Written evidence submitted by the National Oceanography Centre (MAR0009)

1. The UK's National Oceanography Centre (NOC) is one of the world's leading oceanographic institutions with a remit to deliver research from the coast to the deep ocean. Our activities span numerous disciplines, from ocean physics to numerical modelling, marine biology, climate change, marine geophysics and technology innovation. We manage the UK's national fleet of oceanographic research vessels and serve the needs of the UK's marine science community through the National Marine Equipment Pool and the British Oceanographic Data Centre.

2. We welcome the opportunity to provide written evidence to the Committee's inquiry on Maritime 2050. The following response focuses on a number of areas where NOC plays a significant role. We would be happy to follow this up with any further evidence the Committee would find helpful.

Executive summary

- **Ambitions and objectives:** Much of the ambition within Maritime 2050 is welcome. To drive forward change and to give a clearer sense of purpose, we ask the Committee to consider whether a Minister for the Ocean – bringing together often disparate policies – would more effectively progress the Maritime 2050 strategy.
- **Seabed mapping**: A more ambitious timeline should be set out beyond a commencement of mapping of the UK's exclusive economic zone (EEZ) within five years. In line with Seabed 2030, and growing international consensus, transformative progress should be made by the end of the decade.
- **Marine autonomy**: Continued investment is crucial to maintain the UK's strong position, alongside developments in the right regulatory framework. The Department for Transport should publish conclusions to the maritime autonomy and remote operations consultation as soon as is practicable.
- **Green shipping**: Replacing the UK's research ships with net zero alternatives in the coming years can help stimulate a UK green shipping industry, and should be used as a catalyst for investment and development.

- **Skills**: Skills are crucial to advancements towards greener, more automated vessels. This needs to be continually pursued and efforts made to educate school-age children to fuel interest in working in maritime and related sectors.

Whether and how the ambitions and objectives described in Maritime 2050 support the maritime sector

3. We welcome the strategic ambitions within Maritime 2050, in particular the desire to "strengthen our reputation for maritime innovation, maximising benefits to the UK from new maritime technology through our world leading universities, maritime small and medium enterprises (SMEs) and global companies[1]." The theme of autonomy was previously highlighted by the Government Office for Science, which set out that "autonomy is likely to be the single most important marine technological development", bringing with it a range of challenges, including a need for better sensors, improved battery technology, electric propulsion technology, data transfer and inter-device connectivity[2]. Autonomy will create huge opportunities around net zero operations at sea, with often smaller, lighter craft requiring lower power requirements than large manned vessels. NOC continues to work at the forefront of autonomy through our Marine Robotics Innovation Centre at Southampton, including developing novel sensor technology and marinized batteries required to work in inhospitable environments, (e.g. depth in the ocean) and severe and unpredictable weather events. Below we detail progress in this and other areas. However, as a strategic objective it is right to focus on innovation to drive the maritime sector forward.

4. In order to build on Maritime 2050 and to join up wider debates across the ocean environment – encompassing the environment, energy, shipping and other issues – we suggest the Committee considers calls for the creation of a Minister for the Ocean. The Department for Transport leads on shipping, but other departments also play a role - Defra is the UK's lead department for the environment, but ocean management also impacts the Foreign, Commonwealth and Development Office (FCDO) regarding international treaties and partnership working. The issue of the ocean is too big for any one department to manage and greater cross-government work is needed.

5. A Minister for the Ocean could be based in the Cabinet Office and would be responsible for developing an integrated UK ocean strategy, mirroring what has been achieved by the UK in having a space strategy. The Minister would be supported with experts across government, industry and academia to ensure coordination of policy, and work with the new National Science and Technology Council to identify the science, data and evidence needs to support the UK's ocean strategy.

6. Having a single minister for the ocean is not without precedent – in July 2010, the French Prime Minister Jean Castex set up a Ministry of the Sea (Ministére de la Mer), with President Macron viewing maritime strategy as a key priority. Within the UK, there have been attempts to create a single focus for marine science in particular, with the House of Commons Science and Technology Committee recommending in 2007, that a Minister for Marine Science be created within Defra, to "act as the Government champion for the whole maritime strategy[3]". More than a decade on, this has not come to fruition. Current government structures have allocated a Minister for Pacific and the Environment sitting within the FCDO and Defra. However, this excludes the range of government departments that need to be engaged with ocean issues including when meeting obligations to reach net zero (in particular transport, and the innovations and research functions within BEIS.) The Minister for aviation and shipping is removed from ministers and government departments working on energy and environmental concerns. The current arrangements deliver only piecemeal solutions to managing the ocean; not conducive to meeting the UK's net zero governance needs.

7. The requirement for greater integration and coordination within government has been highlighted through a range of government strategies and initiatives. The integrated security, defence and foreign policy review sets out the desire to support a resilient ocean that is "effectively governed, clean, healthy, safe, productive and biologically diverse" by 2030, combining work on "maritime security, the environment and trade[4]". We agree with the Government Office for Science's assessment that "the UK should develop a more strategic position, with clear priorities, with regards to its marine interests.[5]" The importance of the ocean necessitates a single, clear and dedicated governance structure.

Progress towards the ambitions and targets set out in Maritime 2050

8. Ambitions set out in Maritime 2050 are important for the development of the maritime and marine sectors in the coming decades. We focus on four broad areas in this part of the response – seabed mapping, autonomy, green shipping and skills.

9. Over 80% of the world's oceans and sea beds are unmapped. We have more accurate maps of the surfaces of mars, Venus and the Moon than of the Earth's sea floor. High-resolution seafloor mapping is critical for scientific discovery but also for regulating underwater resource exploration, extraction, and equipment, and ensuring ships can safely manoeuvre around natural and human-made structures on the ocean bottom. Maritime 2050 does not set out explicit timescales beyond a commencement of mapping of the UK's exclusive economic zone (EEZ) within five years:

    - 'UK to commence charting its own seabed and EEZ seabed using autonomous vessels to understand the potential economic benefits of the seafloor'
    - 'UK will be at the forefront of international efforts to chart the international seabed area, helping us to understand how to sustainably manage and benefit from the global ocean environment and creating exportable hard technology and soft skills[6]'

10. We would like to see efforts to map the UK's EEZ and contributions towards a global effort, in line with the ambitions of Seabed 2030. Any refresh of Maritime 2050 should make greater commitments towards a 2030 timeline. NOC is providing the Global Data Assembly Centre for seabed data under the global Seabed 2030 programme to map the world's ocean in detail. It is timely to consider how this aspect of Maritime 2050 can be delivered and its timescale brought forward from the present 'beyond 15 years', given the international consensus to make transformative progress by 2030. There is a clear opportunity for UK leadership considering options with industry to remove barriers to routinely collecting seabed data and making it openly accessible. Efforts should also support ocean observing systems to monitor the health of the ocean – utilising commercial shipping and platforms to collect data to further our understanding of the ocean (as suggested by the European Marine Board).[7]

11. Within commitments to map the seafloor, Maritime 2050 makes much of the role of autonomy in the future ocean space. This is transforming work in the ocean. The National Oceanography Centre has a 20-year history in autonomy and houses the most marine unmanned autonomous systems in Europe. At the Marine Robotics Innovation Centre, we help develop the next generation of marine autonomous technology along with a range of commercial organisations. The strategic ambition within Maritime 2050 to "strengthen our reputation for maritime innovation, maximising benefits to the UK from new maritime technology through our world leading universities, maritime small and medium enterprises (SMEs) and global companies[8]" is the right one, particularly with a clear emphasis on collaborative efforts. We agree that "autonomy is likely to be the single most important marine technological development", bringing with it challenges, including a need for better sensors, improved battery technology, electric propulsion technology, data transfer and inter-device connectivity[9]. To help further the UK's position, we call for appropriate funding and regulation. Since 2016 NOC has been providing new autonomous capabilities with innovative vehicle, autonomy, data and sensing solutions opening new areas of opportunity for UK researchers and commercial marine technology users as part of Oceanids, a £16m Marine Autonomous Systems (MAS) programme funded by the government. We estimate that to invest in Oceanids II would cost £6.15 million over the next three years, but offer a wealth of opportunities to scientists and industry to lead the world in these technologies.

12. On regulation, we welcome the Department for Transport consultation on the "Future of transport regulatory review consultation: Maritime autonomy and remote operations" with a view to defining Marine Autonomous Surface Ships (MASS) and remote operations. We look forward to seeing the government response and to continue to provide advice, in particular around the issue of liability in the event of a collision whereby interconnectivity, such as satellite and internet infrastructure, has failed.

13. Thirdly, on green shipping is it is clear that this is one of the main challenges within the Maritime 2050 strategy, and one of the most difficult issues for the industry to address. Maritime 2050 sets out the ambition for the UK to "be seen as a global exemplar in green maritime issues and will be a leading supplier of zero (and low) emission shipping

technology[10].” As part of a drive to net zero, NOC has led a Net Zero Oceanographic Capability (NZOC) review to assess how oceanographic research can become net zero. Ships will need to be replaced by lean-crewed, green-fuelled vessels capable of deploying large and energy intensive equipment. The main findings have considerable read across to the wider maritime sector. They include:

- Research vessels remaining part of the 2040 NZOC ecosystem. New and enhanced technologies will not be available to completely replace them, but they will be adapted to become carbon neutral.
- Significant numbers of new sensors will need to be developed to allow scientists to continue to explore the ocean and understand its role in climate change.
- To make space for the green fuels, some roles will be ‘on-shored’ and some onboard capabilities will instead be delivered from alternative platforms, such as satellites, autonomous vessels and floats.
- The number of autonomous platforms roaming around the ocean will have to increase at least ten-fold (hundreds instead of tens) to take these new sensors to key parts of the ocean.
- To support a more distributed model of collecting observations a data ecosystem will need to be developed that brings the data to the users, making use of digital tools to add value to the observations.

14. Replacement of the UK’s current research ships offers an opportunity for a UK shipbuilding programme, helping to fulfil aims set out in Maritime 2050, and must be considered as part of the wider maritime industry. The government’s refreshed National Shipbuilding Strategy confirms that a decision on the RRS *James Cook* will be made next year:

> *‘UKRI and the Natural Environment Research Council (NERC) are developing a net zero Oceanography Programme with the dual aims of creating the next generation of research capability and eliminating its carbon footprint. The decision of how to approach the future capability currently provided by RRS James Cook will be taken in 2023. The replacement of RRS Discovery will look to encompass a zero carbon design, with a decision point to proceed between 2030 and 2035. The decision to procure a replacement of*

RRS Sir David Attenborough with zero carbon design is expected to take place between 2045 and 2050[11]'.

15. The above could be misinterpreted as a possible strategy to not replace RRS *James Cook* and instead move to one Zero Emissions Ship, RRS *Discovery*, and a fleet of autonomous sensing platforms. It will be important to resolve any uncertainty.

16. The National Oceanography Centre led a study for UKRI-NERC on future 'Net Zero Oceanographic Capability', and made extensive findings and recommendations concerning the capabilities needed for science in the coming decades and the use of new technologies and innovations in ship design to reduce or eliminate the carbon footprint of undertaking oceanographic science[12].

17. The ocean is grossly under-sampled in space and time and new autonomous ocean sensing technologies, for example, offer the promise of massively increasing continuous global ocean sensing presence without growing the size of the research ship fleet. The report does not recommend eliminating research ships from the ecosystem of ocean sensing but does recognise that advances in ship technology (fuels, digitalisation, autonomy) mean the next generation of ships will be different and will work in tandem with other ocean sensing platforms, both fixed and mobile – which will extend the observational footprint of a ship and where ships will be needed to maintain the wider permanent and continuous ocean sensing infrastructures.

18. Replacing UK government owned ships could boost the UK's shipbuilding sector and deliver on Maritime 2050 objectives. It is important that the scientific and wider national considerations are properly understood to support a clear commitment to replace both open ocean deep-sea oceanographic research ships. This could entail life extension of the RRS *James Cook* – including conversion to lower emissions fuels – in order that both RRS *James Cook* and RRS *Discovery* can be replaced with Zero Emissions Vessels (ZEV) in due course in the decade 2030-2040, and before the UK's polar research & supply vessel is eventually replaced by a ZEV in the decade to 2050. Any decision taken in isolation of wider issues, and as early as 2023, not to replace RRS *James Cook* would have wider ramifications which should be understood. These include:

- In order for the UK to retain its significant 'global science superpower' position in oceanographic research, a continual and flexible at sea presence is required. The ocean is grossly under-sampled in space and time and new autonomous ocean sensing technologies could massively increase continuous global ocean sensing presence without growing the size of the research ship fleet. This is not the same as cutting the research ships – although countries like the USA, France, Germany and Japan with large numbers of deep-sea capable ships have more scope to cut fleet size without disproportionate adverse impacts on capability. The UK has only two and a reduction to just one would have major disproportionate implications.
- Research ships will nevertheless continue to have a critical and distinctive role in sampling the ocean in ways that cannot be done otherwise (high energy, high volume sampling) and in servicing continuous and autonomous ocean sampling arrays (both fixed and mobile).
- There are major and growing strategic national interests in the UK maintaining the capability to operate a scientific presence across at least the whole Atlantic basin from Arctic to Southern Ocean and in other oceans too. Deep-sea and open ocean research ships are vital because the ocean is a geopolitical, economic, environmental, technological and scientific frontier where human activities are moving.
- This strategic importance for the UK is referenced explicitly and at length in the Integrated Review (2021) and is important for scientific underpinning *inter alia* the new Implementing Agreement under the UN Convention on the Law of the Sea for Conservation and Sustainable Management of Biological Resources in Areas Beyond National Jurisdiction (BBNJ) – 60% of the ocean area and 40% of the Earth's surface.
- The UK is a maritime nation and a global influence in ocean affairs and potentially contested ocean space will be strongly underpinned by the UK's scientific credibility in deep-sea research, especially as the deep-sea frontier opens even further to human activities.
- Sensing a signal (certainly as early as 2023) that the UK was intent in cutting deep- sea research ship capability by 50% with qualitative loss of operational flexibilities (far in excess of loss of 50% capability) entailed in a one-ship operation would be taken

globally as indication the UK was abdicating its 'premier league' oceanographic science superpower status.

19. The case for retaining a minimum two-ship, deep-sea oceanographic fleet for the foreseeable future (to 2050 say) would be an active one in terms of commitment and a case for the UK taking 'thought leadership' (emphasised in Maritime 2050) and for investing in innovation as an early adopter in the transition to green, more automated research and survey ships. Research ships built in the decades 2030-2050 are likely to be very different from today's ships (green fuels; fewer embarked personnel; greater digitalisation and remote and automated control of over-side sampling operations; operating in synergy within a wider ecosystem of smaller autonomous platforms). However, it would be unwise for the UK to reduce its blue open water deep-sea fleet from two ships to just one - which would have a disproportionately large adverse impact in UK deep ocean capability, even if offset by investment in smaller autonomous sensing platforms. The UK already has a smaller deep-sea fleet in comparison with the other ocean science superpowers of Germany, the USA, France, and Japan and the emerging capabilities of China.

20. To ensure the UK's maritime sector is successful and continues to innovate and progress, skill retention and development are crucial. We welcome the role of the Maritime Skills Commission as investment in training is core to delivering the wider Maritime 2050 strategy, not least in the area of moving towards net zero. It is important to retain expertise within maritime, ensuring those leaving particular sectors remain within the wider maritime family. We would also welcome a greater focus on ocean issues within the national curriculum – inspiring the next generation of scientists, technologists and mariners. The pace of investment in skills will determine much else within the Maritime 2050 strategy and must be continually reviewed.

The effect of Maritime 2050 on Government policies and regulation, maritime sector decision making and economic and environmental outcomes

21. There is much in the Maritime 2050 strategy to welcome. As referenced above, having a single minister responsible for ocean issues could help. During exchanges in the House of Lords in March 2022, Labour peer Baroness Hayman of Ullock was correct to remark that a single minister

would help the UK "capitalise on our status as a maritime nation, bringing together offshore renewable energy, a sustainable fishing policy and blue carbon initiatives[13]". Whilst cross-departmental work is welcome, a single minister focused on delivery would be a welcome step in highlighting the importance of maritime issues and in driving forward change.

Conclusion

22. The ambitions set out in Maritime 2050 are the right ones. In order to retain the right focus and drive, we believe a single minister should drive through these reforms by overseeing all ocean issues. Technology will have a huge impact on the ocean of the future, and investment, regulation and skills need to be focused around green shipping and marine autonomy. The ocean is often a collaborative space across sectors and industries, involving issues such as science, shipping, energy and communications infrastructure. As the Maritime 2050 strategy is assessed, it is crucial that the ocean is viewed as an evolving, mixed and rich space that is forever changing. To succeed, the strategy must continually engage with a wide range of stakeholders working within our oceans, as only collaboration between technology, industry and government can ensure ambitions are truly fulfilled.

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Endnotes

[1] Department for Transport, "Maritime 2050: navigating the future", January 2019, page 37
[2] Government Office for Science (2017) Foresight, Future of the Sea: Industry perspectives on Emerging Technology. London: GO-Science, https://www.gov.uk/government/publications/future-of-the-sea-industry-perspectives-on-emerging-technology, quoted in Government Office for Science, "Foresight Future of the Sea: A Report from the Government Chief Scientific Adviser", 2018, pg 13
[3] House of Commons Science and Technology Committee, "Investigating the Oceans" Tenth Report of Session 2006–07, October 2007, pg 127
[4] HM Government, "Global Britain in a competitive age: The Integrated Review of Security, Defence, Development and Foreign Policy", pg92
[5] Government Office for Science, "Foresight Future of the Sea: A Report from the Government Chief Scientific Adviser", 2018, pg 9
[6] Department for Transport, "Maritime 2050: navigating the future", January 2019, page 119
[7] European Marine Board, "Sustaining in situ Ocean Observations in the Age of the Digital Ocean", June 2021, pg14
[8] Department for Transport, "Maritime 2050: navigating the future", January 2019, page 37
[9] Government Office for Science (2017) Foresight, Future of the Sea: Industry perspectives on Emerging Technology. London: GO-Science, https://www.gov.uk/government/publications/future-of-the-sea-industry-perspectives-on-emerging-technology, quoted in Government Office for Science, "Foresight Future of the Sea: A Report from the Government Chief Scientific Adviser", 2018, pg 13
[10] Department for Transport, "Maritime 2050: navigating the future", January 2019, page 12

[11] National Shipbuilding Office, "National Shipbuilding Strategy: A refreshed strategy for a globally successful, innovative and sustainable shipbuilding enterprise", March 2022, pg 25

[12] National Oceanography Centre, "NZOC: Net Zero Oceanographic Capacity- Summary", 2021, https://noc.ac.uk/files/documents/nzoc_summary_report.pdf

[13] Hansard, Column 275, 16th March 2022, https://hansard.parliament.uk/lords/2022-03-16/debates/C136779C-2587-4D81-A516-96A866467E6C/MinisterForTheOceans