HyImpulse

NAVIGATIONAL RISK ASSESSMENT

SR75 – SECOND FLIGHT

Version 1.6

Document No.:	HIT-SR75-NRA-006
Issue status:	Final
Date of issue:	2026-08-24
Author(s):	V Di Pietrantonio

VERSION CONTROL

VERSION #	REVISION DATE	EFFECTIVE DATE	AUTHOR	MODIFIED SECTIONS	DESCRIPTION OF CHANGES
1.0	2026/01/20		V. Di Pietrantonio		First draft.
1.1	2026/02/26		V.Di Pietrantonio	5 7.6	Exclusion area update and modification of the recovery vessel choice
1.2	2026/03/11		V.Di Pietrantonio	all	Incorporated comments from Spaceport
1.3	2026/05/28		V.Di Pietrantonio	all	Incorporated comments from MCA
1.4	2026/06/23		V.Di Pietrantonio	all	Incorporated comments from MCA, updated hazard log with mitigations in place
1.5	2026/07/09		V.Di Pietrantonio	Table 1	Updated table
1.6	2026/08/20		V.Di Pietrantonio Kapish Aggarwal	Section 4.1 Section 5 Section 6.7 Section 6.6	Updated ground LEZ Updated Table 3, last entry Clarification on beacons Updated Exclusion Zone, added Nominal Impact Area.

Handwritten amendments and revisions are not permitted, except in situations requiring immediate amendment or revision in the interest of safety.
HIT training officer and its deputy are responsible for the issuance and insertion of necessary amendments and revisions.

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1 INTROUCTION

HyImpulse Technologies GmbH is a start-up for hybrid rocket launch vehicles in Germany and represented by the 100% subsidiary HyImpulse UK Ltd in the United Kingdom. HyImpulse is developing a sounding rocket called SR75 with a hybrid rocket motor based on paraffin fuel and liquid oxygen.

The SR75 shall be launched in 2026 for the first time from Lamba Ness, Unst, in cooperation by HyImpulse and SaxaVord Spaceport.

This document integrates the navigational risk assessment of SaxaVord Spaceport [Saxa-01] with the risks associated to a launch of SR75. The launch campaign is expected to last around 2 weeks and will involve one single launch of SR75 from the Lamba Ness range and the partial recovery of its debris from the sea.

2 APPLICABLE AND REFERENCE DOCUMENTS

[CAP-760] Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases

[HIT-01] HIT-SR75-FSA-001 – Part of Launch operator application

[HIT-02] HIT-SR75-GSA-001 - Part of Launch operator application

[HIT-03] SR75-2_Explosives_Hazard_Register

[RD-01] Risk management: Expert guidance

[Saxa-01] SVS-NRA Navigational risks assessment

[Saxa-02] SAXA-UK-OPS-PLN-001 Maritime Emergency Response Plan

[Saxa-03] SAXA-UK-OPS-PLN-001 Maritime Communications Plan

[SIA-01] Space Industry Regulations 2021

3 DEFINITIONS AND ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
FSA	Flight Safety Analysis
GSA	Ground Safety Analysis
HIT	HyImpulse Technologies GmbH, HyImpulse UK Ltd.
NRA	Navigational Risk Assessment
RAMS	Risk Assessment Method Statement
SIA	Space Industry Act 2018
Saxa	Saxa Vord Spaceport
SR75	Sounding Rocket 75 (HyImpulse product)
FTS	Flight Termination System

4 Mission Profile and Drop Areas

SR75 is a guided sounding rocket which is planned to be launched from SaxaVord Spaceport, UK. Engine cutoff will occur approximately 45s after liftoff and it is planned that the rocket will reach an apogee of about 100 km. At the apogee, the nose cone will separate from the booster. The mission profile is summarized in Figure 1.

The impact point of the booster will be inside the drop zone in Figure 1.The rocket booster of the SR75 launch vehicle is expected to land 135 km north of the launch point. The nose cone will fly along a similar trajectory.

A warning area will be defined over the area expected to be interested by the mission (Figure 5), which will be communicated as part of the Notice to Mariners for this launch. A recovery vessel will be within the warning area to initiate the recovery process after the mission is concluded.

An exclusion zone is identified in the area in front of the pad, where the calculated individual risk is >1e-6. This area in front of the pad will be monitored thanks to the spaceport instrumentation as defined later in the document.

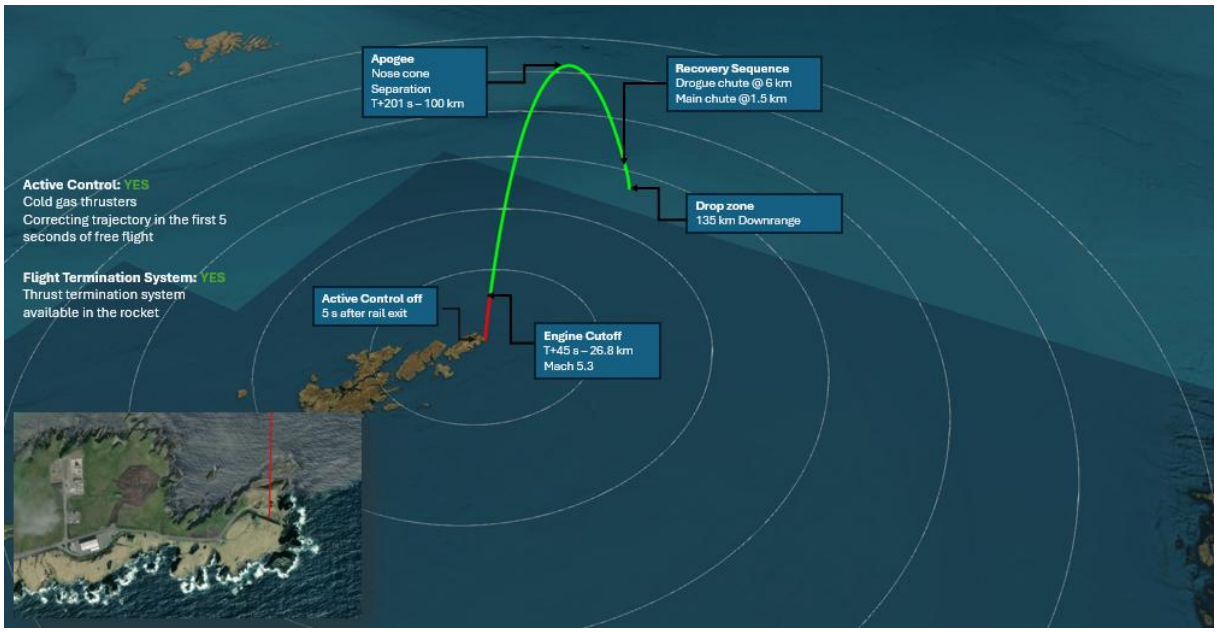

Figure 1 Flight trajectory

4.1 EXCLUSION ZONE ON LAND

The Flight Safety Analysis (FSA) of HyImpulse [HIT-01] identified a hazard area on land, which is protected by roadblocks during loading operations and launch. The spaceport procedure includes the evacuation of the local population and domestic animals within the ground Launch Exclusion Zone (LEZ) identified by HIT. The exclusion zone on land will be monitored by Saxa. The Exclusion Zone on land is limited by the red line in Figure 2 and fully defined in Section 6.6.

Figure 2 Ground Launch Exclusion Zone (part of the Exclusion Zone defined in Section 6.6)

4.2 PLANNED DEBRIS

A recovery system based on parachutes is used to recover the launch vehicle. The number of planned debris falling into the sea is shown in Table 1. A total of 3 beacons are installed on SR75, 2 on the booster and 1 on the drogue parachute. Their signal can be captured within the radius of 2 km with a directional receiver antenna.

Table 1: Debris catalogue

Item	Specifications	Details
Nose Cone NOT recovered	Length 1.5 m Ø 0.64 m 140 kg	Hollow ogive (1.3 m) with a small cylindrical section at the base (0.2 m, 1.5 m total), composite materials. The body is hollow and contains a stainless-steel bar with ballast weights mounted on top. The total weight of the structures and ballast weight is around 140 kg. The body will tumble down and hit the water at around 220 m/s: water is expected to fill the body almost immediately after impact, and the nose cone is expected to sink directly.
Manacle Ring NOT Recovered	Ø 0.64 m 1.5 kg	Booster and nose cone are linked together using a manacle ring, that will be cut at nose cone separation (mechanical separation). The manacle ring is a thin steel band with several rectangular steel inserts along its length. The manacle is expected to sink directly.
Hatch Not Recovered	Length 20 cm Width 60 cm 1.5 kg	The parachute module's hatch is a thin plate, expected to land in the drogue's chute area, shortly uprange of it. It is expected to sink immediately.
Booster Recovered	Length 12 m Ø 0.64 m 800 kg	The booster (800 kg dry mass) will be slowed down with a drogue parachute first, then a main parachute, and it will impact the water together with the main chute. Water is expected to enter in the engine block from the nozzle section and fill it completely. The booster will likely assume a highly tilted/vertical position due to the higher mass of the engine section and relatively low center of gravity of the empty booster without the nose cone. The engine and the next component, the liquid oxygen (LOX) tank, are connected exclusively by the injectors and feed lines: the first interface is characterized by capillary

		holes and small pipes and water will hardly or very slowly be able to penetrate the LOX tank. If the LOX tank started to fill, the process would be very slow (hours).There should be sufficient time to successfully locate and recover the booster before a full filling of the LOX tank. In case the LOX tank is filled completely, the next component is the helium tank: the only interface between the two is, again, the feed line. In this case though, a pressure regulator (spring mechanism) is present and should be able to completely isolate the tank and stop the water. The Helium tank should thus always remain isolated and water-free. Located through on-board transmitter and 2 locator beacons.
Drogue parachute Recovered	Ø 2.8 m 4.8 kg Chute	The drogue will slow down the booster and kill the lateral component of the velocity. It will be cut when the main parachute opens. In a no-wind ideal condition, the drop area will be the same as the booster. The parachute hatch and the structural components are attached to the drogue via aramid rope. During the launch, the effect of the wind on drogue and main parachute (booster) will be simulated (with real wind data), in order to estimate, as closely as possible, the impact areas. The drogue will be located after the booster and recovered. Located through a locator beacon + hand tracker.

4.3 VESSEL TRAFFIC DENSITY

Figure 3 shows a heat map of maritime traffic for March 2025. The area affected by the launch is circled in red. The majority of maritime activity is classed as “Fishing”, with “Other” making up the remainder. This “other” activity is likely connected with the operations at Sullom Voe oil and gas terminal, as tankers transit to and from the terminal on a regular basis.

Saxa also has access to AIS data on vesseltracker.com. Selecting the hazard area associated with this launch and undertaking a historical search for the month of March 2025 shows the following vessel types transiting the area:

- Fishing Vessels
- Cargo Vessels
    - Multi-purpose
    - Refrigerated
    - Palletized
    - General
- Oil and gas tankers

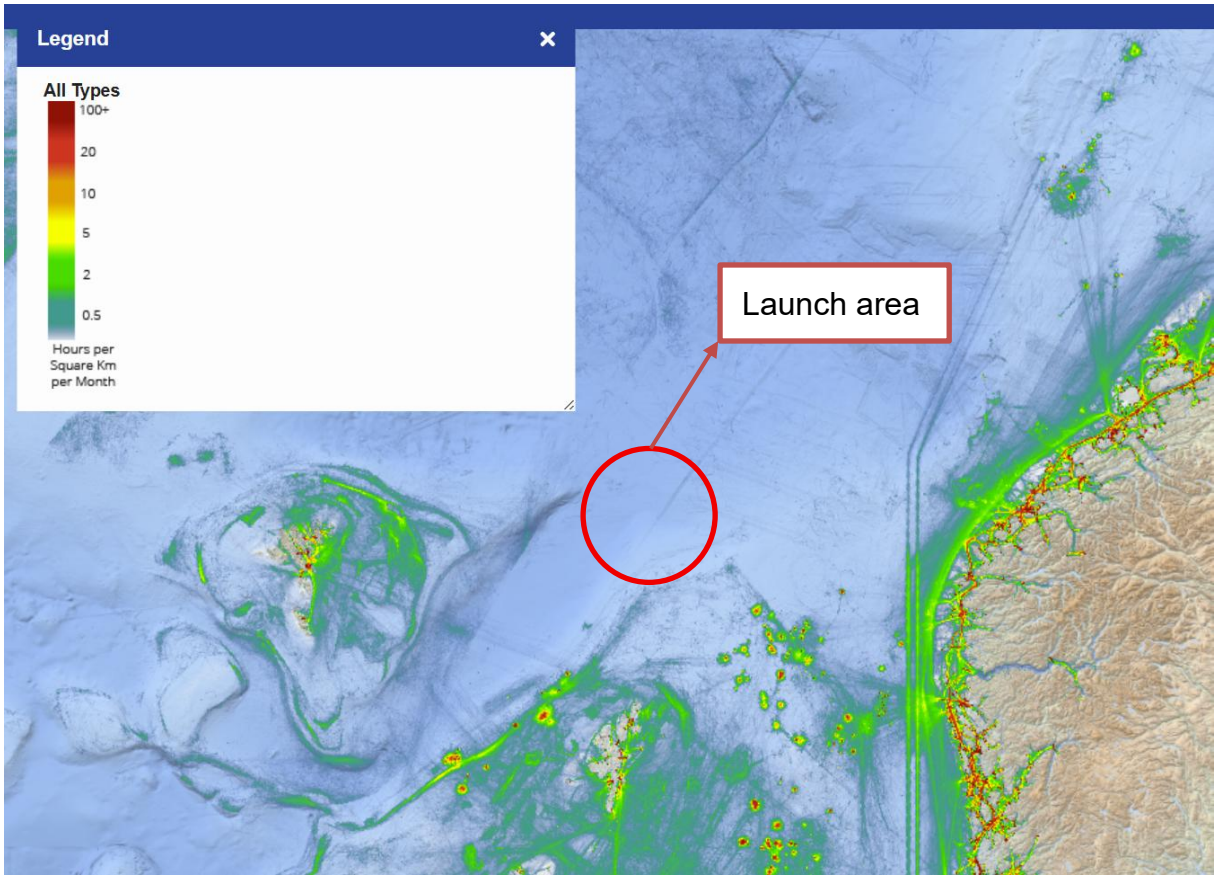

Figure 3 Historical maritime traffic heat map for March 2025 – credit EMODnet

5 RISK ASSESSMENT

The Spaceport assessed the risks deriving from maritime navigation [Saxa-01]. The NRA of the Spaceport identified the risks presented in Table 16 of [Saxa-01], reproduced hereby. Only the scenarios related to the SR75 components is considered for this paragraph. Table 2 summarizes the risks.

Table 2: NRA assessment adapted from [Saxa-01]

No.	Hazard Category	Hazard Scenario	Baseline Risk	Current Risk	Future Risk
6	Contact	Spectator and fishing vessels: sightseeing, day boats and other fishing and recreational craft are not detected in the Launch Exclusion Zone during a launch and are struck by rocket	Tolerable with Modifications	Tolerable with Modifications	Tolerable with Monitoring
1	Contact	A rocket fails/is terminated soon after launch and debris lands on a vessel at sea.	Tolerable with Modifications	Tolerable with Modifications	Tolerable with Monitoring
3	Contact	A vessel strikes rocket debris floating on or just under the sea surface if a rocket fails/is terminated outside the Launch Area	Tolerable with Modifications	Tolerable with Modifications	Tolerable with Monitoring
9	Hazardous	A rocket fails/is terminated soon after launch and debris and material, including parachutes, wires and cables, on or just under the sea surface foul a propeller and disable a vessel's propulsion system or a fishing vessel's nets.	Tolerable with Additional Controls	Tolerable with Additional Controls	Tolerable with Monitoring
7	Hazardous Substance Accidents	A rocket fails/is terminated soon after launch and debris lands in a MPA or SPA and sinks below the surface.	Tolerable with Monitoring	Tolerable with Monitoring	Tolerable with Monitoring
2	Contact	A vessel is struck by a fairing that has been intentionally detached from the rocket as part of the stages of separation during a routine launch and as fallen to the sea surface.	Tolerable with Monitoring	Tolerable with Monitoring	Broadly Acceptable
4	Contact	A fixed offshore structure (oil/gas platform or offshore wind turbine) is struck by a fairing that has been intentionally detached from the rocket as part of the mission profile	Tolerable with Monitoring	Tolerable with Monitoring	Broadly Acceptable
5	Contact	A rocket fails/is terminated and the debris falls on a fixed structure (oil/gas platform or offshore wind turbine).	Tolerable with Monitoring	Tolerable with Monitoring	Broadly Acceptable

10	Contract	A rocket fails/is terminated outside LEZ but prior to and the debris and lands on a vessel at sea.	Tolerable with Monitoring	Tolerable with Monitoring	Broadly Acceptable

The risk assessment relevant for this analysis is given in the last column (Future Risk) once the mitigations were applied by Saxa. A detailed discussion is presented in [Saxa-01], as well as their ALARP justification.
Part of the NRA was also covered by HyImpulse in the HIT-SR75-GSA-001 [HIT-02]. The risks related to the recovery of SR75 are reported in Table 3. The table reports only the risks which are assessed as moderate after the mitigations are applied.

ANNEX A. shows the correlation between the risk levels used in [Saxa-01] and [HIT-02]. The coding refers to an internal structure used to identify the document related (GSA), the phase during which the hazard occurs (RE- recovery) and the top event related (N-motor components still pressurized or powered). Additionally, the presence of the small pyrotechnic charge used as Flight Termination System (FTS) aboard the recovered vehicle has been considered. This charge is of limited size and is maintained in a SAFE state throughout recovery operations, with inadvertent initiation probability negligible by design. The associated hazards to the recovery vessel crew and any third-party mariners in the area are assessed as minor and are effectively controlled through the marine exclusion zone, FTS safe-state confirmation prior to any vessel approach, and the submerged orientation of the charge within the floating vehicle.

Table 3: Identified major hazards – GSA [HIT-02] and Explosive Hazard Register [HIT-03]

Internal code	Hazard	Mitigation	Assessment after mitigations
GSA-RE-N-2	Hazard from damaged component storing high-pressure gas	In the event of splashdown, residual pressure in the rocket's pneumatic systems could present a hazard during recovery if system damage has occurred. This risk is managed through crew training and safety briefings, which include handling procedures for potentially pressurized hardware. A visual inspection is carried out after landing to assess the general condition of the booster and identify any visible signs of damage that could indicate a hazard If any concern arises during inspection, recovery is not carried out, and the booster is left in place. While this may result in the loss of the booster and flight data, estimated at approximately EUR 50K, personnel safety remains the primary consideration. With these operational controls in place, the residual risk to recovery personnel is low, and no additional mitigation has been identified that would further reduce risk without introducing disproportionate complexity or effort.	Minor
GSA-RE-N-5	Hazards from non-empty tanks because of off-nominal trajectory	No possible gas/fluid trap due to the nature of the main valve being a bust valve, all the fluid involved in the combustion will be ejected by the time of recovery	
GSA-RE-N-1	Inaccessibility of shutdown point of RF transmitter causing longer exposure to high frequencies	Operators are able to assess presence of RF signal emission via specific test tool (a credit card shaped RF emission indicator) by placing it on one of the antennas, LED will light up in red indicating transmitter is active. The transmitter outputs 10W of signal power, field strength and safety-distance calculations were performed using the German Federal Network Agency's "WattWächter" tool. The	

		calculation assumptions are conservative, neglecting cable and component losses and assuming idealized antenna gain. The resulting required safety distance is 0.5 m. The results concludes that establishing a 1 m exclusion zone around the antenna during the transport will be enough to assure the safety of the operators in case of inability to turn off the transmitters during recovery operations.	
GSA-RE-N-3	Powered avionics components due to incorrect touchdown detection, overheating of batteries	No further mitigation is envised other than reliable batteries choice. Reliability of such elements is very high for COTS components, no active danger for mariners	
GSA-RE-N-6	Water entering the battery pack enclosure	Inspection and recovery procedures to assure, procedures performed by trained personnel Sealing of the battery pack Timer shut off of the power	
GSA-PO-P-2 GSA-PO-P-3	Floating unplanned debris damaging other vessels	Buoyancy estimation limiting the amount of time the components are floating Beacons tracking allows for quick recovery of the material Landing area reconstruction allows us to promptly approach the designated landing area	
K-3 (different nomenclature in explosive hazard register)	Presence of a small explosive charge within the recovered vehicle during recovery vessel approach.	The FTS is commanded to SAFE state prior to any recovery vessel approach being authorized. The charge contained in the body of the vehicle and is submerged within the floating vehicle, attenuating any surface effect. A maritime Warning Area (Notice to Mariners) is active until operations at sea are concluded. Buoyancy estimation limiting the amount of time the components are floating	

The HIT-SR75-FSA-001 [HIT-01] also covered the risks occurring during flight and thus related to the dispersion of debris over the sea. Table 4 reports only the risks which are assessed as moderate after the mitigations are applied.
The term *offside fatalities* means fatalities occurring outside the boundaries of SaxaVord Spaceport.

Table 4: Identified major hazards- FSA [HIT-01]

Internal code	Event	Cause	Consequences	Mitigation	Assessment after mitigation
FSA-RE-M-1	Nose cone separation failure	Software or mechanism failure	Hard impact upon landing, if hitting vessel could cause offsite fatalities	Vessel safety demonstrated by FSA, Loss of vehicle accepted for the experimental nature of the mission, when public is not affected, Parachute testing and proper folding in the procedure NOTMARs in place in the area expected to be impacted by the flight All these events are still considering landing with	Minor
FSA-RE-M-7		Failure in activating the recovery system	Hard impact upon landing, if hitting vessel could cause offsite fatalities		
FSA-RE-M-2		Parachute ejection failure	Off-nominal landing point; parachute partially functioning reducing the effects of hard impact, if hitting vessel could cause one fatality		
FSA-RE-M-3		Parachute not inflating	Off-nominal landing point; parachute partially functioning reducing the effects of hard impact, if hitting vessel could cause one fatality		
FSA-RE-M-5		Failed structural support for parachute	Hard impact upon landing, if hitting vessel could cause offsite fatalities		
FSA-RE-M-6		Icing of pressure ports	Hard impact upon landing, if hitting vessel could cause offsite fatalities		
FSA-RE-M-4		parachute entanglement with manacle band or fin	Hard impact upon landing, if hitting vessel could cause offsite fatalities		
FSA-FL-J-2	Off Nominal trajectory	Excessive wind gusts	Loss of vehicle; could cause onsite or offsite fatalities	With a detailed weather and wind prediction HyImpulse can foresee	Minor

FSA-FL-J-3		Structural failure due to excessive loads	Loss of vehicle; unplanned debris could cause offsite fatalities (impact with vessels)	whether the debris generated by such occurrence would spread north (water, safe) or south (villages, unsafe) and avoid launching in the second scenario. Structural testing of the various components of the rocket together with hot fire testing guarantees the reliability of the structure of our rocket. The breakup event is anyway included in the FSA and the study mitigates the expected result of the event, meaning that guarantees and acceptable level of confidence regarding the safety even considering a breakup The risks are finally mitigated by the activation of the flight termination system	
FSA-FL-J-5		Burn-through motor casing	Loss of vehicle; unplanned debris could cause offsite fatalities		
FSA-FL-J-1		Manufacturing defect	Loss of vehicle; unplanned debris along trajectory could cause offsite fatalities		
FSA-FL-J-7 FSA-FL-J-8		Guidance malfunction	Loss of vehicle; unplanned debris could cause offsite fatalities		
FSA-FL-J-4		Nose cone separation premature activation	Hard impact upon landing, if hitting vessel could cause offsite fatalities		

The following mitigations measures have been applied by the spaceport:

- Communication with UKHO for Notice to Mariners
- Enforcement of Launch Exclusion Zone
- VHF Sécurité Messages for vessels
- Notices to Mariners
- Emergency response plan
- Regular weather forecasting
- Promulgation of launch information to all stakeholders
- Subcontracting of trained personnel on range vessels

These points will be discussed in the next paragraph.

6 NRA MITIGATION MEASURES

The NRA under which this activity is taking place contains a summary of industry standard risk controls and mitigation measures. These measures are listed below with a summary of the measures Saxa and HyImpulse have taken.

6.1 FLIGHT TERMINATION SYSTEM (HYIMPULSE)

In the FSA it is defined a safe flight corridor which assures the rocket to be within the hazard area that will be notified to Mariners, During the flight operations a dedicated team will be responsible for the continuous tracking of the rocket to assure the trajectory being within the defined corridor. In case unplanned trajectory which could result in increased risk to Mariners, the flight termination system will be activated.

The flight termination system is an heavily tested component and follows rigorous standards to assure its activation and its capability to terminate the rocket flight.

6.2 STAKEHOLDERS NOTIFICATION (SAXA)

Information regarding the project, including coordinates are requested 4 months prior to the launch window by the following organizations:

- Sullom Voe Harbour and VTS
- Shetland Islands Council (Ferries)
- Shetland Maritime Coastguard Agency
- Cooke Aquaculture
- Shetland Islands Fishermen
- Shetland Shellfish Management Organisation
- Scottish Fishermen’s Federation
- North Atlantic Fisheries College
- Seafood Shetland
- Unst Shellfish Ltd
- RYA Scotland
- Seafish
- Fisheries Rep, Defra
- UKHO
- MRCC Shetland
- HMCG Offshore Energy Branch
- NAVAREAXIX
- NLB
- Navigation Branch, MCA
- Lerwick Port Authority

A full list of stakeholders is available in [SAXA-03].

6.3 NOTICE TO MARINERS (SAXA)

Notice to Mariners is due to be requested to UKHO 4 months before launch (L-4mo). The Notice to Mariners is released by UKHO at L-2mo.

6.4 RADIO NAVIGATION WARNINGS (SAXA)

Information regarding this project including coordinates will be provided to the UKHO at L - 7 days for issue at L - 5 days.

6.5 OPERATIONAL PLANNING (HYIMPULSE)

Planning for this launch began in January 2026. HyImpulse identified launch hazard areas that will be finalized by the Flight Safety Analysis due to the CAA UK at L-2mo. Arrangements for recovering the rocket are made by HyImpulse.

6.6 SPACE LAUNCH HAZARD AREAS (SAXA & HYIMPULSE)

The exclusion zone around the launch pad is contained within the following points:

ID	Latitude	Longitude
1	60° 47' 44.16" N	0° 44' 45.24" W
2	60° 47' 43.44" N	0° 46' 28.56" W
3	60° 48' 40.59" N	0° 48' 15.41" W
4	60° 48' 40.59" N	0° 48' 30.90" W
5	60° 49' 25.32" N	0° 50' 08.88" W
6	60° 53' 15.00" N	0° 51' 50.76" W
7	61° 04' 30.00" N	0° 51' 50.76" W
8	61° 04' 30.00" N	0° 39' 48.96" W
9	60° 53' 30.12" N	0° 39' 48.96" W
10	60° 49' 25.32" N	0° 41' 15.54" W
11	60° 48' 40.59" N	0° 42' 48.96" W
12	60° 48' 40.59" N	0° 43' 04.45" W

The warning area is contained in a polygon identified by the following points

ID	Latitude	Longitude
1	60°47′44.16″ N	0°44′45.24″ W
2	60°47′43.44″ N	0°46′28.56″ W
3	61°47′16.08″ N	2°57′12.96″ W
4	62°50′45.24″ N	3°03′36.72″ W
5	63°29′04.20″ N	1°45′10.44″ W
6	63°29′47.04″ N	0°16′04.80″ E
7	62°55′05.16″ N	1°30′59.76″ E
8	61°50′35.16″ N	1°27′47.52″ E

A nominal splashdown area, or nominal impact zone, is defined by HIT as an area encompassing the distribution of all nominal impact points deriving from minor changes to the rocket performance on launch day. It is contained in a polygon identified by the following points:

ID	Latitude	Longitude
1	61°50'12.12" N	0°33'08.73" W
2	61°50'12.12" N	0°57'08.73" W
3	62°01'48.00" N	1°13'30.00" W
4	62°13'24.00" N	0°57'08.73" W
5	62°13'24.00" N	0°33'08.73" W
6	62°01'48.00" N	0°16'47.46" W

The coordinates for the three hazard areas described in Section 6.6 will be promulgated via Notice to Mariners.

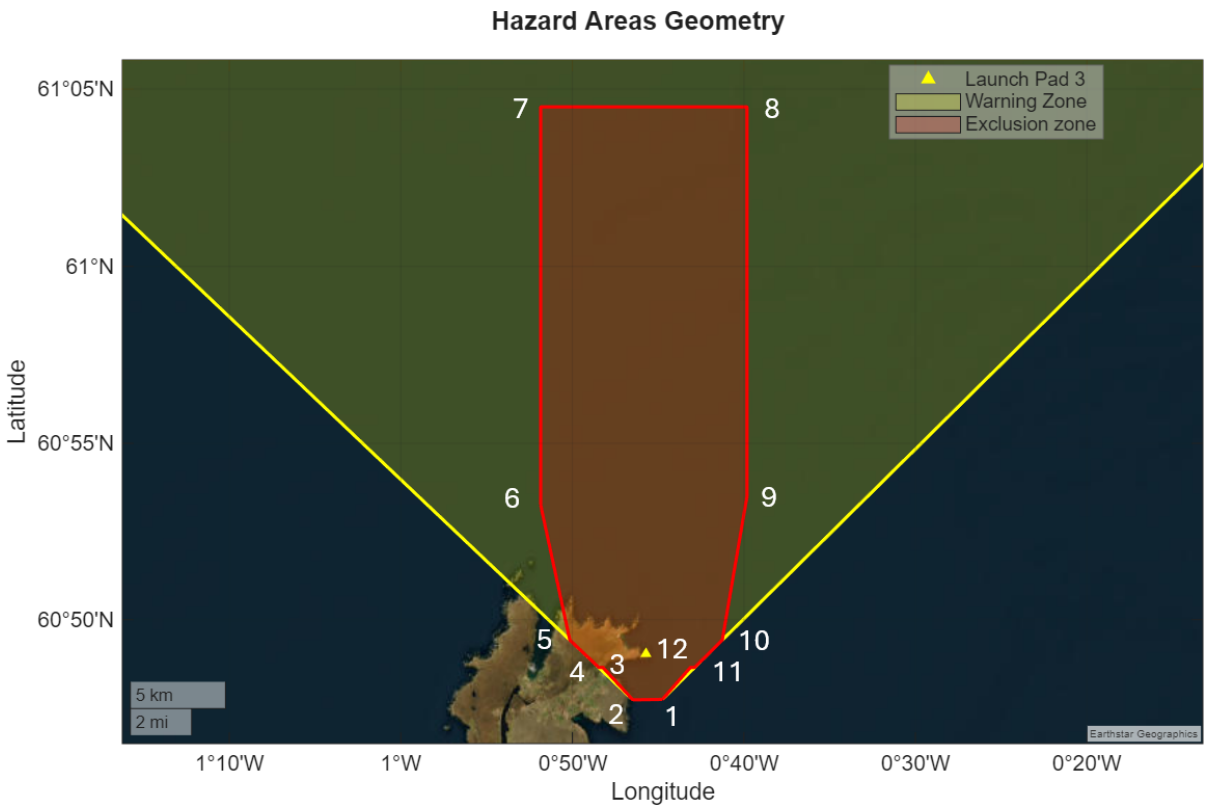

Figure 4 Exclusion Zone

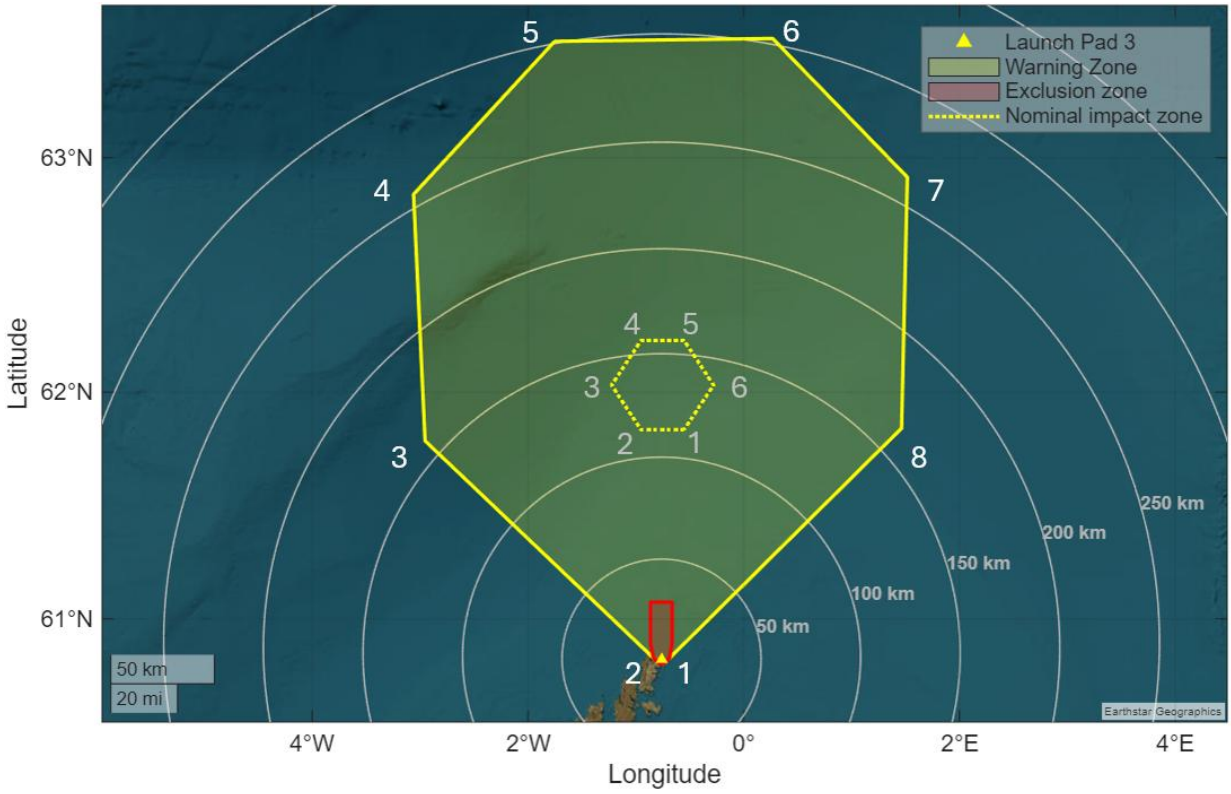

Figure 5 Extended view including Warning Area and Nominal Splashdown Area

6.7 RANGE SAFETY VESSELS AND RECOVERY VESSEL (SAXA AND HYIMPULSE)

HyImpulse and Saxa have engaged the services of a local marine contractor for the provision of Range Safety Vessels (Saxa) and a Recovery Vessel (HyImpulse).
The Range Safety Vessel will provide surveillance coverage and interdiction along the west boundary of the Exclusion Zone shown in Figure 4.
The recovery vessel will be stationing at a given distance from the booster nominal impact point, to promptly commence recovery operations once debris has been located. To localize the booster the latest information from telemetry is used, the booster is also equipped with LoRa beacons under IR2030/1/19 (OfCom license exemption) that will allow the easy trackng of the booster for a quick recovery.
The Recovery Vessel will maintain radio watch on VHF Ch 16 and working channels 2 and 4 throughout launch operations, and switch to hop-communications via the Range Safety Vessel once out of reach from Saxa. The Range Vessel will be instructed by the Range not to enter the drop zone until debris impact has been confirmed and the Range has issued clearance to proceed.
VHF communications between the vessels will be preferred and feasible as long as the Recovery Vessel will be located at the impact point or southern. Alternative communications may be arranged via a satellite phone or satellite internet service, if required.

6.8 VHF SECURITÉ MESSAGES (SAXA)

The Range Safety Vessels will promulgate securité messages via VHF on Channel 16 if they are less than 1 minute long. A working channel for use on the day (likely Ch 67) of the launch will be determined and promulgated closer to the day of launch. The document [Saxa-03] contains more information on communications.

6.9 LIGHTS AND REFLECTIVE TAPE ON PAYLOAD (HYIMPULSE)

HyImpulse implemented several aids to make the rocket debris visible. The IALA recommendations are used as reference [RD-02]. Since rocket debris are not directly mentioned in the IALA catalogue, HIT is using the following aids.

6.9.1 Colour

- Nose cone and 50% of booster (the top part expected to float): white with yellow bands on the recovery module.
- Drogue parachute: white and yellow band at the top and bottom
- Main parachute: white and red

6.9.2 Lights

- The addition of lights is not foreseen, unless there is a clear request coming from MCA.
- HIT is planning for a launch during daylight hours, whenever possible.

6.10 RISK ASSESSMENT METHOD (SAXA & HYIMPULSE)

This document constitutes the RAMS for this launch.

6.11 EMERGENCY RESPONSE PLAN (SAXA)

An emergency response plan is being submitted with the Marine License Application.

6.12 WEATHER FORECASTING (HYIMPULSE)

Weather forecasting is provided if requested by HyImpulse. A possible contractor for HyImpulse is the MetOffice. This includes a Spaceport Weather Matrix at L – 14 and L – 7 days, and an Enhanced Spaceport Weather Matrix from L- 4 days. Saxa is working on providing a weather station on the launch pad assigned to HyImpulse for local real-time data.

6.13 PROMULGATION OF INFORMATION (SAXA)

Local stakeholders, including emergency services will informed of this launch activity using the Notifications process established under the Space Industry Regulations 2021 [SIA-01]. Stakeholders informed include:

- Police Scotland
- NHS Shetland
- Fire and Rescue
- Crofters, Landowners, and Lessees
- Unst Community Council
- Shetland Islands Council
- Local Coastguard
- Local Lifeboat Stations

6.14 TRAINING OF OPERATIONAL PERSONNEL (SAXA, HYIMPULSE)

The necessary currency and competency for Saxa employees to undertake launches and manage Range operations was gained with the project “Exercise Freya” (July 2022) and through the launch preparation for RFA test flight (planned for July-August 2026).
Training to personnel on the recovery vessel to safely recover the booster and parachute is provided by HyImpulse.

6.15 STANDARD OPERATING PROCEDURE (SAXA)

“Exercise Freya” (July 2022). helped test and adjust standard operating procedures for Saxa, as well as recovery operations for Ocean Kinetics and interactions with key stakeholders, such as MCA, UKHO, Marine Scotland, NLB etc.
Launch preparation for RFA test flight (planned for July-August 2026) provided testing and validation of Range procedures required for HyImpulse launch as well.

6.16 COMMUNICATIONS PLAN (SAXA)

The comms plan is available in document SAXA-UK-OPS-PLN-001 Maritime Communications Plan [Saxa-03].

7 MARITIME BOUNDARY SURVEILLANCE

The Exclusion Zone will be monitored using a combination of land-based sensors, with at least one Range Safety Vessel on the west side of the Exclusion Zone off the coast

of Lamba Ness. This solution used for RFA test flight (planned for July-August 2026) is suitable to be applied to HyImpulse.

The land-based sensors will consist of a 4 electro-optical cameras, with infra-red capability, situated at various points on the Lamba Ness Peninsula, and maritime radar to provide positive identification of craft within the Exclusion Zone, plus wider area coverage. In addition to this a bespoke software package is used to visualize the radar and camera imagery. The camera and radar systems are linked and can thus cross cue each other onto points of interest. The maritime radar will have a maximum detection performance ranging from 6nm for small vessels to 40nm for larger vessels. The optical and thermal camera has a detection range from 10nm to 25nm depending on the size of the vessel. AIS data, out to a range of 50nm, will also be overlaid onto this visualization.

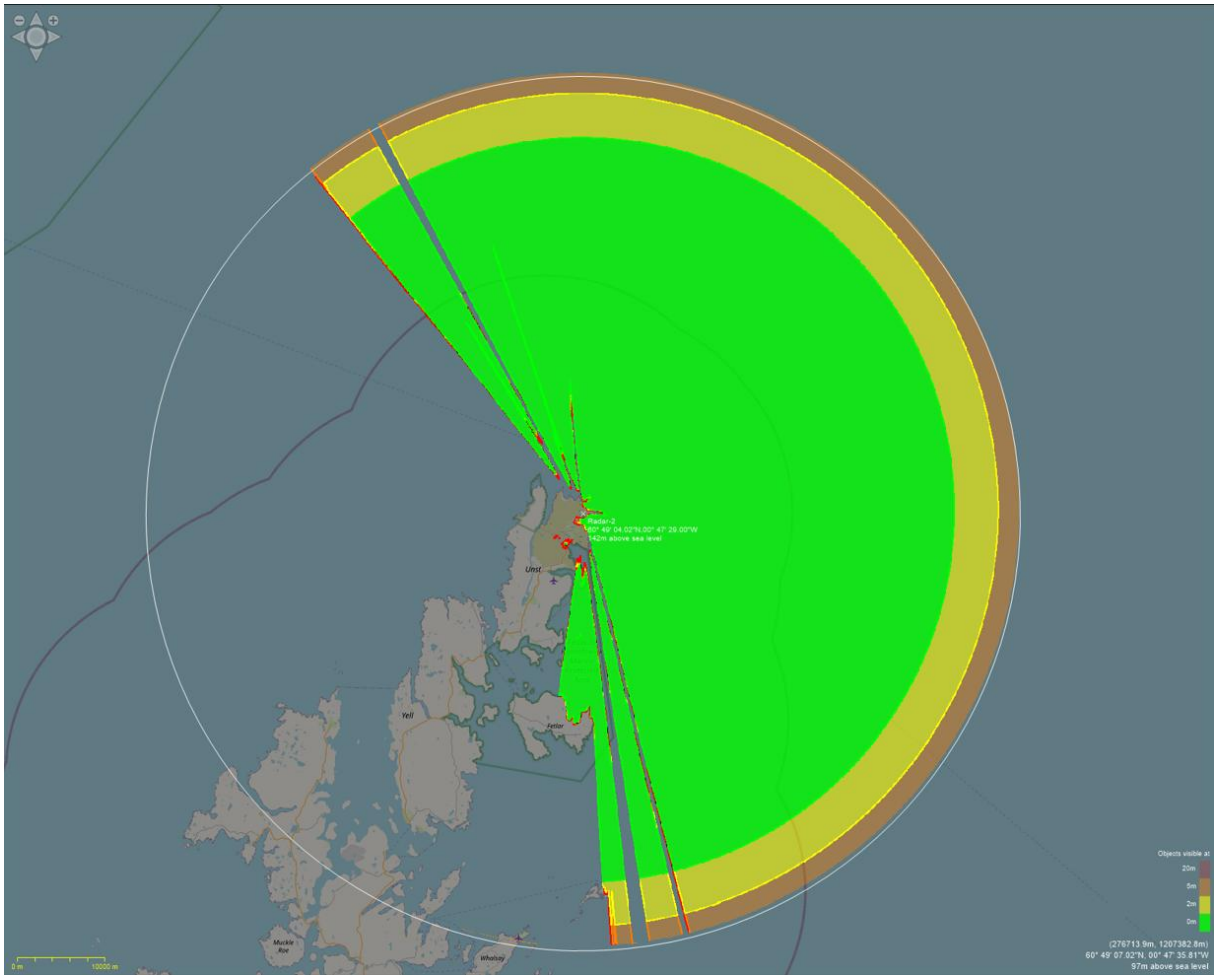

Figure 6 Maritime radar and camera system coverage

Figure 6 the arcs of the electro-optical camera system (green shading) and maritime radar (yellow shading). The Range Safety Vessel will be positioned outside at the west boundary of the Exclusion Zone to complement maritime surveillance for the proposed are. The Range Safety Vessel will also have direct communications with the Range. Information about the communication plan can be found at SAXA-UK-OPS-PLN-001 Maritime Communications Plan [Saxa-03].

Table 5 shows a list of the maritime surveillance assets with further detail on their capabilities.

Table 5: Surveillance Assets

Asset	Capability
AIS Receiver	Provision of vessel data, such as identity, position, speed and course. Coverage out to 50nm
Maritime Radar	Provision of real-time picture of maritime traffic out to 40nm
Pan Tilt Zoom (PTZ), Electro-optical cameras	Provide day, night and all weather visual detection of vessels out to 10-25nm dependent on vessel size
Range Safety Vessel	Physical presence for maritime users and can provide overlap or plug any gaps in land based surveillance systems. Can assist with maritime emergencies and provide interdiction. It is also expected that any vessel undertaking these duties will, as a minimum, be equipped with the following: • VHF radio. Redundancy communications systems may also be required, such as satellite phone. VHF Channels monitored: 16, 67 and 70. • Standard life saving equipment, MOB recovery equipment and firefighting equipment such as a desk wash hose or fire extinguishers. • Medical Equipment – Category B First Aid Kit in line with MSN 1905 • Maritime radar system • AIS transponder

8 CONCLUSIONS

The Launch Risk Assessment of HyImpulse considers the sounding rocket SR75 safe to launch and recover according to the operational procedures drafted by HyImpulse, SaxaVord Spaceport and their Marine Contractors.

ANNEX A.

The risk levels used in the present document correlates to the risk levels used in the Navigational Risk Assessment (Pg. 53, Table 13) [Saxa-01] as follows:

[Saxa-01] – NRA	Outcome	[HIT-02] – NRA	Outcome
21-24: Unacceptable		Unacceptable	
15-20: Unacceptable			
10-14: Tolerable with Modifications			
5-9: Tolerable with Additional Controls		Moderate	
3-4: Tolerable with Monitoring		Minor	
1-2: Broadly acceptable			
0: Broadly acceptable			