A Future Green Navy - Sustainable Support to Royal Navy

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Synopsis

Defence maritime capability is enabled by support activities that span from design and acquisition throughout the life cycle to ultimate disposal of warships. External effects, such as climate change and environmental compliance obligations, act to increase the burden on platform support whilst also making it harder to deliver those activities.

Through-life support requirements are derived for each project by integrated logistic support engineers. They apply an online tool to provide assurance on how the support solution is developing (or operating if the platform is in-service) including consideration of sustainability indicators within the support solution. The suggested support development activities aid compliance and responsiveness to changing legislation and other sustainability considerations, as well as exploiting opportunities to use technology and learn lessons from previous programmes. Effective through-life planning can achieve support advantage, freedom of manoeuvre, and operational availability.

This paper explores how the requirements between through-life support and environmental protection come together to deliver sustainable support advantage for the Royal Navy. It concludes this may be achieved by verification that material state is environmentally sound and assurance the platform can be operated within the Environmentally Sustainable Operating Envelope whilst on military operations.

Keywords: Environmentally sound; Sustainability; Through-Life Support; Environmental Management.
Glossary of Terms: First use highlighted in blue text.

1. Introduction: Sustainable Support

Publication of the Climate Change and Sustainability Strategic Approach (CCSSA) has resulted in a step change in environmental culture across the Ministry of Defence (the Department). Rear Admiral Paul Beattie, Director of Naval Staff, described the measures necessary for climate change adaption in the military as the "*…biggest change programme in defence.*[3]" The Defence Policy effects are profound and diverse including a new strategy for Support and Operational Energy plus new environmental strategies for driving resilience into equipment and warship acquisition.

The Sustainable Support Strategy (SSS) sets out Defence Support's (DefSp) initial response to the challenges climate change poses. It outlines how "Sustainable Support Advantage" is the optimisation between delivering the operational capability requirements and sustainment of that capability in a way that is resilient to external effects (Figure 1). Perceived threats to operational effectiveness include changes in compliance obligations, operating environment, and the ability to sustain capabilities out to end of operational service. The SSS aligns with the CCSSA in delivering Sustainable Support Advantage across all DefSp activity; this paper will focus on its delivery for the Royal Navy (RN).

Figure 1: Dimensions of the Sustainable Support Strategy

Sustainability has a credible purpose in Defence Support

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Jim Goodship is a senior environmental manager within the acquisition organisation of the Ministry of Defence. He is responsible for developing the environmental management system and demonstrating that platforms are environmentally sustainable to operate.
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[3] Parliamentary Defence Committee Inquiry Defence and Climate Change 8th Report dated 4th July 2023.

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1.1 Context

Defence tasks form the basis of the Defence Plan and the delivery of Defence Outputs (*Figure 2*) where Value for Money, Compliance and Net Zero Carbon (NZC) are key government objectives. Military Capability requires platform material state and readiness aligned to planned military operations. Platform availability is therefore a strategic measure of the defence posture and is achieved through competing influences of maintaining the design intent (i.e., limiting the degradation of material state) and capability development to improve operational effectiveness. DepSp provides a governance role within the Department's operating model, adopted by Enabling Organisations and Front-Line Command to deliver their capabilities.

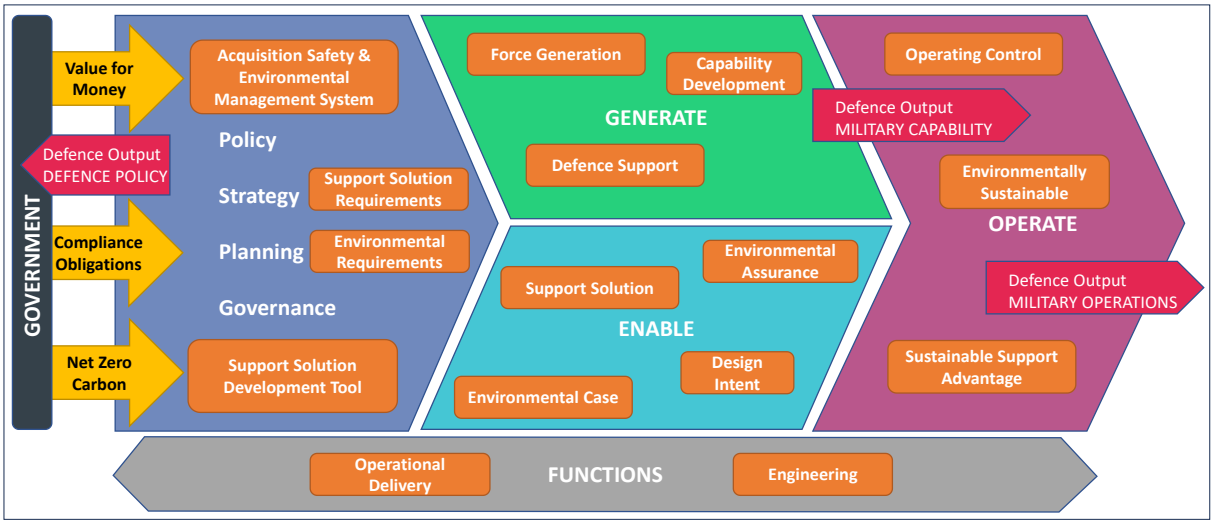

Figure 2: Sustainable Support within the Defence Operating Model

2. Defence Publications

Strategic Command (i.e., the fourth, pan-Domain Military Command) supports the breadth and depth of response to Climate Change and Sustainability across Defence. The Defence Policies relevant to CCS are presented pictorially in Figure 3,. The driving force for change is the CCSSA which sets out the expectations across defence equipment, support, and MOD estate with short (Epoch 1 2021-2025), Medium (Epoch 2, 2025-2035), and long term (Epoch 3, out to 2050) expectations.

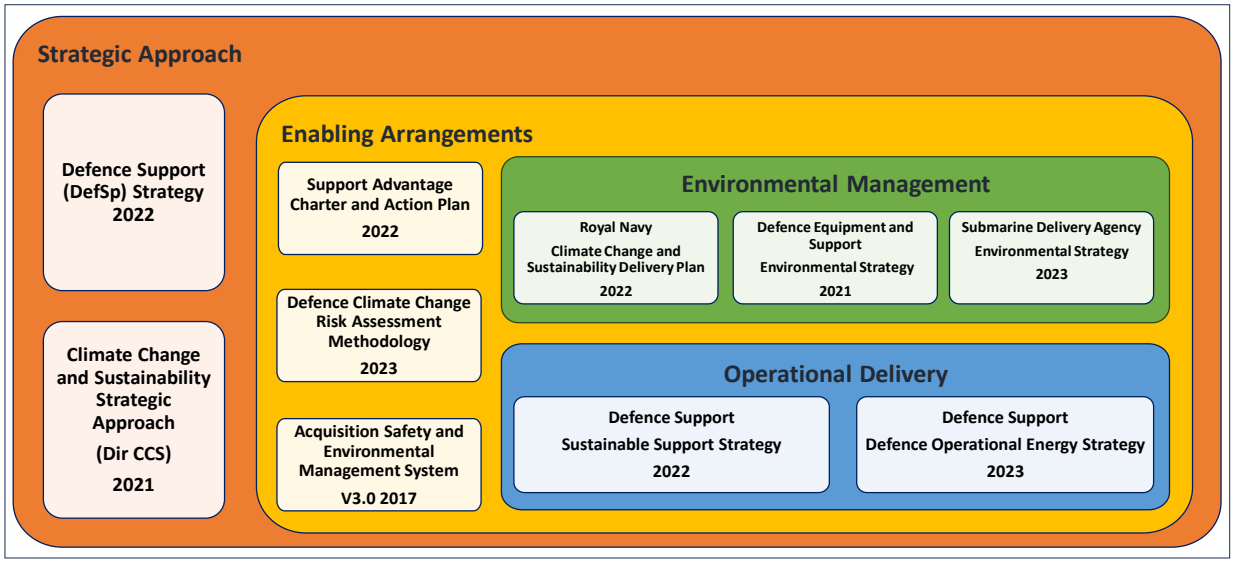

Figure 3: MOD Policy Documents applicable to Maritime Sustainability

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2.1 The Support Solution

It is MOD policy to procure products that meet the required performance to time, cost, and quality, which are fully supportable at the optimum through-life cost. Configured processes shall be applied to all capability / product design, acquisition, and support to ensure they are supportable and sustainable through-life.

The Defence Support Strategy (2020) sets out CDLS' vision over the medium and long term with a diagnosis of the current state of the defence support function and the underlying reasons for the challenges and opportunities underpinned by the Defence Support Operating Model. The Support Advantage Charter[4] was published alongside the Defence Support Strategy and represents a collaboration where "*MOD and Industry agree to work together to improve [Support]*" through key drivers including behaviours, and environmental sustainability.

Aligned to the CCSSA, the SSS (2022) extends the principles of the Defence Support Strategy to Sustainable Support Advantage with six strategic initiatives within DefSp's direct sphere of influence that cover Support activity across Defence[5]. They represent opportunities to address structural factors that can yield significant climate change and sustainability benefits.

The SSS will be deployed (and Sustainable Support Advantage achieved) through the dimensions (Figure 1) that balance military capability with sustainability. Integrated Logistics Support (ILS) processes shall be applied to all capability / product design, acquisition, and in-service support to ensure sustainment. This begins at concept and includes planning for disposal; a 'cradle to grave' approach.

Through-Life Support (TLS) is enabled through the Support Solution Envelope (SSE) that measures performance through criteria that together form the support solution. The Support Solution Development Tool (SSDT) is an online tool to provides assurance on how the support solution is maturing within the acquisition phase (or operating if the platform is in-service).

2.2 The Environmental Case

Health, Safety, and Environmental Protection (HSEP) is an associated discipline with ILS and should already be intrinsic to TLS to prevent harm to people and the environment when operating equipment. HSEP ensures that equipment and services delivered are fit for purpose, safe, environmentally sound and operate within the constraints set by legislation and defence policy, together known as the Safe and Environmentally Sustainable Operating Envelope (ESOE). Also, the Department is held to account by society for its socio-economic, and environmental sustainability that must be factored into capability acquisition and support.

There should be no differentiation in how these requirements are employed for the design, manufacture, operation, or logistics and disposal phases. Therefore, the elements of ILS that contribute to Sound Environmental Performance should be clearly articulated in the response to the Acquisition Safety & Environmental Management System (ASEMS) requirements.

The Department has laid out its strategic approach to meet ambitious environmental objectives[6] and must start planning for the second epoch to achieve success by 2050. Enabling Organisations have issued environmental strategies for their capabilities to deliver these objectives and the RN phase 1 CCS Delivery Plan published in 2022. These documents align how the RN will embed requirements that contribute to support advantage and demonstrate unity under a common vision for CCS out to 2050 (*Table 1* details Goals relevant to Supportability).

[4] 2022 Support Advantage Charter available from .GOV.MOD.UK.

[5] DefSp is the organisation within StratCom that delivers ILS Policy and Guidance across the MOD.

[6] Climate Change and Sustainability Strategic Approach ambitions are Adaptation and Resilience; Sustainability and net zero; and Global leadership.

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Table 1: Ambitions for Sustainable Maritime Support

Defence Equipment & Support Environmental Strategy 2021	Royal Navy Climate Change and Sustainability Delivery Plan 2022	Submarine Delivery Agency Environmental Strategy 2023
SHARED AMBITIONS WITH OUR CLIENTS – DE&S and our clients will set out a shared ambition for our environmental protection and sustainability commitments	*SUPPORT, MAINTENANCE AND LOGISTICS* – A clear plan for implementing sustainable support and logistics will integrate the application of sustainability into its vision. • The Navy will proactively input into the Department's Sustainable Support Strategy to ensure that the Navy's needs are met in a sustainable way that maintains operational advantage. • The Navy will maintain engagement with the Department Support community. • The Navy will implement the MOD CCS Defence Operational Energy Strategy.	*SUSTAINABLE PROCUREMENT* – Work with its suppliers to encourage sustainable behaviours and ensure proactive approaches are integrated in procurement and support arrangements.
INFORMED SELECTION AND SUPPORT – DE&S will provide direction and clarity to all functions on the expectation for acquisition environmental performance objectives & targets. The equipment and support we provide will be designed to both minimise environmental impacts and increase resource efficiencies where possible, as well as be resilient to our changing climate.	*PROCUREMENT AND INDUSTRY* – The Navy will conduct coordinated cross sectoral engagement to influence and exploit the development of future maritime fuels. • The Navy will explicitly require suppliers to implement robust emissions management; also to implement robust sustainability and carbon reduction. • The Navy will ensure that robust Environmental Impact Assessments (including Lifecycle Carbon Assessments) are designed into procurement. • The Navy and its Delivery Agents will ensure that through life support and sustainability requirements are identified and planned for in the procurement process. • The Navy will agree with the Department a Phase 2 plan for sustainability in the Navy's supply chain.	*HAZARDOUS SUBSTANCES AND RESTRICTED MATERIALS MANAGEMENT* – Comply with our obligations applicable across the life cycle phases of our platforms, systems, and equipment.
INFLUENCING OUR SUPPLY CHAIN – DE&S will work closely with our suppliers to encourage sustainable behaviours and ensure proactive environmental management practices are integrated in procurement and support arrangements		*SUBMARINE LIFE CYCLE MANAGEMENT AND DISPOSAL* – Commit to the safe, secure, cost effective and environmentally sound disposal of decommissioned submarines.

In the same way that the support solution provides support advantage, maintaining the design intent is represented through an accurate understanding of the material state. Essentially, when material state is aligned with design intent the platform is available for military operations. This principle applies across all capability requirements but in the context of environmental protection this means that the engineered controls are in place with sufficient assurance that platforms are environmentally sustainable to operate in accordance with their design intent. This is the main function of the platform environmental case; where Claims, Arguments, and Evidence justify the ESOE for the platform. Put simply, the ESOE presents the limits of operation whilst remaining environmentally sustainable (*Figure 4*).

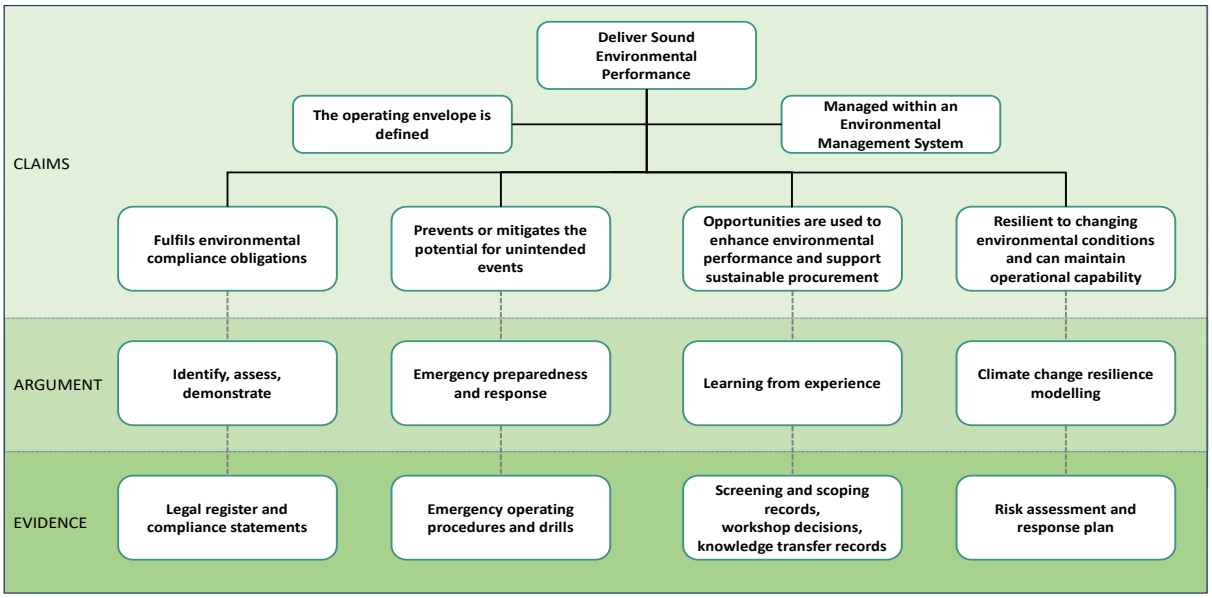

Figure 4: Environmental Case Argument

Where engineering controls are not sufficient to support environmentally sound operation then additional Operational Control is required to lessen the environmental impact (i.e., severity and / or frequency of the activity).

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Operating controls should be overseen by the Operational Commander, effectively trained, practiced, and recorded within the operating documentation such that the platform is operated environmentally soundly.

2.3 Sustainability in the Support Solution

To realise socio-economic development that is sustainable requires breaking down barriers between individuals / organisations / regions / countries and authentic international co-operation (i.e., the 2030 United Nations Sustainable Development Goals, UN SDGs). Likewise, to achieve sustainable military operation requires a communication channel for co-operation between the distinct disciplines of supportability engineering and environmental management. It is not reasonable to expect TLS engineers to be expert environmental practitioners and vice versa. Therefore, to deliver environmentally sustainable military operations, these distinct areas must find common ground. The areas for requirement linkages and practitioner collaboration are presented in *Table 2*.

Table 2: Sustainability in Maritime Support

Management Arrangements	Operational Delivery		Environmental Protection Assurance		Environmental Management
Objective	Support Solution	→	**Environmentally sustainable military operations**	←	Environmental Protection
Outcome	Support Advantage				Sound environmental performance
Policy	Support Advantage Charter	→	**Environmentally sound to operate**	←	Secretary of State for Defence Health, Safety, and Environmental Protection Policy
Management System	Support Solution Envelope				Acquisition Safety and Environmental Management System
Planning	Support Strategy				Environmental Management Plan
Delivery	*Integrated Logistics Support*	→	**Element Plans and Environmental Case Report**	←	*Environmental Protection*
	Maintenance planning				Compliance obligations
	Obsolescence risk				Aspects and impacts
	Reliability and Maintainability				Assurance reporting
	Packaging and Labelling				Emergency preparedness
	Support and Test Equipment				Incident and defect reporting
	Supply Support				
	Technical Publications				
Governance	Supportability Working Group	→	**Stakeholder Communication**	←	Platform Safety and Environmental Panel or Working Group
Assurance Measures	Support Solution Development Tool	→	**Logistics Support Maturity Business Case Milestones**	←	Risk Control Systems Joint Service Publication Expectations
Continual Improvement	In service review	→	**Learning from Experience**	←	Management Review, Incident, and defect reporting
Authority Roles	Operational Commander	→	**Sound environmental performance**	←	Commander Safety and Environmental Assurance
	Operations Manager	→	**Sustainable Support Advantage**	←	Environmental Manager
	Supply Chain Manager	→	**Sustainable Procurement**	←	Supply Chain Manager
	Through-Life Support Manager	→	**Authorisation / Sea Clearance**	←	Chief Engineer
	Modelling and Analysis	→	**Integrated Logistic Support Plan Support Solution Delivery Tool**	←	Design Authority
Industry Role	Support Partner				Technical Authority

3. Horizon Scanning

Horizon scanning is a key approach to better understand potential climate change threats and detect early signs that could have a significant effect on operation. Effective horizon scanning can assist policy makers to build resilience and manage risks and opportunities, clearly linking to SSS and creates a better understanding of environmental threat across the MOD. Within the 2024 Global Risks Report, the World Economic Forum listed climate change as the cause of five of the top ten global risks over the next ten years, with failure to mitigate climate change leading to extreme weather events being the highest long-term risk in terms of severity for the second year in a row.

With the CCSSA stating that defence accounts for 50% of the UK central Government's emissions at the time of publication (2021), it is essential that the MOD understands risks and the environmental threat of climate change. Reducing defence operational emissions positively contributes to legally binding Net Zero emission target by the 2050 (*Figure 2*). The Defence Support Sustainability Scorecard Delivery Partner (SSSDP) introduces the concept of a tangible scorecard of marking sustainability against key environmental impacts, targets, and key performance indicators. Using the balanced scorecard approach, this sprint aimed to identify performance metrics for the SSS initiatives to support the measurement, management, monitoring, and reporting of each impact discussed through the understanding of future environmental threats and then their relation back to Epochs presented in the CCSSA. This offers potential for assimilation by RN within their Climate Change and Sustainability Delivery Plan (CCSDP) where operational capability is one key lines of operation to 2025 (end of Epoch 1) by acting as a launch pad to understand the future threats in a climate-changed world.

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The Defence Operational Energy Strategy (DOES) discusses the need to understand the transition risks for the RN on fuels and resilience that will make it harder to support defence capability in the future. Proactive risk management through horizon scanning to create an adaptive and informed approach to energy availability is needed to ensure the MOD can maintain its ability to operate globally without limiting capability DOES identifies the future cost of fossil fuels will escalate as commercial availability reduces and the price increases. Therefore, there remains need for investment in innovative technologies for propulsion and power generation that have lower through-life carbon emissions, whilst utilising sustainable material choices to aid the application of circular design principles.

3.1 Circling the square

Understanding the principles of reducing, reusing, remanufacturing, and recycling existing material is essential to embedding a Circular Economy within defence acquisition and support. Creating circularity by design breaks away from traditional linear 'take-make-use-waste', towards understanding the overall impact of materials to consider repurposing across their useful lifespan. Allowing margin within the design enables materials to be maintained and circulated to reduce the effect of obsolescence through-life. Integrating circular design principles for the benefit of platform life must not compromise military advantage therefore critical raw materials will continue to be used, but design decisions should consider the embedded value to the whole of defence.

When applying this to MOD shipping, both DE&S and SDA have goals to establish and embrace a circular economy[7]. The RN CCSDP discusses ambition for circular economy to be built into design through procurement and industry partners and a summary of these strategies can be found in *Table 1*.

SDA CEO Sir Chris Gardner KBE discusses that the SDA '*need to ensure that once a submarine has completed its final operations and is decommissioned from service, it is disposed of safely and efficiently, our nuclear legacy managed and the vessel itself recycled with a focus on building a circular economy across defence'*. This will be achieved by safely and securely disposing of our first complete nuclear submarine "Swiftsure" by the end of 2026. This programme aims to recycle at least 80% of the submarine and develop the capability for submarine dismantling within the UK before disposing of further submarines[8].

Identifying key themes in circular design with sustainable procurement in place at the earliest stage is central to success of '*circling the square*'. This includes efficient waste stream identification and minimisation to end of life. These disposal processes also highlight the importance of Learning from Experience (LfE) within the support enterprise. By maintaining disposal logs through platform life and optimising the support solution with decision making linked to the environmental case, the disposal element of the support solution captures key safety and environmental lessons for future disposal of similar assets earlier.

3.2 Supply chain vs Supply circle

Due to the sheer size of the Department, and the breadth of projects it is responsible for, it is obvious that the supply chain plays a vital role in the route to Net Zero and its direct influence on scope 3, the largest proportion of reported emissions[9]. MOD must therefore be aware of its role and relationship with supply chain to place sustainability targets and influence sustainability culture throughout industry. The supply chain is encouraged to enhance environmental performance on their defence contracts, as they are already expected to on civilian contracts by their shareholders. The CCSSA emphasises this responsibility by explaining that defence will *'embrace the circular economy, driving it through our supply chain, the way we partner with others, behave and work.'*

Understanding how to improve circularity in the supply chain is advocated by The Ellen MacArthur Foundation, with three principles:

- **Distributed and interconnected networks** to leverage local and global partnerships with suppliers, customers, and industry peers.
- **Multidirectional flows of information**, goods, and money to enable data — such as the location, material composition, and disassembly options of an item — to flow between network partners.
- The ability to **capture and deliver value** by keeping products and materials in use.

[7] DE&S Goal 5 and 10 focus on resource efficiency, informed selection and support, whilst SDA Goal 8 underlines the importance of submarine life cycle management and disposal in creating a circular economy.

[8] Submarine Delivery Agency Environmental Strategy 2024-2025.

[9] Kraft Foods, road tester for the GHG emissions protocol, found that value chain emissions comprise more than 90 percent of the company's total emissions https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf

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Defence disposal planning processes that set direction in improving communication with manufacturers through-life, and the Department's recent acquisition of Sheffield Forgemasters, demonstrates that where there is a direct need for secure and sustained supply of materiel then a supply circle is preferential to a supply chain.

3.3 Circling back to other industries

The CCSSA uses the phrase 'fast follower' to exploit low carbon technology from applications beyond defence and to integrate sustainability (e.g. circular economy) and life cycle emissions angles. There is evidence of this consideration within the RN where Offshore Patrol Vessels (OPV), Fleet Solid Support Ships (FSS), and Type 26 frigates have considered sustainability requirements by-design.

In oral evidence to the Parliamentary Defence Committee Inquiry[10], Lt Gen (Rtd) Richard Nugee CBE[11] stated '*we can't rule out what the next navy fuel will be and must work collaboratively on this, both defence and industry, because we have to be able to take fuel from wherever it comes from*'. The term 'fast follower' applies beyond RN utilising alternative fuels through ambition to change and work with industry partners within the CCSDP.

4. Maritime Support

RN ships and submarines require global reach and availability to participate in routine military operations and force projection. The RN operate in the most demanding situations without external engineering support on the premise that *the equipped, empowered, and enabled maintainer should be at the heart of a support solution*[12].

Support transformation programmes across flotillas have been implemented with the mandate deliver longer-term improvement in platform availability. They deliver through data driven decision making, collaboration and addressing root causes to achieve the availability that defence requires, underpinned by stable schedules and world-class through-life capability management; i.e., Support Advantage.

Platform availability is dependent on assurance that platforms select the best practicable environmental option by-design, and residual environmental impacts are minimised as far as reasonably practicable within an operational safety and environmental case; i.e., sound environmental performance.

Together, these concepts underpin environmentally sustainable military operation (*Figure 1*). This ambition may be achieved by aligning support solution and environmental protection requirements within the support regime; i.e., combining the requirements of ASEMS with the SSE under the enabling assurance provided by the SSDT (*Table 2*).

5. Conclusion

A decade has passed since the first Future Green Navy paper[13] focussing on design of warships, articulating the environmental expectation, and presenting the case for environmentally sustainable design. The requirements have not changed significantly, but the effects of climate change on military operations and global security have received far greater attention since the 2021 CCSSA. Whilst aspirations are not being met in all areas across defence[3], within the maritime domain force generation and enabling organisations are united under a common vision out to 2050. New enabling arrangements (*Figure 3*) will deliver against wider sustainability objectives within environmental management and through-life support. This paper has considered how these requirements affect the environmental and supportability cases for maritime through-life sustainability to provide assurance that platforms and equipment can perform within their ESOE.

Applying sustainability principles early in the life cycle through horizon scanning will allow the Department to create and embed a circular economy within defence, at concept design and through-life. CCS Delivery plans (*Table 1*) show the ambition of UK defence maritime community and how the Department continuously evolves to overcome future environmental threats (whilst protecting operational capability).

The 'Dimensions' of the SSS (*Figure 1*) represent the balance between military capability, support, and the operational environmental case respect to external threats (e.g. climate change) and minimising harm from capabilities through optimisation of platforms and equipment. However, supportability concepts do not currently feature within the ASEMS toolkit, beyond the concept of considering whole life cost in the assessment. This presents a project risk that the environmental case and support solution deviate from one another as they are driven by separate disciplines. Therefore, requirement linkages and practitioner collaboration should be forged between

[10] Defence and Climate Change HC 179 dated 22nd November 2022.

[11] Climate Change and Sustainability Review Lead in Defence at time of publication of the CCSSA.

[12] Navy Support Division – Key Support Principles driving premise underpins Navy Command Support Directorate Requirements for Single Statement of User Need.

[13] A Future Green Navy – Managing environmental expectation on Naval Ships, INEC 2014.

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support advantage, material state, and the environmental management system to avoid duplicate or conflicting outcomes from the respective analyses (i.e., TLS, Defect & Concession reporting, and ASEMS outputs).

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Glossary of Terms

Availability: The degree to which one can expect a piece of equipment or weapon system is available for use. Anon.

Best Practicable Environmental Option: During Assessment, environmental impacts and risks should be managed to have the least adverse environmental impact, whilst meeting legislative requirements, taking account of what is practicable and acceptable cost constraints. This results in the BPEO being established. Defence Maritime Regulations

Capability Development: to invest and explore opportunities to better develop the capabilities that the UK's Armed Forces, our allies, and partners, need to deter, defend and, if necessary, defeat our adversaries. The Defence Capability Framework

Circular Economy: a model of production and consumption which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended. Circular economy: definition, importance and benefits | Topics | European Parliament (europa.eu)

Design Intent: The relationship between a required capability outcome and the design and its realisation in a product, service, or solution. Legacy JSP886 .GOV.uk

Environmental Impact: Any change to the environment, whether adverse or beneficial, wholly, or partially resulting from an organisation's aspects. ISO14001:2015

Environmental Threat: threats posed to military capability, effectiveness, and efficiency resulting from environmental conditions. Sustainable Support Strategy

Environmental Management: taking a consistent and proportionate approach to identify significant areas of concern and to target effort where it will deliver the greatest benefit. GREEN BOOK: An Introduction to Environmental Management in the MOD Acquisition Process

Environmentally Sound: Demonstration that all environmental aspects are being managed as part of an environmental management system so that harm to the environment is minimised as far as reasonably practicable.

Environmentally Sustainable Operating Envelope: the limits of operation whilst remaining environmentally sustainable. Anon.

Integrated Logistics Support: is a disciplined approach that influences the product design and develops the Support System to optimize supportability and Through-life Cost. DEFSTAN 00-600 pt 1.

Material State: [the difference between design intent and the] operating parameters that it defines to deliver its capability safely. Legacy JSP886 .GOV.uk

Military Capability (MilCap): development of the ability, both now and in the future, to have military influence and project force. Defence Operating Model

Operational Control: represents a mitigating activity to support delivery of sound environmental performance. ASEMS EMP08

Operational Delivery (OD): authority on the optimisation of through-life service support and the management of service delivery. SDA OD Function

Readiness: being the period measured from an initial order to the moment when the headquarters or unit is ready to perform its task from its peacetime location (permanent or forward deployed) or ready for deployment. Armed Forces Readiness Inquiry

Resilience: the degree to which people and capabilities will be able to withstand, or recover quickly from, difficult situations. The Defence contribution to resilience in the UK

Sound Environmental Performance: Valid reasoning and good judgement has been applied to proactively improve environmental performance. ASEMS S&EP Leaflet 18/2023

Support Advantage: Support ensures Defence has the forces and equipment, ready when and where we need them, fully fit, armed, provisioned, and able to deploy quickly and efficiently to confront the threats we face.

Support Solution: the optimised design and provision of a series of interrelated activities and resources required to sustain a capability through-life, in accordance with extant MOD policy; to meet defined user requirements, for a defined period, in defined environments. Support Solutions Envelope (SSE) - KiD - UK MOD

Supportability: Supportability refers to the inherent characteristics of the system and the enabling system elements that allow effective and efficient sustainment (including maintenance and other support functions) throughout the system's life cycle. Anon

Sustainability: Meeting the needs of the present without compromising the ability of future generations to meet their needs. Brundtland UN

Sustainment: involves the provision of in-service support, including repair and maintenance, engineering, supply and replacement parts, configuration management and disposal action. Anon.

Through-Life Support (TLS): maintaining the design intent of platforms and equipment across their operational life to dismantling and ultimate disposal Anon.

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