Design Principles Report – DEFINE Gateway Submission

Contents

List of Abbreviations

Abbreviation	Meaning
GL	Gravitilab Aerospace Services
CAP	Civil Aviation Publication
DP	Design Principle
ACP	Airspace Change Proposal
DP	Design Principle
ANSP	Air Navigation Service Provider
NATS	National Air Traffic Services
DAATM	Defence Airspace and Air Traffic Management
MMO	Marine Management Organisation
MCA	Maritime and Coastguard Agency
UKSA	United Kingdom Space Agency
MOD	Ministry of Defence
CAA	Civil Aviation Authority
EIA	Environmental Impact Assessment
UKHO	United Kingdom Hydrographic Office
UAV	Unmanned Aerial Vehicle
ALARP	As Low As Reasonably Practicable
FUA	Flexible Use Airspace
SUA	Special Use Airspace

Executive Summary

Gravitilab Aerospace Services (GL) is developing the Sea Launch rocket launch site, subject to planning consent, a few miles east off the Norfolk coast. Initially, the purpose of the site is to enable the safe operation of sub-orbital flight. These rocket launches will pose hazards to other airspace users and in GL's case, marine users also and therefore, it is necessary to segregate these activities accordingly. In order to do this, a change in airspace around the immediate vicinity is necessary. This vertical launch spaceport will allow small sounding rockets to be launched in a northward direction from the proposed launch area in the North Sea. These activities will be segregated appropriately to protect other airspace users and the general public from these rocket launches.

As described in the Civil Aviation Publication (CAP) 1616 process, step 1b, the airspace change sponsor, in this case, GL, is required to conduct a detailed stakeholder analysis to ensure engagement with all potential stakeholders and to consequently develop Design Principles (DPs) that will ultimately be used to support and underpin the Airspace Change Proposal (ACP). The DPs developed are based upon a combination of safety, environmental, operational, and regulatory factors, as well as taking into consideration socio-economic impact. They are developed through consultation and engagement with both aviation and non-aviation stakeholders. Not just those directly involved in aviation but anyone who could possibly be affected by the ACP. Including but not limited to, GL reached out to: Air Navigation Service Providers (ANSPs) such as National Air Traffic Services (NATS) and EUROCONTROL; due to high military activity in the area, the Defence Airspace and Air Traffic Management (DAATM), local councils, Natural England, regional and international airlines who make use of that airspace, marine stakeholders such as the Marine Management Organisation (MMO), Trinity House and the Maritime and Coastguard Agency (MCA). Once established, these connections can then be used to appropriately assess our airspace design options in further stages.

GL conducted most of their engagement with potential stakeholders via a series of emailed questionnaires, with a few stakeholders also submitting their thoughts regarding the request via an online form (Microsoft forms) that was created to collect their responses. Other engagements undertaken involved stakeholders emailing GL directly, being contacted over the telephone and via Microsoft Teams meetings. Each time GL contacted a stakeholder for response, GL not only asked for their point of view on the matter but also asked if they knew any other potential stakeholders who may have an interest in the activities being planned, allowing the continual improvement of the list of stakeholders and acquire more feedback, further defining the requirements for the proposal.

The ACP is only one part of the regulatory engagement that GL will need to undertake. Other tasks include planning applications through the necessary councils in Norfolk, the MMO and the chosen port authorities, in addition to applying for a Spaceport and Range operator's license through the CAA. All of the regulatory engagements will have some overlap and will still involve regular public and community engagement. Therefore, although these interactions do not fall entirely under the ACP process, the responses received were considered during the refinement of the DPs.

Although only a small proportion of the contacted stakeholders responded during the second phase of the DP refinement, the responses received (see Appendix 7) suggested that they were satisfied with most of the 11 DPs GL arrived at to guide the planning and design of the ACP. However, the qualitative feedback they provided was detailed and this was considered. Changes

were applied based on suggestions by NATS, Trinity House and the Ministry of Defence's (MOD) DAATM to clarify the wording and purpose of the DPs. GL valued the highly detailed feedback from NATS; GL will work closely with NATS at every stage of the ACP. After removing two DPs, the final set contains 9 different principles. The refined DPs are forwarded to the Civil Aviation Authority (CAA) for approval.

1 Introduction

Throughout Step 1b of the ACP process, GL has identified and established communications with stakeholders across a range of relevant industries and bodies whom the organisation believe may wish to contribute to the DPs; which are to be decided to facilitate the most agreeable airspace change.

1.1 Categorisation of Stakeholders

When defining the list of stakeholders, it was crucial to GL that a full distribution of interested parties, both aviation and non-aviation related, was collected. To streamline communications with these stakeholders, the stakeholders are divided up into four lists corresponding with each stage of GL's DP refinement process. The four listed groups are:

1) Initial Stakeholders – The CAA, NATS and Natural England whom we discussed GL's intentions with during scheduled meetings to understand the core requirements, and to obtain the ideal set of principal stakeholders. Natural England was contacted from the very start because the Environmental Impact Assessment (EIA) must be completed concurrently with the progression through the ACP stages.

2) Principal Stakeholders – 15 organisations who each represented an important player in their respective fields, for example airspace, environmental management, marine licensing, etc. These groups also pointed out additional interested parties included in our next set of stakeholders (see Appendix 2).

3) Comprehensive Stakeholders – A much larger list of relevant national and international organisations. This includes airports, marine users, environmental organisations, local enterprise, local politicians, natural resources, regulatory bodies and more, who could offer quantitative feedback on the DPs. This list is inclusive of the principal stakeholders, for example Trinity House took part in advisory meetings while also later filling out GL's questionnaire for comprehensive stakeholders (see Appendix 5).

4) Responsive Stakeholders – A list containing only those stakeholders who responded to communication from GL. This communication includes those who interacted via the 1st or 2nd questionnaire, both, and by other means (meetings, phone calls, etc.). This allows GL to work closely with these entities in future and avoid unnecessary engagement with those not interested sharing their voice on the project. This is not a finalised list and can be added to if additional stakeholders are found or pointed out.

1.2 Questionnaires

We generated two surveys:

- 1st Questionnaire: 'Investigative Questionnaire' (see Appendix 3)
- 2nd Questionnaire: 'Design Principles Justification Questionnaire' (see Appendix 6)

The first was sent to the principal stakeholders to scope out any concerns they might have and provide advice with which we developed the first set of proposed DPs. The second was provided to comprehensive stakeholders, seeking feedback on the specific wording and intent of these proposed DPs.

The first questionnaire was qualitative, seeking detailed explanations of any issues or suggestions these stakeholders had with each element we were considering. This questionnaire had 10 questions, with the enquiry directed any interested stakeholders to identify any potential concerns that could arise with GL's proposed operations which could consequently affect their own operations.

The second questionnaire was quantitative, asking the comprehensive stakeholders to answer a YES/NO question for the inclusion of each DP, along with a rank from A to E denoting its importance (A = Highest and E = Lowest). However, the option was left open for written qualitative responses in this second questionnaire as GL did not want to miss any insight that could prove useful in the futureproofing of the plans. Unlike the first questionnaire this directly asked about each specific DP. These surveys enabled the refinement of the DPs and helped identify the importance of each DP.

Both questionnaires were sent along with a 'launch project briefing' (see appendix 1).

1.2 Feedback Collection

Most questionnaire-based feedback was collected via email through relevant experts at each responding organisation/body. Some were collected using online forms or by phone call. At the beginning of the process with 'initial' and 'principal' stakeholders, some information was provided in Microsoft Teams meetings, for example a joint meeting containing representatives of the MMO, (United Kingdom Hydrographic Office) UKHO and Trinity House.

Some contacts responded in both the principal and the comprehensive part of the process, which was much appreciated. Due to a strong amount of interaction during the principal phase, GL expanded its principal stakeholder list above the 10 starting choices. Some recipients of the 'design principles justification questionnaire' chose to offer feedback via email instead of completing the questionnaire, and this was also considered where applicable.

2 Design Principles

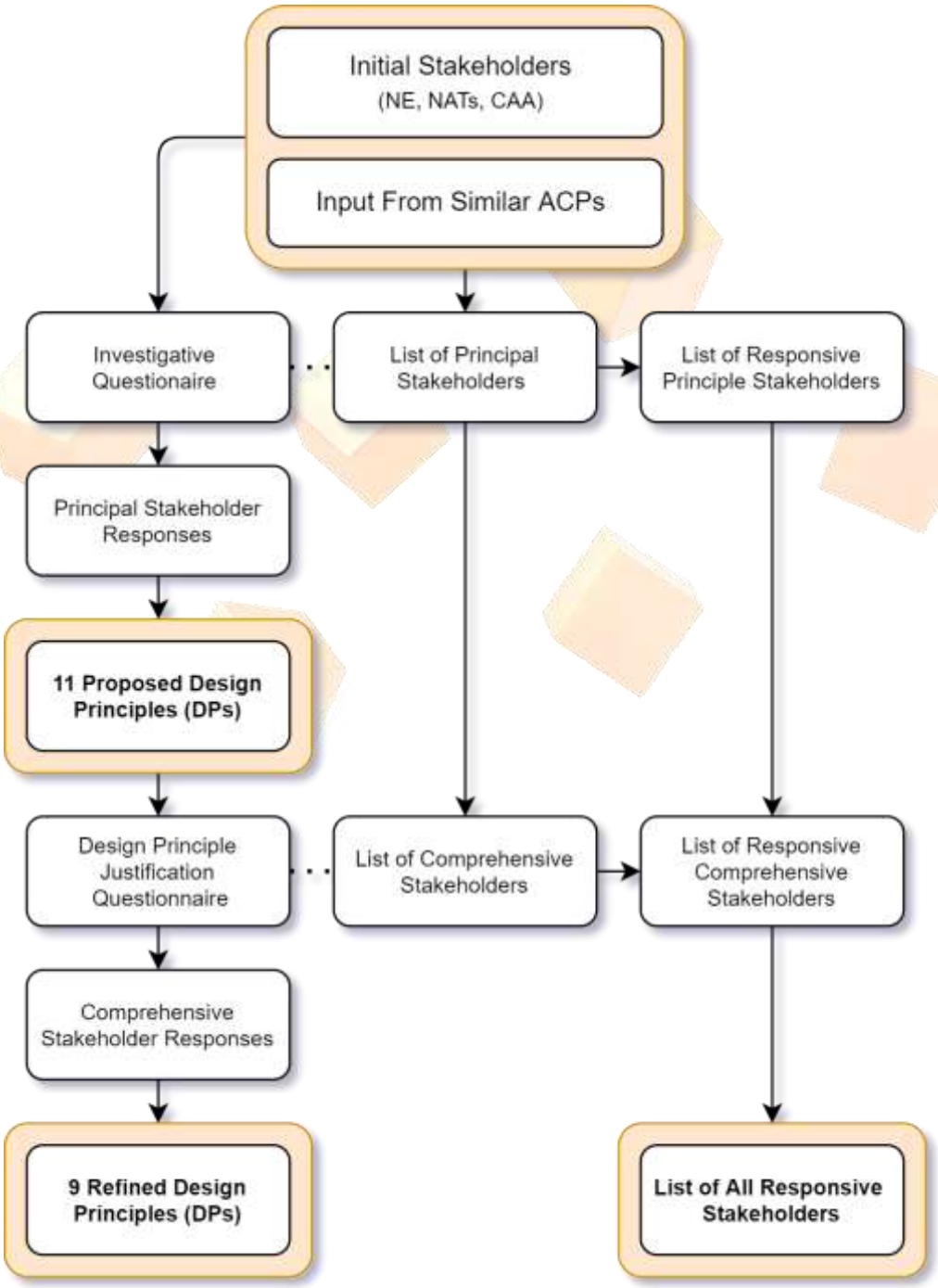
2.1 Design Principles Methodology

The generation of GL's final, refined DPs was divided into stages in a concurrent process with the method for accruing the list of responsive stakeholders. This was to ensure as many viewpoints could be included as possible, and to avoid overlooking any critical considerations. Irrespective of the stakeholder responses, the safety of both the launch operators (GL) and GL's neighbours will always be the top priority of the ACP. The two stages of DP development are:

1) Proposed Design Principles – Based on engagement with whoever was identified as the most important stakeholders for this project, responses received and analysed from the first questionnaire which highlighted any stakeholders' concerns, and as advised by the CAA, inspiration attained through the review of the processes of other ACP reports proposing similar operations to that of GL.

2) Refined Design Principles – Ranked in terms of importance based on feedback to our proposed DPs from comprehensive stakeholders. Edited from previous DPs based on additional qualitative feedback. Rounded up so that 1 A and 1 B = 1 A.

The flowchart below is an overview of the DP methodology:



2.2 Chronology of Engagement

Questionnaire 1 entitled "Investigative Questionnaire" has been sent to 110 organisations referenced in Appendix 5. The initial deadline to answer was 08/10/2021 and has been extended to 15/10/2021.

The dates of engagement and responses are referenced in the table below:

Stakeholder:	Questionnaire sent on:	Feedback received on:
RSPB	17/09/2021	28/09/2021
MOD	17/09/2021	30/09/2021
Natural England	17/09/2021	08/10/2021
Equinor	17/09/2021	15/10/2021
AB Ports	17/09/2021	18/10/2021
MCA	17/09/2021	21/10/2021
Trinity House	17/09/2021	21/10/2021

Questionnaire 2 entitled "Design Principle Justification Questionnaire" has been sent to 9 interested organisations referenced in Appendix 5. The initial deadline to answer was 05/11/2021 and has been extended to 26/11/2021.

The dates of engagement and responses (if any) are referenced in the table below:

Stakeholder:	Questionnaire sent on:	Feedback received on:
MOD	27/10/2021	29/10/2021
Trinity House	27/10/2021	01/11/2021
UKHO	27/10/2021	None
Natural England	27/10/2021	None
MCA	27/10/2021	None
Equinor	27/10/2021	None
HSE	29/10/2021	None
NATS	01/11/2021	03/12/2021
NNFS	12/01/2021	None

Few meetings have been held online along the engagement process and are referenced in the table below:

Stakeholder:	Date:
NATS	31/03/2021
New Anglia LEP	04/10/2021
MCA/MMO/Trinity House/UKHO	21/10/2021

2.3 Proposed Design Principles Development

The following section lists which principal stakeholders responded to each question in the investigative questionnaire (see Appendix 4 for full response detail). This feedback, combined with study of other ACP requests (and some additional communication via meetings & email) allowed GL to propose DPs that reflected the concerns and requirements of those impacted by the airspace change.

Question 1: Equinor, AB Ports, DAATM (MOD), MCA, Trinity House, RSPB

Question 2: Equinor, AB Ports, DAATM (MOD), MCA, RSPB

Question 3: Equinor, AB Ports, DAATM (MOD), Natural England

Question 4: Equinor, AB Ports, DAATM (MOD), MCA, Trinity House, RSPB

Question 5: Equinor, DAATM (MOD), MCA, Trinity House

Question 6: Equinor, AB Ports, Natural England, RSPB

Question 7: Equinor, AB Ports, DAATM (MOD), MCA, Trinity House

Question 8: Equinor, AB Ports, RSPB

Question 9: Equinor, AB Ports, MCA, RSPB

Question 10: Equinor, AB Ports, DAATM (MOD), Natural England, MCA, RSPB

2.4 Proposed Design Principles

The table below gather the 11 proposed DPs. The table is divided in 4 columns:

- Column 1: proposed design principle
- Column 2: design principle category
- Column 3: elements that have been used to develop the proposed DPs

Design Principle	Category	Elements that led to DP
DP1: The Safety of other airspace users and the public is the paramount design principle that ensures the safety of launch operators and neighbours at all phases of the launch procedure	Safety	**Gravitilab Safety Culture** Safety is the paramount factor for the airspace design
DP2: Airspace design will be of the smallest possible volume to safely segregate activities from other airspace users. Airspace volume should be designed to minimise impact on air traffic	Safety	**DAATM (MOD) - Investigative Questionnaire (question 1)** The MOD, in line with the CAA's SUA Policy, would request that the minimum amount of airspace is utilised for this activity

DP3: Gravitilab will design the trajectory such that risk and disturbance to marine and air users are effectively minimised	Operational	Equinor - Investigative Questionnaire (question 1) Develop trajectory analysis, which will ensure launch and recovery activities will not affect local fisheries, oil and gas developers and wind farms, both in operation and in development so other organisations will not lose out on their assets. Cannot cause damage to any of their operations! This will lead to downtime and huge financial losses for that company.
DP4: Factors such as launch frequency and time of day will be chosen to best accommodate existing airspace users. The duration of the airspace activation should be kept to a minimum	Operational	DAATM (MOD) – Investigative Questionnaire (question 1) How many launches will there be per year? What will the schedule look like, i.e. what is the frequency and periodicity? The MOD cannot accurately determine the scale of impacts to our operation until we know the answer to this question.It may be that there are certain times of the day or week (weekends, public holidays, overnight on certain occasions?) where there will be no confliction with military activity, but this will only be known once we have more information.
DP5: Give priority to all emergency vehicles needing our airspace for as long as possible and establish communications to be informed where needed. This requires the ability to halt launch operations at any point during countdown	Operational	DAATM (MOD) – Investigative Questionnaire (question 5) The MOD is responsible for National Security and other Air Policing type events. These are typically no-notice, high urgency events and we already have protocols and agreements to access all UK airspace at any time.
DP6: Gravitilab will investigate and produce a report on the noise and environmental impacts resulting from regular operation of our sea launch platform in the North Sea	Environmental	RSPB – Investigative Questionnaire (question 1) RSPB would object to any activity on or over land and sea which would have a likely significant effect on protected sites and protected species. Natural England – Investigative Questionnaire (question 6) In consideration of the sensitivity of the designated sites and features within the zone of influence of this

		project we advise that an environmental impact assessment(EIA) will be required to fully address the pressures identified and to consider the scope and significance of likely effects, and mitigation measures intended to avoid or reduce any likely harmful effects, alone and in combination, on the European sites.
DP7: A system should be established to inform all air and marine users of our launch windows far in advance of the launch, and also a confirmation of launch time a few hours before. They should be timely and accurate with an established method for rapid notification	Operational	Equinor – Investigative Questionnaire (question 3) -Continuous communication to inform on the progress of your application and business plan. -Continuous communication with our operations team to inform and agree planned activities before and during the launch AB Ports - Investigative Questionnaire (question 4) Best practice would be to provide +24hrs notice of scheduled launches so that mariners proceeding to/from Lowestoft can be informed (via notice to mariners) DAATM (MOD) – Investigative Questionnaire (question 4) Early notification of launches, planned well in advance, so as to fulfil the aforementioned FUA and ASM requirements will be required so as to deconflict with planned military activity. This is likely to be at least 3 months for impacts on the route network to take place but deconfliction against military exercises may need to be completed at least a year in advance. Trinity House – Investigative Questionnaire (question 4) Through email and any communications to the MCA
DP8: Gravitilab will continue to monitor all changes to airspace policies and, if needed, adapt operations accordingly	Regulatory	No stakeholder feedback led to DP8. This DP has been obtained based on DPs from similar ACPs.
DP9: Gravitilab will ensure launch and recovery operations will	Safety	Trinity House – Investigative Questionnaire (question 1)

not affect another organisations assets in anyway and will design the activity area accordingly to avoid this		Activities should be kept away from the major shipping lanes off East Anglia and any debris to fall into areas clear of shipping, Oil and Gas infrastructure, and Trinity House aids to navigation to avoid damage to marine structures/users
DP10: Gravitilab will look to increase job opportunities in and around Norfolk to help local communities as well as the UK economy	Operational	Equinor – Investigative Questionnaire (question 8) We welcome new industries in the area which may provide opportunities for job creation locally as well as research and development prospects AB Ports – Investigative Questionnaire (question 8) Business for the port related to marine craft requirements for project mobilisation
DP11: Gravitilab will analyse the future potential of the business and keep in regular contact with everyone involved to ensure the potential of our growth can be approved without facing issues	Operational	Gravitilab Prosperity Gravitilab needs to sustain business growth

2.5 Refined Design Principles

As shown on the flowchart in section 2.1, Gravitilab came up with 9 refined design principles which are an upgraded version of the 11 initial design principles proposed by Gravitilab. In total, 3 organisations provided highly detailed (written) answers to the Design Principle Justification Questionnaire:

- NATS
- MOD
- Trinity House

Some other organisations like MCA, HSE, Equinor have received the questionnaire, but they didn't provide official responses. MCA and HSE being safety regulators, it is considered outside of their remit to approve/comment on Gravitilab launch design principles.

The 11 proposed design principles have been refined based on NATS, MOD and Trinity House feedbacks as follows:

DP1

Original
"The Safety of other airspace users and the public is the paramount design

principle that ensures the safety of launch operators and neighbours at all phases of the launch procedure."

Stakeholders Feedback

- NATS: YES to design principle
- MOD: YES to design principle
- Trinity House: YES to design principle

New

"The Safety of other airspace users and the public is the paramount design principle that ensures the safety of launch operators and neighbours at all phases of the launch procedure."

DP2

Original

"Airspace design will be of the smallest possible volume to safely segregate activities from other airspace users. Airspace volume should be designed to minimise impact on air traffic."

Stakeholders Feedback

- NATS:
  - YES to design principle
  - Segmentation to allow for activation of only the relevant zones
- MOD:
  - YES to design principle
  - 'Air traffic' is a phrase which suggests commercial aviation, should modify to be more inclusive of MOD
- Trinity House: No comment N/A

New

"Airspace design will be of the smallest possible volume for each major segment of the flight path to safely segregate activities from other airspace users. Airspace volume should be designed to minimise impact to other airspace users."

DP3

Original

"Gravitilab will design the trajectory such that risk and disturbance to marine and air users are effectively minimised."

Stakeholders Feedback

- NATS:
  - YES to design principle
  - Segmentation to accommodate the different trajectories allowing for activation of only the relevant zones (see DP2)
- MOD: YES to design principle
- Trinity House: YES to design principle

New

"Gravitilab will optimise the trajectory of each launch vehicle type such that risk and disturbance to marine and air users are effectively minimised."

DP4

Original

"Factors such as launch frequency and time of day will be chosen to best accommodate existing airspace users. The duration of the airspace activation should be kept to a minimum."

Stakeholders Feedback

- NATS:
  - YES to design principle
  - More important aspect is to keep duration of airspace activation down vs being completely flexible regarding time of day and launch frequency
- MOD: YES to design principle
- Trinity House: No Comment N/A

New

"As a priority, the duration of the airspace activation should be kept to a minimum. Additional factors such as launch frequency and time of day will be considered to best accommodate existing airspace users."

DP5

Original

"Give priority to all emergency vehicles needing our airspace for as long as possible and establish communications to be informed where needed. This requires the ability to halt launch operations at any point during countdown."

Stakeholders Feedback

- NATS:
  - YES to design principle
  - Aircraft/vehicles in emergency situations (i.e. engine loss) may need to enter the airspace at very short notice as well as emergency services, communications must cover this possibility
- MOD: YES to design principle
- Trinity House:
  - YES to design principle
  - Needs to consider marine emergency vessels as well

New

"Immediate priority shall be given to all emergency vehicles/vehicles in a state of emergency/SAR vehicles needing our airspace for as long as is required. This requires the ability to halt launch operations at any point during countdown as well as the possibility for Gravitilab to establish communications with all relevant stakeholders operating/intending to operate in the airspace in an emergency."

DP6

Original

"Gravitilab will investigate and produce a report on the noise and environmental impacts resulting from regular operation of our sea launch platform in the North Sea."

Stakeholders Feedback

- NATS:
  - NO to design principle
  - Study of environmental effects should be focussed on launch vehicle and travel emissions from other vessels/planes, not launch platform

    - Split into more specific design principles for environmental and economic?
    - EIA report (CAP1616A) is a must-have part of the ACP process, so isn't exactly a design principle as design principles must have the end goal of producing a shape for the changed region of airspace
- MOD: YES to design principle
- Trinity House: No comment N/A

New

"Gravitilab will seek to minimise detrimental economic and environmental effects due to increased fuel burn from commercial air travel in addition to emissions from their own operations."

DP7

Original

"A system should be established to inform all air and marine users of our launch windows far in advance of the launch, and a confirmation of launch time a few hours before. They should be timely and accurate with an established method for rapid notification."

Stakeholders Feedback

- NATS:
    - NO to design principle
    - Launch windows times/dates are difficult to keep consistent, so focus on excellent engagement with the relevant parties
    - Systems of notification need to be very clear so that activity can be managed right up to the launch window
- MOD:
    - YES to design principle
    - Acknowledge that systems such as FUA (Flexible use of Airspace), AIRAC cycle are already in place
- Trinity House: YES to design principle

New

"**Safe, efficient and standardised management,** timely and rapid notification, **and activation of airspace, utilising Flexible Use of Airspace (FUA) principles and Special Use of Airspace (SUA) will be used. Information will be sent to stakeholders regarding potential launch activity at least 3 months before the intended date."**

DP8

Original

"Gravitilab will continue to monitor all changes to airspace policies and, if needed, adapt operations accordingly."

Stakeholders Feedback

- NATS:
    - NO to design principle
    - If official CAA guidance is changed, Gravitilab **must** ensure their ACP is in accord with that guidance
    - Similar point to DP 11
- MOD: YES to design principle
- Trinity House: No comment N/A

New

"Gravitilab will ensure their ACP is always in accord with the most up-to-date CAA guidance documentation when changes occur. Stakeholders will be consulted on all changes."

DP9

Original
"Gravitilab will ensure launch and recovery operations will not affect another organisations assets in anyway and will design the activity area accordingly to avoid this."

Stakeholders Feedback

- NATS: NO to design principle
- MOD: YES to design principle
- Trinity House:
    - YES to design principle
    - Any strategies toward avoiding damage to marine assets very welcome

New
"Gravitilab will ensure launch and recovery operations will not affect another organisations assets (**using safety-focused recovery methods)** and will design the activity area accordingly to avoid this."

DP10

Original
"Gravitilab will look to increase job opportunities in and around Norfolk to help local communities as well as the UK economy."

Stakeholders Feedback

- NATS:
    - NO to design principle
    - This is more focused on business strategy instead of airspace change
- MOD:
    - YES to design principle
    - Ranked the least
- Trinity House: No comment N/A

New
[DESIGN PRINCIPLE REMOVED]

DP11

Original
"Gravitilab will analyse the future potential of the business and keep in regular contact with everyone involved to ensure the potential of our growth can be approved without facing issues."

Stakeholders Feedback

- NATS:
    - NO to design principle
    - This is more focused on business strategy instead of airspace change
    - If new the change in business strategy required a new ACP anyway, this DP is irrelevant
- MOD:
    - YES to design principle
    - Ranked the least

- Trinity House:
  - YES to design principle
  - Ranked the least

New
[DESIGN PRINCIPLE REMOVED]

2.6 Refined Design Principles Development

The refined design principles are based on the 11 initial design principles proposed by Gravitilab and contained some updated information based on the feedbacks received by NATS, MOD and Trinity House. The final list contains 9 design principles (2 have been deleted because they were not relevant to the ACP) which are ranked from A to D depending on their importance. Note that the ranking is completely based on stakeholders feedbacks and we will make sure to prioritize design principles with the highest score namely DP1, DP2, DP4, DP5.

The rank of the design principles has been obtained by averaging the 3 scores given by NATS, MOD and Trinity House for each of them. For instance, referring to Appendix 6, DP3 has been ranked twice "B" and once "A". Based on the majority of votes and Gravitilab judgment, it is estimated that DP3 gets a score of "B". For most of the DPs, we received similar rankings which facilitated our final decision on the order of importance of the 9 DPs.

Design Principle	Category	Description	Rank
DP1	Safety	The Safety of other airspace users and the public is the paramount design principle that ensures the safety of launch operators and neighbours at all phases of the launch procedure	A
DP2	Safety	Airspace design will be of the smallest possible volume for each major segment of the flight path to safely segregate activities from other airspace users. Airspace volume should be designed to minimise impact to other airspace users	A
DP3	Operational	Gravitilab will optimise the trajectory of each launch vehicle type such that risk and disturbance to marine and air users are effectively minimised	B
DP4	Operational	As a priority, the duration of the airspace activation should be kept to a minimum. Additional factors such as launch frequency and time of day will be considered to best accommodate existing airspace users	A
DP5	Operational	Immediate priority shall be given to all emergency vehicles/vehicles in a state of emergency/SAR vehicles needing our airspace for as long as is required. This requires the ability to halt launch operations at any point during countdown as well as the possibility for Gravitilab to establish communications with all relevant stakeholders operating/intending to operate in the airspace in an emergency	A
DP6	Environmental	Gravitilab will seek to minimise detrimental economic and environmental effects due to increased fuel burn from re-routing commercial aviation, in addition to any emissions from their own operations	B

DP7	Operational	Safe, efficient and standardised management, timely and rapid notification, and activation of airspace, utilising Flexible Use of Airspace (FUA) principles and Special Use of Airspace (SUA) will be used. Information will be sent to stakeholders regarding potential launch activity at least 3 months before the intended date	B
DP8	Regulatory	Gravitilab will ensure their ACP is always in accord with the most up-to-date CAA guidance documentation when changes occur. Stakeholders will be consulted on all changes	D
DP9	Safety	Gravitilab will ensure launch and recovery operations will not affect other organisations assets (using safety-focused recovery methods) and will design the activity area accordingly to avoid this	B

2.7 Modified Design Principles

As part of "Stage 1 – Define" of the CAP1616 airspace change process, the UK Civil Aviation Authority (CAA) has completed a Define Gateway Assessment of Gravitilab Aerospace airspace change proposal (ACP). Based on the outcomes of the January Gateway Meeting held at the CAA on Friday 28th, Gravitilab Aerospace had to take the following post gateway action (to be resolved with a deadline of midday Friday 04/02/2022): "*Review the wording of the DPs as many of them are worded and prioritised in such a way that they may limit the Design Principles Evaluation in Stage 2*".

The CAA and Gravitilab met online on Monday 01/02/2022 to get additional information and examples that would help to complete this post-gateway action.

The modified DPs in the table below are a slightly changed version of the refined design principles in section 2.6 and are based on the CAA feedbacks gathered during the post-gateway meeting with Gravitilab. The table is divided into 5 columns:

- Design principle reference number
- Refined design principles (from section 2.6)
- CAA feedback
- Actions taken
- Modified design principles (based on CAA feedbacks)

Note that the new formulation of the DPs does not affect what each individual DP is trying to achieve. The CAA also highlighted that short and concise DPs are better than wordy ones, so Gravitilab tried to get DPs as simple and clear as possible.

Design Principle	Refined Design Principles	CAA Feedback	Actions taken	Modified Design Principles
DP1	The Safety of other airspace users and the public is the paramount design principle that ensures the safety of launch operators and neighbours at all phases of the launch procedure	DP1 needs to say that safety isn't just important, but it will be ensured.	Feedback accepted and wording changed accordingly.	The safety of other airspace users and the public shall be ensured as a key factor of the airspace design
DP2	Airspace design will be of the smallest possible volume for	DP2 is suitable but needs to be	Feedback accepted and	The airspace volume shall be kept to a

	each major segment of the flight path to safely segregate activities from other airspace users. Airspace volume should be designed to minimise impact to other airspace users	reviewed to make sure we haven't limited ourselves.	wording has been simplified and clarified.	minimum and segmented to safely segregate other airspace users and minimise impact on their activities
DP3	Gravitilab will optimise the trajectory of each launch vehicle type such that risk and disturbance to marine and air users are effectively minimised	DP3 needs clarification.	Feedback accepted and wording has been simplified and clarified.	Gravitilab shall optimise the trajectory of each suborbital rocket so that risk and disturbance to marine and air users are effectively minimised
DP4	As a priority, the duration of the airspace activation should be kept to a minimum. Additional factors such as launch frequency and time of day will be considered to best accommodate existing airspace users	DP4 is good in its current form.	Feedback accepted and no change made.	As a priority, the duration of the airspace activation should be kept to a minimum. Additional factors such as launch frequency and time of day will be considered to best accommodate existing airspace users
DP5	Immediate priority shall be given to all emergency vehicles/vehicles in a state of emergency/SAR vehicles needing our airspace for as long as is required. This requires the ability to halt launch operations at any point during countdown as well as the possibility for Gravitilab to establish communications with all relevant stakeholders operating/intending to operate in the airspace in an emergency	The use of "vehicle" in DP5 is confusing. Vehicles is often associated to ground-based systems.	Feedback accepted and the term "vehicle" has been refined.	Immediate priority shall be given to all marine vessels and aircrafts in state of emergency for as long as is required. This requires the ability to implement emergency and priority routines in the airspace design, as well as procedures to maintain efficient and constructive communications with vehicles in a state of emergency
DP6	Gravitilab will seek to minimise detrimental economic and environmental effects due to increased fuel burn from re-routing commercial aviation, in addition to any emissions from their own operations	DP6 needs to be more explicit: what are the environmental effects mentioned?	Feedback accepted. Gravitilab clarified the design principle and added examples of environmental effects.	The airspace shall be designed to limit environmental disturbances (e.g. noise, fuel emissions, debris impacts) to the surrounding area
DP7	Safe, efficient and standardised management, timely and rapid notification, and activation of airspace, utilising Flexible Use of Airspace (FUA) principles and Special Use of Airspace (SUA)	DP7 is suitable but needs to be reviewed to make sure we haven't limited ourselves. Rev isit the 3-	Feedback accepted and wording has been simplified and clarified. There is no mention to	A safe, efficient and standardised management is to be implemented in the airspace design. As a priority, Gravitilab shall aim to ensure

	will be used. Information will be sent to stakeholders regarding potential launch activity at least 3 months before the intended date	month notice and the use of the term special airspace.	specific design solutions as this will be covered in stage 2.	timely and rapid notification of the airspace use
DP8	Gravitilab will ensure their ACP is always in accord with the most up-to-date CAA guidance documentation when changes occur. Stakeholders will be consulted on all changes	Consultation in that case is not a CAP1616 requirement. However, Gravitilab can make sure the stakeholders are informed of the changes.	Feedback accepted and change made accordingly.	Gravitilab shall ensure their ACP is always in accord with the most up-to-date CAA guidance documentation. When changes occur, Gravitilab will inform stakeholders (if necessary)
DP9	Gravitilab will ensure launch and recovery operations will not affect other organisations assets (using safety-focused recovery methods) and will design the activity area accordingly to avoid this	DP9 and DP3 are contradictory. The conflict comes from one saying we will not affect others and the other saying we will minimise effects. Needs clarification.	Feedback accepted. Gravitilab added a comment to specify that it is physical assets that are mentioned in DP9.	Gravitilab shall ensure that launch and recovery operations do not impact other organisations physical assets (e.g. wind turbine) and will design the airspace accordingly to avoid this

3 Conclusion and Next Steps

This document will be submitted to the CAA as evidence to support Stage 1, Step 1B of the CAP 1616 airspace change process. This documentary evidence is provided to inform the CAA's decision to sign off the DEFINE Gateway at the gateway assessment meeting. Sign off will enable ACP-2020-093 to proceed to Stage 2 of the process.

4 Responsive Stakeholder List

This section presents the list of responsive stakeholders i.e., only those stakeholders who responded to communication from GL. This communication includes those who interacted via the 1st or 2nd questionnaire, both, and by other means (meetings, phone calls, etc.). This allows GL to work closely with these entities in future and avoid unnecessary engagement with those not interested sharing their voice on the project. This is not a finalised list and can be added to if additional stakeholders are found or pointed out.

AB Ports: Associated British Ports Holdings Ltd owns and operates 21 ports in the United Kingdom, managing around 25 per cent of the UK's sea-borne trade. The company's activities cover transport, haulage and terminal operations, ship's agency, dredging and marine consultancy.

New Anglia LEP: New Anglia Local Enterprise Partnership works with businesses, education and local authority partners to drive growth and enterprise in Norfolk and Suffolk. Responsible for

securing public and private investment to deliver a range of programs and initiatives with partners to improve infrastructure, skills and business support.

Norfolk Wildlife Trust: The Norfolk Wildlife Trust (NWT) is the oldest of 46 wildlife trusts covering Great Britain, Northern Ireland, Isle of Man and Alderney. Norfolk Wildlife Trust plays a very important part in protecting our natural heritage. It gives conservation advice to individuals and organisations, provides educational services to young people on field trips and organises events across numerous nature reserves to raise awareness.

North Norfolk Fisherman's Society: The North Norfolk Fishermen's Society (NNFS) is an organisation that has existed for over fifty years, supporting the local fishing industry.

HSE: The Health and Safety Executive is a UK government agency responsible for the encouragement, regulation and enforcement of workplace health, safety and welfare, and for research into occupational risks in Great Britain. HSEprovides information on how to carry dangerous goods by road or rail and reduce hazards such as fire, explosion and environmental damage.

JNCC: The Joint Nature Conservation Committee is the public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation.

MMO: Responsible for the determination of a Marine License for the Proposed Development.

MCA: The Maritime and Coastguard Agency is responsible for producing legislation and guidance on maritime matters and for working to prevent the loss of life on the coast and at sea.

Trinity House: Responsible for safeguarding shipping and seafarers; hold a statutory duty as General Lighthouse Authority to deliver a reliable aid to navigation service for all mariners.

Natural England: The government's adviser for the natural environment in England. Help to protect and restore our natural world.

UKHO: The UK Hydrographic Office (UKHO) is a world-leading center for hydrography, specialising in marine geospatial data to support safe, secure and thriving oceans.

Equinor: Equinor is an energy company with more than 21000 employees developing oil, gas, wind and solar energy in more than 30 countries.

DAATM: The DAATM acts as the MOD representative organization, in close collaboration with the CAA, within Europe. The DAATM interacts with NATO, European Aviation Safety Agency (EASA) and the European Defense Agency to ensure that legislative developments regarding Airspace, ATM and Communication, Navigation and Surveillance requirements are known.

NATS: The National Air Traffic Services provides air traffic control services to aircraft flying in UK airspace and over the eastern part of the North Atlantic. It is the main air navigation service provider in the United Kingdom.

Airtask: Provide bespoke mission-based aviation solutions to government and commercial clients around the world. Services include the provision of host aircraft, operating protocols, mission systems, role equipment, modification design, manufacture, installation, testing and certification.