Appendix 1 – Sea Launch Project Briefing

1. Introduction

Gravitilab Aerospace Services is developing the Isaac launch vehicle (~7m height, 120km max altitude) for a suborbital service based in the UK. This small rocket is optimised to carry small payloads (~10 kg) in contrast to old, outdated vehicles which are larger, and unsuitable for modern small payloads. Although Isaac is optimised for the current Newspace market, a commercial penalty for this innovation is the cost per-launch from spaceports. A large vehicle with a payload capacity of 100 kg may be charged £100,000, but Isaac will be subject to the same cost per launch despite its much smaller size. Therefore, to deliver >100 kg of payload, Isaac will incur ~10 times the cost to deliver a similar amount of payload to space. It is for this reason that Gravitilab Aerospace Services are proposing their own launch pad on the coast of Norfolk.

2. Platform

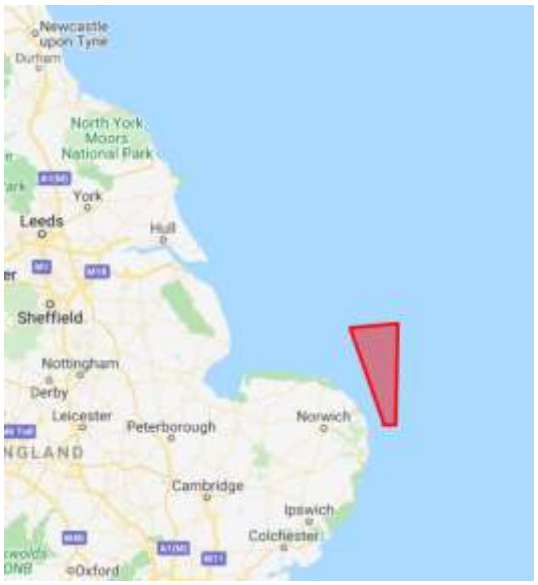
A jack-up barge would be utilised as a platform for our portable 'Talon' launch system. This means the entire launch process can be conducted from port to the launch site and back to port in a single day. Gravitilab would be the launch operator and range operator. This operation is possible due to low water depths off the Norfolk coast, and existing expertise in jack-up barge operations due to the offshore energy sector. The concept of using a jack-up barge for launch has already been demonstrated successfully by Copenhagen Suborbitals.

Copenhagen Suborbitals' jack-up barge

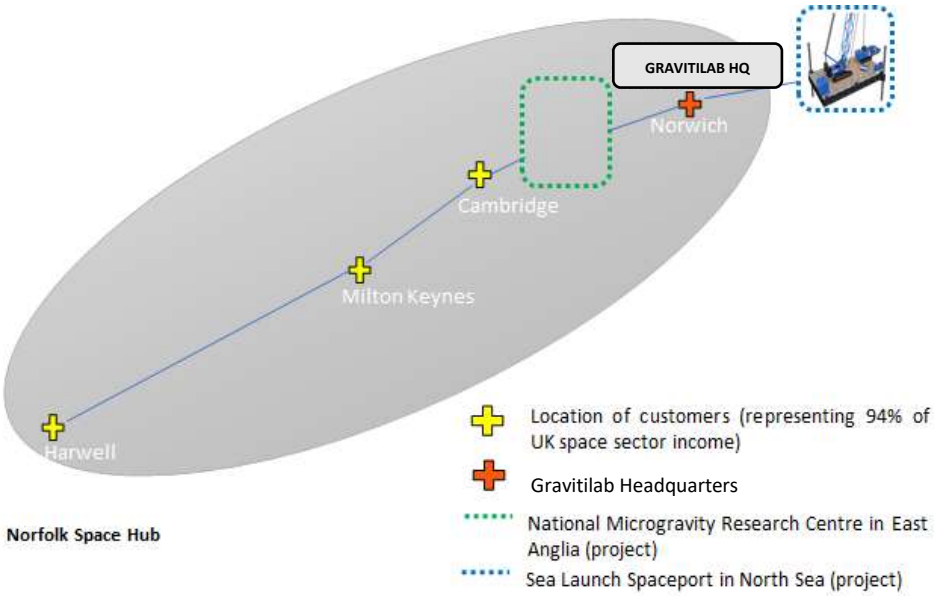
Gravitilab's business case for Isaac calls for 12 launches per year by the 2nd year of operation. At this point, Gravitilab would have paid £1.2 million in launch fees to the land spaceport or could have paid for the launch platform over this timescale, after which only the operational costs can be considered, and a target for the operational cost should be <£10,000. A jack-up barge suitable for these activities would cost in the region of £800,000, equivalent to 8 launches from a UK spaceport. The marine operations in terms of support vessels should be a service-contract with a local company which can offer the appropriate vessel and staff.

3. Airspace

The choice of location was made for proximity to Gravitilab's offices and customers, with the landing area avoiding the local wind farms and offshore oil and gas platforms. The images below show the proposed changes to the airspace.



4. Impact on the Region



The Sea Launch project presents a significant economic opportunity for the East of England as it will generate new jobs, support diversification in existing sectors, and attract academic research and development into the area.

The A11 Tech corridor will be significantly impacted by this opportunity. The image above illustrates that this site connects up the majority of the UK space sector with launch, putting space launch within a 2-hour drive of potential customers such as Lockheed Martin, Airbus and others. This will be the only site in England for vertical launch (rockets) to access space and is 20 hours travel time closer than closest alternatives, making it a more sustainable choice.

5. Concept of Operations

Order	Process	Time from launch
1	Airspace Change Application – CAA	18 months
2	Spaceport Licence Application	TBC
3	Range License Application	TBC
4	Space launch license application under SIA – CAA	12 months
5	Marine licence	TBC
6	Notifications for Notam, Navarea/Notmar to CAA, UKHO and MCA, Harbour Master at Gt Yarmouth. Broadcast and other media in advance of the launch date, and on the launch date.	Periods of 3 months, 1 month, 1 week, day prior and on the day
7	Weather updates to confirm the launch window is valid.	T - 5 days
8	Gravitilab's 40-foot shipping container arrives at the port. The container houses the launch infrastructure and the vehicle (Isaac rocket).	T – 7 hours
9	A crane lifts the container (~5 tonnes loaded) onto a jack-up barge at the port. The location of the container is chosen to offer maximum stability to the platform with consideration to the moment created when the launch rail is erected.	T – 6.5 hours
10	Tug tows the platform to the launch location (duration ~2 hours).	T – 5.5 hours
11	The barge lowers its legs for stability making contact with the sea floor ~20 m. A further 5-10 m gap is attained from the sea surface to the platform height giving a requirement of ~30 m local leg length capability.	T – 3.5 hours
12	Gravitilab staff access the barge and begin operations to open the container.	T – 2 hours
13	Launch rail raised. Transfer of N2O to flight tank.	T – 1 hour
14	Full diagnostics.	T – 45 min
15	All staff leave platform. Command vessel retreats to 1km distance. Aeolus wind sensors launched to give live wind data. Live modelling enacted to inform parameters for launch rail elevation and azimuth (remotely operated).	T – 30 min
16	Confirmation that the launch hazard area is clear.	T – 20 min
17	'Go' from Range.	T – 5 min
18	Launch.	T – 0
19	Tracking and recovery boat underway.	T – 0
20	Rail retracts, container closes, legs withdrawn.	T + 5 min
21	Barge begins return to port.	T + 30 min
22	Recovery of payload.	T + 1 hour
23	Barge arrives at port.	T + 3 hours