ADDENDUM

TO

ACP-2017-079

SHETLAND SPACE CENTRE LIMITED (SAXAVORD SPACEPORT) AIRSPACE CHANGE PROPOSAL

CAP1616 STAGE 4B SUBMISSION

AMENDMENT TO PROPOSED AIRSPACE DESIGN

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DOCUMENT CONTROLS

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1. INTRODUCTION

1.1. Overview.

As part of its Stage 5 ("Decide") activities, CAA (Space Team) regulators suggested that SaxaVord's ACP-2017-079 proposed airspace design might require revision to ensure that it was suitable to contain the potential hazards presented by off-nominal launch events. Such revision(s) could include an extension to the boundary south of the spaceport and an extension of lateral boundaries to provide containment for launch azimuths approaching the 330T/030T extremities.

CAA would consider the extent of any proffered amendments against the criteria in CAP1616 (Para 200). CAA offered that they would expect that any such amendments would be likely to fall within CAP 1616, Para 243.

As such, CAA directed SaxaVord to submit any proposed amendments to the ACP-2017-079 proposed airspace design with a rationale stating how the amendment accords with the considerations of CAP1616, Para 200 and the requirements of CAP1616, Para 243.

Consequently, SaxaVord re-assessed the design against the latest evolving launch vehicle (LV) data available and elected to make minor amendments to the proposed airspace design. Such amendments would increase the utility of the airspace for different launch operators' LVs and, in particular, for those LVs with limited flight heritage (referred to as "immature" LVs in the ACP-2017-079 Stage 4 Submission).

1.2. Permanent Danger Area (DA).

Separate to the ACP-2017-079 application, CAA considered SaxaVord's application for a restricted area (RA) to be implemented at the spaceport site.

CAA opined that a Flight Restriction Zone (FRZ) would be established by UK regulation[1] when the SaxaVord Spaceport was licenced, CAA did not, however, consider an RA to be the appropriate airspace structure. Whilst CAA acknowledged the potential hazards posed by various operations likely to be undertaken at the spaceport, CAA considered the notification of a danger area (DA) to be both appropriate and proportionate for the SaxaVord Spaceport.

CAA, therefore, directed SaxaVord to add a DA of appropriate dimensions to the ACP-2017-079 submission, by amendment or addendum. CAA considers the addition of this DA to fall within the CAP1616 process.[2]

1.3. Submission of Addendum to the ACP-2017-079 Proposed Airspace Design.

Accordingly, this amendment to the ACP-2017-079 proposed airspace design is submitted to CAA. This Stage 4 addendum must be read in conjunction with the ACP-2017-079 Stage 4 Submission document.

1. CAP722C "*Unmanned Aircraft Systems: UAS Airspace Restrictions Guidance and Policy*" (online), accessed on 19 Sep 23.
2. CAP1616, Para 243.

2. AMENDMENT TO THE ACP-2017-079 PROPOSED AIRSPACE DESIGN.

2.1. Justification/Rationale For Amendment of the Proposed Design.

SaxaVord re-assessed the proposed airspace design against the latest evolving LV data available and elected to make minor amendments to the airspace design. In particular, the likely launch azimuths of immature LVs were considered and the resulting airspace reservation that would be required to continue to ensure safety by exclusion.

SaxaVord's reassessment identified the requirement for 4 additional segments to the airspace design. A 5th permanent portion of the DA was added to protect other airspace users from routine and potentially hazardous spaceport operations, which could occur at any time and at short notice (articulated at Section 1.2, above). Details of the evolution of the amended airspace design are provided in Section 2.2, below.

Stage 4's Design Option 3 remained sufficient for anticipated sub-orbital launches, continuing to satisfy the Statement of Need and Design Principles (DPs). Operational flexibility and benefit for orbital launches, however, could be further enhanced by the proposed amendments to the airspace design. Consequently, the remainder this document pertains to orbital LVs only.

2.2. Evolution of the Amended Design.

The overarching premises remain those of safety by exclusion and activation of the amended airspace design for the minimum period necessary to support launch operations. To achieve safety by exclusion, immature LVs are anticipated to require a larger airspace reservation than mature LVs, as explained in the ACP-2017-079 Stage 3 Consultation materials.

The segmented structure of Stage 4's Design Option 3, coupled with the segmented structure of the proposed amendment continues to afford flexibility in the implementation of the DA, in turn, reducing the potential impact on airspace users and the ATM network. The proposed amended design continues to cater for safety in the initial ascent phase of the launch.

Typically, the launch azimuths for immature LVs would be 360°T and, for sun-synchronous orbit, approximately 344°T, as these are safe directions from a geographic perspective. A launch azimuth of 030°T would be unlikely due to identified constraints, such as North Sea energy surface infrastructure and adjacent land masses (i.e. Norway) to the northeast. A launch azimuth of 330°T would be unlikely, but some utility could easily be gained from appropriate sizing of additional airspace for 344°T azimuths. These basic scenarios are considered in further detail below with respect to up range, downrange and cross range sizing of the airspace.

2.2.1. Downrange.

The current design downrange parameter was assessed as being suitably sized (i.e. no extension required to the north of Design Option 3).

2.2.2. Up Range.

A small addition of approximately 6 nm has been made to the south of tile A, i.e. the "box" around the launch site; this amendment is tile "AK" in Figure 1.

2.2.3. Cross Range to the West.

Two additions have been made to support launch azimuths to the west: the first tile, "AH" in Figure 1, is suitable for both 330°T and 344°T launch azimuths; the second tile, "AL" in Figure 1, is suitable for 344°T launch azimuths.

Tile AL has not been extended to accommodate the 330°T azimuth immature LV case as SaxaVord considered that the required size of the amended airspace would be disproportionately large when it was not considered a likely immature LV launch azimuth.

2.2.4. Cross Range to the East.

One addition has been made, tile "AJ" in Figure 1. Although a northeasterly launch azimuth (such as 030°T) for an immature LV is considered unlikely, the addition of tile AJ would afford utility for cross range requirements for other launch azimuths in the immediate vicinity of the launch site. Tile AJ is comparable to tile AH but is truncated at the eastern boundary of the UK Flight Information Region.

2.2.5. Permanent DA.

As described in Section 1.2, above, a proportionate permanent DA has been added to ACP-2017-079.

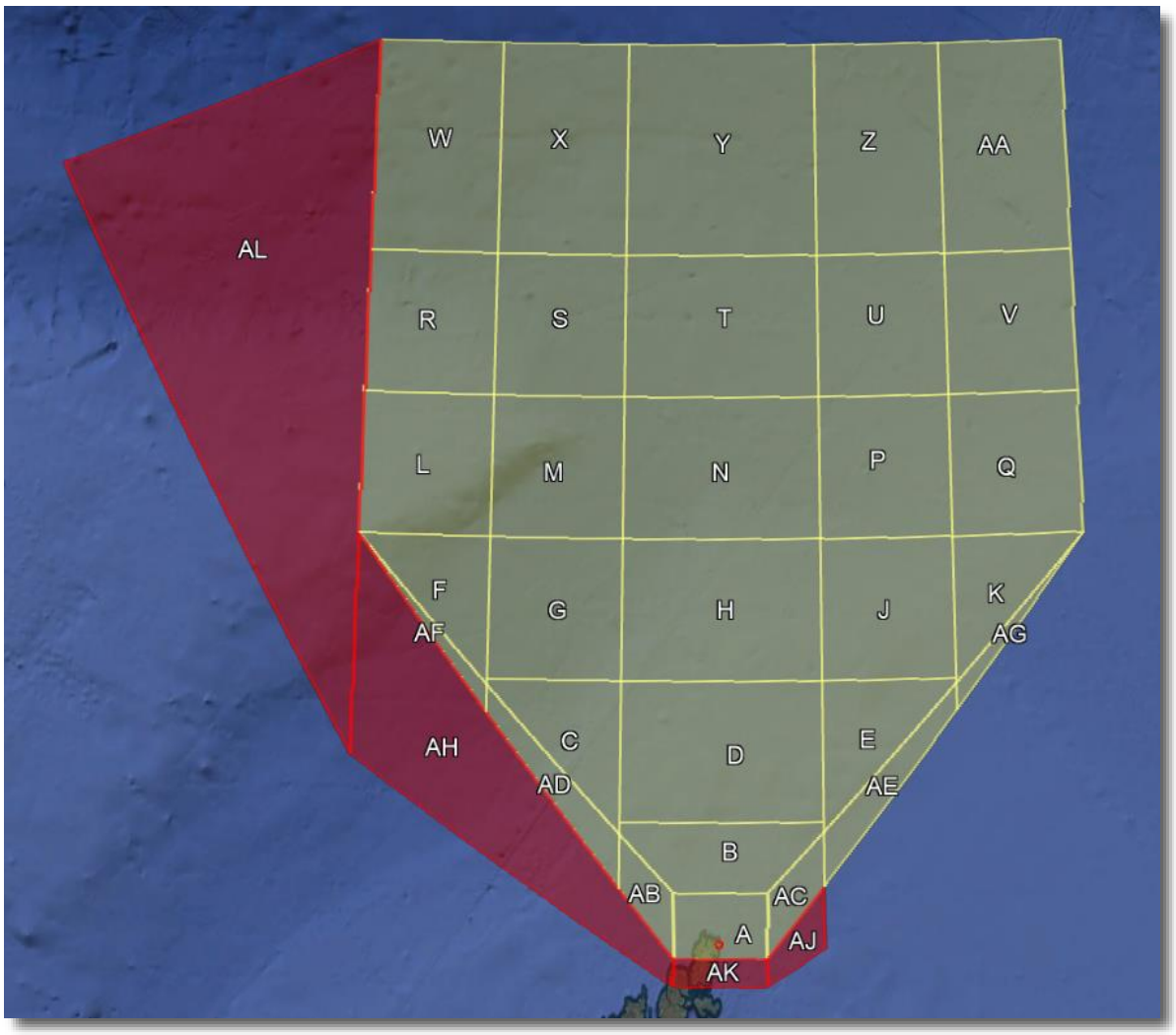
In accordance with UK Space Industry Regulations, SaxaVord will implement safety clear zones for anticipated hazardous pre- and post-flight operations at the spaceport, which might be conducted as part of launch or other operations. These activities could be frequent, occur at any time of the day and at short notice; a proportionate permanent DA is, therefore, appropriate.

To achieve any required individual safety clear zone at the spaceport (and, in turn, achieving safety by exclusion), the permanent DA would be sized 0.75nm radius centred on Launch Pad 2 (LP2) and 3,000ft Above Mean Sea Level (AMSL). LP2 is located near the centre of the SaxaVord launch area and is approximately equidistant from the spaceport's other 2 launch pads.

This single simple, proportionate and permanent DA would, therefore, accommodate appropriate safety clear zones up to the maximum anticipated at any of the 3 launch pads and other locations on the launch site.

2.3. Proposed Amended Design Option.

Figure 1, below, indicates the proposed amended Design Option. The proposed amendment airspace is depicted in red against Design Option 3.



Source: Google Earth

Figure 1 - Proposed Amended Airspace Design Option (with Segmentation)

3. QUALITATIVE ANALYSIS OF AMENDED DESIGN OPTION

The detailed quantitative analysis of Design Option 3 is contained within the ACP-2017-079 Full (and *de facto* Final) Options Appraisal, which has been reproduced at Annex A to the Stage 4 Submission document.

As Annex A to the Stage 4 Submission document offered, the most impacted flight could be subject to a 31km route extension and that this corresponded to a 0.39% increase in the total flight distance of the subject flight. SaxaVord's Final Options Appraisal applied this 31km flight route extension to all potentially impacted flights to derive a working assumption upon which to base the Appraisal's CO2e and flight fuel-burn analyses; this was a significantly longer extension than the increased flight distance for the majority of the potentially impacted flights identified and analysed.

Comparing Figure 1 (i.e. the amended proposed airspace design), above, with Figure 7 from Annex A to the Stage 4 Submission document, a qualitative analysis of the potential flight re-route, fuel burn

and corresponding CO2e impacts of the activation of the amended proposed airspace design could be assessed as negligible.

The proposed amended airspace design could result in increased total flight distances of in the region of a few kilometres per impacted flight, *versus* the original Stage 4 analysis of 31km per flight, which SaxaVord used to quantify a most limiting scenario. Accordingly, any variance in total flight distance as a result of the amended airspace design could be seen to have been contained within this overall limiting case of the 31km applied to all potentially impacted flights in SaxaVord's Final Options Appraisal, as set out in Table 1 in Annex A to the Stage 4 Submission document.

The new permanent DA incorporated within the amended airspace design would not impact the re-routing of traffic patterns below 7,000ft AMSL.

The proposed amendments to the airspace design can, therefore, be seen to have no significant additional impact on the stakeholders already consulted at Stage 3; additionally, there are no new stakeholders impacted as a result of the proposed amendments to the airspace design.

Accordingly, the stakeholders identified and consulted at Stage 3 need not, therefore, be re-consulted on the amended ACP-2017-079 proposed airspace design.

3.1. Qualitative Re-assessment of Stage 4 Analyses.

3.3.1. Airspace Description Requirements.

SaxaVord's assessment of the Airspace Description Requirements for ACP-2017-079 remains unchanged and is contained within Table 2 of the Stage 4 Submission document.

3.3.2. Safety Assessment.

The ACP-2017-79 "ACP Safety Assessment" document[3] provides the safety assessment of the proposed permanent airspace reservation, which remains unchanged.

3.3.3. Operational Impact.

SaxaVord's assessment of the Operational Impact for ACP-2017-079 remains unchanged and is contained within Table 3 of its Stage 4 Submission document.

3.3.4. Supporting Infrastructure Resources.

SaxaVord's assessment of Supporting Infrastructure Resources for ACP-2017-079 remains unchanged and is contained within Table 4 of its Stage 4 Submission document.

3.3.5. Airspace and Infrastructure.

- Airspace & Infrastructure - General Requirements.

  SaxaVord's assessment of Airspace & Infrastructure - General Requirements for ACP-2017-079 remains unchanged and is contained within Table 5 of its Stage 4 Submission document.

- Airspace & Infrastructure - ATS Route Requirements.

  SaxaVord's assessment of Airspace & Infrastructure - ATS Route Requirements for ACP-2017-079 is contained within remains unchanged and is contained within Table 6 of its Stage 4 Submission document.

3. LP-015-SAXA dated 7 Jul 23.

- Airspace & Infrastructure - Terminal Airspace Requirements.

SaxaVord's assessment of Airspace & Infrastructure - Terminal Airspace Requirements for ACP-2017-079 remains unchanged and is contained within Table 7 of its Stage 4 Submission document..

- Airspace & Infrastructure - Off-route Airspace Requirements.

SaxaVord's assessment of Airspace & Infrastructure - Off-route Airspace Requirements for ACP-2017-079 remains unchanged and is contained within Table 8 of its Stage 4 Submission document.

3.3.6. Environmental Assessment

SaxaVord's summary Environmental Assessment for ACP-2017-079 remains unchanged and is contained within Table 9 of its Stage 4 Submission document.

4. POTENTIAL IMPACTS

As cited in Section 3, above, there are no new potential impacts associated with the amendment of the proposed design and the existing impacts cited in the ACP-2017-079 Stage 4 Submission document remain unchanged.

The amendments to the proposed airspace design do not alter the intended use of the proposed airspace, such that any stakeholders not previously consulted could now be impacted.

The amendments to the proposed airspace design do not alter the use of the proposed airspace, to the extent that the impact on one or more stakeholders already consulted has changed substantially and negatively.

SaxaVord asserts that there is no requirement to re-consult the application's stakeholders.

5. CONCLUSION

As part of its Stage 5 ("Decide") activities, CAA (Space Team) regulators suggested that the proposed ACP-2017-079 airspace design might require revision to ensure that it was suitable to contain the potential hazards presented by off-nominal launch events. CAA directed SaxaVord to submit any proposed amendment(s) to the ACP-2017-079 proposed airspace design with a rationale stating how the amendment accords with the considerations of CAP1616.

SaxaVord re-assessed the proposed airspace design against the latest evolving LV data available and elected to make minor amendments to the airspace design, incorporating 4 additional airspace segments; a 5th permanent portion of the DA was added to protect other airspace users from routine and potentially hazardous spaceport operations.

Comparing the proposed amended airspace design with that submitted at Stage 4, a qualitative analysis of the potential flight re-route, fuel burn and corresponding CO2e impacts of the activation of the amended proposed airspace design could be assessed as negligible.

The proposed amended airspace design could result in increased total flight distances of in the region of a few kilometres per impacted flight, *versus* the original Stage 4 analysis of 31km per flight, which SaxaVord used to quantify a most limiting scenario. Accordingly, any variance in total flight distance as a result of the amended airspace design could be seen to have been contained within this overall limiting case of the 31km applied to all potentially impacted flights in SaxaVord's Final Options Appraisal. Moreover, the new permanent DA would not impact the re-routing of traffic patterns below 7,000ft AMSL.

The proposed amendments to the airspace design can, therefore, be seen to have no significant additional impact on the stakeholders already consulted at Stage 3; additionally, there are no new stakeholders impacted as a result of the proposed amendments. Accordingly, the stakeholders identified and consulted at Stage 3 need not be re-consulted on the amended ACP-2017-079 proposed airspace design.

SaxaVord's Final Options Appraisal concluded that the wider ATM/airspace network and its users could incorporate the unmitigated activation of Design Option 3 with minimal/negligible impact on the baseline prevailing traffic scenario. SaxaVord's qualitative assessment is that the amended airspace design could be accommodated similarly and without significant impact.

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