CAA CAP 1616 Options Appraisal Assessment (Phase I Initial)

Title of Airspace Change Proposal:	Shetland Space Centre (SaxaVord Spaceport)		
Change Sponsor:	Shetland Space Centre Ltd		
ACP Project Ref Number:	ACP-2017-79		
Case study commencement date:	17/11/2022	**Case study report as at:**	07/12/2022

Account Manager: [redacted]	**Airspace Regulator (Engagement & Consultation):** [redacted]	**IFP:** [redacted]	**OGC:** [redacted]
Airspace Regulator (Technical): [redacted]	**Airspace Regulator (Environmental):** [redacted]	**Airspace Regulator (Economist):** [redacted]	**ATM (Inspector ATS Ops):** [redacted]

Instructions

To aid the SARG project leader's efficient project management, please highlight the "status" cell for each question using one of the four colours to illustrate if it is:

Resolved - GREEN Not Resolved – AMBER Not Compliant – RED Not Applicable - GREY

Guidance

The broad principle of economic impact analysis is **proportionality**; is the level of analysis involved proportionate to the likely impact from that ACP There are three broad levels of economic analysis; qualitative discussion, quantified through metrics, and monetised in £ terms. The more significant the impact, the greater should be the effort by sponsors to quantify and monetise the impact.

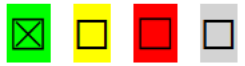
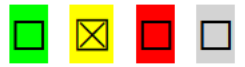
1. Background – Identifying the impact of the options (including Do Nothing (DN) / Do Minimum (DM))			Status
1.1	**Are the outcomes of the Initial Options Appraisal (IOA) (Phase I) clearly outlined in the proposal?**		☒ ☐ ☐ ☐
1.1.1	Has the change sponsor completed an Initial Options Appraisal? [E12]	Yes, the sponsor provided the IOA which is embedded in the main submission document named Stage 2 Develop & Assess Submission V2 1.	☒ ☐ ☐ ☐
1.1.2	Does the Initial Options Appraisal include: - a comprehensive list of viable options; - a clear description of the baseline scenario; - an indication of the environmental impacts; - a high-level assessment of costs and benefit involved	Yes, the IOA does include two options considered against the baseline option which are concluded to be both viable. The sponsor expanded significantly on the description of the baseline option with collecting the current flight data in the airspace determined to be affected by the airspace change. There is also significant description for the noise and CO2 impacts along with the description of other environmental impacts that needs assessing for an airspace change. The sponsor provided a high-level qualitative and to some extent quantitative assessment of costs and benefits of the environmental impacts mainly. PH – The sponsor states that the baseline reflects the current traffic scenario as there are no extant space launch activities taking place. The sponsor has also provided a traffic analysis study to support the description of the baseline. An indication of the current and potential direct (from the space launch activities) and indirect (from the consequential rerouting of other airspace users) environmental impacts has also been provided.	☒ ☐ ☐ ☐
1.1.3	Has the sponsor stated on what criteria the comprehensive list of viable options has been assessed?	The sponsor provided the criteria for the impact assessment in the IOA that is available in the Table E2 produced for Design Option 1 and Design Option 2.	☒ ☐ ☐ ☐
1.1.4	Where options have been discounted as part of the IOA exercise, does the change sponsor clearly set out why?	The sponsor has stated in the IOA that their preferred option is Design Option 2 – Airspace Reservation (Segmented) and this option will be taken forward to	☒ ☐ ☐ ☐

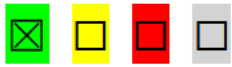
		Stage 3 which means Design Option 1- Airspace Reservation (Non-Segmented) is actually discounted in the IOA because Design Option 2 offers the flexibility to tailor an airspace volume to a specific LV's operating characteristics and orbital trajectory requirements, the sponsor concluded Design Option 2 would reduce the airspace requirements for individual launch operations and hence minimise impact on the network and other airspace users.	
1.1.5	Has the change sponsor indicated their preferred option(s) as a result of the IOA (Phase I - Initial)? [E12]	The preferred option is determined to be Design Option 2 – Airspace Reservation (Segmented) due to the feedback received from the majority of stakeholders and due to the reasons explained in Question 1.1.4 above.	☒ ☐ ☐ ☐
1.1.6	Does the IOA (Phase I - Initial) detail what evidence the change sponsor will collect, and how, to fill in any evidence gaps and how this will be used to develop the Options Appraisal (Phase II - Full)?	The change sponsor only mentioned the evidence they will collect at Stage 3 for CO2 emissions impact assessment; at Stage 2 it is stated that annual totals for potential traffic impacts and CO2 emissions are offered but a more detailed assessment of fuel and CO2 impacts of the proposed airspace design options utilising TAG would be provided at Stage 3. PH – The sponsor has stated that only the monetisation of indirect GHG impacts will be done at Stage 3. Given the low number of aircraft movements impacted, the monetisation of other indirect environmental impacts (noise, local air quality) is considered disproportionate. There is no requirement to monetise the noise impacts from the direct space launch activities. References to the *SaxaVord Spaceport AEE V2.1 Assessment of Environmental Effects* dated 30/09/22 are given for additional assessment details regarding the direct impacts from the space launch activities.	☒ ☐ ☐ ☐
1.1.7	Does the plan for evidence gathering cover all reasonable impacts of the change? [E12]	The sponsor has provided separate CAP 1616 Table E2 for considered viable options. Table E2 format is directly taken from CAP 1616 Table E2 so covers all airspace	☒ ☐ ☐ ☐

		change related impacts but few recommendations will be shared with the sponsor to enable a more detailed analysis at Stage 3.	

2. Impacts of the proposed airspace change					Status
2.1	**Are there direct impacts on the following:**				☐ ☒ ☐ ☐
2.1.1	*Examples of costs considered (please add costs that have been discussed, and any reasonable costs that the Airspace Regulator (Technical) feels have NOT been addressed)*				
2.1.2	Airport/ANSPs	Not applicable	Qualitative	Quantified	Monetised
	- Infrastructure	X			
	- Operation	X			
	- Deployment	X			
	- Other(s)	X			
2.1.3	Commercial Airlines/General Aviation	Not applicable	Qualitative	Quantified	Monetised
	- Training	X			
	- Economic impact from increased effective capacity	X			
	- Fuel burn		N/A	N/A	N/A
	- Other(s)	X			
2.1.4	General Aviation	Not applicable	Qualitative	Quantified	Monetised
	- Access	X			
2.1.5	Military	Not applicable	Qualitative	Quantified	Monetised
		X			
2.1.6	Wider society, i.e., wider economic benefits, capacity resilience	Not applicable	Qualitative	Quantified	Monetised

		X			
2.1.7	Other (provide details)	Not applicable	Qualitative	Quantified	Monetised
		X			

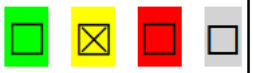
2.2	**Are there direct beneficial impacts on air traffic control / management systems? Provide details.** The change sponsor stated in the IOA that the proposed airspace design options will not require a change in airport/air navigation service provider costs due to the fact that airspace reservations and their management are a routine occurrence for ANSPs.	
2.3	**Where impacts have been monetised, what is the overall value (expressed in net present value (NPV)) of the project?** N/A – The sponsor has only taken into account environmental impacts and has not yet conducted the full Cost Benefit Analysis. Hence, the information for the NPV is not available.	
2.4	**Has the sponsor provided an accurate and proportionate assessment of the proposed airspace change impacts?** The sponsor has succeeded to explain all environmental impacts related to an airspace change in a proportionate way. However, the sponsor has not provided sufficient detail with regards to certain economic costs (i.e. fuel burn). Therefore, the sponsor will be advised to indicate monetised cost for fuel burn at Stage 3.	

3. Changes in air traffic movements and projections				**Status**
3.1	**If the proposed airspace change has an impact on the following factors, have they been addressed in the proposal?**			
		Not applicable	Qualitative	Quantified/ Monetised
3.1.1	Number of aircraft movements	X		
3.1.2	Number of air passengers / cargo	X		
3.1.3	Type of aircraft movements (i.e., fleet mix)	X		
3.1.4	Distance travelled		X	X
3.1.5	Operational complexities for users of airspace	X		

3.1.6	Flight time savings / Delays	X		
3.1.7	Other impacts	X		
	Comments: The IOA stated for the considered Design Option 1 and 2 that these airspace design options will not drive changes that increase air transport numbers and estimated passenger numbers or cargo tonnage carried. However, in terms of the distance travelled, the CO2 analysis the sponsor conducted in the IOA demonstrated that the negligible re-route impacts associated with activation of the proposed airspace design has an equally negligible impact on CO2 emissions; in some cases, the potential re-route could produce either a shorter, equivalent or longer flight distance.			
3.2	• Has the sponsor used the most up-to-date, credible and clearly referenced source of data to develop the 10 years traffic forecast and considered the available guidelines (i.e., the Green Book and TAG models) in a proportionate and accurate manner? [B11 and E11] The sponsor has extracted traffic forecast data from Eurocontrol's Traffic Forecast Update for Europe 2022-2028, dated October 2022. By using this data, the base scenario forecast is considered the measure for extrapolating data to 2028. The sponsor explained their methodology to drive the forecast from 2019 to 2031 in detail in the IOA; the assumed base and application of percentage variance by year is set out to see the differentiation for the 10-year period and the sponsor estimated the potential number of flights impacted by the airspace activation following the variances determined for low, base and high scenarios. The IOA also stated the analysis assumed the most limited airspace design, Design Option 1. • Has the sponsor explained the methodology adopted to reach its input and analysis results? [B11 and E11] The sponsor has explained the methodology adopted to reach its indicative results for indirect CO2 emissions impacts. The calculations are based on generalised assumptions related to aircraft type, track mileage and fuel burn and will be developed further in Stage 3 when these impacts are monetised. The methodologies adopted for the assessment of direct environmental impacts from the space launch activities are provided in the *SaxaVord Spaceport AEE V2.1 Assessment of Environmental Effects* dated 30/09/22 and are backed-up by reputable sources and references to comprehensive analysis documents and guidance.			
3.3	**Has the sponsor developed an assessment of the following environmental aspects?** The sponsor has assessed the direct impacts (spaceflight activities) as well as indirect consequential impacts (other airspace users) on environmental metrics. The sponsor has presented references and conclusions from the *SaxaVord Spaceport AEE V2.1 Assessment of Environmental Effects* dated 30/09/22 to account for the direct impacts related to noise, GHG emissions, local air quality, tranquillity and biodiversity. The sponsor has stated that there is no indirect impact on noise, overflight and local AQ due to no change in traffic patterns below 7,000 ft. This rationale is supported by an airspace traffic analysis based on ADS-B surveillance data from Jan-Dec 2019. The sponsor has also assessed the CO2 emissions resulting from a reroute extension of 30km for 10 aircraft impacted over the 30 annual			

	activations of the design options corresponding with the launches. These are estimated to be 1,145 tCO2/year representing an increase of 0.375% compared to the baseline. The sponsor does not anticipate any indirect impacts upon tranquillity and biodiversity as a result of the proposed change in airspace.				
		Not applicable	Qualitative	Quantified	Monetised
3.3.1	Noise		X	X	
3.3.2	Operational diagrams	X			
3.3.3	Overflight		X		
3.3.4	CO2 emissions			X	
3.3.5	Local air quality		X	X	
3.3.6	Tranquillity		X		
3.3.7	Biodiversity		X		
3.4	**What is the monetised impact (i.e., Net Present Value (NPV)) of 3.3? (Provide comments)** N/A - The sponsor confirmed that for the CO2 emissions associated impacts, TAG will be utilised to conduct a detailed monetised analysis at Stage 3.				

4. Economic Indicators of the ACP	**Status**
4.1	**What are the qualitative / strategic impacts described in the ACP?** SaxaVord Spaceport seeks to conduct vertical launch operations for orbital and sub-orbital activities on Lamba Ness, Unst. A suitable airspace reservation of defined dimensions is required to ensure the safety of other airspace users from SaxaVord launch activities and to ensure the safety of SaxaVord launch activities from other airspace users. The proposed airspace reservation would be activated for the minimum specified periods necessary to support nominated launch operations and would extend from surface (SFC) to unlimited (UNLTD). The wider society and airlines may benefit from the negligible impacts associated with activation of the proposed airspace design that has an equally negligible impact on fuel burn and CO2 emissions which is some cases lead to a shorter or equivalent flight distance.
4.2	**What is the overall monetised and non-monetised (quantified) impact of the proposed airspace change?** The sponsor quantified the impact for CO2 emissions and confirmed that it will be monetised by using TAG tool as well. SaxaVord analysed surveillance data to establish a pre-COVID-19 baseline traffic assessment to identify potential impacts of the proposed airspace design options on the network. Considering macro and micro levels of airspace volumes SaxaVord reached the maximum potential number of flights that could be impacted by the designs were identified. SaxaVord identified a peak day and hour to see how the proposed airspace design impacted by the activation. As a result, flight distances were observed to be impacted by between -19 and +31km. SaxaVord assumed an absolute worst-case scenario of an additional 30km for each flight. Extrapolating this extended flight distance across 10 flights and 30 instances (i.e. SaxaVord

	launches), the annual impacts for flight distance and CO2 emissions could be shown to increase by 9,000 km and 1,145 tonnes respectively, representing a 0.375% increase in both metrics above the measured baseline calculations. SaxaVord, therefore, concludes that, even in a most limiting case, the wider network could incorporate the activation of the proposed airspace design with negligible impact on the baseline prevailing traffic scenario.	
4.3	**What is the Net Present Value of the proposed options? Has the sponsor used this information to progress/discount options? Has the sponsor provided the benefits-costs ratio (BCR) of the proposed options and used it to support the choice of the preferred options? [E44]** N/A – The sponsor has discounted Design Option 1 even though it is a viable option by relying on the fact that the majority of the stakeholders favoured Design Option 2 and for the reasons outlined in answer to the Question 1.1.4.	
4.3.1	**If the preferred option does not have the highest NPV or BCR, then has the sponsor justified the reasons to progress this option? [B50 and E23]** Please refer to the answer above at Question 4.3.	
4.4	**Have the sponsors provided reasonable justification for the proportionality of analysis above?** The sponsor provided proportionate environmental impacts assessment and confirmed that they will conduct a detailed monetised analysis by using TAG greenhouse gas assessment at Stage 3. However, in terms of the economic impact that need to be assessed for an airspace change i.e. fuel burn etc. were neglected by the sponsor So, this will be highlighted in the bottom (Issues section) so that the sponsor is recommended to provide more detailed analysis i.e. quantitative and monetised at Stage 3 in the Full Options Appraisal.	

5. Other aspects	
5.1	N/A

6. Summary of the Initial Options Appraisal & Conclusions	
6.1	The sponsor has provided proportionate environmental analysis for the Initial Options Appraisal; they haven't just qualitatively discussed the cost and benefits of the airspace activation proposed and its impacts on wider society in terms of noise and CO2 emissions. SaxaVord managed to quantify the CO2 emissions impact. SaxaVord also provided explanation to detail their methodology to drive the estimation on CO2 emissions analysis and the traffic forecast driven from 2019 to 2031. However, the sponsor neglected to quantify fuel burn change as a result of potential rerouting that need to be assessed for an airspace change proposal alongside the CO2 emissions impact. This has been flagged in this report to recommend sponsor how the initial phase of the options appraisal needs to be developed into a more quantified and monetised analysis at the second phase (Full Options Appraisal).

Outstanding issues		
Serial	Issue	Action required
1	CAP 1616 Table E2 for Design Option 2. The Table E2 for Design Option 2 has references to Design Option 1 in several impacts which is probably caused due to copy paste issues. The sponsor should correct these to be consistent.	The sponsor should correct these to be consistent.
2	Lack of the assessment of fuel burn change.	The sponsor should provide quantitative and monetised analysis for fuel burn costs at the Full Options Appraisal which is only analysed qualitatively at this stage even though the sponsor put significant effort to calculate the CO2 emissions impact at the IOA [CAP 1616 E32-E36 & Table E2].
3	Methodology to appraise incremental change between Design Option 1 and Design Option 2.	The sponsor should quantify and monetise the difference between Design Option 1 and 2 when compared against the baseline option if possible at Stage 3. As mentioned in the feedback call after Gateway meeting held on 30th November 2022, one approach to achieve this might be considering the average of the total cumulative additional re-route of 10 flights for Design Option 2 along with the current assumption of the worst-case scenario for Design Option 1 [CAP 1616 E29-E44 & Table E2].

CAA Initial Options Appraisal Completed by	Name	Signature	Date
Airspace Regulator (Economist)	[redacted]	[redacted]	07/12/2022
Airspace Regulator (Environmental)	[redacted]		07/12/2022