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Best Practicable Environmental Option

2026

Marine Licensing Application

Commercial in Confidence

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Contents

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Configuration Page

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1. Applicable and Reference Documents

ID	Definition
AD1	Marine (Scotland) Act 2010
AD2	Scotland's National Marine Plan (2015)
RD1	Machrihanish Navigation Risk Assessment, Project: Lowlander Pathfinder (EXO_SSL _NRA)

2. Introduction

Under the Marine (Scotland) Act 2010, a Marine Licence is required for the deposit of substances or articles within waters adjacent to Scotland. The proposed Lowlander Pathfinder mission involves launch vehicle components descending under parachute and splashing down within Scottish waters prior to recovery. Accordingly, a Best Practicable Environmental Option (BPEO) assessment has been undertaken to demonstrate that alternatives have been considered and that the proposed mission and recovery approach minimise environmental effects so far as reasonably practicable.

As there is currently no marine licensing guidance or standard BPEO template specifically developed for spaceflight activities, this document applies the principles of the established BPEO process to a launch and recovery operation. The assessment considers the Lowlander vehicle components, their recovery configuration, the expected environmental pathways should recovery not be achieved, and the environmental considerations that have informed the selected mission design and recovery approach. Compliance with relevant policies within Scotland's National Marine Plan is also considered.

3. Methodology

The assessment identifies each vehicle component, its recovery configuration and its likely behaviour if unrecovered. It then considers the principal environmental pathways associated with the preferred recovery option and evaluates the proposal against the general policies of Scotland's National Marine Plan. Mission trajectory, splashdown and navigational controls are addressed separately in EXO_SSL_NRA.

4. Debris Categorisation & Justification

The table below provides a debris catalogue for the "Lowlander" launch (RD1). All parts of the vehicle are intended to be recovered, through a combination of a drogue and main parachute to lower the speed of the debris upon splashdown, tethered components to avoid straying or sinking of individual components from the splashdown zone, deployed inflatables to ensure all components float, and GPS/Smoke signals for aiding in locating the debris for recovery.

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Table 1: Debris Categorisation & Justification

Component	Mass & Dimensions	Principal Material	Recovery Configuration	Marine Behaviour if Unrecovered	Principal Environmental Consideration
Nose Cone	1.4 kg; 0.8 m × 156 mm	Fibreglass / aluminium	Attached to recovery system	Floodable; may sink if flotation lost	Localised seabed presence
Upper Airframe	1.7 kg; 0.764 m × 156 mm	Fibreglass composite	Attached to recovery system	Floodable; may sink if flotation lost	Contains electronics and batteries
Nose Cone Coupler	1.5 kg; 0.245 m × 152 mm	Fibreglass composite	Attached to vehicle	May remain buoyant or sink with assembly	Persistent composite material
Mid-Section Coupler	0.905 kg; 0.6 m × 152 mm	Fibreglass composite	Attached to vehicle	Floodable; may sink if flotation lost	Persistent composite material
Lower Airframe	3.37 kg; 1.53 m × 156 mm	Fibreglass composite	Attached to recovery system	Floodable; may sink if flotation lost	Localised seabed presence
Fins	2.145 kg total	G10 fibreglass	Attached to lower airframe	Sink with assembly	Persistent composite material
Vinyl Stickers	Negligible	Vinyl	Bonded to airframe	Potential detachment	Minor debris
Motor Mount	0.325 kg	Fibreglass composite	Internal assembly	Sink with assembly	Persistent composite material
Motor Casing	3 kg; 1 m × 98 mm	6061-T6 aluminium	Attached to vehicle	Likely sink if flotation lost	Localised seabed presence
Drogue Parachute	0.425 kg; 1.22 m	Nylon ripstop	Tethered to vehicle	May float or follow assembly	Entanglement / debris risk

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Main Parachute	0.855 kg; 3.66 m	Nylon ripstop	Tethered to vehicle	May float or follow assembly	Entanglement / debris risk
Nozzle	Included in motor mass	Phenolic / clay composite	Attached to motor	Sink with assembly	Persistent solid material
O-rings	5 g	Viton fluoroelastomer	Internal motor component	Sink with assembly	Negligible
Fixings	1 kg total	Stainless steel / nylon	Distributed throughout vehicle	Sink if detached	Minor marine debris
Smoke Device	1 kg	Biodegradable dye composition	Consumed during descent	Not expected to enter sea intact	Negligible
Electronics	1 kg	PCB, chips, Li-ion	Enclosed in upper airframe	Follow assembly	Potential contamination source
Inflatable Devices	0.195 kg	Nylon TPU + CO_2	Attached to vehicle	Provides buoyancy	Recovery aid
Tethers	0.575 kg	Kevlar	Connect all major assemblies	Follow assembly	Limited entanglement risk
$BKNO_3$	<10 g	$BKNO_3$ composition	Consumed during deployment	Fully consumed before splashdown	Negligible

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Table 2 - Environmental Pathways by Material Group

Material or article group	**Relevant Lowlander components**	**Credible environmental pathway if unrecovered**	**Potential effect**
Fibreglass composites and cured epoxy	Nose cone, upper and lower airframes, both couplers, fins and motor mount	Persistent solid components may remain at the surface while flotation operates or settle to the seabed following flooding or flotation failure	Localised seabed occupation and persistent unrecovered debris. No continuous operational discharge would occur from the structural articles
Aluminium alloy	Motor casing and nose-cone tip	Flooded or detached aluminium hardware would be expected to sink and remain on or within the surface seabed sediments	Localised physical presence and gradual weathering or corrosion in seawater
Stainless steel and nylon fixings	Vehicle fasteners and structural fixings	Individual items could sink if mechanically detached from the vehicle	Non-metallic items could float if detached serving as unrecovered debris
Nylon parachute fabric	Main and drogue parachutes	Canopy material could remain suspended near the surface, become waterlogged or follow the tethered assembly; detachment could allow dispersion	Unrecovered floating debris and entanglement risk to marine fauna, particularly from the larger main canopy and its lines
Kevlar cord	Recovery tethers and harnesses	Detached or exposed cord could remain in the marine environment as a flexible article	Entanglement risk and persistent unrecovered floating debris
Nylon/TPU flotation devices and	Inflatable recovery devices	Inflatable bodies remain attached and provide buoyancy; punctured or detached devices could	Small floating debris pathway and potential separation

CO_2 cartridges		become floating or submerged debris	of the metal cartridge
Printed circuit boards and Li-ion batteries	Flight computers, sensors and associated power supplies	Prolonged immersion or damage to the upper-airframe enclosure could expose electronic materials and battery contents to seawater	Localised contamination and water-quality risk. This is the component group with the clearest potential chemical-release pathway
Paint, lacquer and vinyl finishes	External surfaces of nose cone, airframes, couplers and fins; vinyl markings	Extended immersion and weathering could cause coatings or stickers to deteriorate or detach	Small quantities of persistent coating or plastic material could enter the marine environment
Phenol-formaldehyde and kaolinite nozzle material	Motor nozzle	Nozzle remains attached to the motor assembly and may settle with the lower airframe if flotation fails	Localised persistent solid material on the seabed

Under the nominal recovery scenario, all major vehicle components remain tethered together, descend under parachute and are maintained at the surface by attached inflatable flotation devices to facilitate recovery. Should recovery not be achieved, the majority of the structural components comprise fibreglass composites and aluminium alloys which are expected to remain localised rather than disperse widely within the marine environment. The principal environmental pathways for unrecovered debris are therefore associated with flexible materials such as parachutes and tethers, and the potential release of contaminants from electronic components and Li-ion batteries following prolonged immersion.

The likelihood ratings in Table 3 below are qualitative and are based on the number and combination of recovery-system failures required, taking account of tethering, flotation, redundant tracking, visual aids and dedicated recovery arrangements. They do not represent calculated numerical probabilities.

Table 3 - Scenario Descriptions & Probabilities

Scenario	Likelihood	Description	Consequence	Recovery and Mitigation
Nominal launch and recovery	Likely	The drogue parachute deploys at apogee, followed by	The complete tethered assembly remains afloat and trackable within or	The recovery vessel uses the GPS position and visual recovery aids to

		deployment of the main parachute at the intended altitude. The vehicle assembly remains securely tethered together. Flotation devices deploy and the redundant GPS tracking systems and visual recovery aids operate as intended.	close to the predicted splashdown area. Its presence in the marine environment is limited to the active recovery period.	locate and retrieve the complete assembly. All recovered components are checked against the debris inventory.
Main parachute fails to deploy, drogue-only descent	Unlikely	The drogue parachute deploys correctly, but the main parachute does not deploy. The vehicle descends at a higher speed compared to the nominal scenario, although the vehicle assemblies, flotation devices and tracking systems may remain available.	Increased descent speed and splashdown loading could damage components or flotation devices. If the tethered assembly remains afloat or partially afloat, recovery remains practicable.	The recovery vessel proceeds to the position provided by the redundant GPS systems or, if GPS signals are lost, to the last reported position and predicted splashdown area. Recovery prioritises the complete assembly and any attached flexible material.
Main parachute deploys at apogee	Unlikely	The main parachute deploys earlier than intended, at or close to apogee, rather than at its planned deployment altitude.	The vehicle may experience a longer period under the main parachute and increased drift from the nominal trajectory. This could move the splashdown point away from the centre of the predicted recovery area, but the vehicle is expected to descend at a relatively low speed.	Redundant GPS tracking supports continuous or last-known-position monitoring. The recovery vessel adjusts its search and recovery route using the reported position, observed trajectory and drift conditions. The vehicle assemblies remain tethered to limit separation and dispersal.
No parachute deployment or ballistic descent	Very Unlikely	Neither the drogue nor the main parachute deploys, resulting in a high-speed or ballistic descent.	High splashdown loads could cause major structural damage, failure of flotation devices, loss of GPS transmission or partial separation of individual components. The assembly could sink rapidly, although securely tethered components may remain together rather than dispersing over a wide area.	The recovery response uses redundant GPS data, the last reported position, trajectory information and observed impact location to define the search area. Floating debris is recovered where safe and practicable, with priority given to parachutes, tethers, flotation material, electronics and batteries.
Partial or complete	Unlikely	One or more flotation devices fail to deploy or are damaged	The assembly may sit lower in the water, become partially	Redundant GPS systems and last-known-position information support the

flotation failure		during splashdown. The principal vehicle assemblies remain securely tethered together.	submerged or sink if sufficient buoyancy is lost. Reduced visibility may make visual recovery more difficult.	recovery effort. Because the payload bay and other principal components are heavily tethered together, the credible outcomes are expected to be recovery of the connected assembly or loss of the connected assembly through sinking, rather than widespread dispersal of individual major components.
Loss of one GPS tracking system	Unlikely	One GPS tracker fails, is damaged or stops transmitting following descent or splashdown.	Positional information from the affected tracker is unavailable, but the remaining GPS tracker and visual aids may continue to support recovery.	The independent GPS tracker provides positional redundancy. The tethered configuration also reduces the likelihood that the payload bay or another tracked component will become separated from the wider assembly.
Loss of all GPS tracking signals	Very Unlikely	Both GPS tracking signals are lost due to damage, submersion, power loss or another common event.	Direct position reporting is unavailable, increasing the size and complexity of the search area. Recovery may still be possible using the last reported GPS positions, trajectory data, visual observations and the predicted splashdown area.	The recovery vessel searches from the last reported positions and observed or predicted splashdown point, taking account of elapsed time, wind, currents and the expected drift of the tethered assembly. Visual recovery aids are also used where available.
Recovery delayed by sea state, visibility or vessel constraint	Unlikely	The recovery vessel cannot immediately reach or safely recover the assembly following splashdown.	The assembly remains in the marine environment for longer than planned. This increases the opportunity for drift, reduced flotation, loss of tracking, interaction with vessels or fauna, and deterioration or detachment of lightweight materials.	GPS tracking is maintained for as long as practicable. Recovery is undertaken when conditions permit. The location of any known floating or partially submerged hazard is retained and communicated through the established operational and maritime notification chain where appropriate.
Partial separation of parachute, tether or flotation material	Very Unlikely	A flexible or lightweight item becomes detached from the principal tethered assembly during descent, splashdown or the subsequent recovery period.	The detached material could float or remain suspended in the water column, creating persistent unrecovered debris and a localised entanglement pathway for marine mammals, seabirds or vessels.	Search and recovery activities prioritise parachutes, lines, tethers and flotation material. The last known location of any unrecovered item is recorded. Tethers and lines are fastened as securely as possible. The

				remaining major components are expected to stay connected through the principal tether system.
Catastrophic vehicle break-up during flight or descent	Very Unlikely	A major propulsion, structural or recovery-system failure causes the vehicle to break up before splashdown.	Components may be distributed across a wider area, making complete recovery more difficult. Flexible materials could create floating debris and entanglement pathways, while denser components could sink and remain as localised seabed material. Damage to electronics or batteries could create a localised contamination pathway.	Trajectory information, redundant GPS data, last reported positions and observed impact information are used to define an expanded search area. Recovery prioritises floating debris, flexible recovery materials, electronics and batteries where recovery is safe and practicable.

A "Do Nothing" option has been considered. If the proposed launch were not to proceed, we would be unable to demonstrate the planned splashdown and recovery process, validate operational procedures, or support the commissioning of the launch rail and associated ground infrastructure. This mission represents an important risk-reduction step within a wider development programme and will generate essential flight, recovery and operational data to inform and de-risk subsequent launch activities. A nominal launch outcome includes full recovery of all vehicle components; however, materials, recovery systems and operational procedures have been selected to minimise environmental impact should recovery not be achieved.

The expected outcome of the Lowlander operation is complete recovery of the tethered vehicle assembly. The use of securely tethered major components, flotation devices, redundant GPS tracking systems and visual recovery aids means that the failure of one recovery element does not automatically result in non-recovery or floating debris.

The principal vehicle components, including the payload bay, are intended to remain connected throughout descent, splashdown and recovery. This limits the potential for widespread dispersal and means that the most credible outcomes are either recovery of the connected assembly or, following a severe impact or flotation failure, loss of the connected assembly through sinking.

Partial or complete non-recovery is assessed as very unlikely because it would require a major failure or combination of failures affecting descent, flotation, tracking and the subsequent recovery effort. If non-recovery occurs, parachutes, suspension lines and other flexible materials would present the principal entanglement hazard, while floating or partially submerged components could create a localised navigational hazard, and electronics and batteries would present the clearest potential contamination pathway.

These residual risks are not treated as inherently acceptable. They have been reduced so far as reasonably practicable through recovery-led design, tethering of the major components, redundant positional tracking, flotation, visual recovery aids and dedicated recovery operations.

5. Compliance to Existing Policies

The below table adheres to the general policies set out in Scotland's National Marine Plan, showing how the launch mission complies in best effort to such policies.

Table 4: Debris Categorisation & Justification

Policies		Details
GEN 1	**General planning principle** "There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan"	The proposed use of the marine area has been designed to align with the sustainability objectives of the Scottish National Marine Plan. Operational decisions incorporate relevant environmental considerations, including minimising the footprint of the activity, prioritising full recovery of debris from the mission, and selecting low-impact materials should any debris remain unrecovered. This approach ensures the activity is undertaken in the most sustainable manner practicable while enabling responsible development within Scotland's emerging space sector.
GEN 2	**Economic Benefit** "Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan"	The proposed activity will support ongoing development of aerospace R&D facilities at the Machrihanish site through the first controlled sea-recovery launch from this location, demonstrating the viability of the site as a national and European centre of excellence. Machrihanish Airbase (MACC) has been selected due to current space-sector investment and active use, including initiatives such as the annual MACH-X student rocketry competition and hosting of the European Space Agency Academy's rocketry training programme. This operation contributes to continued development of the site and supports growth of Scotland's emerging space sector and local workforce while providing associated economic benefit to the local area. Operations at the site already supports 6 FTE high-skilled jobs and the success of this activity is expected to create at least two additional FTE within the next 18 months. Local suppliers have been used in the development of the infrastructure that will be used during the activity and will be used during the campaign to support surveillance, recovery, catering and accommodation. Site

		usage fees will be paid to Machrihanish Airbase Community Company, a charity that exists to benefit the local community.
GEN 3	**Social Benefit** "Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of this Plan"	The activity contributes to local social benefit by supporting job creation and skills development as the Machrihanish site progresses alongside other emerging Scottish launch facilities. Operations help build specialist capabilities in the region and rely on support from local foundational industries, including machining, fabrication, logistics, and project services, which strengthens wider community employment. Continued activity at Machrihanish reinforces the site's role in Scotland's developing space sector and supports long-term opportunities for the local workforce.
GEN 4	**Co-Existence** "Proposals which enable coexistence with other development sectors and activities within the Scottish marine area are encouraged in planning and decision-making processes, when consistent with policies and objectives of this Plan"	The operation has been designed to coexist with other users of the marine environment through stakeholder engagement, advance notification procedures, and the establishment of a temporary Safety Exclusion Zone. Vessel activity assessments demonstrate that the majority of maritime traffic remains outside the operational area and that any temporary avoidance of the area requires minimal deviation from typical routes. The launch and recovery activities are of short duration and are not expected to materially affect other marine users.
GEN 5	**Climate Change** "Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change"	The proposed activity consists of a single launch and recovery operation and is expected to make a negligible contribution to greenhouse gas emissions. Due to the limited scale and duration of the operation, no measurable impact on climate change is anticipated. The activity will be monitored under Exotopic's published Carbon Reduction Plan, reporting annually.
GEN 6	**Historic Environment** "Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance"	No impacts on historic marine or coastal heritage assets are anticipated as a result of the proposed operation. The activity is temporary in nature and does not require any planned seabed works, excavation, dredging or installation of permanent infrastructure. In the unlikely event that recovery is unsuccessful, the potential environmental pathways associated with unrecovered components have been assessed in Section 4.

GEN 7	**Landscape/Seascape** "Marine planners and decision makers should ensure that development and use of the marine environment take seascape, landscape and visual impacts into account"	The launch is a temporary activity of limited duration and is not expected to result in any lasting impacts on landscape or seascape character. All major vehicle components are intended to be recovered following splashdown.
GEN 8	**Coastal process and flooding** "Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding"	This launch has no impact on coastal process and flooding.
GEN 9	**Natural Heritage** "Development and use of the marine environment must: (a) Comply with legal requirements for protected areas and protected species. (b) Not result in significant impact on the national status of Priority Marine Features. (c) Protect and, where appropriate, enhance the health of the marine area"	The proposed launch and recovery activities are located within the wider Sound of Gigha Special Protection Area (SPA), which is designated for internationally important wintering populations of great northern diver, Slavonian grebe, common eider, and red-breasted merganser. The Lowlander operation consists of a single, temporary launch and recovery activity of short duration, with all major vehicle components intended to be recovered following splashdown. No permanent infrastructure, seabed disturbance, or long-term alteration of habitats is required. Any disturbance associated with the launch, recovery vessel movements, or temporary presence within the SPA is expected to be localised and short-lived, comparable in duration to routine vessel movements that already occur within the area. Given the limited scale, duration, and frequency of the proposed operation, significant impacts on the qualifying interests of the Sound of Gigha SPA are not anticipated. In the very unlikely event that parachute or tether material becomes detached and remains unrecovered, it could create a localised entanglement pathway for marine mammals and diving or surface-feeding birds. This risk is

		reduced through secure attachment of flexible materials to the principal vehicle assembly, redundant flotation and tracking, immediate recovery operations, and prioritised retrieval of any detached parachutes, lines or tethers. Given the single-event nature of the activity, limited quantity of flexible material and very low likelihood of separation and non-recovery, significant effects on protected species or the qualifying interests of the SPA are not anticipated.
GEN 10	**Invasive non-native species** "Opportunities to reduce the introduction of invasive nonnative species to a minimum or proactively improve the practice of existing activity should be taken when decisions are being made."	This launch has no introduction of invasive non-native species.
GEN 11	**Marine litter** "Developers, users and those accessing the marine environment must take measures to address marine litter where appropriate. Reduction of litter must be taken into account by decision makers"	All major vehicle components are intended to be recovered following splashdown through the use of parachutes, tethered assemblies, inflatable flotation devices and GPS-based recovery. In the event recovery is unsuccessful, the principal residual pathways are associated with persistent unrecovered debris, parachutes and recovery lines, and the potential long-term presence of structural components on the seabed. The environmental fate of each component has been assessed within Section 4 and has informed the selection of materials and recovery systems. In the unlikely event that an item cannot be recovered during the initial operation, its last known position and expected drift or sinking behaviour will be recorded. Further search and retrieval actions will be considered on a risk-based basis, with priority given to parachutes, tethers, flotation material, electronics and batteries because of their potential entanglement, navigation and contamination pathways. The proposal therefore applies an avoidance and reduction hierarchy through retention of components, immediate recovery, prioritised retrieval of higher-risk materials and recording of any residual unrecovered debris.
GEN 12	**Water quality and resource** "Developments and activities should not result in a deterioration	The Lowlander vehicle is powered by a commercially manufactured CTI M1450-CL solid rocket motor utilising APCP-based propellant. Under nominal operation, the propellant is substantially consumed during powered flight, and the vehicle carries no liquid fuels or oxidisers. Any remaining motor hardware is intended to be recovered as

	of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply"	part of the vehicle recovery process. Consequently, no significant impact on water quality is anticipated. The potential environmental effects of unrecovered debris have also been assessed. Structural components are primarily constructed from fibreglass composites and aluminium alloys, whilst electronics and Li-ion batteries remain enclosed within the vehicle structure. These components are intended to be recovered following splashdown and no significant effect on water quality is anticipated.
GEN 13	**Noise** "Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects"	The proposed activity consists of a single, short-duration launch event. Noise generation is limited to the powered ascent phase of the vehicle, which occurs primarily over land immediately following launch. As the vehicle ascends, the rocket motor operates at increasing altitude and progressively further from receptors within the marine environment. Motor burnout occurs during ascent, after which no further propulsion-related noise is generated. Given the limited duration, infrequent nature, and small scale of the operation, significant adverse effects from launch noise or vibration on the marine environment are not anticipated. Any disturbance is expected to be temporary and comparable to other transient noise sources routinely experienced within the wider coastal and maritime environment.
GEN 14	**Air quality** "Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits"	The proposed activity is a single, short-duration launch and recovery operation and is not expected to result in any measurable deterioration in local or regional air quality. Emissions associated with the launch are temporary, limited in scale, and occur predominantly during the brief powered ascent phase of the vehicle. Given the infrequent nature of the operation and the small scale of the launch vehicle, no significant impact on air quality is anticipated.
GEN 15	**Planning alignment A** "Marine and terrestrial plans should align to support marine and land-based components required by development and seek to facilitate appropriate access to the shore and sea"	The proposal aligns marine and terrestrial planning by integrating land-based launch operations at Machrihanish with coordinated access to the adjacent marine area for recovery operations. The mission is overseen through Exotopic's Range Control Centre, which acts as the central communications hub throughout the operation. Engagement has been undertaken with relevant stakeholders, including the MCA, UKHO, NLB, MD-LOT, HM Coastguard, harbour authorities, fisheries organisations, recreational boating representatives, and

		other maritime users. Appropriate notifications and communication channels will remain active throughout the launch and recovery phases to ensure effective coordination between land and marine activities.
GEN 16	**Planning alignment B** "Marine plans should align and comply where possible with other statutory plans and should consider objectives and policies of relevant non-statutory plans where appropriate to do so" **<applies to inshore waters only>**	Not applicable for this launch mission.
GEN 17	**Fairness** "All marine interests will be treated with fairness and in a transparent manner when decisions are being made in the marine environment"	The mission supports the principles of fairness and transparency by ensuring relevant marine interests are provided with an opportunity to participate in the planning process. Stakeholder engagement has been undertaken with maritime authorities, local harbour operators, fisheries representatives, recreational boating organisations, and other affected parties. Information relating to the proposed activity, launch window, and safety arrangements has been shared through appropriate channels to ensure all marine users are treated fairly and transparently.
GEN 18	Engagement "Early and effective engagement should be undertaken with the general public, and all interested stakeholders to facilitate planning and consenting processes"	Early and effective engagement has been undertaken with stakeholders across terrestrial, maritime, and regulatory sectors. This includes engagement with the MCA, UKHO, NLB, MD-LOT, HM Coastguard, harbour authorities, fisheries groups, recreational boating organisations, port operators, and other maritime stakeholders identified through the Navigational Risk Assessment process. Stakeholders have been provided with information regarding the launch window, splashdown area, recovery operations, and relevant points of contact to facilitate effective coordination and consultation.
GEN 19	**Sound Evidence** "Decision making in the marine environment will be based on sound scientific and socio–economic evidence"	The proposal is supported by a clear evidence base covering operational safety, environmental considerations, and material behaviour in the marine environment. This limited-scale launch provides a controlled opportunity to gather additional data ahead of a larger test later in the year. Precautionary measures and mitigations have been incorporated into the mission planning, including assessment of environmental impacts within the marine area and measures to minimise potential effects. A risk

		assessment underpins all operational decisions, and the project will continue to take account of any new or updated information relating to the marine environment to ensure the activity remains compliant and precautionary where required. Additional evidence relating to component materials, buoyancy characteristics, recovery systems and environmental fate has been incorporated into the debris assessment to support consideration of recovery-failure scenarios.
GEN 20	**Adaptive Management** "Adaptive management practices should take account of new data and information in decision making, informing future decisions and future iterations of policy"	The proposal incorporates adaptive management by using the 3–4 km launch as an opportunity to gather data and lessons learned that will directly inform the planning, risk assessment, and environmental management measures for the larger 20 km launch later in the year. Operational procedures, recovery methods, and mitigation measures will be refined based on evidence from this initial mission. Any new information relating to environmental conditions or regulatory requirements will be integrated into future decision-making to ensure subsequent operations remain compliant, precautionary, and informed by the most up-to-date understanding of the marine environment.
GEN 21	**Cumulative Impacts** "Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation"	The proposed activity is a single, limited-scale launch with a small marine footprint and is not expected to generate significant cumulative effects within the plan area. Potential interactions with other marine activities have been assessed through risk assessment and stakeholder engagement, and the operation is planned to avoid interference with existing uses. Information gathered from this mission will further inform assessments for future launches to ensure cumulative considerations remain fully addressed.