



GLOBAL IMPACT OF UK SCIENCE

We began 2021 with much celebration when the impact of our publicly funded work was independently evaluated as excellent across the 3 areas assessed. I was proud and delighted to hear the NOC hailed as 'making a vital contribution to the UK's leading position in environmental science'.

As well as demonstrating our expertise in ocean research, the evaluation also shows the NOC provides a great environment for scientists, engineers and innovators to thrive, delivering positive societal impact. Our ambition in 2022 is to continue to grow from this solid foundation and expand our endeavour to provide public benefit in all we do.

Outstanding examples of this scientific excellence in 2021 include our Exports programme, a global research project with two other world-leading organisations - NASA and Woods Hole Oceanographic Institution. Using the RRS Discovery and underwater gliders, our scientists and engineers took vital ocean measurements of the changing Atlantic Ocean to understand how it will evolve as a result of climate change and human exploitation. This is a great example of how global collaboration can truly inform international policy and ocean literacy.

Our activities and influence around national and international policy included a successful contribution to the G7 Decade Navigation Plan, shaping UK

co-ordination for the UN Ocean Decade, engaging in discussions at COP26, and supporting marine science collaboration within the UK.

We have started to build strong partnerships with industry and donors and would like to thank '10% for the Ocean' for their donation and support this year, and also West P&I whose support has allowed us to widen participation in pioneering oceanography to young researchers across the world. These illustrate how, as a newly independent charity that benefits from a stable environment and long-term strategy, we can now develop philanthropic partnerships to expand our work in new ways.

Thank you to our Board and every team at the NOC. Together we have continued to lead in ocean science and innovation, in spite of many challenges. Next year promises to be an exciting one for us, with COP26 having amplified our voice and accelerated global awareness of the ocean's role in managing our climate.

Aurth

PROFESSOR ED HILL CBE Chief Executive



OUR YEAR IN PICTURES



LONGTERM MONITORING BY THE RAPID ARRAY CONTINUES TO EXPAND OUR UNDERSTANDING OF CHANGING CARBON IN THE OCEAN

THE WINNERS OF THE OCEANOGRAPHY SOCIETY'S OCEAN OBSERVING TEAM AWARD EMBODIED OUR VALUES OF EXCELLENCE AND PARTNERSHIP A PIONEERING FLOOD HAZARD ALERT SYSTEM TO PROTECT COASTAL COMMUNITIES UNDERWENT RIGAROUS TESTING

AUTOSUB6000 WAS DEPLOYED TO COMPLETE INDEPTH HABITAT MAPPING OF THE OCEAN FLOOR

THE NATIONAL CENTRE FOR OPERATIONAL EXCELLENCE IN MARINE ROBOTICS WAS ESTABLISHED AT THE NOC INNOVATION CENTRE THE RAPID ARRAY IN THE ATLANTIC OCEAN WAS MAINTAINED BY OUR EXPERT SCIENTISTS, ENGINEERS AND CREW ON RRS DISCOVERY

THE PORCUPINE ABYSSAL PLAIN SUSTAINED OBSERVATORY (PAP-SO) CELEBRATED OVER 30 YEARS IN CONTINUOUS OPERATION 30,000 VISITORS MET BOATY MCBOATFACE AT THE LATEST RRS S/R DAVID ATTENBOROUGH CELEBRATION

150,0000

WEST WING

CONTINUOUS DATA FROM THE PAP-SO ENABLED ANALYSIS OF CLIMATE CHANGE IMPACTS ON THE OPEN OCEAN AND DEEP-SEA ECOSYSTEMS THE FIRST EVER DEPLOYMENT OF A GLIDER USING A NEW IN-WATER RELEASE TROLLEY COLLABORATION WITH TRUSTED PARTNERS SUCH AS THE MET OFFICE EMPOWERED GREATER RESEARCH AND INFLUENCE

THE NEW AUTOSUB LONG RANGE VEHICLES PASSED TRIALS FOR UNDER-ICE CAPABILITY AND ARE READY FOR ACTION THE BRAND NEW ROBOTIC CARTRIDGE SAMPLING INSTRUMENT (ROCSI) WAS TESTED AND DEPLOYED

OUR CARBON CAPTURE RESEARCH IS AT THE FOREFRONT OF NATURE BASED SOLUTIONS FOR A NET ZERO FUTURE

CELEBRATING OUR SUCCESS

Every day NOC staff bring our charitable purpose and shared values to life, here are just a few examples of their outstanding commitment and hard work.

BIRTHDAY HONOURS

Our Chief Executive, Professor Ed Hill, was awarded a CBE in the Queen's Birthday Honours 2020 list in recognition of his services to ocean and environmental sciences. Ed is a world-leading authority on ocean science and is dedicated to raising awareness of ocean issues and advancing the science and technology to understand our seas. Having been part of the Natural Environment Research Council (NERC) for over 20 years, he led us into becoming an independent charity, using our new freedom and scientific expertise to drive forward greater innovation and influence.

WORLD LEADING EXPERTISE

NOC scientists Professor Stephanie Henson and Dr Catia Domingues were lead authors on the Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC AR6), which assesses the physical science basis of climate change, providing the latest assessment of scientific knowledge about the warming of the planet, the impacts on climate systems and projections for future warming.

COMMUNITY RECOGNITION

At the 2021 European Geosciences Union Assembly, NOC scientists, Dr Marilena Oltmanns and Professor Richard Lampitt, received awards for their ground-breaking work. Richard was presented with the 'Fridtjof Nansen Medal', established by the Ocean Sciences division of the conference, which is awarded for distinguished research in oceanography. Marilena received the 'Ocean Sciences Division Outstanding Early Career Scientists Award' which recognises scientific achievement made by an Early Career Scientist in the division related to ocean sciences.

OUTSTANDING OBSERVATIONS

The Oceanography Society (TOS) has named several collaborative multidisciplinary teams who make critical Atlantic climate observations as the inaugural recipients of the TOS Ocean Observing Team Award. This award recognises innovation and excellence in sustained ocean observing for scientific and practical applications. The citation on the team's certificate recognises them for transforming our understanding of Atlantic circulation with a breakthrough in observing system design providing continuous, cost-effective measurements. The Selection Committee noted that this international team, which we are part of, has sustained a core array of moorings across the Atlantic at 26^oN for more than 16 years, monitoring changes in the strength of the Atlantic Meridional Overturning Circulation.



4 WAVES OF OCEAN ACTION

The NOC Ocean Alliance is a collection of funds to focus on four key areas; ocean science, innovation, empowering sustainable ocean economies and passing our collective legacy to future generations. Together, these funds will promote knowledge, innovation and the sustainable use of the ocean.

The NOC has the existing scale and infrastructure to deliver the science the ocean needs. However, ocean science receives less than 1% of all philanthropic funding and to be able to succeed in our mission there is a need to leverage more financial support.

The strong commitment, trust and voice of the NOC Ocean Alliance partners enable the NOC to drive discovery and pursue bold new lines of ocean research in ways other funding types cannot. Whether your passion is combating the climate crisis, conserving and protecting ocean life or developing the next generation of marine robotics, supporting the NOC allows you to have a direct impact on world leading ocean research and innovation.



The NOC Ocean Alliance aligns and supports the UN Decade of Ocean Science's seven ambitious outcomes and global ocean challenges that need to be confronted, addressing many of the UN's 17 Sustainable Development Goals (SDG's).



INNOVATE

USING SCIENCE AND TECHNOLOGY TO FUEL INNOVATIVE SOLUTIONS TO CREATE A THRIVING OCEAN ECONOMY FOR ALL

EMPOWER

INFORMING GOVERNMENT POLICIES, GOOD CORPORATE PRACTICES, AND A STEP CHANGE IN PUBLIC AWARENESS OF THE ROLE THE OCEAN PLAYS

EDUCATE

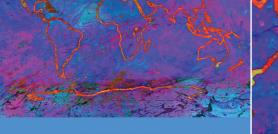
A DIVERSE WORLD OF FUTURE SCIENTISTS TO ENSURE THE OCEAN REGAINS AND MAINTAINS ITS HEALTH

ADVANCE **AUTHORS OF CHANGE**

The Intergovernmental Panel on Climate Change (IPCC) is a body of the United Nations responsible for advancing knowledge on humaninduced climate change. Their latest Assessment Report, IPCC AR6, was the culmination of over 3 years work by authors spanning the globe, including the NOC's Professor Stephanie Henson and Dr Catia Domingues. The unequivocal conclusion, that human activities are the main driver of increases in atmospheric greenhouse gas concentrations since the pre-industrial period, builds on a legacy of independent interdisciplinary NOC research and engineering.

IDCC INTERGOVERNMENTAL PANEL ON **Climate change**

Climate Change 2021 The Physical Science Basis Summary for Policymakers





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"This report provides the scientific evidence of human-induced climate change, how it will impact all aspects of our ocean, atmosphere and land, and the implications for reaching the Paris Agreement target of limiting global warming to 1.5°C.

The evidence suggests that the biological carbon pump is an important component of the ocean carbon cycle, but there is really large uncertainty around how it will respond to ongoing climate change and how that will feed back to atmospheric CO₂ levels. The observational and modelling work we're doing at the NOC will hopefully start to fill some of these knowledge gaps over the coming years."

PROFESSOR STEPHANIE HENSON IPCC AR6 CHAPTER 5 LEAD AUTHOR



At the core of the report is an ensemble of global climate projections to which the UK contributed the UK Earth Sea Model (UKESM1), a collaborative development between the NOC. Met Office and centres from the Natural Environment Research Council. In this partnership, we played a leading role in developing and supporting the marine biogeochemical component, and in spinning up and analysing the model. We also developed and supported the physical ocean component underpinning UKESM1 via the Joint Marine Modelling Programme.

In addition, the NOC's Permanent Service for Mean Sea Level (PSMSL) is the global data bank for long-term mean sea level data and was an integral component of the relative sea level change rates used in the IPCC AR6 projections of sea level change. The dataset contains 2,362 stations, 73,797 years of data, from 188 suppliers. In 2021, with valuable contributions from our citizen scientists, we updated 633 stations with 1,095 years of data.

Everyone at the NOC has played a collaborative role in enabling delivery of these new data, models and insights, and are proud to have been a critical part of such a seminal report. It reinforces our united endeavour to make sense of the changing ocean, upon which future human prosperity and wellbeing depends.

ADVANCE UNDERSTANDING PLASTIC POLLUTION

The NOC's Microplastics team carries out cutting-edge research to assess the distribution and transport of plastics to and within the ocean. This is essential if society is to understand and tackle the effects of plastic contamination on ecosystem health, now and in the future.

As experts in the field we have not only led and collaborated on several significant academic discoveries this year but we've also consulted widely on ocean plastic issues at national and international level. A key report on ocean plastics has been published publicly on our website and is a pillar of our future ocean literacy endeavours. "Without substantial changes in the amount of plastic waste society generates and how and where it is disposed of, the amount of plastic in the marine environment will continue to increase, while existing debris will continue to degrade and fragment into microplastics."



"While bans on unnecessary single use plastics are steps in the right direction, these objects do not account for the largest sources of plastics entering the ocean."

"Actions at the top of the chain will be required to prevent further loss of plastic to the environment."

"Target areas should include policy change, industry action to change or modify manufacturing processes, improved global waste management and publicity and societal change in the approach to disposable plastic use. These approaches will all have significant challenges in their implementation and will not be quick fixes but will be key to long-term solutions."

SOURCES, AMOUNTS & PATHWAYS OF PLASTICS ENTERING THE GLOBAL OCEAN

INNOVATE SEAGRASS SOLUTIONS

The UK Government has recognised nature-based solutions to climate change as an important component of achieving Net Zero emissions by 2050. Seagrass meadows create a highly efficient and long-term store of carbon in their marine sediments, providing an opportunity for their restoration to become a key contributor to these solutions. The NOC is at the forefront, providing the key underpinning evidence by estimating the capacity of UK seagrasses to capture carbon dioxide. "This is an exciting opportunity to deliver evidence to create a shift in thinking and policy change for how we perceive and manage the UK's coastal habitats. ReSOW UK will create a case study that transforms

how we regard marine resources and how we move forward in the design and scaling-up of restoration strategies to enhance ecosystem services for the benefit of people and planet."



DR CLAIRE EVANS RESOW UK PRINCIPAL INVESTIGATOR

Seagrass meadows are the powerhouses of coastal seas and have been neglected for decades, which has led to their large-scale degradation and loss. This loss now provides an opportunity for environmental renewal through large-scale restoration.

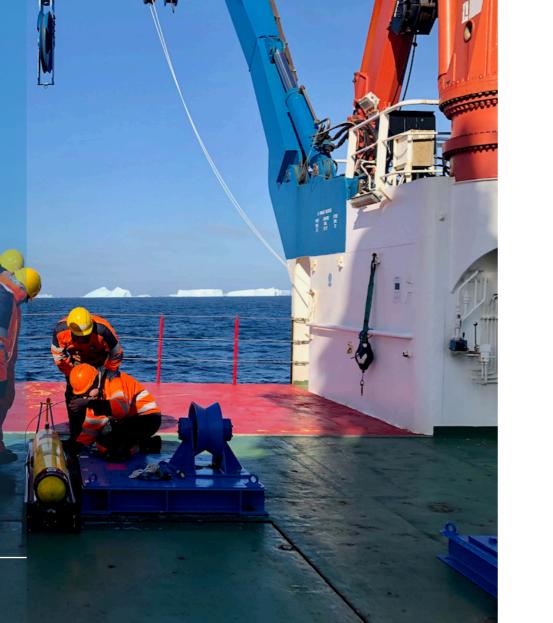
'Recovery of Seagrass for Ocean Wealth UK' will promote long-term recovery and enhancement of the natural environment, whilst helping to mitigate climate change, improving sustainable commercial activity and promoting social welfare. We are working alongside eleven principal scientists, political bodies and NGOs concerned with seagrass management.

Together we will provide scientific evidence and a strategic vision for ecological renewal. It will further facilitate informed management and restoration of seagrass for sustainable social, environmental, and economic net gains for the UK.

INNOVATE INVESTIGATING **ICEBERGS**

These exciting images show a robotic underwater glider being launched from the RRS James Cook, marking the start of a four-month mission to investigate the massive A-68a iceberg in the South Atlantic; one of the largest icebergs ever identified by scientists.

After satellite images revealed this giant iceberg (which had calved off from Antarctica's Larsen C ice shelf in 2017) moving out into the southern ocean, our technicians rushed to prepare ocean gliders capable of monitoring the impact it would have on the area around South Georgia. These gliders were subsequently launched from the RRS James Cook having been flown to the Falkland Island to rendezvous with the ship. Thanks to development of our new web application, the gliders were able to collect measurements of seawater salinity, temperature and chlorophyll close to the iceberg all whilst being remotely piloted from the Southampton office.



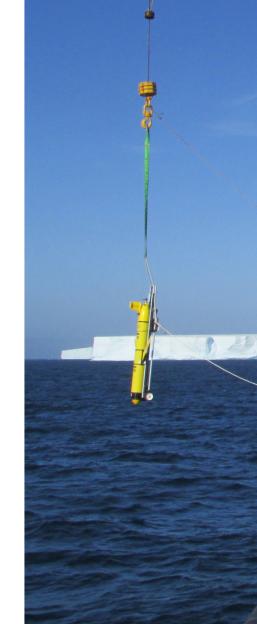
"We have developed a world leading web application to pilot and manage the data from long range ocean robots. It uses satellite data to assist in piloting the gliders which can be deployed from anywhere in the world. We use a variety of different glider types that can be fitted with a bespoke combination of sensors as required by different science campaigns.

Having an advanced piloting tool makes these bespoke operations a lot easier. For this campaign we adapted the software to show the A-68a position from satellite data. This allows us to get the glider close to the ice and to take the necessary measurements. These measurements will allow the science team to better understand the impact of the A-68a on the local environment and marine life."

MAATEN FURLONG HEAD OF MARINE AUTONOMOUS & ROBOTICS SYSTEMS

Historically this data collection could only be carried out using sensors attached to large specialised research ships. Not only is this method costly, but data could only be captured for a limited period of time and carbon emissions would be high. The development and deployment of autonomous technology is part of the solution to reducing the carbon footprint associated with current marine research. The UK is at the forefront of this research and we are playing a leading role.





EMPOWER GLOBAL **LEADERSHIP**

The COP26 summit brought change makers together to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change. The NOC attended many events as both UK delegates and invited observers.

Our call to change makers centred on five critical actions:

- 1. Ocean's role in climate
- 2. Carbon sinks
- 3. Sea level rise
- Global underwater ocean monitoring
- 5. Reducing emissions from research



OCEAN'S ROLE IN CLIMATE

The interrelationship between the ocean, biodiversity, carbon absorption and climate change must be recognised, understood, and incorporated into global government policies.

CARBON SINKS

Understanding ocean carbon sinks and the links between climate change and the health of vital marine ecosystems will provide the scientific evidence to support nature-based solutions.

SEA LEVEL RISE

Investment in more accurate tide gauges at the coast and on oceanic islands will better predict mean and extreme sea levels. Sharing these data through a 'digital ocean' allows us all increased understanding and ability to drive change.

GLOBAL UNDERWATER OCEAN MONITORING

Sustained long-term finance of the Global Ocean Observing System (GOOS) is critical for sensing Essential Ocean and Climate Variables. This is necessary to track climate change impacts, and to enable access and participation of LDCs and SIDS in this global effort.

REDUCING EMISSIONS FROM RESEARCH

Investment in autonomous technologies as well as planning for the next generation of research ships built in the decade 2030–2040 to be Zero Emissions Vessels.

"To really manage climate change and achieve ambitious net zero goals, we need to be able to understand and measure change. 93% of excess heat and 25% of carbon dioxide produced by human activities is absorbed by the ocean it is our biggest hero in tackling climate change. We can do so much more to better utilise the ocean's carbon sinks and storage, as well as measuring changes to sea level rise. If we understand more about the ocean's relationship with the climate, through sustained ocean observations, cutting-edge scientific analyses, and innovative underwater technology, we can develop long-lasting solutions.

At the NOC, we house world leading ocean experts in marine science and technology. We hope that global leaders continue the momentum generated from COP26 and recognise the need to understand climate change and measure our impact on it. The ocean is the answer to some of the world's biggest challenges - we should use it wisely."

PROFESSOR ED HILL CBE

WORLD OCEANS DAY 2021

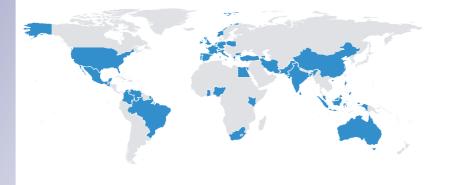
On World Oceans Day, we provided a free digital Open Day of educational talks, hot topic discussions and virtual tours to replace the usual on-site event.

Follow us on social media to find out about future celebrations of World Oceans Day.

7462WEBINARS AND INTERVIEWSACTIVE PARTICIPANTS- SAFE CARBON STORAGE
- OCEAN SCIENCE IN ACTION
- OCEAN ROBOTS
- OCEAN PLASTICS- INTERVIEW WITH
OUR CHIEF SCIENTIST
- BLUE CARBON
- THE OCEAN FROM SPACE

EXPANDING OUR REACH

Our ambition is to inspire a new Generation Ocean to bring about positive impact and drive change globally.



USA • MEXICO • GUATEMALA • COLOMBIA • VENEZUELA • BRAZIL FALKLAND ISLANDS • SPAIN • PORTUGAL • IRELAND • GHANA • UK • FRANCE BELGIUM • NETHERLANDS • NIGERIA • SWITZERLAND • GERMANY • NORWAY MALTA • ITALY • POLAND • GREECE • SOUTH AFRICA • BULGARIA • EGYPT TURKEY • KENYA • AZERBAIJAN • IRAN • PAKISTAN • INDIA • SRI LANKA BANGLADESH • CHINA • MALAYSIA SINGAPORE • BRUNEI • INDONESIA PHILIPPINES • AUSTRALIA

PRESENTING GLOBALLY

Our first ever digital event allowed us to reach people from 41 countries around the world for the first time with 40% of our visitors from outside the UK.

1,878 2019 TOTAL ATTENDANCE

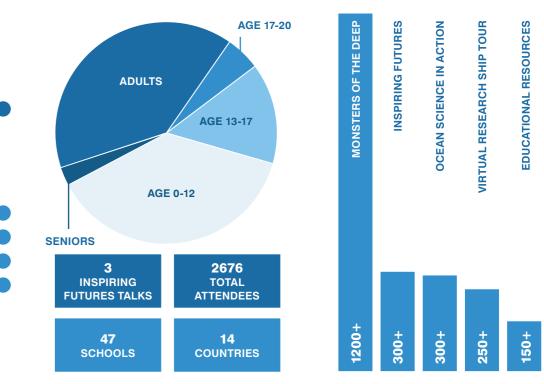
4,074

2021 TOTAL ATTENDENCE ON THE DAY



INCREASING ATTENDANCE

We saw a dramatic increase in the amount of people attending on the day, more than double our previous total.



INSPIRING GENERATIONS

We reached a wide demographic with over half attendees under 20 years old.

AMAZING CONTENT We shared a diverse range of downloadable content.

EDUCATE INTERNATIONAL **BURSARY PROGRAMME**

A bursary made available by West of England P&I club (West P&I) and managed by the NOC has had a highly successful first year, despite the challenges of the COVID-19 pandemic.

Although this year's bursary had to be held virtually due to COVID-19 restrictions, five recipients of the bursary, joining from Ghana, Brazil and the UK were able to access an exciting two-day workshop led by NOC scientists, including a bespoke 3D tour of the NOC's world class research ship, the RRS Discovery. The students were also offered a 6-month mentoring programme with a NOC scientist, to learn about their specialist areas of science.

Scientific leadership of the bursary program was provided by Dr Ben Moat, Prof. Penny Holliday and Dr Carla Sands supported by the CLASS National Capability programme. The awardeementor pairs were: Selasi Yao Avornyo with Dr Dave McCann; Maurício Santos-Andrade with Dr Francisco de Melo Virissimo: Kelsey Archer Barnhill with Dr Veerle Huvenne and Dr Jen Durden; Adeola Dahunsi with Dr Xiaoyan Wei; and Mariana Gandra with Dr Alejandra Sanchez-Franks.

The bursary recipients found the programme an overwhelmingly positive experience, with 100% reporting learning new skills from the programme, and finding the bursary a valuable experience despite the challenges presented by COVID-19.

The bursary will continue to be managed by the NOC over the next nine years and will deliver valuable learning experiences for recipients, including joining sea going expeditions on the NOC's two world-class research vessels the RRS James Cook and RRS Discovery, as well as other vessels involved in the NOC's research projects.

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"From the onboarding workshop through the virtual ship tours to the mentorship under the 2021 West P&I bursary, it has

been a wonderful experience that will stay with me throughout my career as I hope to be a part of the in-person ship going experience in the future."



ADEOLA MICHAEL DAHUNSI BURSARY RECIPIENT

"High-quality mentorship has a major influence on young scientists' future achievements. I am proud that, despite the

Covid-19 pandemic, the NOC has widened participation in its world-leading research. This kind of work depends of philanthropic support and we are grateful to West P&I."

SAMIA BURRIDGE HEAD OF PHILANTHROPY



OCEAN SCIENCE IN ACTION

Our Massive Open Online Course, named Ocean Science in Action: Addressing Marine Ecosystems and Food Security in the Western Indian Ocean, has introduced learners to innovative marine technologies and their applications used to tackle the challenges of the sustainable management of marine ecosystems.

FIVE STAR

USER RATING





THIRTY VIDEO LECTURES



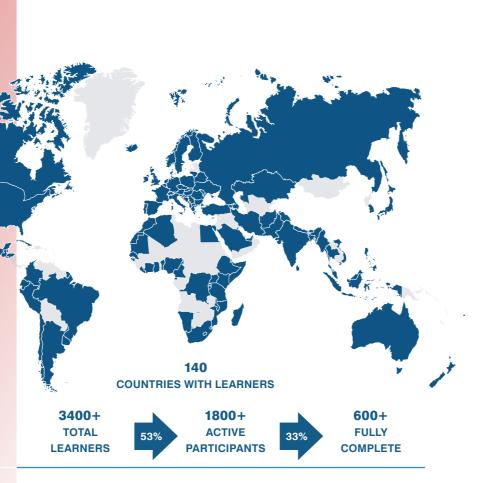
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3500+ INTERACTIVE

COMMENTS

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ADDRESSING SIX OF THE UN SUSTAINABLE DEVELOPMENT GOALS





DECENT WORK AND ECONOMIC GROWTH



LIFE BELOW WATER



PARTNERSHIPS FOR THE GOALS



CONTRIBUTING TO THE UN DECADE OF OCEAN SCIENCE PRIORITY AREAS



UNDERSTANDING OF OCEAN ECOSYSTEMS AS THE BASIS FOR THEIR MANAGEMENT



EARTH SYSTEMS OBSERVATIONS AND PREDICTIONS SUPPORTED BY SOCIO-ECONOMIC SCIENCES



CAPACITY DEVELOPMENT, TECHNOLOGY TRANSFER AND OCEAN LITERACY

JOIN THE NOC OCEAN ALLIANCE

We are looking for new partners who share our common purpose and passion to explore and conserve the ocean through:

- Partnerships to advance ocean science
- Innovation and technology partnerships

Education and outreach partnerships

Ocean stewardship partnerships

By joining the NOC Ocean Alliance there are a number of ways you can support our work as an individual, company or philanthropic foundation including;

- An accelerator gift to one of the NOC Ocean Alliance funds
- Funding a programme or piece of equipment
- Sponsorship opportunities
- Naming rights

- Creation of a named competition or award
- Allocating a percentage of your annual giving to our work
- Gifts in Kind

Our Ocean Alliance partners receive bespoke updates showing the global impact of your support. We'll also invite you to exclusive events that give you the opportunity to experience our world leading science and innovation, and enable you to help to shape the ocean's future.

To learn more about joining the NOC Ocean Alliance, and how we develop flexible and mutually beneficial partnership options that achieve your goals, please get in touch with our Partnerships and Philanthropy team.

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The NOC is the UK's centre of excellence for research and technology development in marine science.

To get bitesized updates on our Science and Technology, Latest News, Public Events, Career Opportunities and Educational Resources, subscribe to NOCMail via our website or follow us on social media:



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Registered Address National Oceanography Centre, European Way, +44 (0)23 8059 6666

L3 5DA, United Kingdom +44 (0)151 795 4800

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Find out more at noc.ac.uk

SUPPORTING OUR OCEAN RESEARCH & INNOVATION

Whether your passion is combating climate change, conserving and protecting ocean life or equipping the next generation of marine scientists, supporting the National Oceanography Centre allows you to have a direct impact on world leading ocean research and innovation and helps ensure we continue to make global impact from the coast to the deepest ocean.

We are a world leader in oceanographic science, research and innovation. Working in some of the remotest, deepest and most hostile parts of the ocean our scientists bring a greater understanding of issues that affect our environment, our landscapes, our health and our prosperity.

With your support our scientists and engineers can continue to push the boundaries of knowledge and exploration to protect our oceans, our planet and our futures.

Find out more at noc.ac.uk/about-us/giving