TECHNICAL NOTE

SPACEPORT 1, SCOLPAIG

VERSION 1.1

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1 INTRODUCTION

Metrica Environmental Consulting Ltd ('Metrica') has been commissioned by Atlantic58 ('the Client') to provide support during the Airspace Change Proposal (ACP) process associated with Spaceport 1 ('the Development), a new spaceport to be built and operated at Scolpaig, North Uist.

As part of this process, Metrica has been responding to comments relating to noise from the Civil Aviation Authority (CAA) following submission of the Development's EIA Report[1]. This Technical Note provides a formal response to the most recent comments from the CAA.

2 LAUNCH VEHICLE NOISE MODELLING AND FREQUENCY SPECTRUM

The CAA provided the following comment[2] with regard to the 1/3 octave band frequency spectrum shown in Chart 1 of Section 3.1 of the EIA Technical Assessment[3]:

"Rocket launches generate a lot of low frequency noise, however, the sponsor's 1/3 octave band spectrum exhibits very little low frequency noise, as if it is already A-weighted"

The method for determining the sound power level and associated frequency spectrum for launch noise is described in NASA 1971[4]. This is the method employed by the RUMBLE 2.0 launch noise modelling software, and has been validated by the software authors through measurement.

As the method relies on the physical characteristics of the launch vehicle, the resulting frequency spectrum is specific to the launch vehicle used. The values presented in the EIA Technical Assessment have been checked as requested; we can confirm that they are correct and are unweighted dB(Z) values.

It is important to note that the bandwidth of each 1/3 octave band is substantially smaller at lower frequencies (i.e., in the order or 10 Hz), than at higher frequencies (i.e. in the order of 1000 Hz). As such, the levels in low-frequency bands will intrinsically appear lower than those at higher frequencies, even where the level of energy at each frequency is the same, (e.g. white noise). This gives an impression form the chart that the launch vehicle emits 'very little' low-frequency noise when that is not the case in practice.

3 PREDICTED SOUND LEVELS: dB(Z)

With regard to predicted sound levels, the CAA queried the relationship between LAmax(slow) and LZmax(slow) levels, and stated that the assessment is required to *"remodel and map all areas exposed to spaceflight noise exceeding 100, 105, 110, 115 and 120 dB LZmax. The maps must illustrate any structures in the area impacted above 100 dB LZmax."*

[1] Spaceport 1 EIA Report, Chapter 19: Noise and Vibration, Aquatera Ltd and Western Isles Marine and Environment Ltd, 2021

[2] Received by email from Client, dated 30/01.2024

[3] Spaceport 1 EIA Report, Appendix 19.1: Technical Appendix: Noise, Aquatera Ltd and Western Isles Marine and Environment Ltd, 2021

[4] NASA SP-8072 Acoustics Loads Generated by the Propulsion System, National Aeronautics and Space Administration, 1971

With regard to the difference between A-weighted and Z-weighted levels, whilst the difference does not change with level in its pure sense, it does vary with distance from the source, due to the frequency spectrum becoming gradually weighted toward lower frequencies with increasing distance, due to air and ground absorption effects.

Therefore, and as requested, the RUMBLE model has been re-run using the same input parameters as those used in the EIA; and the resulting LZmax(slow) contours shown in Figure 1. In addition, the figure shows any / all residential dwellings and scheduled monuments that are predicted to experience noise levels above 100 dB, LZmax(slow). As stated in the EIA Report, Scolpaig Farmhouse will not be reinstated as a residential dwelling, instead being integrated and redeveloped as part of the Development; it is therefore not a noise-sensitive receptor for the purposes of this assessment.

As can be seen, 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[5]).

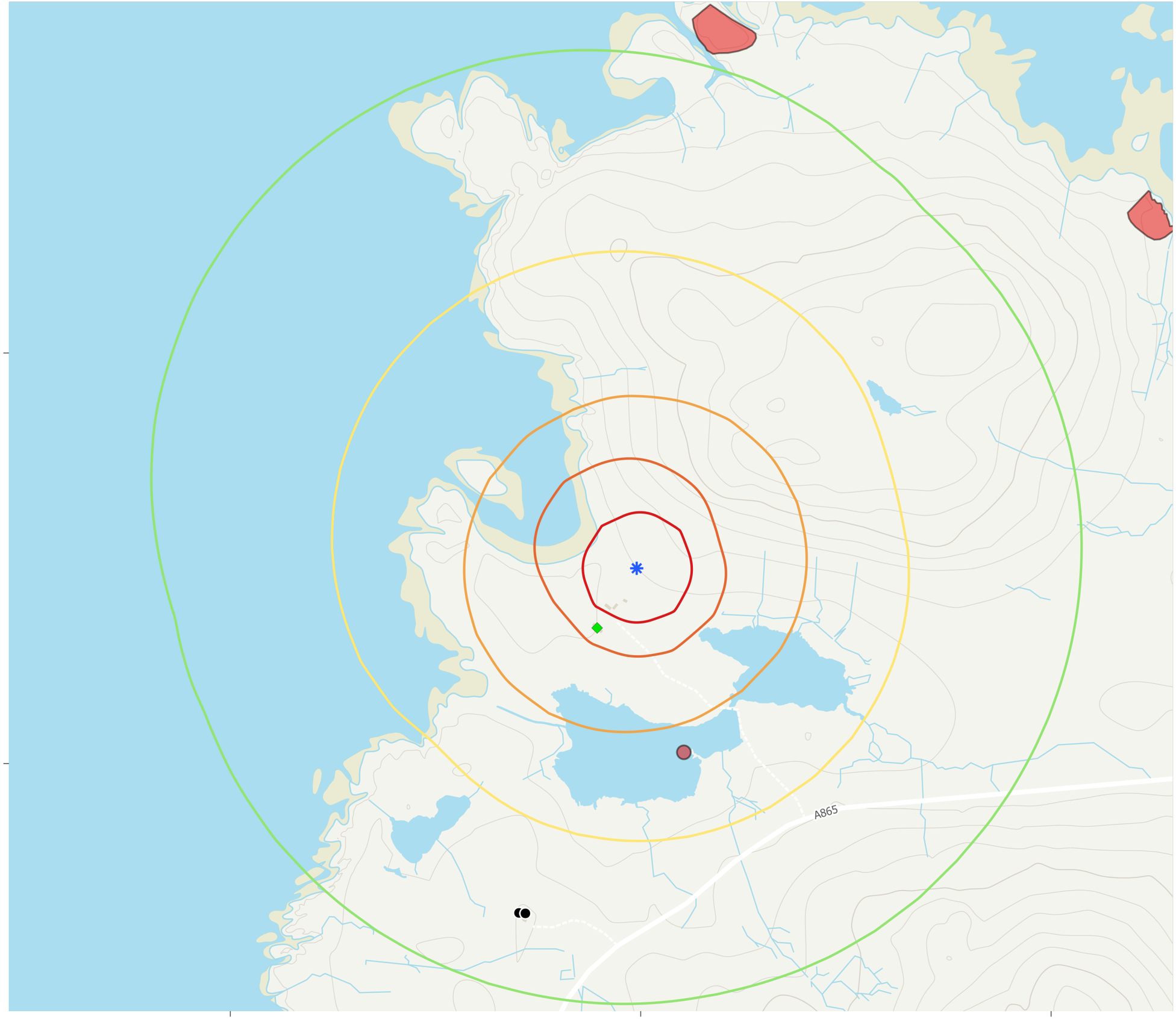
4 CONCLUSION

As requested by the CAA, this technical note has provided responses to the queries surrounding the launch vehicle frequency spectrum, and the difference between A-weighted and Z-weighted Lmax(slow) levels.

Regarding the frequency spectrum, the values presented in the EIA Technical Assessment have been checked as requested, and it is confirmed that they are correct.

With regard to the difference between A-weighted and Z-weighted levels, whilst the difference is relatively modest at distances relating to the identified receptors, it is acknowledged that the levels differ increasingly with distance from the launch site due to air and ground absorption (by up to 5 dB at distances of approximately 2 km). As requested, noise levels arising from operation of launch vehicles have been recalculated in terms of LZmax(slow); levels all receptors have been found to remain within the relevant criteria, and the outcome of the EIA therefore remains unchanged.

[5] Guidance to the regulator on environmental objectives relating to the exercise of its functions under the Space Industry Act 2018, Department for Transport, UK Government, 2021



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- Potential Noise Receptor
- Discounted Receptor (Scolpaig)
- Launch Point
- Scheduled Monument

Predicted Noise Level dB, LZmax(slow)

- 100
- 105
- 110
- 115
- 120

N

0 250 500 m

1:9,000

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Figure 1
LZmax(slow) Noise Contours

Spaceport 1, Scolpaig Farm
Noise Technical Note