November 2022

Challenger Wave

Monthly newsletter of the Challenger Society for Marine Science (CSMS)

NEWS

SUT announces winner of Gwyn Griffiths Award 2022

The Society for Underwater Technology's (SUT's) Gwyn Griffiths Award for Underwater Robotics has been won by Rustom (Rusty) Jehangir, founder and CEO of Blue Robotics, an ocean technology company based in Torrance, California. "The standard of entries for the SUT's Gwyn Griffiths Award for Underwater Robotics was extremely competitive this year, and the nominees of high calibre, which challenged the judges to select this year's winner," said Neil Bose, Chair of SUT's Underwater Robotics Panel, and Vice President (Research), Memorial University, Newfoundland and Labrador's University. "On behalf of the Panel, the judges and SUT, we would like to recognise the talent, innovation, and qualities of all the entrants working in underwater robotics."

On hearing the news of the Award, a delighted Rustom said: "Wow! I'm honoured and humbled to receive this award bearing Gwyn Griffiths' name, given all that he accomplished and contributed to the field of marine robotics. I consider this Award to be an honour for my whole team."

The submission nominating Rustom Jehangir for the Award stated "Under Rusty's vision and leadership, Blue Robotics has dramatically reduced the cost of ocean robotics, reshaped market expectations of ocean engineering components, enabled hundreds of new research efforts using turn-key affordable platforms, and empowered thousands of new learners to gain practical experience with ocean technology. Blue Robotics is the exemplar of the current market trend that sees the cost of ocean robotics decreasing while the capabilities are increasing. This is double leverage and driving significant growth in the New Blue Economy."

Looking to the future Rustom explained "We're eight years into our journey and I'm having more fun than ever I truly believe in our core mission of making affordable, capable components and systems to enable people to do more with marine robotics and we're going to keep doing that. We've learned a lot and we can keep doing it better and better. The ocean is a big place and there's a lot of room to grow and a lot of opportunities."

More information on what inspired his interest in subsea engineering, how he became involved in robotics, advice he would give to someone interested in a career in this field and his advice on innovation and starting your own company is in the current issue of the Big Blue World, the global newsletter of the SUT. Information on Blue Robotics can be found at bluerobotics.com/.

HRH the Princess Royal visited PML for the launch of the National Centre for Coastal Autonomy

The potential for autonomous technology to advance understanding of our constantly evolving ocean and coastlines has taken a major step forward with the launch of the National Centre for Coastal Autonomy, www.marineresearchplymouth.ac.uk/coastal-autonomy. The UK's first autonomous fully integrated coastal observing and monitoring network employs the

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latest autonomous technologies to drive towards a net zero oceanographic capability, delivering world-leading and cutting edge science.

A fleet of state-of-the-art surface autonomous vessels, sub-surface coastal platforms and sophisticated scientific buoys are integrated on a unique high-speed award-winning marine communications network. The high resolution data it produces will support policy makers and other organisations to enable good stewardship and an enhanced understanding of the coastal environment. It will also deliver a platform to train and develop the next generation of scientists and technologists in partnership with industry and the public sector.

The National Centre for Coastal Autonomy has been founded by the partners in Marine Research Plymouth, www.marineresearchplymouth.ac.uk/, the Marine Biological Association, www.mba.ac.uk/, Plymouth Marine Laboratory, pml.ac.uk/, and the University of Plymouth, www.plymouth.ac.uk/research/institutes/marine-institute; and was officially launched by HRH The Princess Royal.

HRH Princess Royal talking to some of the next generation of marine scientists and technologists, including some students from City College Plymouth, www.cityplym.ac.uk/

Professor Icarus Allen, Chief Executive of Plymouth Marine Laboratory, said: "The centre builds upon Plymouth's incredible legacy as a world-leading hub for marine science and technology and creates a unique capability in coastal science and net zero oceanography for the UK. It's a pioneering initiative to expand the horizons of scientific endeavour using the very latest in technology and innovation. We're incredibly proud to be a part of it, as we work towards a sustainable ocean future."

Professor Judith Petts CBE, Vice-Chancellor of the University of Plymouth, said: "If we are to bring about lasting and positive change for the environment, we need to employ the latest technological capabilities. Delivering policy relevant data that can identify challenges and inform solutions at a local and global scale is essential. By equipping our students with this knowledge, we are not only enabling a technological revolution but empowering the future workforce to apply it to societal and economic benefit."

Professor Willie Wilson, Director of the Marine Biological Association, said: "At the MBA we plan to work with our Plymouth partners at the new Centre to develop autonomous biodiversity monitoring of the global ocean using cutting edge biomolecular tools. Ultimately it will allow us to develop biodiversity forecasting as a tool to help manage the impacts of climate change. It is a perfect example of the synergy of the Marine Research Plymouth partnership that will allow us to develop advanced solutions for ocean management."

Staggering sea-level rise in the Mediterranean Sea revealed by new study

Scientists from the National Oceanography Centre (NOC) have discovered a substantial rise in sea-levels in the Mediterranean Sea, using a vital new method to measure changes in sea-level. The study, published in Journal of Geophysical Research: Oceans, demonstrated that sea levels in the Mediterranean Sea have risen at vastly higher rates over the past 20 years compared to the entire of the 20th century.

The study revealed that sea level in the Mediterranean Sea increased by about 7 cm in the period 2000–2018. Previous changes in sea-level rise in the Mediterranean Sea have been highly unpredictable due to limited observational data but using this latest method, scientists analysed sea-level data from tide gauges and satellites to reveal an enormous increase as a result of ocean warming and land ice-melt. Dr Francisco Mir Calafat, Senior scientist from the Marine Physics and Ocean Climate group at the National Oceanography Centre, said: "Our research demonstrates how climate change has sped up sea-level rise in the Mediterranean significantly since the turn of the millennium through increased melting of land ice. This is especially true in the Adriatic, Aegean and

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Levantine Seas which are rising even faster than the rest of the Mediterranean."

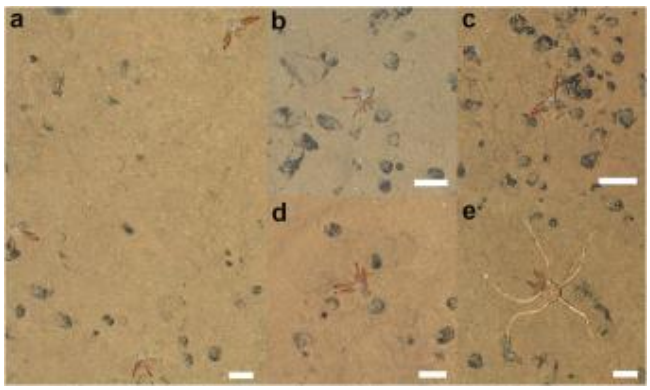
The previous lack of long-term sea-level records has hampered the ability to make long-term plans for local coastal defences. Dr Calafat continued: "This is the first time we are able to clearly distinguish between natural variations in sea-level rise and changes arising from sustained human impact in the Mediterranean Sea, based on observations alone. We have achieved this by analysing data from tide gauges and satellite altimetry together with sea-level patterns of response to land-ice melting, which explain how sea-level rises thousands of miles away from melted land ice sheets. The new estimates will allow us to detect acceleration in sea-level rise much earlier, allowing more time to increase adaptation. We expect this new dataset will be extremely valuable not only to the wider science community, but to policymakers, coastal planners, and coastal communities at large."

The new datasets will help local authorities with planning coastal defences that protect local communities, as well as better determining the most appropriate levels of protection required in certain areas. Being able to accurately project regional sea-level rise is critical to ensuring the correct coastal adaptation strategies are developed and implemented. As one of the most vulnerable regions susceptible to climate change, the Mediterranean's World Heritage sites are already at risk from coastal flooding and erosion. The full paper can be read here, agupubs.onlinelibrary.wiley.com/doi/10.1029/2022JC019061.

Study reveals massive fall of dead red crabs in the deep-sea

Scientists from the National Oceanography Centre (NOC) have made a surprise discovery of thousands of dead swimming crabs, 4,000 metres deep in the abyssal Pacific. NOC scientists, working in partnership the GEOMAR Helmholtz Centre for Ocean Research Kiel and the Scottish Association for Marine Science (SAMS) made the discovery while exploring the area using the NOC ocean robot Autosub6000 for the first time.

The crabs were found 1,500 km away from their spawning areas off the NW American coast, raising questions for ecologists and oceanographers about how such a large swarm ended up in the depths of the Pacific Ocean. This unexpected discovery will change the way scientists view how carbon is transferred from the atmosphere to the deep-ocean floor. A critical part of the Earth's carbon cycle occurs in the ocean, where carbon recycling occurs through the marine food web. This discovery suggests that these mass crab falls supply a very large quantity of food to the area – an amount of carbon far greater than was expected for the whole year. Before the study, there was no knowledge that these crabs could fall to such depths and provide food to the region, as well as playing a role in carbon transfer.



Carcasses of red crab Pleuroncodes planipes *photographed by Autsub6000 during seabed surveys in the NE abyssal Pacific*

Although relatively little is known about the deep sea, the most characteristic feature of abyssal ecosystems of depths from 3,000–6,000 m, is the extremely low availability of food. Deep-sea animals are thought to have adapted to very low food supplies, meaning this feast of surface ocean swimming crabs must represent an extraordinary bonus food input for these abyssal communities. This NOC study, published in the journal Ecology, reveals the untold fate of crab swarms swept offshore to open waters, in a way only previously known from beach strandings, but now discovered thousands of miles away from their spawning areas. The research paves the way for further studies into these key oceanographic processes. To read the paper in

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full, visit esajournals.onlinelibrary.wiley.com/doi/10.1002/ecy.3898.

Earth Science Women's Network (ESWN) support webinar

Are you interested in the NERC Independent Research Fellowships (IRFs) ?, or thinking about how to interview for NERC research fellowships in the future ?, unsure of what to revise or nervous about what to expect ?, wanting to learn more from those who work on and have experience of the fellowship ?. The Earth Science Women's Network is hosting a webinar on November 24th 2022 at 1330 UTC. This event will focus on interviewing for the NERC IRF and we hope to set you up for interview success. This event is totally free, and is the second in a two-part series. You can catch up with Part 1 on applications here, youtu.be/hSPk7ZaHR94. You can find the start time in your time zone using this link, www.timeanddate.com/worldclock/fixedtime.html?msg=Demystifying+the+NERC+IRF%3A+Interviews&iso=20221124T1330&p1=136&ah=1&am=30.

We will be joined by James Box (NERC Senior Programme Manager, Talent and Skills and NERC IRF Lead), Emily Mitchell (University of Cambridge), Jennifer Morris (NERC Programme Manager), Carol Robinson (University of East Anglia), and Clare Warren (Open University).

The agenda for the event is as follows,

- Welcome and Introductions [5 mins]
- Presentation on NERC IRF Interviews (James Box) [20 mins]
- Panel Discussion and Q&A [30 mins]
- Breakout Rooms, meet the panellists [35 mins]
- Event Close

All parts of this workshop (except the breakout rooms) will be recorded. A link will be made available to participants after the workshop. To register, visit forms.gle/R9mcbTuuEMG5WaYA7. We are excited for you to join us, if you have any questions please contact us via events@eswnonline.org.

Call for Decade Actions No. 04/2022 is open

The vision of the United Nations Decade of Ocean Science for Sustainable Development is 'the science we need for the ocean we want'. The Ocean Decade provides a convening framework for diverse sectors from around the world to co-design and co-deliver the scientific knowledge and the partnerships needed to achieve a better understanding of the ocean system, and deliver science-based solutions to achieve the 2030 Agenda for Sustainable Development.

To achieve the Ocean Decade vision, a wide range of partners will implement endorsed Decade Actions in the form of programmes, projects or activities over the next ten years. You are invited to contribute to that vision by requesting endorsement for transformative Decade Actions via the Call for Decade Actions No. 04/2022. To access the Call documentation and submit your Action, you will need to be a member of the Ocean Decade Global Stakeholder Forum. We encourage you to join the Forum as soon as possible, forum.oceandecade.org/login.

This Call for Decade Actions, which is the fourth of a series that will be launched every 6 months as part of the Ocean Decade, focuses specifically on programmes contributing to Ocean Decade Challenge 6, Coastal Resilience and Multi-Hazard Early Warning Systems, and Challenge 8, Digital Representation of the Ocean. Programmes that contribute primarily to other Ocean Decade Challenges will be able to complete an 'Expression of Interest' form and will be advised on their suitability to submit a proposal to the current Call.

The Call is soliciting initiatives that have synergies with one of the 25 endorsed Decade Programmes that have indicated that they are ready to solicit projects under the current Call. Please see the Guidance Note for Applicants which is available on the Take Action page of the Global Stakeholder Forum for the full list.

You are invited to take part in a community-wide survey to identify knowledge gaps in understanding biology's role in ocean carbon storage

The survey forms part of the BRICS project,

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noc.ac.uk/projects/brics, which aims to identify the gaps in our understanding, and highlight model limitations, which result in uncertainty in contemporary and future ocean carbon storage. The survey results will be used to inform later fieldwork campaigns and model development as part of a larger programme (BIO-Carbon) funded by the UK's Natural Environment Research Council. The survey will take about 15 minutes to complete and all responses are anonymous. The survey will remain open until 5th December. The survey can be found here, plymouth.onlinesurveys.ac.uk/brics-final. Please feel free to pass the survey link on to anyone in your network. Thank you for your participation. ***– Dr. Chelsey A Baker, National Oceanography Centre***

Climate Linked Atlantic Sector Science, CLASS, project opportunities

Berths available on CLASS expeditions

The sustained observation expeditions have berths available for students and early career researchers (ECRs) to join them and make measurements or collect samples for projects in collaboration with CLASS researchers. Students and ECRs will receive support in collecting their data and samples at sea, gain experience in a range of seagoing activities and benefit from working closely with CLASS researchers.

ECRs can apply for a berth on a CLASS research cruise through one of three options:

a) A berth funded by the ECR's own project, to collect data and/or samples to carry out research that will enhance CLASS objectives.
b) A berth associated with a CLASS ECR Fellowship (see below) or a PhD with a CLASS Principal Investigator
c) A berth as a volunteer for the core science team. Some, but not all, CLASS cruises need volunteers for their core team of people who take samples and process data.

Details of CLASS cruises and deadlines for applications can be found in the Application Form on the CLASS website. ECRs considering applying for a berth on a CLASS cruise should contact the Principal Investigator (PI) to discuss their ideas and plans first. More information, including contact details for the PI, what you need to know, and where to send your form, is given in the Application Form, projects.noc.ac.uk/class-project/academic-engagement. Applications can be submitted at any time.

CLASS Fellowships for Early Career Researchers

CLASS has an ECR Fellowship scheme to support extended visits by graduate students or postdocs to NOC and SAMS. The purpose of CLASS ECR Fellowships is to support the career development of ECRs by enabling collaborative working with CLASS researchers, as well as access to CLASS facilities, data sets, model output and tools, and berths on CLASS cruises.

The research carried out by the ECR during the Fellowship should enhance the CLASS objectives and build on the project's observations and/or modelling and/or technology development. Applications are invited for CLASS Fellowships at NOC and SAMS. The deadlines are given at projects.noc.ac.uk/class-project/academic-engagement.

VIEWS

Sonardyne's Ranger 2 USBL for MBARI's state-of-the-art research ship

US oceanographic research centre Monterey Bay Aquarium Research Institute (MBARI) has chosen deepwater positioning technology from Sonardyne for its new, state-of-the-art scientific flagship the R/V David Packard. The 50 m-long research vessel, named in honour of MBARI's founder, David Packard, is being built to undertake a diverse range of missions in Monterey Bay and beyond, supporting the institute's mission to advance marine science and technology to understand a changing ocean.

Once operational, the ship will accommodate up to 18 researchers and will enable MBARI's continued exploration of the deep sea, from the midnight zone to the abyssal seafloor. The R/V David Packard will be the command center for the ROV Doc Ricketts, MBARI's deep-diving remotely operated vehicle. The new research vessel will also be capable of deploying a variety of autonomous underwater vehicles (AUVs).

Underpinning this deep-water capability will be Sonardyne's Ranger 2 Ultra-Short BaseLine

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(USBL) system, with an HPT 7000 transceiver, which will be integrated into the vessel via a Sonardyne deployment machine.

The R/V David Packard will usher in a new era for MBARI's work. The new state-of-the-art research vessel is currently under construction in Vigo, Spain. MBARI will welcome the new vessel into its fleet in late 2023. Illustration: Glosten © 2021 MBARI

The choice means the R/V Packard is the latest in a line of MBARI vessels to utilise a Sonardyne USBL system for its science missions. In fact, MBARI was an early adopter of Sonardyne's first USBL system, installing it on the institute's very first research vessel, Point Lobos (retired in 2012), in the early 1990s. The R/V Western Flyer, MBARI's current flagship vessel that will be retired this fall ahead of the arrival of the R/V David Packard in late 2023, was also fitted with Sonardyne's first USBL system and has upgraded over the years to the latest, industry standard Ranger 2.

Ranger 2 is also the preferred USBL solution for many of the world's leading ocean research institutes, where efficient use of vessel time and accuracy are paramount. It provides researchers with the ultimate flexibility, with its capability to track and communicate simultaneously with multiple scientific instruments, vehicles or towed platforms, at ranges up to 10,000 m. With Ranger 2, operations from seafloor geodesy through to AUV survey missions are supported, anywhere in the ocean.

"The ocean is vital to life on Earth. In the face of rising threats like climate change, MBARI's work is more important than ever. We depend on a suite of diverse research tools to study the ocean. Sonardyne technology will help coordinate these instruments to give us valuable insight into a changing ocean," said MBARI Director of Marine Operations Michael Kelly.

Geraint West, head of science at Sonardyne, commented, "We've had a long-running and close relationship with MBARI, so we're really proud to be part of the next chapter in their story. At Sonardyne, we strongly believe in the critical work that MBARI is engaged in, as a better understanding of our changing oceans is critical to the future well-being of our planet."

The ship is being built at the Freire Shipyard in Vigo, Spain and the order for the Ranger 2 system for the R/V David Packard was placed via Spanish integration company/agent EMA, Sistemas de Monitorizacion.

IMAGE Project with Voyis, Cellula Robotics Ltd., Shift Environmental Technologies Ltd. and Fisheries and Ocean Canada

Voyis is excited to announce the development of the IMAGE project, Image Mapping & Analysis for Governance and Education, funded through Fisheries and Oceans Canada's Ocean Management Contribution Program (OMCP), www.dfo-mpo.gc.ca/oceans/funding-financement/management-gestion/index-eng.html. This project will bring together many strong industry partners, Voyis (voyis.com/), Cellula Robotics Ltd. (www.cellula.com/), and Shift Environmental Technologies Ltd. (shiftenvironmental.com/). Together, these organizations will conduct Autonomous Underwater Vehicle (AUV)-based image mapping and interpretation of Canadian Marine Protected Areas (MPAs) to efficiently monitor, manage, and educate in ocean management.

The OMCP provides funding opportunities to eligible applicants to support marine conservation initiatives with an emphasis on outreach, monitoring and stewardship, as well as capacity building initiatives.

Marine researchers increasingly rely on remote video and images from underwater vehicles to monitor marine habitats like coral reefs, boulder fields, kelp forests, and other underwater habitats. With new high-resolution 3D data, high-speed imaging, and machine learning approaches, there is an opportunity to automate MPA surveys and use this data automatically by classifying and counting the abundance of various species over time. Yearly datasets can be consistently collected and compared to infer environmental and population changes, possibly

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caused by climate change, pollution, or other external factors.

This project seeks to demonstrate that the Canadian Ocean Management can apply this autonomous monitoring approach on a wider scale. This objective can be accomplished by developing a robust commercial solution with Cellula's Solus-LR AUV fitted with Voyis optical sensors, in addition to demonstrating surveys with local indigenous stakeholders who could become the future stewards of an MPA monitoring strategy. The project has four main goals to be successfully completed:

- *Goal 1* - Monitoring Solution Development: Design and integration of Voyis optical sensors into the Solus-LR, www.cellula.com/solus-lr, to build an MPA monitoring and interpretation solution
- *Goal 2* - Indigenous Training & Mission Planning: Engage and build the Indigenous community's technical ability to participate in marine environmental monitoring and ocean conservation planning
- *Goal 3* - Survey & Analysis: Execution of survey operations and data analysis following developed mission plans
- *Goal 4* - Governance & Education: Dissemination of collected data to improve education and inform new methodology and site establishment

Voyis will supply a laser scanning, voyis.com/insight-laser-scanners/, and imaging package, voyis.com/observer-and-nova/, for integration into Cellula's Solus-LR AUV to complete the first goal. Using Voyis' stills camera and LED panel, voyis.com/observer-nova-pro/, the project will improve the researcher's ability to monitor large areas of seafloor with high-resolution images and laser data with new automated image interpretation software. This high-resolution technology, combined with the new image interpretation software, will improve the localization of seabed features for future data comparisons using optical navigational aiding algorithms.

Solus-LR is a hydrogen fuel cell powered AUV with a submerged range of over 2,000 km. Solus-LR was developed by Cellula for Defence Research Development Canada under the Arctic all domain situational awareness program. Cellula will integrate the Voyis camera system and plan and execute the MPA survey missions.

To achieve the second project goal, Shift Environmental Technologies Ltd. will leverage its existing First Nations relationships to facilitate training of the indigenous community on AUV survey operations and gain input on selecting survey locations. With the first two goals completed, we will be able to achieve the third one and complete the survey and data analysis, which will rely on all project partners working together. And for the fourth outlined goal, an educational organization will join the consortium to build on its world-leading contributions to monitor remote MPAs: along with Fisheries and Oceans Canada, they will use the high-resolution wide-area datasets collected in the project to drive improvements in ocean education programs, governance, and monitoring methodologies.

Challenger Society merchandise store on Teemill

Please visit challengersociety.teemill.com/ where you can browse, and even purchase items if you like. Please feel free to provide feedback in the help section.

SALTS

RRS *Discovery* begins 9,000-mile voyage

The RRS *Discovery*, operated by the National Oceanography Centre (NOC) set out on a 9,000-mile expedition at the end of October to conduct an extensive scientific survey within the South Atlantic Ocean, and possibly discover new

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species in previously unexplored depths. Scientists from the Centre for Environment, Fisheries and Aquaculture Science (CEFAS)-led expedition, and crew members from the NOC, will spend around 60 days at sea in total on board the RRS Discovery.

The ship contains dry and wet labs for scientists to store and analyse the samples collected, as well as state-of-the-art survey equipment such as deep-water cameras. Beyond the work of the expedition, *Discovery* will be the scientists' home for this time, with facilities such as a gym, mini-cinema room and cafeteria on board.

During its 6-week voyage, scientists will complete a number of activities including:

1) Collecting physical and video samples from seabed and previously unexplored seamount habitats on the mid-Atlantic ridge, at depths of up to 4,000 metres;
2) Take water samples to monitor quality and properties;
3) Using technology to detect and assess the number of species key to local fisheries, informing sustainable management quotas;
4) Monitoring and surveillance of human activities, such as illegal fishing, in the Marine Protected Environments.

Once the data and specimens have been collected, work will begin between experts in the UK and the remote British Overseas Territories of Ascension Island and St Helena, supported by the UK Government's Blue Belt Programme, www.gov.uk/guidance/the-blue-belt-programme, to analyse key findings, with a report expected in 2023.

Unique marine life the survey may encounter include inflated rattails, viper fish and common fangtooth identified on previous trips. There is a real chance the expedition will also discover species of the deep ocean unknown to humankind, which will be exhibited in the Natural History Museum upon the scientists' return.

St Helena and Ascension are home to two of the world's largest Marine Protected Areas and host a plethora of species, such as whale sharks, yellowfin tuna, humpback whales and green turtles. Yet despite their ecological importance, very little is known about their waters. Underwater cameras, deployed as part of the Global Ocean Wildlife Analysis Network, assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1077626/Global_Ocean_Wildlife_Analysis_Network_summary.pdf, will gather data that will significantly enhance scientific understanding of this unique marine environment.

The survey will further support the islands' governments in sustainably managing our oceans – protecting them for future generations. The ship is the latest research vessel to take the Discovery name, following the original voyage that took Captain Robert Falcon Scott to Antarctica in 1901. The BBC World Service visited NOC and toured the RRS *Discovery,* interviewing key members of the team including CEFAS's Paul Whomersley, and NOC's Captain Antonio Gatti and Dan Comben (left to right below).



CALENDAR

27th–30th November 2022: 2nd Springer MedGU Annual Meeting 2022
Marrakech, Morocco
The Mediterranean Geosciences Union, association.medgu.org/, in collaboration with Springer and Ibn Tofail University (Morocco)

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organizes the 2nd MedGU. Visit our website (www.medgu.org) to learn more about the event.

On this occasion, we are pleased to invite you to take part in the conference (in-person or virtually) and share/discuss your latest research findings. The MedGU Annual Meeting is one of the largest international geoscience meetings (200 attended in-person the MedGU-21 in Istanbul and 250 online). The MedGU Annual Meeting aims to provide a forum where geoscientists, especially early career researchers, can present and discuss their findings with experts in all fields of geosciences. It will feature talks and panels covering a diverse range of geoscience and geoscience-society topics.

The MedGU-22 encourages submissions of research works from all regions of the world. The MedGU-22 Proceedings will be published in Springer ASTI Series (indexed in Scopus & SCImago). Contact us, if you need more information, contact@medgu.org.

5th-6th December 2022: Royal Society meeting focusing on Atlantic overturning, new observations and challenges

London, UK

Scientific discussion meeting organised by Professor Meric Srokosz, Professor Penny Holliday and Professor Harry Bryden, hosted by the Royal Society, royalsociety.org/about-us/contact-us/carlton-house-terrace-london/. The Atlantic Meridional Overturning Circulation (AMOC) modulates our climate, including being a potential cause of rapid change. New observations over the last decade or so have revealed surprising aspects of the AMOC and led to a re-consideration of its stability and variability, its role in physical and biogeochemical components of the climate system, and its representation in climate models.

More information about the schedule of talks, and speaker biographies, will be available soon. Speaker abstracts will be available closer to the meeting date. Meeting papers will be published in a future issue of *Philosophical Transactions of the Royal Society A*, royalsocietypublishing.org/journal/rsta.

There will be an in person poster session on Monday 5th December at the meeting venue and an online poster gallery for the duration of the meeting. If you would like to apply to present a poster please submit your proposed title, abstract (not more than 200 words and in third person), author list, name of the proposed presenter and institution to the Scientific Programmes team at scientific.meetings@royalsociety.org no later than Monday 17 October 2022. Please include the text 'Poster abstract submission' in the email subject line. Please note that places are limited and posters are selected at the scientific organisers' discretion.

This meeting is intended for researchers in relevant fields.

- It is free to attend
- Both in-person and online attendance will be available
- Limited places, advance registration essential (more information about registration will be available soon)

If you have further enquiries please contact the scientific.meetings@royalsociety.org.

23rd-28th April 2023: EGU General Assembly 2023

Vienna, Austria

The EGU General Assembly 2023 will bring back many of the features the EGU community enjoyed before the pandemic, including: orals, posters, and, PICO sessions, in a new hybrid format, as well as a wide variety of networking opportunities. At the same time, we are very keen to improve the experience for our virtual attendees, and are working hard to connect the virtual and on-site experiences as much as possible.

EGU23 invites you to take an active part in organizing the scientific programme of the conference. From 1st November 2022 until 20th January 2023 you can apply for Townhall Meetings. Townhall Meetings offer an active discussion platform that is open to all interested participants to inform them of new opportunities and initiatives. Rooms for a splinter meeting can be booked for smaller, targeted discussion groups. Splinter Meeting booking opened on the 1st November 2022, meetingorganizer.copernicus.org/EGU23/provisionalprogramme.

When suggesting a Townhall Meeting, as a general guideline, we strongly encourage considering and promoting under-represented demographics, in particular including: (i) multiple countries and institutes, (ii) different career stages, with particular attention to the

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participation of Early Career Scientists, (iii) different genders and all other forms of diversity, and (iv) diverse scientific approaches. Please check with all conveners that they agree to take part in the proposed meeting. Please see the convener guidelines and rules for further information, egu23.eu/guidelines/conveners.html.

If you have questions about the appropriateness of a specific meeting topic, please contact the programme group chair and/or the officers of the specific programme group, www.egu23.eu/about/programme_committee_composition.html.

For conveners

a) The call for abstracts, meetingorganizer.copernicus.org/EGU23/programme, is open, so advertise your session. The abstract submission deadline is 10 January 2023, 13:00 CET.
b) Have a question about being a convener? Find all convener guidelines & rules on our website egu23.eu/guidelines/conveners.html.
c) Don't forget, the rating for the Roland Schlich travel support will begin on 2 December 2022.

For authors

a) Apply for financial support by submitting your abstract by 1 December 2022, 13:00 CET egu23.eu/guidelines/supports_and_waivers.html.
b) Submit your regular abstract to the session format of your choice by 10 January 2023, 13:00 CET, meetingorganizer.copernicus.org/EGU23/programme.
c) Looking for tips on how to submit your abstract? Find instructions on how to submit on the EGU23 website, egu23.eu/programme/how_to_submit.html.
d) If you are unsure which session or format to submit to, find out more about the planned format for EGU23 on our website.

For attendees

a) Learn more about the planned format for EGU23 on our website, egu23.eu/about/meeting_format.html.
b) If you need a registration fee waiver to attend EGU23, apply for financial support with your abstract submission by 1 December 2022, 13:00 CET, egu23.eu/guidelines/supports_and_waivers.html.

The EGU23 Artists in Residence scheme is now open for applications until 5 December 2022. Find out more and apply, www.egu.eu/news/929/apply-to-be-one-of-our-artists-in-residence-for-egu23/.

4th – 6th November 2023: Arctic Circle Japan Forum

Tokyo, Japan

The Arctic Circle is collaborating with the Sasakawa Peace Foundation in organizing the Forum. Governments, universities, companies, research institutions, organizations, associations and other partners were invited to submit proposals for Sessions. For more information visit www.arcticcircle.org/forums/arctic-circle-japan-forum. Submit your session proposal before 15th December, forms.monday.com/forms/03999d408a6c49c50bb45f8d8b3aca44?r=use1.

The CSMS email address is challenger.society@gmail.com. Contributions for next month's edition of Challenger Wave should be sent to: john@vectisenvironmental.com by the 30th November.

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JOBS and OPPORTUNITIES

Senior Robotics & Embedded Software Engineer, Planet Ocean ecoSUB Robotics Division, NOC, Southampton

Planet Ocean ecoSUB Robotics Division are seeking a talented individual to join our small team to develop our capabilities at this next crucial growth phase of the technology. Our ecoSUB Division is based within the Marine Robotics Innovation Centre within the National Oceanography Centre Southampton.

ecoSUB Autonomous Underwater Vehicles (AUVs) are robotic platforms at the leading edge of subsea technology development. They are affordable, intelligently designed and extremely disruptive to the market, markedly increasing accessibility to a wide range of users in research, offshore energy, and defence markets. Following the release of production systems, the ecoSUB division is in the process of growing a strong team of talented engineers to advance the system and achieve the growth plan.

This position will primarily be responsible for software development for the ecoSUB AUV. The embedded software is very much at the heart of the AUV system and as such is the lead engineering role. This role involves working closely with mechanical and electronics development to ensure complete system functionality and cohesive operation. The role is primarily R&D focused with aspects of existing system support. The Senior Robotics & Embedded Software Engineer role will involve supporting colleagues and will benefit from career development opportunities and excellent compensation. The role will involve fieldwork and travel, with time spent at sea guaranteed. Required offshore training will be provided.

Please contact carole@planet-ocean.co.uk for further information and visit www.ecosub.uk.

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PhD studentships in oceanography at UEA

We welcome applications for funded PhD studentships in ocean science to start in October 2023 at the University of East Anglia, available through the NERC-funded ARIES doctoral training programme, www.aries-dtp.ac.uk/.

- The sea ice carbon pump in Antarctic waters, www.uea.ac.uk/course/phd-doctorate/the-sea-ice-carbon-pump-in-antarctic-waters-bakker-uenv23aries
- Ocean-atmosphere-ice interactions on the Antarctic continental shelf, www.uea.ac.uk/course/phd-doctorate/ocean-atmosphere-ice-interactions-on-the-antarctic-continental-shelf-heywood-uenv23aries
- Leaky ocean eddies, www.uea.ac.uk/course/phd-doctorate/leaky-ocean-eddies-zhai-uenv23aries
- The Antarctic Circumpolar Current and the role of bathymetry, eddies and sea ice, www.uea.ac.uk/course/phd-doctorate/the-antarctic-circumpolar-current-and-the-role-of-bathymetry-eddies-and-sea-ice-stevens-umth23aries

Please apply online, www.uea.ac.uk/apply/postgraduate/research, (emailed applications cannot be considered, sorry). The deadline is 11th January 2023. If you have any questions, please feel free to email Karen at k.heywood@uea.ac.uk. Professor Karen J. Heywood OBE FRS, Centre for Ocean and Atmospheric Sciences, School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, United Kingdom

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MASTS Impact And Forums Manager. Closing Date: 22nd November 2022

This exciting new role involves inspiring and enabling interdisciplinary marine research, identifying and promoting impact, outreach across levels, and other activities across the wider marine science community, including science, social science, and the arts, to address major challenges for the ocean environment, people, and the planet. In the context of the climate and biodiversity crises, we seek to boost interdisciplinary cooperation and enable enhanced impact from the Sustainable Management of UK Marine Resources (SMMR programme) and through Marine Alliance for Science and Technology for Scotland (MASTS) networks. Reaching beyond 'traditional' routes to research impact, through new collaborations across disciplines and sectors, is a particular opportunity. For more information see masts.ac.uk/vacancies/masts-impact-and-forums-manager-masts/.

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There are jobs on the IMBER web site

http://www.imber.info

IMBeR Integrated Marine Biosphere Research

Jobs and opportunities

New

- MASTS Impact and Forums Manager - MASTS, University of St Andrews, UK. Apply by **22 November**
- Postdoc: eDNA metabarcoding to assess and predict African mangrove faunal biodiversity, Stellenbosch University, South Africa. Apply by **25 November**
- EBUS International Summer School, 6-12 November 2023, Coquimbo Chile. Apply by **30 November 2022**
- MSc, PhD and Postdocs: Computational ecology Multistatefoodweb. Apply by **1 December**
- Two Tenure-Track positions: Chemical Oceanography, University of South Florida, USA. Apply by **2 December**
- Assistant Prof: Coastal ecology, University of Washington, Seattle, USA. Apply by **2 December**
- Post-doctoral position: Benthic macrofauna and biodiversity research, University of Cádiz, Cádiz, Spain. Apply by **21 December**
- PhD students IIASA summer program **1 June – 31 August**, Laxenburg, Austria. Apply by **12 January 2023**
- Call for applications: 2023 ANSO PhD scholarship, USTC, CAS or UCAS, China. Apply by **15 February 2023**
- Postdoc: Submarine groundwater discharge, Old Dominion University, VA, USA. Apply **now**
- Postdoc: Southern Ocean trace metal - phytoplankton interaction. Stellenbosch University, South Africa. Open **until filled**
- Omics Positions: NOAA's Atlantic Oceanographic and Meteorological Laboratory, Miami, USA. Open **until filled**
- International Ocean Institute Ocean Academy: Online modules in Egypt, Turkey, Black & Mediterranean Seas, South Africa, Maldives. Apply **now**

In case you missed it...

- Open Call: Shipboard training fellowship: Global observation scheme for the ocean. Apply by **30 November**
- Postdoc: Ecology and sustainability, UiT, Tromsø, Norway. Apply by **1 January 2023**

imber@imr.no

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