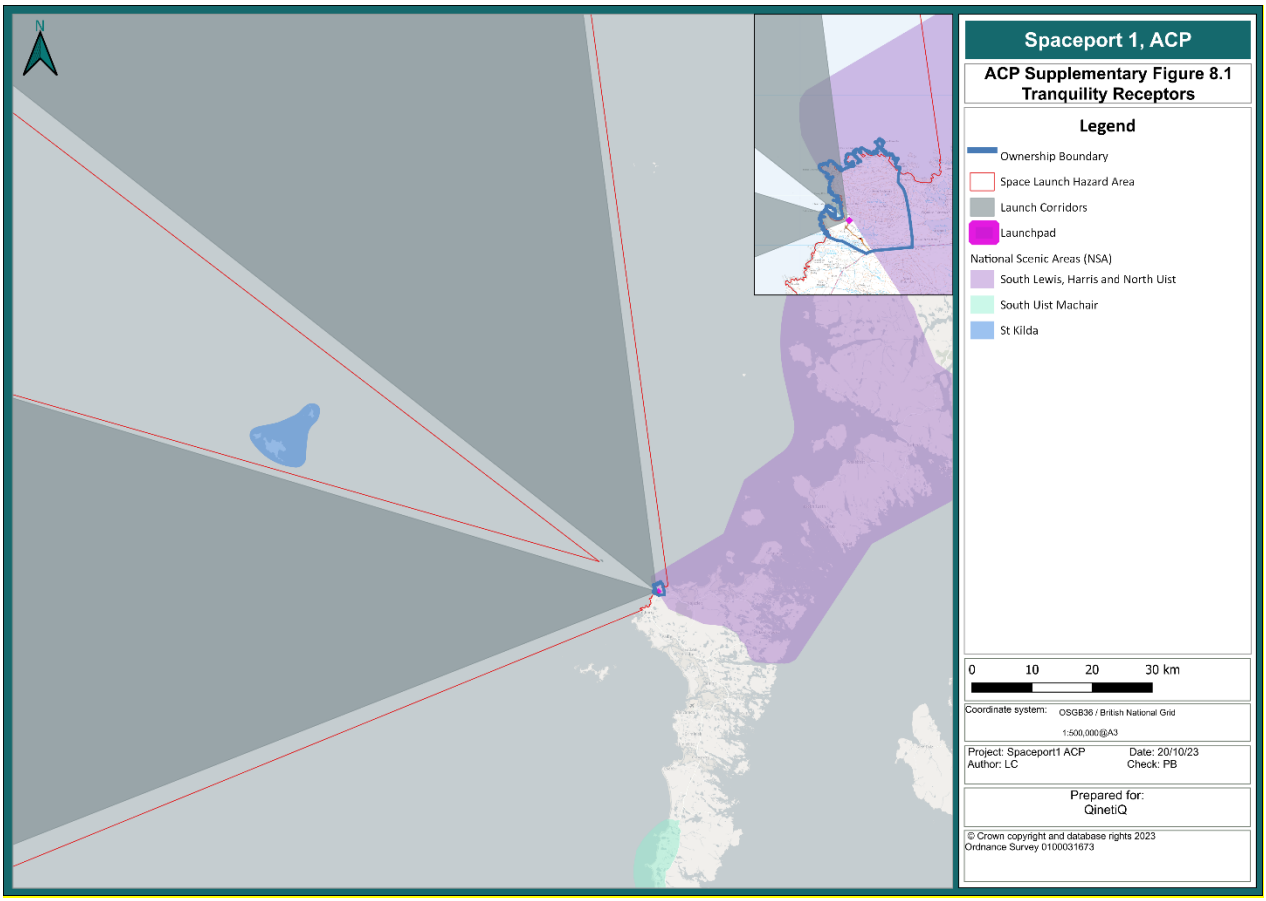

Figure 21: Diagram showing tranquillity receptors and expected launch corridors with trajectories between 225º and 315º (Source: Atlantic58, 2024).

3.7.9 **Biodiversity and habitats regulations assessment**

The 2021 EIA Report assessed impacts based on two years of baseline surveys between April 2019 and March 2021 covering two breeding[85] 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.

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

[85] Bird breeding seasons.

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.

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.

Screening identified potential impacts on five SPAs (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 22*).

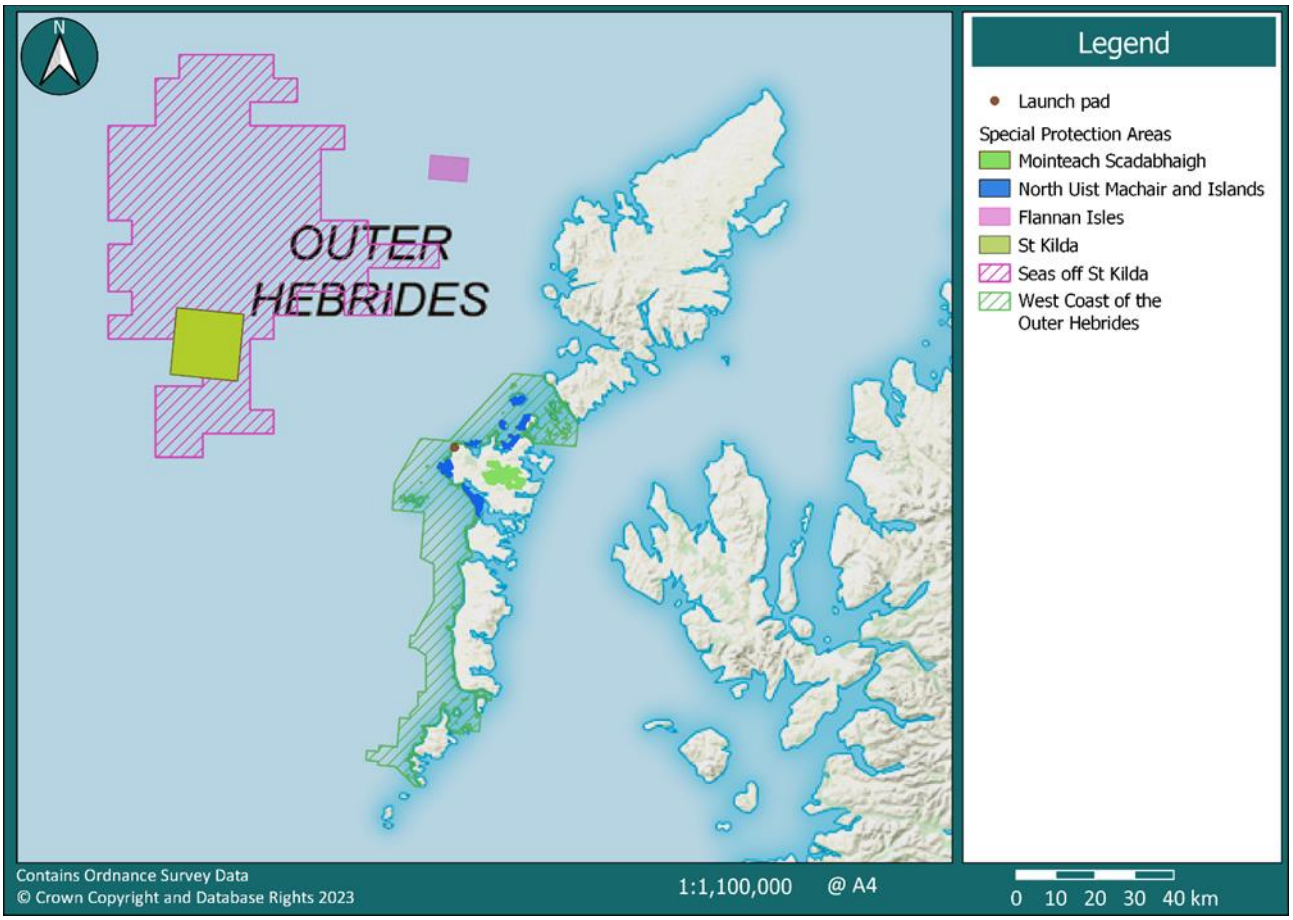

Figure 22: Special Protection Areas (extracted from SP-1 EIA Report).

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.

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.

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.

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.

Several Important Ecological Features (IEFs) were identified, including the following statutory designated sites: North Uist Machair SAC and Vallay Site of SSSI; Annex 1 habitats, wet dwarf shrub heath and dune grassland; protected species, otter; and a local biodiversity priority, great yellow bumblebee, see *Figure 23*.

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.

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.

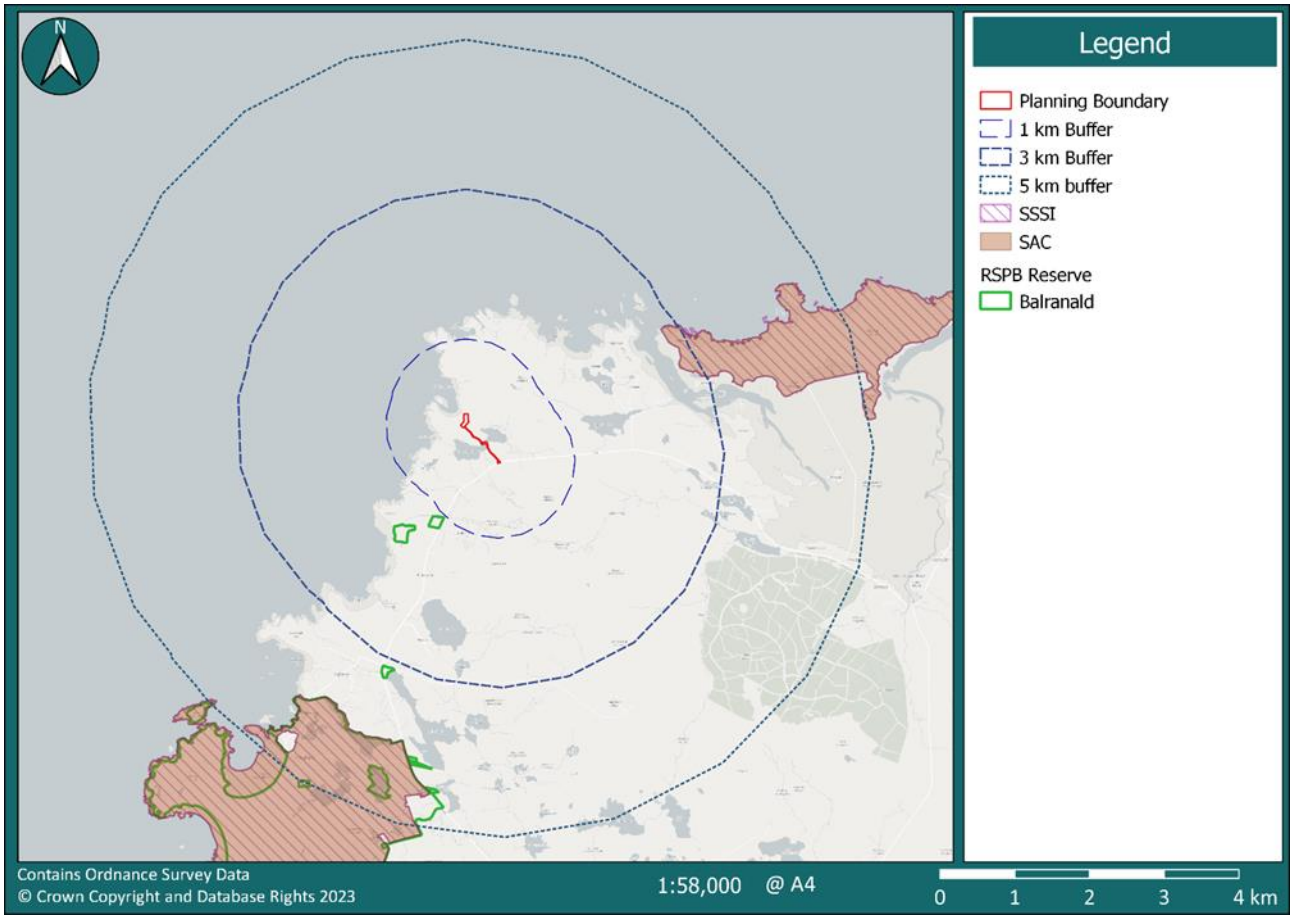

Figure 23: Terrestrial ecology study area (figure extracted from SP-1 EIA).

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), SACs, SSSIs and Designated Seal Haul-out Sites), benthic habitats and species, fish (including basking shark and Atlantic bluefin tuna), cetaceans and seals.

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.

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.

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.

3.8 Final Options Appraisal

3.8.1 Description of Final Design Option

The final option, Option 3, includes the new fillet of SUA around Launch Site between D701 and D704, a small SUA around the launch pad, a FRZ and utilisation of elements of D701 as necessary to contain the hazards associated with rocket launch, flight and splashdown, see *Figure 25*. This design has only seen one modification during Stage 2 of the ACP process, when the eastern boundary was re-profiled to enable Sollas beach landing site to operate when the SUA is active. The subsequent engagement activities with key stakeholders and the formal airspace consultation did not provide any arguments, feedback or suggestions for modifying the airspace design as proposed during Stage 3. Therefore, it is determined that the 'Final Options Appraisal' is de facto the same as the 'Options Appraisal Phase II (Full). Comprehensive details can be found at Reference [C].

The new SUA 'fillet' will be activated by NOTAM in exactly the same manner as D701. This provides a permanent airspace solution over the launch site and connectivity to the D701 DAs. Both the fillet of airspace and D701 will 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 will be treated as an extension of D701 for ASM[86] purposes, and the associated D701 areas would be activated as needed to meet the safety trace requirements of the LV being launched. Notification, activation and deactivation would follow existing procedures and LoAs.

[86] MOD remains the Sponsor for the D701 complex when active for SP-1 operations and will 'approve' such use. However, the Launch Vehicle (LV) provider, Spaceport Operator and QinetiQ, as the Range Operator, are wholly responsible for safety of these activities under the CAA licencing and approvals process. QinetiQ is the Sponsor for the new SUA fillet and small SUA within, (EGD designators to be defined in due course).

SPACE PORT 1

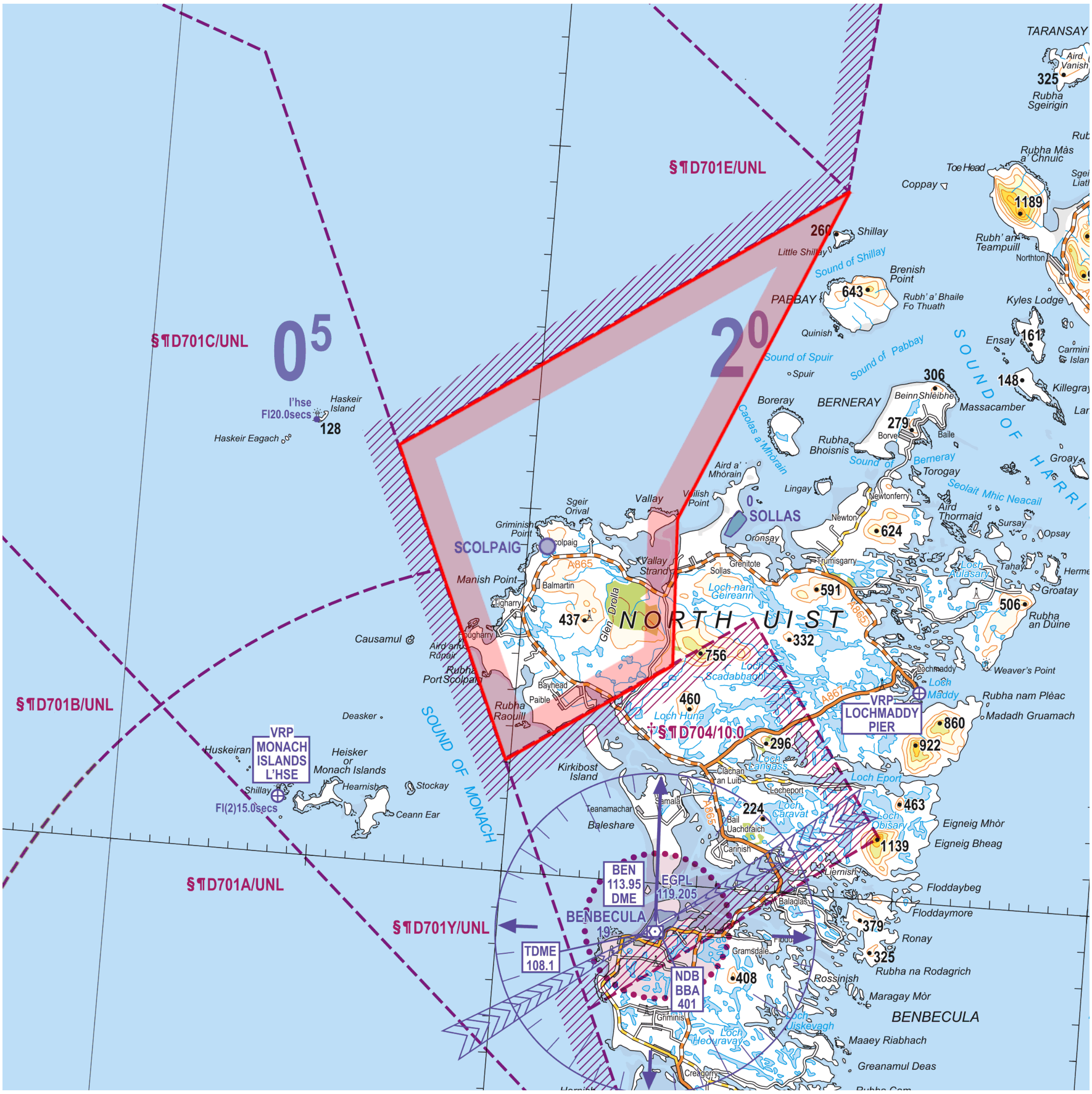

Figure 24: New airspace 'fillet' (in red outline) as it will be depicted on CAA 1:250000 Chart once approved (DA number will be inserted) (Source: CAA, Topographical Air Chart of the United Kingdom 1:250,000, Sheet 1 Northern Scotland West Edition 13 (2024)).

The final airspace option also includes the small additional circular area SUA around the launch pad extending 1000m in radius from SFC to 3000ft above ground level (agl), see *Figure 12*. This additional area would be activated by NOTAM outside of periods when the fillet is activated. The purpose of this additional SUA is to protect SP-1 ground personnel from the distraction caused by the sudden appearance/noise of low flying aircraft while they are engaged in critical pre-launch activities (such as arming/refuelling). Furthermore, this area of SUA will provide protection from unwanted HF transmissions from low flying aircraft that may interfere with some rocket systems. Additionally, a FRZ

will be established around the Spaceport in the form of a circle of radius 2.7 NM centred on the launch pad and extending SFC to 2000 ft agl, (see Figure 13).

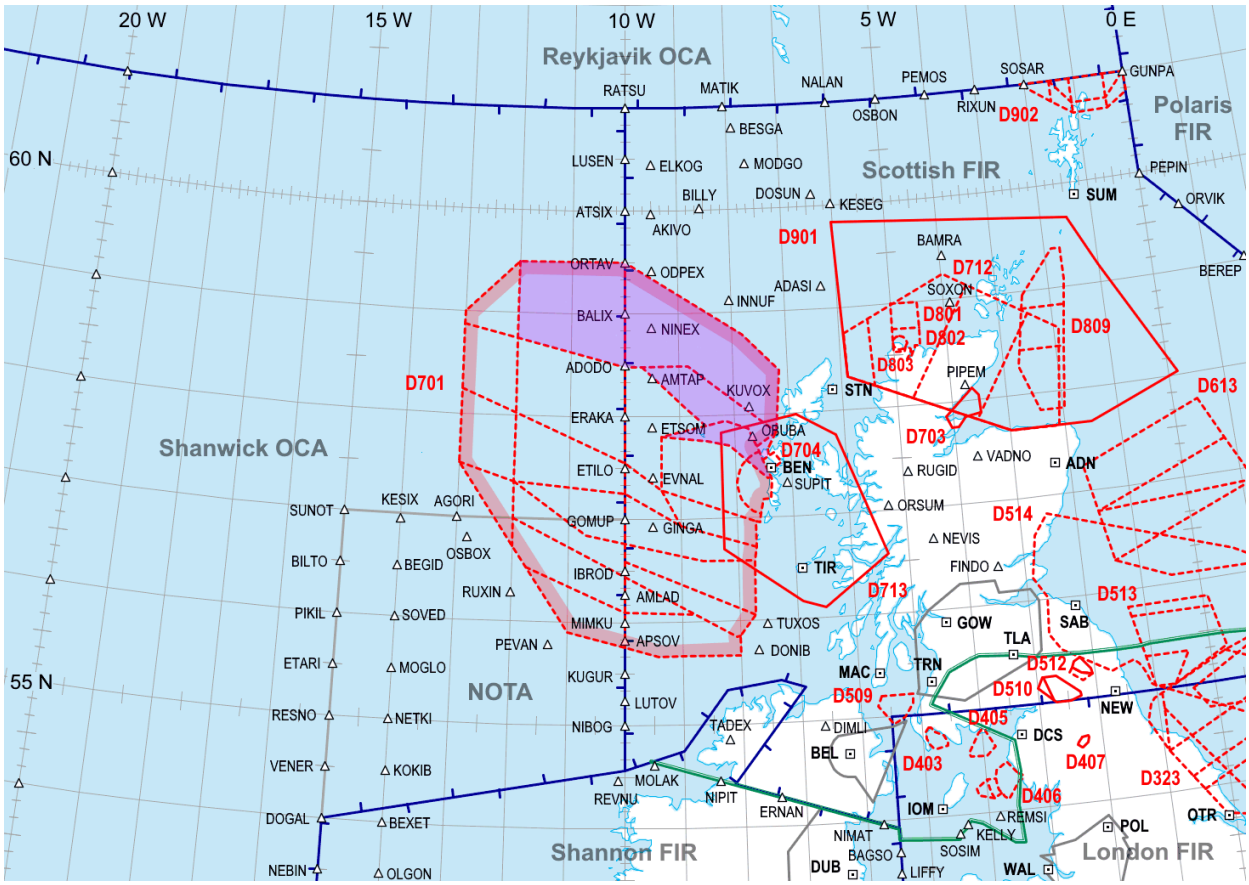

Figure 25: Option 3 - New airspace fillet and use of existing airspace structure D701 MOD Hebrides Range. D701 shaded areas shows an example of D701 areas required for an exemplar long-range sounding rocket (Source: QinetiQ 2024).

Option 3 was considered the preferred option for the following reasons:

- it meets the SoN;
- it meets the majority of the DPs and those it does not meet are partially met;
- it is the least costly option;
- it is the simplest to understand and implement; and,
- it is considered the safest option.

3.8.2 **Criteria & methodology to assess impacts of airspace change and consistency between options appraisal phases**

It was recognised during Stage 2 that the preferred option (Option 3) would, on occasions, result in more airspace being used than is absolutely necessary to contain the safety trace of the sounding rocket. It was considered important to understand whether this increase in airspace usage, when

compared to the other options, would increase the impact on the air traffic network. Conscious that the other options were more complex and costlier to implement it was essential to conduct a cost benefit analysis. This was accomplished by firstly assessing the air traffic impact each option would have when operating both short and long range rockets, and secondly; by considering the changes required for each option and a Rough Order of Magnitude (ROM) of the cost of these changes.

Air traffic impact options comparison - This analysis was performed by EUROCONTROL whom explored the different 'traffic impact assessment' the three options have on transatlantic air traffic. The main focus was to establish 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 was considered vital to understand whether the additional airspace made available by these two options actually provided any benefit in terms of reducing the additional track miles flown by aircraft needing to deviate off route (to avoid the activated areas), as both the other options were more costly and complex to implement than Option 3. A similar comparison was also made between Option 3 and Option 4 with regard to a long-range rocket launch. Using their sophisticated flight modelling and prediction tools for a single 'typical busy' day for flights over Scotland EUROCONTROL performed the analysis using two different exemplar rocket profiles (short-range and long-range); the aim of the analysis was:

- to ascertain whether Option 5 (sub-dividing/re-profiling existing D701 areas) had any significant benefit (i.e. lower impact on NAT tracks) than using the existing D701 areas for short-range rocket launch. For completeness, Option 4 (bespoke new areas) was also tested; and,
- to ascertain whether there was any difference in the impact on NAT tracks when using Option 3 when compared with Option 4 for long-range rocket launch.

Task method – EUROCONTROL were provided with five different airspace scenarios against which to test the impact on NAT tracks; see Figure 26.

Three of the scenarios used the airspace requirements for an exemplar short-range rocket launch while two scenarios used the airspace for an exemplar long-range rocket launch. EUROCONTROL considered a single day traffic sample on 11th January 2023 where there was a high level of westbound transatlantic air traffic routing through the Scottish Prestwick (EGPX[87]) airspace where the SP-1 AOI sits; this constitutes a worst case scenario. Two three-hour time periods (potential launch windows 1000-1300 UTC and 1300-1600 UTC) were studied with the morning scenarios labelled 'a' and the afternoon scenarios labelled 'b':

- Scenario 1 – uses Option 5 (sub-division/re-profiling D701) for short-range rocket;
- Scenario 2 – uses Option 3 (utilisation of existing D701 areas) for short-range rocket;
- Scenario 3 – uses Option 4 (new bespoke design) for short-range rocket;
- Scenario 4 – uses Option 3 for long-range rocket; and,
- Scenario 5 – uses Option 4 for long-range rocket.

Note: Option 5 uses less airspace than Option 3 only in the case of short-range rocket launches therefore the traffic impact assessment for long-range rockets only compares Option 3 with Option 4.

[87] EGPX is the ICAO designator where 'EG' is the UK designator and PX the designator for Prestwick.

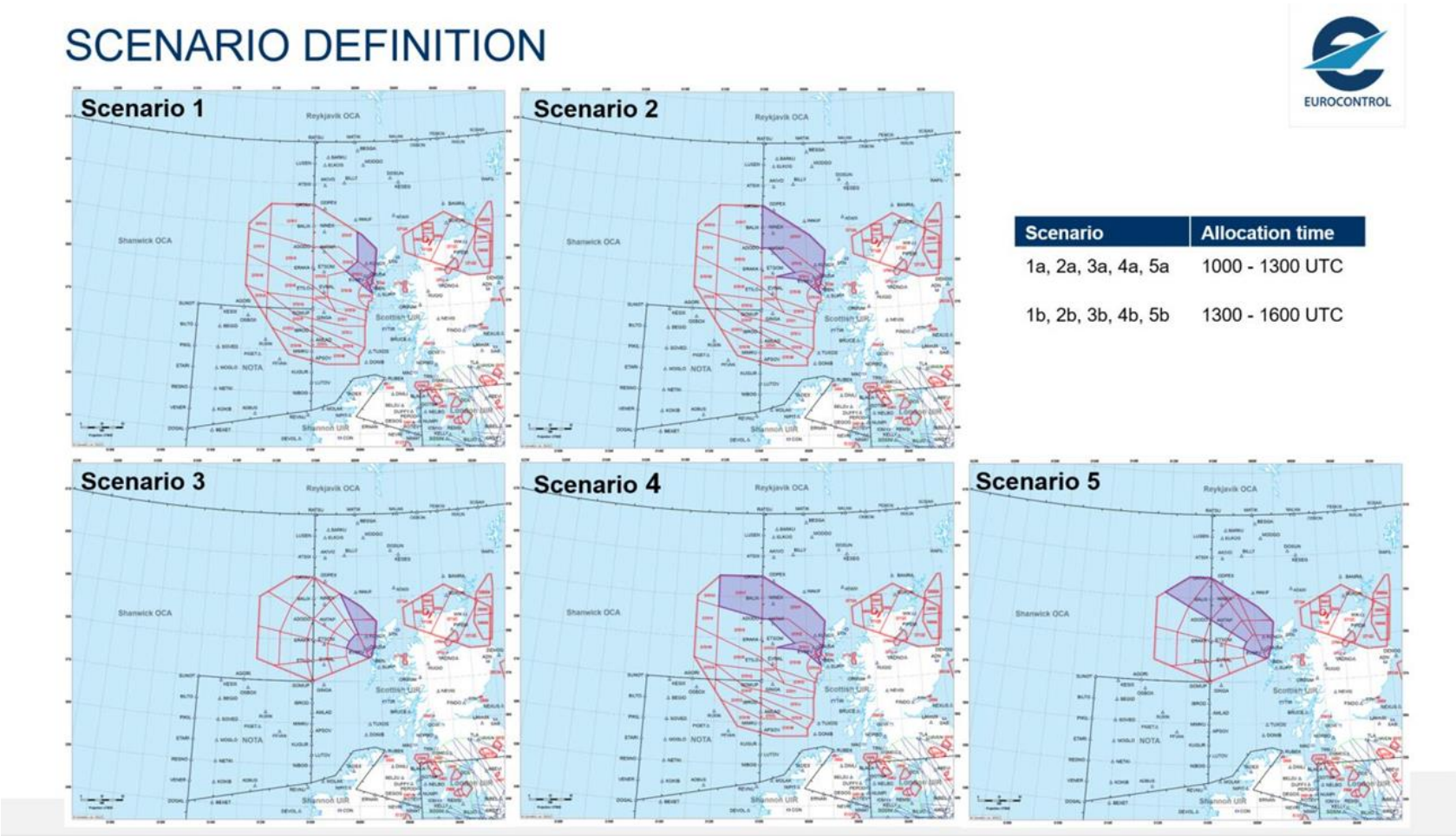

Figure 26: Five scenarios EUROCONTROL were tasked to evaluate for the two time periods indicated, where Scenario 1 is Option 5, Scenario 2 & 4 are Option 3 (for short and long-range rocket respectively) and Scenario 3 & 5 are Option 4 (for short and long-range rockets respectively) (Source: EUROCONTROL 2023).

EUROCONTROL findings – are contained in Table 4 below and show, against each scenario:

- the total number of flight passing through the AOI;
- the number of flights deviated around the SP-1 airspace activations and the total length of the deviations in NM; and,
- the actual number of flights that have to fly extra track miles with associated total extra fuel burn.

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: Options comparison where Scenario 1 is Option 5 (for short-range rockets); Scenarios 2 & 4 are Option 3 (for short- and long-range rockets respectively) and Scenarios 3 & 5 are Option 4 (for short- and long-range rockets respectively). The 'a' against the scenario indicates time frame 1000-1300 & the 'b' indicates 1300-1600; all times UTC (Source: EUROCONTROL 2023).

3.8.3 **Findings evaluation** – When comparing the scenarios for afternoon short-range rocket launches[88] – shown by the rows outlined in purple in Table 4 – it is evident that there is no difference

[88] The majority of rocket launches are expected to take place in the afternoon so they do not impact on the maximum number of OEPs that may be closed before 1400 UTC (one hour earlier in the summer)

in impact of the three Options. This 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, the extra track miles flown by those additional affected flights is insignificant in terms of extra fuel burn (in particular for the afternoon[89] time period). This is further reinforced by the EUROCONTROL findings shown in *Figure 27.* It is also evident that due to the configuration of the D701 DAs – the wider the north-south expansion of areas activated, the greater the impact on NAT traffic; expansion to the west has far less consequence. 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.

For long-range afternoon rocket launches, it seems that Option 4 (in Scenario 5) gives a slightly greater impact than Option 3 (In Scenario 4).

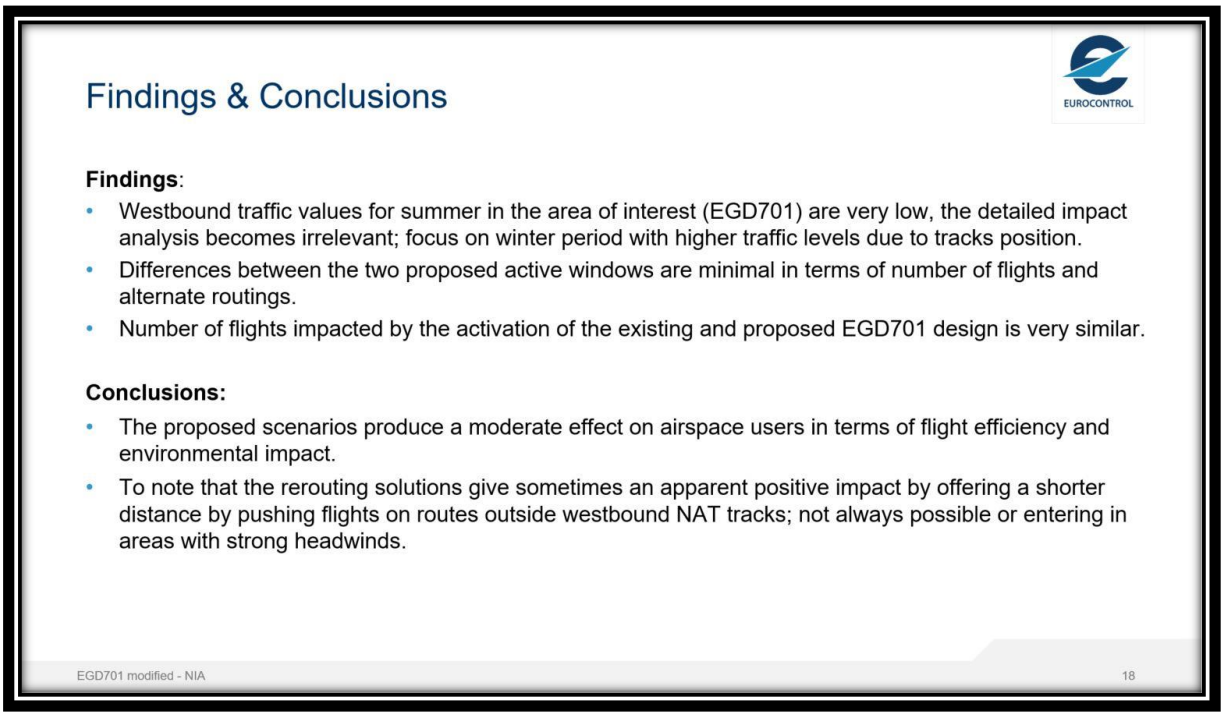

Figure 27: EUROCONTROL task, summary of findings and conclusions (Source: EUROCONTROL).

ROM for each airspace change option - To determine the ROM for each of the three options, the Change Sponsor made a number of request to NATS (the most impacted ANSP) for their ROM costs associated with the three Options; the response from NATS suggested that: *'NATS internal policy will limit future responses to confirming whether or not the cost to deploy identified options are materially different to each other, or whether they are, materially, cost agnostic. It is unlikely that NERL will choose to release commercially sensitive material to sponsors around the cost to implement'*. The MOD Hebrides Range also declined to provide any detailed ROM costs associated with any of the

per annum, as agreed in MOD Hebrides Range LoA [H]. Furthermore, the time needed to complete all set up activities and procedures will normally preclude a morning launch.

[89] It is considered unlikely that there will be any morning long-range rocket launches pre-1300 UTC; short-range rockets may be launched prior to 1300 UTC but only where the D701 areas used do not impact on the OEPs.

changes due commercial sensitivities. Therefore a quantitative assessment was made that Option 3 was the least costly based upon the following criteria:

- there is no requirement for 5LNCs being reserved with International Code And Route Designators (ICARD) – new reporting points – to allow circumnavigation the new airspace structure, as these are already in place and feature in existing flight planning system; so no updates[90] required, (Option 4 would necessitate a number of 5LNCs to be added and Option 5 may need 5LNCs to be added);

- FBZs are already in place for the D701 areas and any new FBZs will only be required for the small airspace 'fillet', (both Option 4 & 5 would necessitate new FBZs to be developed);

- only two reference points (associated with the 'fillet') will need to be ADQ validated, (both Option 4 & 5 would necessitate many new ADQ points to be deigned and validated, especially in the case of Option 4);

- special instructions and associated training costs for ANSP and MOD Hebrides Range staff will be less than those for the other options where significant airspace changes are required, (Option 4 would see the biggest change to the airspace and thereby induce the highest training costs, Option 5 would be slightly less costly than Option 4);

- only the small airspace 'fillet' will require integrating into Local and sub-regional airspace management support system (LARA)[91] as all other areas already exist, (both Option 4 & 5 would need more significant upgrading of LARA, especially Option 4);

- ATC and MOD Hebrides Range system mapping will only require minor modifications to include the airspace 'fillet', (Option 4 would induce significant map upgrades, Option 5 would need minor changes);

- only very minor updates to aeronautical and maritime charts, (Option 4 would see significant changes to both and Option 5 would see more change than Option 3); and,

- it is possible to make minor amendments to current LoAs, ASM processes and procedures to include SP-1 negating the need for new standalone documents, (Option 4 would necessitate new standalone documents and procedures, Option 5 would need significant changes to be made to current LoAs).

Option 3 was also considered the safest based on the fact it induces the minimum of change and adds little additional complexity to the existing airspace structure, unlike Option 4 and, to a lesser degree, Option 5.

Despite not receiving ROM costs, it was acknowledged by the MOD Hebrides Range that Option 3 would be significantly cheaper to implement than the other two options as the changes to publications,

[90] It is recognised that the new 'fillet' of airspace will need to be included in an update to systems but the change is very small in comparison with other options and it is considered no new 5LNCs will be required.

[91] LARA is the preferred ASM tool used by EUROCONTROL and UK AMC.

Range orders and equipment were so much smaller; furthermore, Option 3 would induce minimum training costs. It is assumed that NATS would agree this position given the overall airspace change is much smaller. Moreover, as the EUROCONTROL traffic impact analysis strongly suggests that there would be little or no benefit to adopting Option 4 or Option 5 in preference to Option 3, it was considered that any further investigation to ascertain these costs would be disproportionate to the scale of the airspace change. Therefore, the Change Sponsor proposed that the qualitative assessment that Option 3 will be significantly lower cost to implement than Option 4 or Option 5 is sufficient for the purposes of the Final Options Appraisal.

3.8.4 **Description of data sources reference materials and assumptions used** – The data sources used in developing the final options appraisal during the ACP process include:

- Danger Area infringement data 10 year 2012 - 2022 comparison between MOD Aberporth and MOD Hebrides Ranges, (Source: NATS);
- AIRPROX data 20-year positional data 2000 – 2021, (Source: UK AIRPROX Board);
- Sollas typical traffic patterns and movement data 2015 – 2022, (Source: Sollas fly in coordinator and LAA Highlands Strut);
- Benbecula Airport runway usage comparison (Runway 06 compared to Runway 24), (Source: Benbecula ATC);
- Loganair flight profiles and schedules; assumption: no significant change expected in next 10 years, (Source: Loganair);
- Hebridean Air services schedules, assumption: no significant change expected in next 10 years, (Source: Hebridean Air Services webpage);
- Stornoway SAR tasking 12-month period March 2021 – March 2022, assumption: no significant change expected in next 10 years, (Source: Dft National Statistics for SAR);
- Benbecula airport monthly movements for 2019 and 2022, assumption: no significant change expected in next 10 years, (Source: CAA UK airports statistics 2019 & 2022);
- military low flying statistics for 2019 for Low Flying Area (LFA) 14 and night flying region 1B, (Source: MOD UK Mil AIP), assumption: no significant change expected in next 10 years;
- data on ‘other’ aircraft movements in the SP-1 local area gained from PGD Aviation; NLB, Babcock Aviation; Bristow helicopters and Gamma aviation via email, assumption: no significant change expected in next 10 years;
- EUROCONTROL air traffic impact assessments for three airspace options (Option 3, 4 & 5), analysis and conclusions. Data analysis conducted for 11 January 2023 assumed to be the busiest day of the year for NAT westbound traffic. Scenarios tested against two time periods namely 1000-1300UTC and 1300-1600UTC, (Source: EUROCONTROL 2023);
- NAT OTS seasonal variation assessment conducted by QinetiQ Ltd using 12 months data for 2018, assumption: NAT OTS provides a reasonable indicator of traffic levels in the region on specific days (Source: QinetiQ research project);

- QinetiQ baseline traffic analysis & worst case scenario impact assessment using ADS-B data for 2019, assumptions:
    - the majority of aircraft in the NAT (over 95%) are ADS-B equipped;
    - the most common aircraft type operating in the NAT is B777 all variants;
    - fuel burn calculations based on B777 using source: ICAO Carbon Emissions Calculator;
    - one tonne of aviation fuel burnt produces 3.18 tonnes of CO_2, (Source: ASTM D1655, ASTM, 2015);
    - jet fuel price data obtained from International Air Transport Association (IATA) 'jet fuel price monitor' price point 5 Jan 24;
    - rocket launch 1300-1600UTC;
    - there will be a maximum of 9 airspace activations that will impact on peak traffic flows;
    - long range rockets will account for 6 airspace activations using D701 A-G, S, T & Y, and short range rockets for 3 airspace activations using D701Y, C, E & F;
    - ANSPs apply 30NM buffer (separation criteria to D701 areas west of 10º west and 5NM to the east;
    - assessment of additional tracks flown assumes track deviation commences at the Scottish FIR boundary and not before; and,
    - average flight deviation is 22.8 km per flight.
- ADS-B data provided by Spire Aviation Sep 23;
- 7-year forecast traffic levels for commercial air transport, assumption: extrapolating the 'base scenario' to 2035 provides the 10-year forecast, (Source: EUROCONTROL 2023);
- environmental assessment (direct impact) data obtained from EIA and SEI (developed as part of the SP-1 site planning process) and used and enhanced in the ACP process, (source: Atlantic58); and,
- socioeconomic data obtained from CnES.

3.8.5 **Quantitative assessment of the impacts of the final airspace** design – Stage 3 'Consultation' concluded that the airspace design at Option 3, as presented, did not require any refinement. Therefore, the 'impacts' associated with this airspace change have not altered from those described in the 'Options Appraisal (Phase II - Full) at Reference [C]. These are summarised in Table 5 below.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
Communities	Noise impact on health and quality of life. Additional guidance under s70(2)(ca) Transport Act 2000: Carrying out air navigation functions for the purpose of spaceflight activities'; removes the requirement to monetise noise. associated with space launches	It is recognised that the nature of sounding rocket launch will create noise at the time of launch albeit for only a short period of 1-2 minutes. However, there are only a small number of dwellings in the immediate vicinity of the launch site so the number of individuals affected will be low. Furthermore, the launch site is restricted to 10 launches per year so it is considered that the noise impact will be low. Details of noise profiling can be found in the EIA at [J] The location of the airspace around the launch site should not cause any deviation of the scheduled flights operating to Benbecula or divert any GA or helicopter traffic in the local area such that there should not be any noticeable difference in local flying activity that would induce noise in areas not normally affected by aircraft noise.	**DIRECT Impact** - Sounding rocket launch will create noise at the time of launch albeit for only a short period between 43 and 120 seconds. There are only a small number of dwellings in the immediate vicinity of the launch site that are likely to be affected meaning the number of individuals disturbed will be low. Given the short time period, the fact the noise does not exceed 100 dBs at the nearest receptor (see paragraph 3.7.3), it is considered the noise is no worse than that of a motorbike. Furthermore, the launch site is restricted to 10 launches per year so it is considered that the noise impact will be very low. Details of noise profiling can be found in paragraph 3.7.3 and at Reference [G]. **INDIRECT Impact** - The location of the airspace around the launch site should not cause any deviation of the scheduled flights operating to Benbecula or divert any GA or helicopter traffic in the local area such that there should not be any noticeable difference in local flying activity that would induce noise in areas not normally affected by aircraft noise. Aircraft operating IFR to runway 06 at Benbecula may experience slight delays where D701A or Y are active; these potential delays are partially mitigated through the LOAs, local procedures and the likelihood that occurrences such as this will be extremely infrequent given the limited number of airspace	No change to current noise levels as Spaceport would not be able to safely operate. +10 years – Any change to current noise levels would be commensurate with any changes in local activities.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
			activations and infrequent use of runway 06 when compared to runway 24 (see paragraph 3.1.3). There is no evidence to suggest that there will be any noticeable increase in aircraft movements at Benbecula or Barra airports in the next 10 years (see paragraph 3.7.2)	
Communities	Local Air Quality	With no expected impact on GA or CAT aircraft operating below 7000ft in the local area, the air quality associated with this activity will remain unchanged. It is anticipated that the air quality in the immediate vicinity of the launch site may be affected for a short period (a few seconds) during the actual launch but this should quickly disperse and, given the prevailing wind is from the south-west, be experienced largely over the sea. It is not anticipated that the air quality for communities would be affected by any re-routing of air traffic in the upper air caused by activation of D701 or the fillet of airspace around the launch site.	**INDIRECT Impact** – As there is no expected impact on GA or CAT aircraft operating below 7000ft in the local area, the air quality associated with this activity will remain unchanged. Local air quality for communities should not be affected by any re-routing of CAT in the upper air (above FL195) caused by activation of D701 or the airspace fillet around the launch site. **DIRECT Impact** - The air quality in the immediate vicinity of the launch site may be affected for a short period (a few seconds) during the actual launch but this should quickly disperse and, given the prevailing wind is from the south-west, be experienced largely over the sea. This is expanded at paragraph 3.7.7 and detailed further in the EIA and SEI [G] & [J]. When incorporating existing background concentrations, all 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.	No change to current air quality as Spaceport would not be able to safely operate. +10 years - Any change to current air quality would be commensurate with any changes in local activities.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
Wider society	Greenhouse gas emissions	The nature of sounding rockets, engine design and fuel used will result in greenhouse gas emissions, which will vary between different rocket types and so is difficult to quantify at this stage. It is thought that the impact should be fairly negligible given the number launches will average at less than one per month. Of more significance is the greenhouse gas impact caused by CAT having to fly extended track miles to route around the active elements of D701, although this only becomes significant for the longer range sounding rockets where a large number of D701 areas are used. It is anticipated that several of the sounding rockets will remain within the 'inner' D701 areas – areas that do not noticeably impact CAT.	**DIRECT Impact** - The nature of sounding rockets, engine design and fuel used will result in greenhouse gas emissions, which will vary between different rocket types and so is difficult to quantify at this stage. As detailed at paragraph 3.7.5 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). Using the metric that 1 tonne of CO_2 costs $93.93, then 14 tonnes costs $1,315. 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. More detailed information can be obtained in the EIA Appendix 18.1 'Detailed Dispersion Modelling' [G]. As these figures are based on a maximum of 10 launches per year it is not anticipated that this number will increase in 10 years-time therefore any increase in cost will be commensurate with annual inflation costs over this period. LV operators will be encouraged to utilise cleaner fuels where these do not have any consequential environmental impacts. **Indirect Impact** – It has been identified that there will be little or no disruption to air traffic flying below 7000ft therefore greenhouse gas emissions	No change to current levels of greenhouse gas emissions as Spaceport would not be able to safely operate. +10 years - Any change to current greenhouse gas emissions would be commensurate with any changes in CAT and local aviation activity and influenced by more economic/cleaner engines and biofuels.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
			associated with local air traffic will not change (see paragraph 3.7.2). Of more significance is the greenhouse gas impact caused by CAT having to fly extended track miles to route around the active elements of D701; this is covered in detail at paragraph 3.7.6 in this document. It is estimated that in a single year a worst case maximum of 704.4 tonnes of CO_2 could be created. Using the metric that 1 tonne of CO_2 costs $93.93, 704.4 tonnes costs $66,164. The 10 year estimate based on EUROCONTROL predictions could see the CO_2 emissions rise to 802.7 tonnes in a year with an associated cost of $75,397.6 by 2035.	
Wider society	Tranquillity	Tranquillity impact was not assessed during Stage 2 however, the EIA at Reference [G] was signposted.	Details of tranquillity impact are contained within the EIA at Reference [G] and summarised at paragraph 3.7.8. The impacts are not considered significant and there is no expected change over the next 10 years as rocket launches will remain at 10 per year or less.	No change to current tranquillity levels as Spaceport would not be able to safely operate. +10 years - Any change to tranquillity will be commensurate with any changes in local activities.
Wider society	Biodiversity	Biodiversity impact was not assessed during Stage 2 however, the EIA at Reference [G] was signposted.	Details of biodiversity impact are contained within the EIA at Reference [G] and summarised at paragraph 3.7.9. The impacts are not considered significant and there is no expected change over the next 10 years as rocket launches will remain at 10 per year or less.	No change to current impact on biodiversity as Spaceport would not be able to safely operate.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
				+10 years - Any impact to biodiversity will be commensurate with any changes in local activities.
Wider society	Capacity / resilience	Where a large number of D701 areas are active this could potentially induce a capacity issue on the NAT track structure where other adjacent airspace reservations are also active. This can be alleviated by using the same extant airspace protocols and ASM procedures in place for D701, for SP-1 operations. This would mean certain adjacent DAs not being active at the same time as D701. Moreover, by adhering to the limitations posed on the time of day when specific D701 areas are activated, the impact on the ATM network is further reduced.	There is no impact on CAT or local aviation activity through the activation of the new airspace fillet (or SUA around the launch pad contained within) in isolation. The impact of activating a number of D701 areas on CAT and capacity of the NAT track structure is mitigated through the application of the conditions contained in LoAs and airspace protocols as described in Section 3 and paragraph 3.2.2. Moreover, through the selection of trajectories that require the minimum number of D701 areas to be activated in support of SP-1 and launching post 1400 UTC further reduces the impact on capacity. It is not possible to monetise this impact as there are too many variables associated with sub-orbital rockets with regard to the number and location of the D701 areas that will be required. These are determined by the safety trace of the individual rocket being launched, the environmental conditions and rocket payload. The information will not be known until the rocket provider commits to a SP-1 launch and the preliminary planning commences. It is also not possible to predict what other airspace reservations may be in place at the time of a SP-1 launch and what the combined impact on the ATM network will be; this simply cannot be quantified at this stage of the process.	No change to current capacity or resilience of the ATM network as the Spaceport would not be able to safely operate. +10 years - Any change to current capacity or resilience levels would be commensurate with national and local changes in air traffic levels.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
			Furthermore, the airspace protocols for rocket launch still need to be developed and ratified at governmental level before any meaningful detailed impact analysis can be conducted.	
General Aviation	Access	There may be a very small impact on GA when the airspace around the launch site is activated, especially on non-radio fitted aircraft. It is anticipated that access for radio fitted aircraft will be possible during periods where the airspace is activated but launches are delayed or awaiting full range clearance. As is current practice for the D701 areas, MOD Hebrides Range staff are able to permit aircraft to enter active DAs when considered safe to do so. Given the extremely light levels of GA activity and the infrequent use of the segregated airspace around the launch site, any impact on GA is considered negligible.	Non-radio fitted aircraft will be unable to enter the airspace fillet or D701 DA complex during notified activation periods. It will be possible at times, to enable radio fitted aircraft access to the airspace during periods where the airspace is activated but launches are delayed or awaiting full range clearance (see paragraphs 3.1.7 & 3.3.3). This is current practice for the D701 areas, MOD Hebrides Range staff are able to permit aircraft to enter active DAs when considered safe to do so. Emergency flights and aircraft on National security operations will be afforded the highest priority and will be given access to the airspace fillet and D701 when it is safe to do so. If necessary launches will be delayed or cancelled to enable these aircraft access. Access will only be denied should the rocket be in the final stages of launch countdown, is in flight or has created a debris field, see paragraphs 2.9.6 & 3.3.8 .	No change to current GA operations as Spaceport would not be able to safely operate. +10 years - Any change to current GA levels would be commensurate with any local changes in aviation activity.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Not Applicable	Not applicable	Not Applicable

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
General Aviation / commercial airlines	Fuel burn	Activation of the fillet of airspace around the launch site is unlikely to invoke any increase in fuel burn for either GA or CAT; however, activation of D701 can lead to increase in fuel burn for CAT where they are forced to fly additional track miles around active DAs. This increase in fuel burn can be calculated more easily for known combinations of D701 than for a new airspace structure such as Option 4. Extant ASM processes and procedures detailed in current LoAs associated with the MOD Hebrides Range, are an important facet in reducing the impact D701 has on CAT and their subsequent additional fuel burn. In particular, the limitations posed on the time of day when certain D701 areas are activated is crucial in reducing the impact on the ATM network. Utilising these same procedures and LoAs for rocket launch and use of D701 as proposed under this option, means that 'best practice' is being followed and consequential impact on CAT is minimised.	**DIRECT Impact** - Activation of the airspace fillet around the launch site is unlikely to invoke any increase in fuel burn for either GA or CAT; however, activation of D701 can lead to increase in fuel burn for NAT air traffic where they are forced to fly additional track miles around active DAs. The worst case scenario for an increase in fuel burn is detailed at paragraph 3.7.6, where the total additional fuel burn for CAT operating in the NAT in a year is calculated as 221.5 tonnes. Using the metric that 1 tonne of aviation fuel costs $104.39[92] then the total additional fuel costs are $23,122.4. Fuel burn for aviation activities below 7000ft will be unaffected as explained in paragraph 3.7.2. LoA at Appendix C – Draft Letter of Agreement (3) and procedures contained therein together with the associated airspace protocols for rocket launch (and use of D701 DAs) will help mitigate some of the 'direct impact'.	No change to current levels of fuel burn as Spaceport would not be able to safely operate. +10 years - Any change to current fuel burn levels would be commensurate with any changes to CAT and GA traffic levels and more efficient/cleaner engines/bio fuels.

[92] International Air Transport Association (IATA) (2023), "Jet Fuel Price Monitor". Accessed 9 Jan 24, available online at: IATA - Fuel Price Monitor. Price point: 5 Jan 24.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
Commercial airlines	Training costs	Not Applicable	Not Applicable	Not Applicable
Commercial airlines	Other costs	Not Applicable	Not Applicable	Not Applicable
Airport /ANSP	Infrastructure costs	Not Applicable	Not Applicable	Not Applicable
Airport /ANSP	Operational costs	The operational cost should be minimal other than the cost of capturing the small fillet of airspace around the launch site into the ATC training system and any additional training associated with the minor amendments to extant LoAs and SOPs. By using D701 in its current form, the costs to ANSPs remains at the lowest possible as ASM processes and procedures remain largely unchanged. A similar argument applies for Benbecula airport where utilisation of existing LoAs, modified to include SP-1 and the fillet of airspace around the launch site, reduces the cost especially when compared to the creation of a new bespoke set of DAs or, to a lesser degree, modification of the existing D701 areas.	The operational cost should be minimal, consisting only of the cost of capturing the small new airspace fillet (and SUA around the launch pad) into the ATC training system and any additional training associated with the minor amendments to extant LoAs and SOPs. By using D701 in its current form, the cost to ANSPs is minimised as ASM processes and procedures remain largely unchanged. The Change Sponsor was unable to obtain associated ROM costs for the change but produced a qualitative assessment that the final option would be significantly cheaper to implement than the other two options; this is detailed at paragraph 3.8.3.	No change to current operational costs as Spaceport would not be able to safely operate. +10 years - Any change to current operational costs would be commensurate with any changes to operational and ASM procedures/equipment.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
Airport /ANSP	Deployment costs	The deployment cost should be minimal other than the cost of introducing the small fillet of airspace around the launch site into the ATC and ASM systems and applying a new FBZs where appropriate. Other costs would include making minor amendments to extant LoAs and SOPs and minor amendments to aeronautical charts including two new Aeronautical Data Quality (ADQ) points to be validated for the airspace fillet. Using D701 in its current form means the costs to ANSPs remains at the lowest possible as there would be no requirement to: •Introduce new additional reporting points. •Make large changes to ATC and MOD Hebrides Range systems mapping. •Introduce wholly new LoAs, ASM processes or procedures (and associated training costs). A similar argument applies for Benbecula airport where utilisation of existing LoAs, modified to include SP-1 and the fillet of airspace around the launch site, reduces the cost especially when compared to the creation of a new bespoke set of DAs or, to a lesser degree, modification of the existing D701 areas.	The deployment cost will be minimal, consisting only of the cost of introducing the small airspace fillet around the launch site into the ATC and ASM systems, applying a new FBZs where appropriate; making minor amendments to extant LoAs and SOPs; and minor amendments to aeronautical charts including two new Aeronautical Data Quality (ADQ) points to be validated for the airspace fillet. Using D701 in its current form means the costs to ANSPs are minimised as there is no requirement to: •Introduce new additional reporting points (5LNCs). •Make large changes to ATC and MOD Hebrides Range systems mapping. •Introduce wholly new LoAs, ASM processes or procedures (and associated training costs). A similar argument applies for Benbecula airport where utilisation of existing LoAs, modified to include SP-1 and the airspace fillet around the launch site, reduces the cost especially when compared to the creation of a new bespoke set of DAs or, to a lesser degree, modification of the existing D701 areas. The Change Sponsor has been unable to gain sufficient evidence to provide a quantitative assessment and as such these costs have not been monetised. The Change Sponsor offers a simple qualitative assessment as detailed in paragraph 3.8.3 of this document.	No change to current deployment costs as Spaceport would not be able to safely operate. +10 years - Any change to current deployment costs would be commensurate with any changes to operational and ASM procedures/equipment.

Group	Impact	Final Airspace Design Option (Option 3)		
		Qualitative assessments of impacts for all metrics in Stage 2	**Quantified and monetised assessment of the impact of final design**	**Baseline & Baseline + 10 years**
Airport/ANSP	Other Costs	Not Applicable	There are no other costs to airports or ANSPs associated with this ACP other than those already described above in operational/deployment cost.	No change to current costs as Spaceport would not be able to safely. + 10 years - Any change in costs would be as a result of changes driven by HIAL (for the local airports) and changes made by the ANSPs.

Table 5: Qualitative, quantified and monetised assessment of the impacts of the final design option for all relevant metrics

3.8.6 **Cost benefit Analysis of ACP**

In accordance with CAP 1616i paragraph 10.8; Change Sponsors of ACPs to facilitate spaceflight activities are not required to undertake a cost benefit analysis of the ACP.

3.9 List of Supplementary Documents

3.9.1 The following list of supplementary documents are provided as Appendix to this report:

- Draft Letter of Agreement (LoA) Between MOD Hebrides Range, MOD Defence Equipment & Support (DE&S) and Comhairle nan Eilean Siar (CnES) Spaceport-1 (Sp-1) Concerning Activation, Usage and Operational Management of DAs – Details of the conditions of use of the MOD Hebrides Range D701 complex for commercial rocket launch.

- Draft Letter of Agreement Between Highlands & Islands Airports Ltd (HIAL), the MOD Defence Equipment & Support (DE&S) on behalf of MOD Hebrides and Comhairle nan Eilean Siar on behalf of Spaceport-1 – Detailing the procedures between HIAL (Benbecula, Barra & Stornoway) and MOD Hebrides Range concerning the activation of D701 and new airspace fillet in support of sub-orbital rocket launches.

- Draft LoA between NATS (en route) plc – Scottish Control (Prestwick) And Shanwick Oceanic Area Control (Prestwick), MOD Defence Equipment & Support (DE&S), Civil Airspace Manager AMC UK Military Airspace Manager, Civil Aviation Authority (CAA) Safety & Airspace Regulation Group, Irish Aviation Authority (IAA) Director Safety Regulation, The Irish Air Navigation Service trading as AirNav Ireland (ANI) General manager Shannon ACC, QinetiQ Ltd (MOD Hebrides Range), and Comhairle nan Eilean Siar (CnES) – Developer of/on behalf of Spaceport-1.

- QinetiQ safety report – Additional safety information of a commercially sensitive nature provided to the CAA.

4 References

A. ACP-2021-012 Stage 2 Step 2A Airspace Design Options and Design Principle Evaluation Report Version 2 dated 17th March 2023, online, available at: Airspace change proposal public view (caa.co.uk)
B. ACP-2021-012 Stage 2 Step 2B Options Appraisal (Phase 1) Initial Version 3 dated 11th May 2023, online available at: Airspace change proposal public view (caa.co.uk)
C. ACP-2021-012 Stage 3 Step 3A Options Appraisal (Phase II – Full) Version 4, 5 March 2024 online available at: Airspace change proposal public view (caa.co.uk)
D. CAA SARG Policy Statement 12 February 2024 – For the establishment and Operation of SUA available at: Controlled Airspace Design Policy
E. Airspace Modernisation Strategy 2023–2040 Part 1: Strategic objectives and enablers CAP 171, online available at: CAP 1711 Part 1 Airspace Modernisation Strategy 2023-2040
F. CAP 1616 Fifth Edition published 2 January 2024; online, available at: CAP1616: The Process for Changing the Notified Airspace Design | Civil Aviation Authority

G. EIA Environmental Impact Assessment Spaceport-1 Scolpaig, online, available at: https://cne-siar.gov.uk/home/busines/spaceport-1/
H. Letter of Agreement between NATS (en Route) plc, MOD DE&S, AMC UK, QinetiQ Ltd, UK CAA, IAA and Shannon V1.0 effective 1st May 2023.
I. MKA Economics 'Spaceport 1 Socio-Economic Impact Assessment 2023/24 – 2025/26' Final Report dated November 2022, online, available at: https://cne-siar.gov.uk/home/busines/spaceport-1/
J. Spaceport 1 EIA Report - Supplementary Environmental Information SEI Addendum Report dated January 2023, online, available at: https://cne-siar.gov.uk/home/busines/spaceport-1/

5 Summary

ACP-2021-012 was commenced in 2021 in order to enable the safe launch, flight, and splash down of sub-orbital rockets from SP-1 site at Scolpaig, North Uist. The ACP petitions for SUA in the form of a small DA around the launch pad to protect SP-1 ground personnel, contained within a larger volume of SUA (DA) referred to as the 'airspace fillet' that is necessary to contain any credible hazards to aviation that sub-orbital rocket launch may cause during the launch and initial flight stages. In addition to the new SUA, the ACP solicits use of the MOD Hebrides Range D701 DAs for the main trajectory flight profile and splash down of the LVs.

The ACP process is an iterative process where the airspace Change Sponsor, QinetiQ Ltd, firstly presented a SoN detailing the requirement. The SoN was supported by a set of high level DPs that stakeholders were invited to review. Once the DPs were agreed and modifications adopted following feedback, several different airspace design options were presented. The airspace design options were for sub-orbital launch only as the requirement for orbital launch was removed from the ACP in 2022. Once the airspace requirements had been de-scoped to solely sub-orbital launch, it became apparent that much of the work conducted under a separate ACP, for a TDA around Scolpaig (ACP-2021-037), could be read across to ACP-2021-012. This included the safety work and rational for re-profiling the eastern boundary line of the airspace fillet so it no longer impacted on the beach landing site at Sollas.

The sub-orbital airspace options were submitted and evaluated against the SoN and DPs, again with stakeholder input; this informed the options appraisal phase I (Initial). Three potential airspace options were taken forward to the next stage of the ACP process and Phase II of the options appraisal conducted. Here quantitative assessments of the various impacts each option would have on a number of metrics were evaluated and the 'preferred option' determined. The process advanced to the formal consultation stage where a much broader group of stakeholders and interested parties were invited to comment and provide feedback on the ACP and the full options appraisal Phase II.

Consultation feedback was received from a diverse ensemble of stakeholders and organisations, none of which made any suggestions to modify the preferred airspace design option. Feedback from organisations mostly focussed on airspace management procedures and protocols; local responses concentrated mainly on opposition to a Spaceport being located on the Outer Hebrides. As there were no suggested actionable changes to the airspace design, it was determined that Options Appraisal Phase II (Full) would be the 'Final Options Appraisal'.

It was concluded that the proposed airspace fillet and small DA contained within, will have very little impact on aviation activities either in the local area or high level air traffic transiting the NAT. It is the corresponding activation of the D701 areas that has the main effect and it is here the Change Sponsor has presented the most detailed analysis and environmental impacts. It is evident from the options appraisal that none of the options taken forward lessoned the impact on the NAT air traffic or

consequential environmental impact caused by these aircraft flying extended track miles to avoid the activated D701 DAs. To assist in mitigating the impact on NAT air traffic, airspace protocols will be put in place for SP-1 that largely follow extant ASM procedures for the D701 areas. These are contained in the relevant LoAs.

It is further concluded that the final airspace design (Option 3) meets the aim of the ACP and SoN *'to facilitate the safe launch, flight and splashdown of sub-orbital rockets operating from the SP-1 launch facility at Scolpaig North Uist such that these activities pose no additional risk to other airspace users'*. Furthermore the design meets the objective of minimising disruption to other airspace users through the most efficient use of the airspace by meeting the DPs.

This report has been compiled in accordance with the template and instructions contained within CAP 1616 Edition 5 and is presented to the CAA for Stage 5 'DECIDE' of the ACP process.

Appendix A – Draft Letters of Agreement (1)

LETTER OF AGREEMENT (LOA) BETWEEN MOD HEBRIDES RANGE, MOD DEFENCE EQUIPMENT & SUPPORT (DE&S) AND COMHAIRLE NAN EILEAN SIAR (CnES) SPACEPORT-1 (SP-1) CONCERNING ACTIVATION, USAGE AND OPERATIONAL MANAGEMENT OF DANGER AREAS

1 Scope

1.1 This LOA details conditions and arrangements, and assigns responsibilities for the activation, access and operational management of the following DAs (DAs):

EGD701A-Y (herein referred to as D701) & SP-1 Airspace fillet DXXX *{DA number to be inserted}*

1.2 Provision and activation of D701 & DXXX is to be requested by SP-1 (through QinetiQ) for the purposes of sub-orbital sounding rocket launch, whose use of the DAs should be in accordance with the CAA approved designators list in the UK AIP ENR 5.1 as 'Other Munitions and Explosives (OME)' until otherwise updated by the CAA.

1.3 Use of D701 in support of SP-1 activities is subject to the published DE&S Ranges booking procedures and to a commercial agreement with QinetiQ (MOD Hebrides) under the Other Works Approvals (OWA) Long Term Partnership Agreement (LTPA) process.

1.4 The minimum SP-1 requirement for D701 is nominally D701Y, D701C or D701E as these are the permitted ingress/egress points from EG *{insert DA number}*. Provided that D701Y, C or E have been requested activated, any or all of the remaining D701 DAs may also be requested activated, provided that they are contiguous.

1.5 The provisions of this LOA apply only when EG *{insert DA number}* is active.

1.6 Temporary changes to cover non-standard requirements may be made subject to prior consultation and written agreement between DE&S and Comhairle Nan Eilean Siar (CnES) on behalf of SP-1.

2 Use of D701 DAs

2.1 Use of the D701 by SP-1 is subject to the following conditions:

a. [redacted]

b.

c. [redacted]

d. [redacted]

3 Booking Responsibilities

3.1 [redacted]

3.2 [redacted]

4 Launch Management & Responsibilities (including ingress/egress of DAs)

4.1 [redacted]

[redacted]

[redacted]

4.2 SP-1 Operator shall hold a valid Spaceport Operator (SPO) Licence (or obtain the necessary CAA permissions for ANO launches) and is responsible for:

[redacted]

4.3 The LV provider shall have the necessary regulatory licence and approval/permissions required for launch and shall be responsible for:

[redacted]

[redacted]

[redacted]

5 DA Activation/De-Activation Responsibilities

5.1 Subject to a commercial agreement established between SP-1 and QinetiQ i.a.w. 1.3 above.

[redacted]

5.2 MHRC is responsible for:

[redacted]

6 Operational Management of DAs

6.1 MHRC are responsible for:

[redacted]

[redacted]

7 Review

7.1 This Agreement [redacted]

7.2 This Agreement is to be reviewed at intervals not exceeding 12 months. Subject to the consent of all parties, changes may be made to the Agreement if the intention is that any changes would not introduce additional restrictions that would adversely affect the conduct of either party's business.

7.3 [redacted]

ANNEX A TO:
LOA BETWEEN MOD HEBRIDES RANGE, MOD DE&S AND SPACEPORT-1
Dated: xx May 25

DE&S RANGES – BOOKING PROTOCOLS FOR EGD701

[redacted]

Lead Protocols

The lead protocols are:

- [redacted]

- [redacted]
- [redacted]

Booking Protocols

[redacted]

[97] As per UK AIP ENR 5.1 - LINK Core hours generally Mon-Fri 0800-1700.

[redacted]

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Appendix B – Draft Letter of Agreement (2)

Draft Letter of Agreement Between Highlands & Islands Airports Ltd (HIAL), the MOD Defence Equipment & Support (DE&S) on behalf of MOD Hebrides and Comhairle nan Eilean Siar on behalf of Spaceport-1

SENT AS SEPARATE ATTACHMENT

Appendix C – Draft Letter of Agreement (3)

Draft LoA between NATS (en route) plc – Scottish Control (Prestwick) And Shanwick Oceanic Area Control (Prestwick), MOD Defence Equipment & Support (DE&S), Civil Airspace Manager AMC UK Military Airspace Manager, Civil Aviation Authority (CAA) Safety & Airspace Regulation Group, Irish Aviation Authority (IAA) Director Safety Regulation, The Irish Air Navigation Service trading as AirNav Ireland (ANI) General manager Shannon ACC, QinetiQ Ltd (MOD Hebrides Range), and Comhairle nan Eilean Siar (CnES) – Developer of/on behalf of Spaceport-1

SENT AS SEPARATE ATTACHMENT

Appendix D – Additional Safety Information

SENT AS SEPARATE ATTACHMENT

Appendix E – Draft AIP Entry

Identification and Name Lateral Limits	Upper Limit Lower Limit	Remarks (time of activity, type of restriction, nature of hazard, risk of interception)
1	**2**	**3**
Danger Area		
EGD tbd Spaceport-1 574128.00N 0073703.00W 574923.00N 0071500.00W 574003.88N 0072231.89W 573600.81N 0072210.50W 573305.00N 0073017.00W 574128.00N 0073703.00W	Upper limit: UNL Lower Limit: SFC	AMC Manageable. Activity: Spaceflight Activities/Ordnance Munitions and Explosives. Service: SUAAIS: Scottish Information on 127.275MHz. Contact: Pre-flight information: MOD Hebrides Range Control, Tel: 01870-604449 SUA Authority: QinetiQ Ltd Hours: Activated by NOTAM between the hours of: 0700-2000 Mon-Fri 0700-1800 Saturday.
EGD tbdZ Spaceport-1 574536N 0074217W - 575332N 0072012W, thence clockwise by the arc of a circle, radius 5NM, centred on 574923N 0071500W to 574800N 0070601W - 573438N 0071315W, thence clockwise by the arc of a circle, radius 5NM, centred on 573601N 0072210W to 573152N 0071700W - 572857N 0072506W, thence clockwise by the arc of a circle, radius 5NM, centred on 573305N 0073017W to 573106N 0073848W - 573929N 0074535W, thence clockwise by the arc of a circle, radius 5NM, centred on 574128N 0073703W to 574536N 0074217W.	Upper limit: As per AUP/UUP Lower Limit: SFC	For IFR flight planning purposes only

Identification and Name Lateral Limits	Upper Limit Lower Limit	Remarks (time of activity, type of restriction, nature of hazard, risk of interception)
1	2	3
EGD tbc Spaceport-1 A circle, 1000m radius, centred at 573900.51N 0072904.61W	Upper Limit: 3000 AGL Lower Limit SFC	AMC Manageable. Activity: Spaceflight Activities/Ordnance Munitions and Explosives. Service: SUAAIS: Scottish Information on 127.275MHz. Contact: Pre-flight information: MOD Hebrides Range Control, Tel: 01870-604449 SUA Authority: QinetiQ Ltd Hours: Activated by NOTAM between the hours of: 0700-2000 Mon-Fri 0700-1800 Saturday.
EGRU tbc Spaceport-1 A circle, 2.7 NM radius, centred at 573900.51N 0072904.61W	Upper Limit: 2000 AGL Lower Limit SFC	FRZ Active H24. Unmanned aircraft flight not permitted unless permission has been granted by the relevant Air Traffic Service unit or aerodrome operator. Contact: MOD Hebrides Range Control, Tel: 01870-604449

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