MARINE TECHNOLOGY REPORTER

July/August 2023
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The OceanGate Tragedy &
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Volume 66 Number 5

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Chris Gibson, CEO, VideoRay.

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Editorial

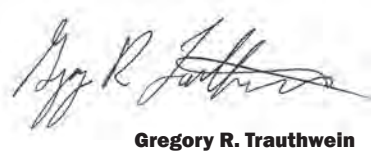
This edition of *Marine Technology Reporter* starts and ends with the loss of the **OceanGate submersible Titan**, an event that dominated global news headlines for the better part of two weeks. It started with the news that the vehicle and its occupants were off-grid during a dive on **Titanic** – arguably the world's most famous shipwreck – followed by the frantic search by international teams, the confirmation of loss and then the immediate aftermath analysis.

While I did not know any of the central players personally, this one is personal, as the international subsea exploration community is a relatively small, tight-knit group; truly unlike anything I've ever seen across the maritime, offshore energy, ports and logistics markets we serve.

At this very early stage, opinions on the loss span the full spectrum, fueled mainly by the fame of the shipwreck itself with the cumulative net worth of the submersible's mission specialist passengers a close second. The events that led to the loss will be analyzed closely for years, and undoubtedly the result will be a new set of rules that helps to dictate how subsea exploration is conducted, particularly the exploration/tourism branch.

Deep under the water where nature, science and engineering meet, there are no guarantees. As I've written hundreds of times in my 30+ year career, it is "one of the most inhospitable and unforgiving environments on the planet," which was proven again last month with loss of Titan, captain and crew.

But explorers explore, and what cannot be lost is that the vast majority of subsea missions that go off without a hitch, missions that are instrumental in helping us to explore, analyze, understand and preserve earths most dominant and complex feature, its oceans and waterways.



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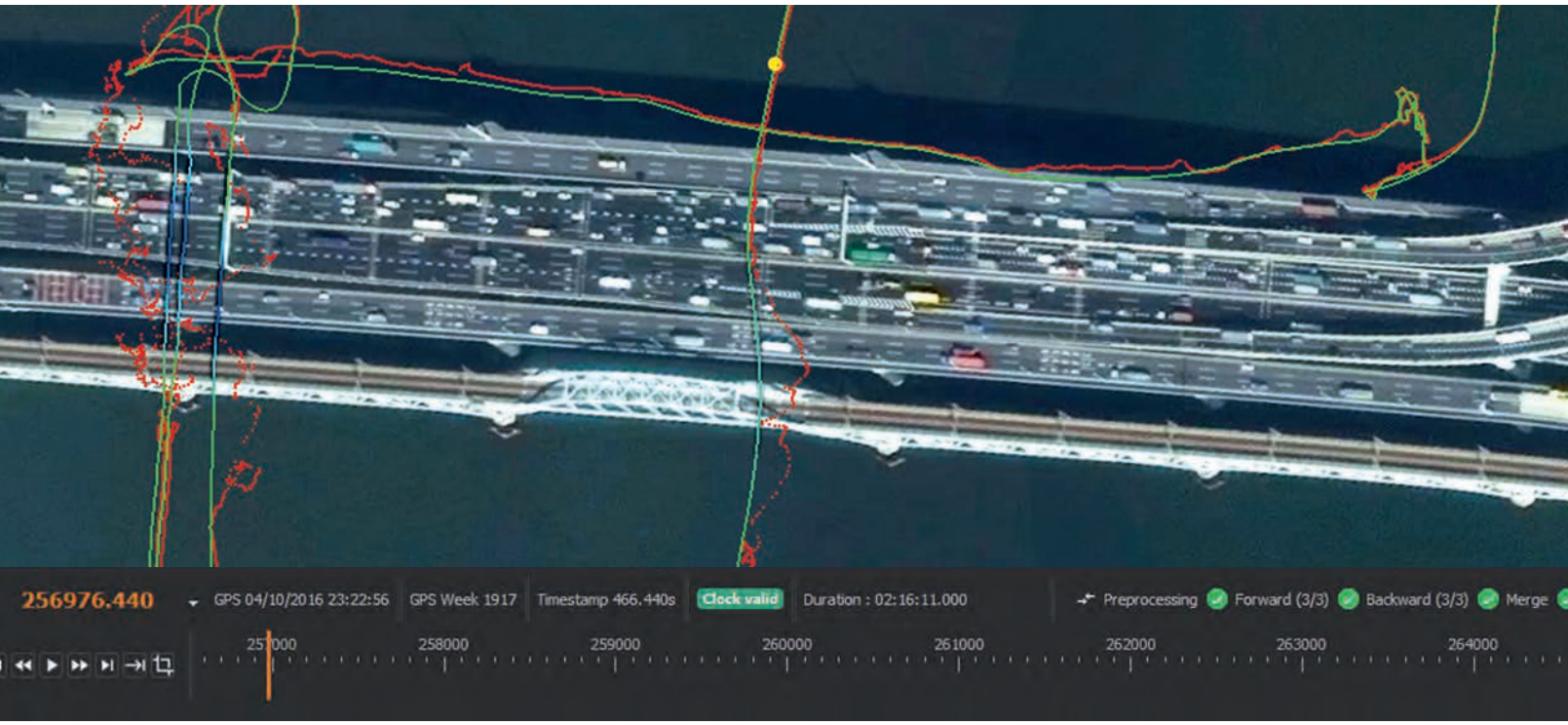
Qinertia

The Next-generation INS/GNSS Post-processing Software

Data Sheet



Quality: *Green -> centimetric position; Blue -> decimetric < 30cms; Red -> Raw GNSS data*

SURVEYING UNDER BRIDGES MADE EASY

This survey has been done with an APOGEE INS under very challenging conditions for the GNSS receiver (red dots).

The boat is crossing multiple times three large bridges including one made of steel.

With Qinertia and its unique 100% in-house GNSS/INS tightly coupled forward / backward processing, data collected under the bridges are fully exploitable (blue / green trajectory).

Altitude – Left GNSS only, Right: Post-processed

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Example: up to 80 seconds *outages and multi-path effects*
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Many thanks to Hydro Systems Development (HSD Japan) for their kind collaboration.

Full data available upon request at marketing@sbg-systems.com
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MTR Editorial Advisors

Gallaudet

The Honorable Tim Gallaudet, PhD, Rear Admiral, U.S. Navy (ret) is the CEO of Ocean STL Consulting and host of The American Blue Economy Podcast. He serves on several boards, is a fellow at The Explorer's Club, and is a strategic advisor for a few dozen startups, research institutions, and nonprofits in the ocean, weather, climate, and space sectors. Gallaudet is a former acting Undersecretary and Assistant Secretary of Commerce, acting and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA), and Oceanographer of the Navy. He has a bachelor's degree from the U.S. Naval Academy, and master and doctoral degrees from Scripps Institution of Oceanography.

Hardy

Kevin Hardy is President of Global Ocean Design, creating components and subsystems for unmanned vehicles, following a career at Scripps Institution of Oceanography/UCSD. He holds important patents in the field of ocean landers. He is on the academic advisory board of Instituto Milenio de Oceanografía at the Universidad de Concepción, Chile. Hardy received an honorary Doctor of Science degree from Shanghai Ocean University in 2018. He proposed making thick wall glass spheres to Nautilus Marine Service/Vitrovex (Germany) that opened the hadal depths to routine exploration. Hardy was the Lander Team Leader for James Cameron's DEEPSEA CHALLENGE Expedition. He writes for the Journal of Diving History and the Marine Technology Reporter.

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Captain George Galdorisi (USN – retired) is a career naval aviator whose 30 years of active duty service included four command tours and five years as a carrier strike group chief of staff. He is the author of 15 books, including four NYT best-sellers. The views presented are those of the author, and do not reflect the views of the Department of the Navy or the Department of Defense.

Gullick

Huw Gullick is Associate Director at NOC Innovations. His role involves finding real life application for the technology, science and wider capability of National Oceanography Centre's research.

Konowe

Celia Konowe is from Reston, Va., and has a bachelor's degree in environmental studies. She has study abroad experience in France and Ecuador. Currently, she is pursuing her master of environmental studies degree at Dalhousie University.

St. John's, Newfoundland, Canada: Polar Prince towing **OceanGate Expeditions submersible vessels** on a barge as it leaves for the Titanic wreck site to tour below the ocean.

WE CANNOT LET THE OCEANGATE TRAGEDY PUT A PAUSE ON OCEAN EXPLORATION

By Rear Admiral (ret.) Tim Gallaudet, PhD

In the wake of the catastrophic implosion of OceanGate's Titan submersible during a dive on the wreck of RMS Titanic, the marine technology community continues to question how to prevent such a tragedy from recurring. An obvious option is to impose international safety regulations regarding such expeditions.

For manned submersibles, there is merit in considering restrictions based upon technical criteria. OceanGate refused to obtain DVL certification for Titan. This was one of several safety concerns raised by the manned underwater vehicles committee of the Marine Technology Society in a 2018 letter to OceanGate CEO Stockton Rush, who was among the victims in the mishap.

The Titan also lacked critical technologies which could enhance submersible safety, such as a high precision inertial navigation system (INS), an Emergency Position Indicating Radio Beacon (EPIRB), and a means of reliable and redundant communications with her mothership.

Mandating technical standards for essential life support and operational systems in manned submersibles can mean the difference between success and failure – as well as life and death – in future undersea expeditions. Consider the remarkably similar situation following the sinking of Titanic.

Two years after the disaster, the major maritime nations passed the International Convention on the Safety of Life at Sea (SOLAS), which established the minimum safety measures in the construction, equipment, and operation of merchant ships. Because SOLAS has been the backbone of maritime safety for nearly a century, the international community should convene a SOLAS-like convention for manned submersibles or incorporate this vehicle class in the SOLAS convention itself.

At the same time, we must ensure any international regulations acknowledge the stellar track record of both manned and unmanned ocean exploration. Record-setting explorer

Victor Vescovo, for example, has completed 15 successful submersible dives to Challenger Deep in the DNV-certified submersible Limiting Factor, in addition to reaching all four of the ocean's 10,000+ meter deepest points. In the case of unmanned exploration, during my tenure with the National Oceanic and Atmospheric Administration's (NOAA), I initiated the 2020 national strategy to map, explore, and characterize the ocean in the U.S. EEZ, the implementation plan for which emphasizes the use of autonomous underwater systems and remotely operated vehicles (ROVs).

Ocean exploration is about much more than the purpose of OceanGate's expedition – adventure tourism. At stake are the immense benefits to national, natural, and economic security of such activity. Consider the Woods Hole Oceanographic Institution's human occupied vehicle Alvin. For over six decades, the Office of Naval Research has sponsored research using the submersible to gain valuable technical knowledge for the U.S. Navy's undersea warfare capabilities. Similarly, for over two decades NOAA's Office Ocean of Exploration and Research has managed ocean mapping and scientific discovery missions to inform sustainable fisheries management, development of offshore renewable and nonrenewable energy, and protection of economically important natural and cultural resources.

For these reasons, I signed an agreement with Victor Vescovo which we described in our previous editorial in the **"The Final Word"** section of the November/December 2022 issue of *Marine Technology Reporter*. This agreement between NOAA and Caladan Oceanic resulted in the survey of over 1 million square kilometers of previously unsurveyed seafloor, including the mapping of the Aleutian Trench for the first time, as well as the most precise depth measurement of Challenger Deep. As we argued in the article, beneficial accomplishments like these will continue to accrue as long as regulations do not overly restrict their safe and sustainable execution. he massive media response to the OceanGate tragedy showcased a cadre of commentators who have decades of leadership in the arena of ocean science, technology, and discovery. These included **Dr. Robert Ballard**, the man who found Titanic, and **James Cameron**, producer of the Oscar winning film about the tragic ship. The common denominator between them and the unfortunate crew of Titan was an unbounded interest in undersea exploration. If we wish to honor the lives of these fellow explorers lost too soon, we should not put a pause on what was their greatest passion.

MTS marine technology society

A MESSAGE FROM THE MARINE TECHNOLOGY SOCIETY (MTS)

We are deeply saddened at the loss of the crew of the submersible Titan. Our underwater community is close-knit and deeply connected; many of us worked with and knew those onboard. We appreciate and extend our gratitude for the efforts of the hundreds of volunteers and professionals who worked tirelessly on the complex and difficult search. That numerous agencies and commercial partners, from multiple nations, rapidly responded and deployed cutting-edge technologies is a testament to the strength and cohesion of the maritime sector – and emblematic of the Mariner's Code that connects all seafarers. Along with the entire marine technology community, MTS offers our sincere condolences and sympathies to the families and friends of the Titan's crew.

MTS was established in 1963, and our member community has a long history and broad experience in the technology and business of submersibles. In 1960, Captain Don Walsh, USN (Ret), was aboard the first submersible to reach the deepest known point in the ocean – the Challenger Deep. Dr. Edie Widder, Victor Vescovo, Patrick Lehey, and Dr. Mandy Joye—all winners of the annual MTS and Society for Underwater Technology (SUT) Captain Don Walsh Award for Ocean Exploration—have made hundreds of submersible dives between them, including to the deepest points in each ocean basin. Also, one of our founding members, Dr. Allyn Vine, led the development of crewed submersibles and was the driving force behind the creation of the DSV ALVIN, which has completed 5,000+ safe dives, including to the wreck of the RMS Titanic.

Today, one of our many professional committees is the Submarine Committee, formerly named the Manned Underwater Vehicles (MUV) Committee. This committee has a long history of organizing the leaders in this field at a technical convening alongside the Underwater Intervention conference. As with all our committees, sections, and events, we depend upon volunteer members to share their expertise and address challenges and opportunities relevant to their specific discipline. MTS recognizes the global expertise and experience of the Submarine Committee and commends its annual conference as an example of valuable service to the marine technology community.

In 2018, this group of volunteer members collaborated to draft a cohesive, and directed, message to OceanGate on best practices for the safe development and operation of new submersible technologies. The content of this draft letter has been widely shared by the media in recent days. The Submarine Committee never signed or sent this draft letter to OceanGate and the draft letter was not approved or issued as a formal statement on behalf of MTS or the committee. The letter draft was shared, though, with OceanGate by a committee member during the drafting process. OceanGate CEO Stockton Rush and the Submarine Committee chair engaged in discussions and agreed to disagree on the technical topics of the letter. Recent media coverage has highlighted OceanGate's views on these technical topics, as expressed in a 2019 company blog post. This history is shared here with no opinion on the un-

derlying considerations raised - it is important, however, to accurately acknowledge the history of these events.

MTS is a professional society that convenes experts from government, academia, and industry on topics of interest to the community and disseminates that expertise broadly. As a professional society, MTS was not established to and does not develop rules, classify technologies, or regulate individuals or organizations working in marine technology; rather, we inform those who do. Our operating practices and policies have been designed to empower volunteers and informed technical experts to serve the wider marine technology community—to advance best practices, to inform standards and regulations, and to catalyze the development of new ocean and underwater technologies. As we did in 2018, and we have done since our founding in 1963, we continue to act in that fashion and operate in accordance with our exempt purpose.

While this recent incident has been very challenging, it is important to acknowledge that ocean technology is in an important growth phase. MTS believes that advancements in the development and use of marine technologies are essential to support responsible and sustainable use of the ocean. Enabled by underlying technologies such as graphical processing units (GPUs), global internet connectivity, and artificial intelligence and machine learning, the marine technology field is expanding rapidly. New instruments such as synthetic aperture sonar and undersea lidar are showing us the undersea features of our ocean planet in rich new detail. Emerging sensors such as in-situ gas analyzers and environmental DNA samplers enable broad area bio-geochemical monitoring to better understand the entire water column and ecosystem. A diverse and rapidly expanding array of ocean platforms such as gliders, uncrewed undersea vehicles (UUVs), and uncrewed surface vehicles (USVs) bring human awareness to the entirety of our ocean planet at low cost and large scale. Collectively, these developments are catalyzing a new phase of the blue economy.

MTS is a diverse community that creates and delivers opportunities to both individuals and organizations. Individual members, which include students, early career professionals (ECOPs), volunteer leaders and recognized senior leaders in their fields, are provided with a path to advance their professional practice and expand their network throughout their careers. Organizations, including universities, start-ups, established businesses, non-governmental organizations, intergovernmental and government agencies support and actively engage meaningful initiatives throughout our community. We welcome all those who wish to support the next 60 years of marine technology for responsible use of our ocean planet.

Justin Manley, *President*
Zdenka Willis, *Immediate Past President*
Susan Hunt, *President-elect*
Chris Ostrander, *Chief Executive Officer*

THE MEANING OF 'INNOVATION'

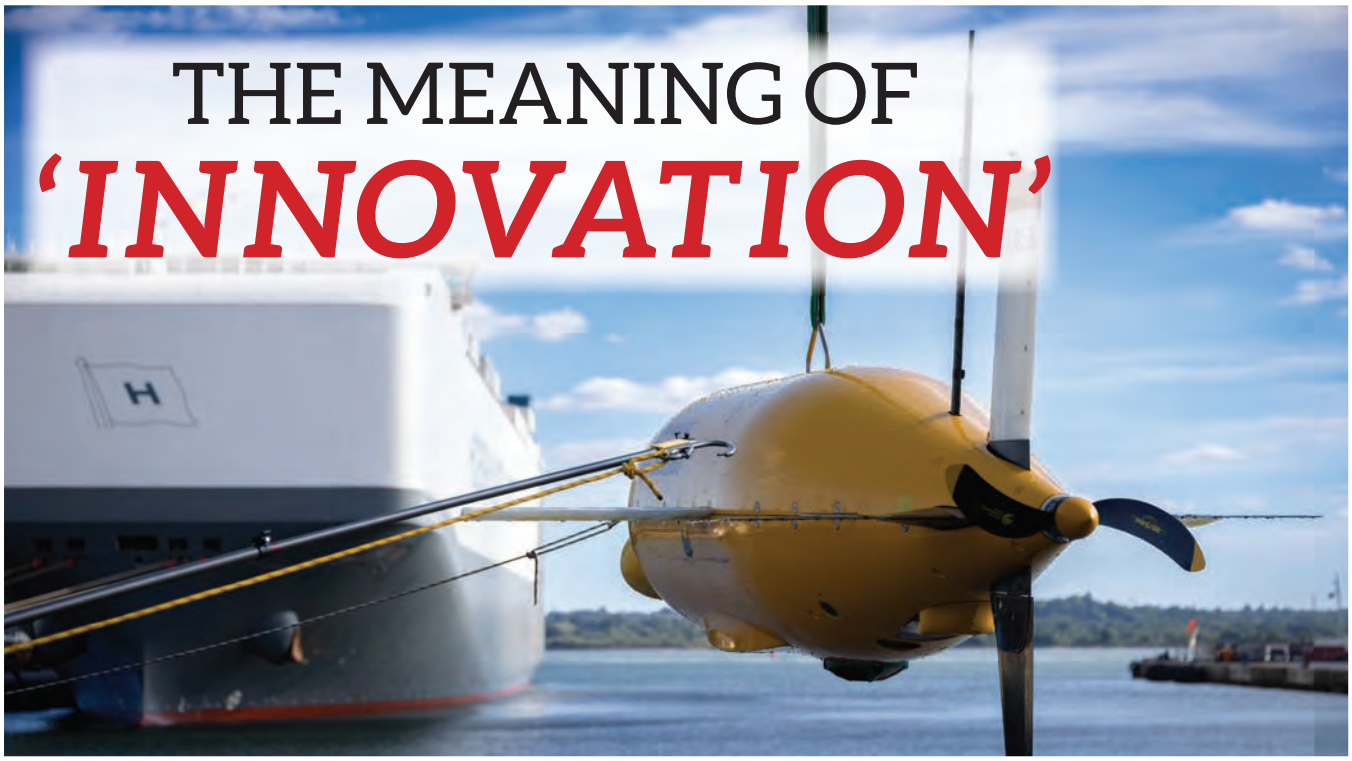

Image courtesy NOC

By Huw Gullick, Associate Director, NOC Innovations

Not a day goes by when we don't hear the word innovation, it's slipped into everyday life, employed as a standard by which we should all be operating by. If you aren't innovative, you are so 20th century, and it's seen as the only way that things get done - "that hasn't worked so let's try this innovative approach". Some of us even rely on it to have a job. But innovation seems to have slipped through the net when it comes to definitions and meanings. We all nod our heads knowingly when someone talks about innovation but do we really know what it means? Of course, there is a dictionary definition for it but what does it mean in practical terms? What is the real-world manifestation of innovation? When can you see and touch innovation and should we even care? It is easy to get swept along with all of the hype and conjure up images of robots flying airplanes, teams of scientists and engineers in super-labs with VR headsets on, holograms of DNA floating in the air and digital twins of the ocean projected 360° around them, or AI so clever it is now teaching half the curriculum in school. It's often easier just to tie the concept of innovation to something new or doing things faster, going further or creating something that we didn't know we needed rather than unpick what it may really mean. In my work at NOC, I operate in an environment where I am constantly surrounded by this stereotypical conception of innovation; teams of scientists and engineers unravelling the mysteries of the ocean and developing new technology to explore areas we have never been to before and collect data we could previously only dream of. It's inspiring stuff, and highly innovative. Whilst I am in awe of this and privileged to be immersed in it, I often question whether what I am experiencing really is innovation; cutting edge technology, pioneering science – is this really innovation, and if not, what is innovation?

It's a complex one to answer. What I see is innovation in the sense that it is pushing the boundaries of what is possible from an engineering perspective and creating new scientific knowledge and understanding that didn't exist or wasn't known. However, this is only part of what innovation means, an important part but still only a small part. A really succinct definition of innovation would have to be "creating and orchestrating the conditions that allow something to happen that has such an impact that it fundamentally shifts our interaction with the world around us or how we think about our world". For me, innovation has to be coupled with impact otherwise it only exists as an idea, a concept, or at best an experiment undertaken by a few scientists confined and limited to a laboratory.

Thinking Innovation

Innovation needs to be thought of in a multi-layered way, it's a bit like an onion. What you see is the outer layer, the manifestation of a system of things that happen to create the outer layer. In the marine context, autonomous vessels are the physical manifestation born out of a complex system of conditions that have allowed them to be created; societal expectations of cleaner ways of working, engineering evolution, market forces and more. Whilst autonomous vessels are innovative in themselves, the ability to create the conditions among this complex system to develop them is the true innovation. For me, innovation is much more about how we see and approach the world and what

impact we want to achieve more than simply the physical thing.

Innovation Today

I believe that we live in a world where technology is moving so quickly that true innovation needs to be directed at the adoption and scale of new technologies rather than any new technologies or discoveries themselves. Our natural thirst for adventure and understanding will always force us to "come up with something new" but innovation is about creating the conditions in which these new things can actually achieve impact in the real world. Creating and orchestrating the conditions to allow this to happen is extremely difficult. It's that moment where businesses either succeed or fail, or where ideas become reality or simply wither away. This innovation can only be done by humans, and it's a state of mind and set of human behaviors that lie at the core. They aren't new, shiny or particularly innovative in the common understanding of the term, but rather they lie at the heart of what I believe innovation to be and are essential to create the conditions that allow something to have such an impact that it fundamentally shifts our interaction with the world around us and how we think about it; bold ambition, clarity of goals, building relationships, being vulnerable, focus and hard work, diversity of skills, experience and cultural background. Recognizing the need for these, seeking them out, applying them in the right amount and at the right time whilst adapting, reacting, and leading the world around you to create the conditions for the "thing" to flourish and scale up achieving real impact, that is true innovation.

The Real Meaning of Innovation

I realize that this goes very much against the grain of what we typically assume innovation to mean. Many people might assume that the version of innovation I have spelt out equates to "getting stuff done". However, achieving this on scale is fundamentally essential to actually getting important things done, no matter the new ideas, technology or engineering. Seeing this as an integrated partnership is true innovation that will have the largest and longest impact. It doesn't take a lot to work out that my innovation is essentially the core traits required to "get stuff done", something we all possess. If we can truly hone this to create those conditions for the "things" to flourish and achieve impact at the right time, then that is the key surely? Keep the good ideas, clever engineering, amazing science coming and pair it with my innovation and that's our future neatly sown up. If only it were that simple! The thing about innovation is that it is completely subjective. Overlay that on my definition, and we are back to square one.

TITANIUM AND OCEAN LANDERS

Figure 1
RBR compact, lightweight titanium housings for deepwater temperature and pressure loggers.

Photo courtesy of Keith Johnstone, RBR Ltd, Ottawa, ON, Canada

By Kevin Hardy, Global Ocean Design, MTR Columnist

Titanium is an ideal oceanographic material with high strength, low density, and excellent corrosion resistance. It is the fifth most abundant material in the Earth's crust, with properties between aluminum and steel. The production of titanium was initially developed to meet the needs of the aerospace industry, while the ocean industry benefitted from cross-over adaptation.

The principal alloys used in unmanned undersea systems are 1) Grade 5, Ti-6Al-4V (6% Aluminum, 4% Vanadium) and 2) Grade 2, commercially pure titanium (99% pure). Many machinists prefer the higher strength Ti 6-4 alloy (Grade 5) as it provides better finishes compared to the softer commercially pure Grade 2 unalloyed material. Titanium has a machinability index similar to that of stainless steels.

Cost and availability of the material has limited the wider use of titanium. Still, titanium has important application in Ocean Landers. Long duration landers may use titanium fasteners for assembly, the threads lubricated with zinc oxide paste to prevent galling. Other precision elements, such as sensor heads and instrument housings require no ongoing maintenance (see Figure 1).

Titanium's corrosion resistance comes from a dense and tightly bound oxide layer that forms in a matter of a few minutes in air. The titanium oxide film resists attack by chloride ions in seawater, making the metal highly resistant to corrosion fatigue and corrosion cracking. This allows the material to be deployed for long periods of constant immersion without fear of degradation.

Titanium is non-magnetic, providing opportunity for through-hull magnetic coupling to sensors or Hall-effect switches for control.

SOURCING (DFARS) AND MATERIAL ASSAY CERTIFICATIONS

Right up front: Buyer beware of where your titanium comes from. The high temperature (1620°F/880°C) metallurgical process requires time and an inert environment to develop the proper body-centered cubic crystalline structure. Improper billet manufacturing can result in parts that will fail prematurely.

Importantly, an assay based on XRF (X-ray fluorescence) can show a sample has the proper alloy elements in the correct proportions, but cannot confirm the proper crystalline structure.

I have personally experienced Grade 5 Titanium 6-4 material, improperly created at a foreign mill and inadvertently inserted into my production run. The material had the aluminum on one side of the bar, and the titanium on the other. This created a Ti-Al battery driven by galvanic potential. It was the first time I saw titanium corrode badly. The sensor body later passed the XRF (X-ray fluorescence) test, confirming it was Grade 5. It's level of corrosion suggested something else.

To help avoid poor Ti 6-4 material, end users must specify material sourced from "U.S. Mill or DFARS Only" in addition to material assay certification "Material Certs Required". "DFARS" is the "Defense Federal Acquisition Regulation Supplement". The list of DFARS nations is rather lengthy. As a first-order check, if the material assay certification is in any language other than English, you may have a serious problem and need to double check.

Specifying Grade 2 unalloyed titanium provides a better shot at getting excellent corrosion resistance at the cost of strength. I still call out "DFARS Only" in addition to requiring material assay certifications. There's always the possibility that the wrong material is delivered with the certs from another run, but that requires diligence by and trust in your vendor. It helps if your vendor is ISO 9001 certified.

The reader is referred to the SME text *"Tool and Manufacturing Engineering Handbook, Volume III, Materials, Finishing and Coating"* for further discussion of Titanium metallurgy and fabrication.

GALVANIC SERIES AND ISOLATION

While it is good practice to avoid joining dissimilar materi-

Photo by Kevin Hardy, Global Ocean Design

Figure 2

Corrosion of non-DFARS Titanium 6-4. The aluminum rich side corroded due to galvanic action.

als, occasionally designers are faced with that challenge. It is important to recall that corrosion requires both an electron path and an ion path. Seawater is assigned the role of ion path. Isolating dissimilar materials with a non-conductive material breaks the electrical path, and thereby the galvanic cell. I have used flanged Delrin washers to isolate titanium fasteners from an aluminum frame.

The frame has survived multiple year-long deployments without harm. I tried a similar approach with connectors of one material into a housing of another material using Delrin or Peek insulators (Figure 3).

Tests in early 1965 of Titanium 721 at the Naval Applied Science Laboratory showed signs of stress corrosion cracking. Ti-6AL-4V ELI grade (Extra Low Interstitials) was developed to have more resistance to this failure mode.

To manage costs, lander frames can be made from FRP structural elements, with side panels from HDPE, reducing cost and weight. Lifting bales are preferentially made of aramid fibers such as Kevlar, as they are lighter, stronger and can tolerate flex cycles normally experienced on recovery better than materials that are prone to work hardening.

MACHINING AND FABRICATION

Titanium fabrication requires an appreciation for the unique characteristics of the metal including: lower modulus of elasticity, lower ductility, low thermal conductivity, a tendency to gall, and a higher melting temperature coupled with a sensitivity to welding contamination. Welding requires shielding from air using Argon or Helium gas shielding techniques to avoid brittle welds. Galling can make tapping difficult.

ANODIZING TITANIUM

Titanium can be anodized. One patented process is called "Tiodize". The surface growth is ranges from 20-200nm, little enough that no machining tolerance is required. Titanium anodize is suggested for threads that would otherwise gall. The use of zinc oxide lubricant is still recommended. While the anodize oxide is transparent, the parts can appear to have vivid rainbow-like colors due to interference coloring.

BONDING

Titanium's dense oxide layer creates a low surface energy substrate that is difficult to bond to. The oxide layer can be abrasively blasted then primed within 2-3 minutes to create a satisfactory bonding surface.

CASTING AND 3D PRINTING

Casting of titanium parts is done in an inert atmosphere for reasons noted above. Laser sintering of titanium has been shown as a practical 3D print process, but also requires an inert atmosphere. Both have less strength due to porosity and lack of grain structure found in wrought material.

ACKNOWLEDGEMENTS

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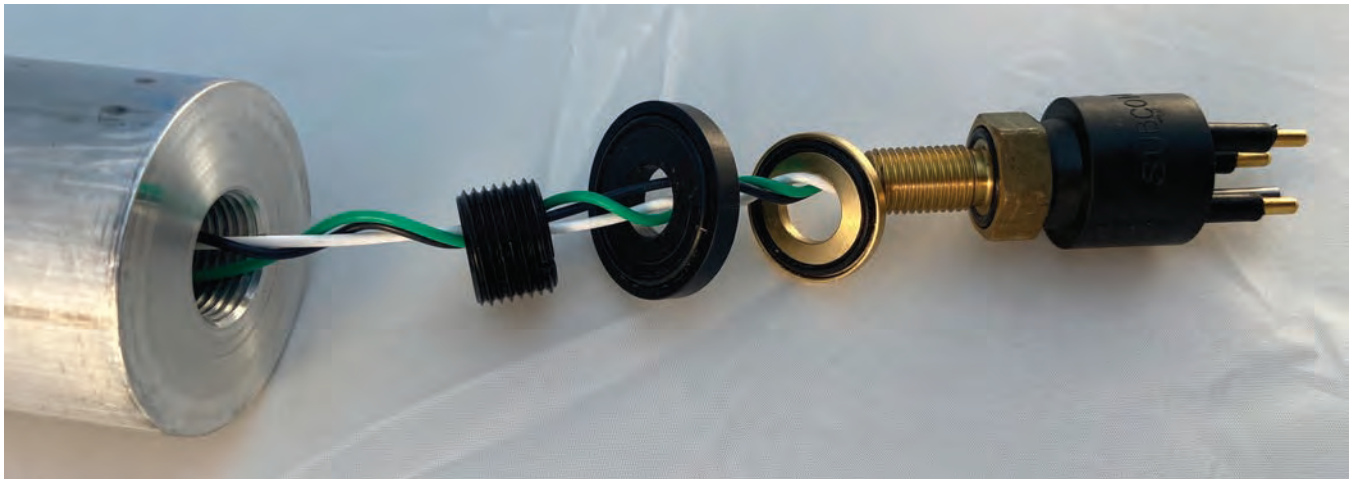

Photo by Kevin Hardy, Global Ocean Design

Figure 3

A brass MCBH bulkhead connector is isolated from an aluminum housing using a two-part Delrin insulator. The adapter assembly is (left-to-right) Delrin internal/external threaded insulator, Delrin adapter plate, and brass adapter plate. The combination has been tested to 10,000psi.

Photo Courtesy of John Head, Prevco

Figure 4
PREVCO Subsea 6000m depth rated titanium subsea Enclosures.

Photo courtesy Jack Rowley

Unmanned Maritime Systems Development Accelerates

By Captain George Galdorisi

There is little question that world militaries see the value of unmanned systems to complement their manned counterparts. The wars in Iraq and Afghanistan accelerated the development of unmanned aerial systems and unmanned ground systems to meet urgent operational needs. Now, there is increasing interest in unmanned surface systems, resulting in their placement on an accelerated development path.

Like their air and ground counterparts, these unmanned surface systems are valued because of their ability to reduce the risk to human life in high threat areas, to deliver persistent surveillance over areas of interest, and to provide options to warfighters that derive from the inherent advantages of unmanned technologies.

Taking these unmanned surface systems from the drawing board to development and fielding is not a trivial task. However, it is one that has been quickened by a wide range of U.S. national and international exercises, experiments and demonstrations where these systems have been put in the hands of operators who have provided valuable feedback that has led to iterative improvements in these systems.

Column space does not allow for a full review of all of these events, but briefly, these include S2ME2 ANTX, the Bold Alligator series, Valiant Shield, Dawn Blitz, Steel Knight, Valiant Shield, Trident Warrior, Coastal Trident, the Integrated Battle Problem series, and many others.

In just the last year alone we saw International Maritime Exercise, Autonomous Warrior, NATO Robotic Experimentation and Prototyping Maritime Uncrewed Systems, Digital Horizon, Fifth Fleet Cutlass Express, Digital Shield, Integrated Battle Problem, and BALTOPS, among others.

While it is difficult to single out one exercise as emblematic as one that has accelerated unmanned surface system development and that presages the future use of these USVs for a variety of important military missions, Digital Horizon is a good exercise to unpack to understand the strides made with these systems. Here is how one analyst previewed this exercise:

> *A flotilla of unmanned floating sensor platforms is underway in the Arabian Gulf to help the U.S. Navy find and respond to abnormal maritime activity … Digital Horizon is integrating 15 different types of unmanned systems—10 of them operating with the U.S. 5th Fleet for the first time—as well as communications, artifi-*

cial intelligence and machine learning technologies from industry partners.

Digital Horizon 2022 will feature a formidable fleet of cutting-edge platforms and technologies. The USVs taking part include Elbit Systems' Seagull, iXBlue DriX, L3Harris Arabian Fox, Marine Advanced Robotics WAM-V, MARTAC's Devil Ray T-38, Ocean Aero TRITON, Open Ocean Robotics Data Xplorer, Saildrone Explorer, Seasats X3 and SeaTrac SP48.

Digital Horizon was a three-week event in the Middle East focused on employing artificial intelligence and 15 different unmanned systems (12 USVs and 3 UAVs), many of which operated in the region for the first time. The exercise, meant to be a continuation of IMX22 but at a significantly larger scale, was hosted by Task Force 59, and builds on the work done during IMX22.

Digital Horizon brought together new, emerging unmanned technologies and combined them with data analytics and artificial intelligence in order to enhance regional maritime security and strengthen deterrence by applying leading-edge technology and experimentation in unmanned and artificial intelligence applications for the Navy. A key goal of Digital Horizon was to speed new technology integration across the 5th Fleet, and seek alternative, cost-effective solutions for conducting Maritime Domain Awareness (MDA) missions.

One of the features of Digital Horizon, and in line with the first word of the exercise, "Digital," was the ability to command and control five unique drones from a single point of contact, a capability long sought by U.S. Navy officials. The Navy is acutely aware of the increasing cost of manpower and is dedicated to moving beyond the current "one UXS, multiple joysticks, multiple operators," paradigm that has plagued UXS development for decades.

While it was not called out as an explicit goal of Digital Horizon, the sheer volume of data vacuumed in by the myriad of unmanned platforms participating in the exercise advanced the use of big data, artificial intelligence and machine learning as assets that could take this vast amount of data—far too much for even a large number of humans to make sense of—and turn it into meaningful and actionable information of immediate use to operators.

Another benefit of leveraging these cutting-edge technologies—especially in light of recent actions such as Iran's seizure of two U.S. Saildrone USVs in the Red Sea in September 2022—is that no valuable data is retained on the USV. Rather, that data is pushed to the cloud (for Digital Horizon, via a Silvus mesh network) where it is protected and can be downloaded by friendly forces. This presages a concept-of-operations (CONOPS) that will likely advance the use of unmanned surface systems, as concerns about adversaries stealing and exploiting data can be completely eliminated.

While the focus of this article is on the totality of Digital Horizon, I am using the T-38 Devil Ray as an example of how many similar-sized USVs can be equipped with multiple state-of-the-art COTS sensors to provide persistent surveillance.

For example, the T-38 provided AIS, full motion video from SeaFLIR-280HD and FLIR-M364C cameras, as well as the display of radar contacts on a chart via the onboard Furuno DRS4D-NXT doppler radar. These were all streamed back to Task Force 59's Robotics Operations Center via high bandwidth radios and SATCOM.

Most military mariners who have had the experience of one organization or another installing new technology on their ships are well (often painfully) aware of the plethora of rules and regulations that must be followed before any new systems can be bolted onto a ship—let alone the difficulties of integrating that technology into the ship's other systems and sensors. The value of using a COTS USV such as Devil Ray for a surveillance mission is that new technology can be inserted without these restrictions, thus achieving the U.S. Navy's goal of accelerating technology insertion into the fleet. World navies will be well-served to leverage the lessons of Digital Horizon to accelerate the use of unmanned surface systems in their fleets.

CEO in Focus: VideoRay's Chris GIBSON

About five years ago, with a plethora of low-cost ROV manufacturers entering the market, VideoRay had a decision to make: sell higher volumes of lower cost units, or switch gears and sell fewer, higher cost units. Leadership chose the latter, a decision that has paid off handsomely with annual revenue growing 20-60% per year each of the last four years, driven by military/government sales. ***Marine Technology TV*** *recently sat down with* ***Chris Gibson*** *– a 20-year veteran of the company who recently ascended to the CEO seat – for his insights on the pace and direction of VideoRay and the ROV market at large.*

MARINE TECHNOLOGY TV

Watch the full interview with Chris Gibson, CEO, VideoRay, https://youtu.be/p5EefJFm4_0

By Greg Trauthwein

All images courtesy VideoRay

"We moved into more of a specialized, rugged, even more reliable systems following military grade standards ... our **Mission Specialist technology**. *As a result, we've been selling fewer, but more expensive systems. While we've seen our volume go down,* **we've seen our revenue go up, increasing 20 to 60% a year** *for the last four years."*

– Chris Gibson, CEO, VideoRay

Chris, to start us off please give a 'By the Numbers' look at VideoRay today.

We have more than 4,000 systems sold to 1,700 customers in 75 countries using our products, supported both directly and indirectly through sales and support channels, leveraging around 30 international dealers.

Our business changed a lot over the last five years when we made a strategic decision in 2017 to refocus our business. Prior to 2017, VideoRay was a low-cost provider of relatively reliable, rugged, football-sized ROV equipment.

But we saw changes coming.

We decided to move into more of a specialized, rugged, even more reliable systems following military grade standards; we did this for business that we were working on with the US Navy, which coincided with the launch of our Mission Specialist technology. As a result, we've been selling fewer, but more expensive systems.

While we've seen our volume go down, we've seen our revenue go up, increasing 20 to 60% a year for the last four years, which is mirrored by the success that we've had with the US Navy Maritime Expeditionary Stand-off and Response program.

You said you "saw changes coming." Can you elaborate?

We saw a lot of low-cost providers coming into market. At the time, VideoRay was selling a Scout system that retailed for around $4,500. When we looked at that scout system, and looked at the technology that was coming on market, we didn't feel with that we were competitive, so we had a decision to make: Did we want to make a lot of low-cost systems, or did we want to make fewer, higher-end systems? We made the decision to make fewer, higher-end systems better.

When you look at the VideoRay you joined more than 20 years ago, how was it most the same; how is it most different?

What's most the same is our focus on customer service. Scott Bentley founded the company with Bob Christ, and myself as well as a lot of other people here at VideoRay have software backgrounds. When you are doing software, you have to provide a high level of customer service. Our customers expect it, and we brought that to the maritime industry. We smothered them with customer service, and that's stayed true. That customer focus directly correlates to solid, reliable products, because that's what customers want: when they put the unit in the water, they know it's going to work.

The biggest difference, especially over the last six months since I took over, is that we've doubled the size of our leadership team, surrounding myself with experts (both promoted from within and brought in from the outside) as we grow the business.

Your career parallels an evolution and maturation of the ROV market. Can you point to one or two technologies that you think have most significantly added to ROV adoption, use and growth?

We see some big changes happening now that mirror the early days of VideoRay. In the early days commercial divers were

terrified about using ROVs because of job security. Today we are seeing new technologies coming aboard that are replaying that same scenario with ROV pilots. This new technology makes it easier for ROVs to operate, and it's going to change the type of operator that you need.

[Another change centers on] the way we 'see' underwater with multibeam sonars. Most of our customers work in low visibility waters, and when you put an ROV in the water the first thing you see is nothing: it's just brown or green; It's rarely blue, and you rarely see nature in its natural state.

Multibeam sonars provide the ability to see something at a distance and then navigate to it easily; it makes using an ROV a lot easier. When we first started selling that technology on the VideoRay systems, I would say that we sold maybe one in 10 systems; now it's about nine out of every 10 systems. It became a popular accessory as the technology has evolved, as it's gotten smaller, less expensive and better.

[Bigger picture, the miniaturization of all types of sensors and tooling has driven and opened up the market]. A lot of things that you [previously] could only put on larger ROVs, the manufacturers are now going through and miniaturizing them, making things smaller, lighter and less expensive. It's opening up the market, and making ROVs more effective tools.

VideoRay made the decision six years ago to emphasize selling fewer, higher cost units and the military market. Assuming that space is becoming a bit more crowded too, how does VideoRay differentiate itself?

There's a box that we like to operate in, and that box has always been one man portable, one man recoverable. We've had internal discussions about building larger equipment, but that's the box we stay in.

The other things that make VideoRay stand are reliability and openness. We are open in regards to our architecture, our modularity, we make it very easy for people to go through and put on different types of sensors, accessories and video.

One of the most important things that we do is we make our systems, for the most part, backwards compatible. So, the tethers that we went through and sold with the first Pro 2 systems will work on Defender systems today. The sonars that you use on our Pro 5 can be used on a Defender system.

The systems that we sold, for example, to the Navy in 2017 can now take battery technology that we developed after they were released and before we even thought about integrating it onto our systems. But all in all, the most important thing that differentiates us is customer service. Not a lot of people will go through and buy their first system because of customer service. Everyone expects when they buy a new anything, it has great customer service. But our customers learn pretty quickly that VideoRay has pretty good customer service, and we're there to support them and their success.

We've talked about the military, but I know VideoRay ROVs are found in more than a dozen industries. Looking at all the markets you serve, what do you see as "hot" right now?

Defense is really hot for VideoRay right now, with a program of record and some other programs that we're working with the [U.S.] Navy, plus we've seen an uptick with foreign militaries with a lot of conflict around the world right now. The other hot market that we're working on now is offshore wind and renewables. VideoRay has a really strong customer base in Europe, and now we see that customer base migrating to the United States.

Can you discuss in greater detail the VideoRay Mission Specialists series? What are the key technology differentiators?

The architecture inside the mission specialist systems is modular. We work in an unforgiving environment, and things happen. When there is a problem, it needs to be fixed without sending something back to the factory.

So, we took our modularity concept to another level. I think a lot of ROV manufacturers today have modular thrusters. If a thruster breaks, you can go through and plug a new one in pretty easily, but every working component of the VideoRay can basically be replaced in a matter of three to five minutes by simply unplugging it and plugging it back in.

What we do is we provide the Navy that capability so that they can repair any systems that they need to, as close as they possibly can to the operator. [At the outset] they explained to us, "You're going to be measured on operational reliability."

We took that to heart, so we went through and looked at how we manufacture things, and we instituted what we call military grade manufacturing.

The other thing is flexibility. Because of the modularity, the VideoRay Defender gives them flexible payload integration. The open architecture of the mission specialist allows customers to go through and do this without VideoRay assistance. It allows them to go through and put different types of payloads for EOD or MCM operations pretty easily.

Can you discuss any recent case studies that highlight the VideoRay capability?

Well, my favorite I really can't discuss, and that's why the Navy choose VideoRay for program of record!

I think the one that I'll talk about is Proceanic, an offshore O&G company that does business globally out of Houston. The company revolutionized how VideoRay's equipment is used to do class inspections, saving them and their customers

millions of dollars. It's been disruptive to industry, which is great for us, and their customers are going through and getting really good inspection service, really high level engineering services at a fair and reasonable price.

Just one more question. How is VideoRay investing today to ensure its tomorrow?

We're investing several different ways, first and foremost in people, particularly as our business has grown significantly over a relatively short period of time.

But all of that goes through and ties into the technology. So, the people will help us grow and support our existing customers, but they'll also go through and help us develop this next, new generation of technology that ultimately is going to make it easier for people to do work underwater.

When you think today about how people pilot ROV systems, they have to deal with current and water visibility [among many other factors]. They have to know where things are, they have to have a really good understanding about spatial awareness about where things are underwater. That all changes with new technology that's being developed now.

How does data get analyzed? When I go through and I inspect something today, how does that data that I collect compare with an inspection that I did six months to a year ago?

We're also working on perceptive technologies, autonomous technologies and AI. So, all of those things will help robots find things underwater faster, navigate to them seamlessly, and then interpolate what to do when they go get there. Our systems will start to self-diagnose based on AI, which is both interesting and scary.

Advanced Navigation Expands DFOG Range

Advanced Navigation announced the expansion of its Boreas digital fiber-optic gyroscope (DFOG) range: the new A Series. The Boreas A90 and A70 are strategic-grade inertial measurement units (IMU) designed to deliver acceleration and orientation with accuracy, stability and reliability under all conditions with no reliance on GNSS. They also feature automatic gyrocompassing with favorable size, weight, power and cost (SWaP-C) characteristics.

MTR had the opportunity to discuss with **Advanced Navigation CEO Xavier Orr** the merits of the company's recent launch.

Image courtesy Advanced Navigation

What hole did you see in the market, and how do the new units aim to fill that hole?

Our world-first Boreas digital fiber-optic gyroscope (DFOG) technology represented a step-change for fiber-optic gyroscopes. With the addition of the A Series, consisting of the Boreas A90 and A70, we now have a greater ability to meet the rapidly growing demand for ultra-high accuracy solutions, even in the most demanding conditions.

The Boreas A90 and A70 are strategic-grade inertial measurement units (IMU) that deliver acceleration and orientation with superior accuracy, stability and reliability under all conditions with no reliance on GNSS. They also feature automatic gyrocompassing with industry-leading reductions in size, weight, power and cost (SWaP-C) compared to competing systems on the market. We created this technology to unlock new possibilities across an expanse of fields, from autonomous vehicles to subsea navigation and mining.

What specific applications will this have for the maritime/subsea markets?

The Boreas A90 and A70 are IMUs that contain ultra-high accuracy DFOG and high performance closed-loop accelerometers. Boreas A90 offers ultra-high performance, while the A70 offers high performance. Featuring ultra-fast gyrocompassing, both systems can acquire and maintain an accurate heading under all conditions with no reliance on GNSS. This makes them well-suited for maritime and subsea markets, where businesses often need to conduct surveying, mapping and navigation in GNSS-denied environments.

Can you give some specifics on the development?

DFOG is Advanced Navigation's patented technology, developed over 25 years involving two research institutions. DFOG was created to meet the demand for smaller and more cost-effective FOGs, while increasing reliability and accuracy.

The first generation of FOG made available in 1976 used analog signals and analog signal processing. The second generation was developed in 1994 and is still used to this day. It improved upon the first generation with a hybrid approach using an analog signal in the coil with digital signal processing. In 2021, FOG evolved into DFOG. This third generation of FOG sets itself apart by being completely digital, providing higher performance and reliability while enabling up to 40% reductions in SWaP-C.

The Boreas DFOG range is the world's only DFOG, and contains Advanced Navigation's sensor fusion algorithm, designed to extract significantly more information from the data by making use of human-inspired artificial intelligence. It was designed for control applications, with a high level of health monitoring and instability prevention to ensure stable and reliable data. Both the hardware and software are designed and

tested to safety standards and have been environmentally tested to military standards. Between 2021 to 2022, Advanced Navigation launched the Boreas D90 and D70 (D Series), both strategic-grade inertial navigation systems (INS) offering accurate and reliable navigation. The new A series was a natural step from the D series to expand product offerings, meet changing customer demands and capitalize addressable markets.

What are your maritime/subsea customers asking of you today that will further drive Advanced Navigations' product and service development for tomorrow?

The maritime and subsea markets are heavily trending towards using inertial navigation systems (INS) for marine navigation purposes. The primary reason is the INS' ability to provide updates at a higher rate than a GNSS. By using accelerometers and gyroscopes as the motion and rotation sensors to calculate the location, orientation and velocity of a moving object, INS can output data much faster and provide orientation data, roll pitch and heading.

Further, an INS can operate in GNSS-denied environments, such as out in the ocean, and any area with tall obstacles, ravines, canyons and valleys.

Also, driven by the commercial need to reduce vessel size, crew numbers, and minimize offshore time and carbon emissions, maritime companies are looking at alternative solutions to carry out marine-based assignments such as surveying and offshore inspection. The answer to this would be autonomous surface vessels with built-in artificial intelligence (AI) capabilities. Advanced Navigation has always been at the forefront of this. We integrate AI across our portfolio of navigation systems to deliver unparalleled capabilities and performance. This allows vessels and vehicles to make informed, AI-based decisions with high accuracy, ultimately helping companies to improve operational efficiency and safety, downsize crew and equipment and reduce time-to-mission.

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Resolute to the Core

The **JOIDES Resolution** embarks on Expedition 395 to understand the impacts of mantle plumes on deep ocean currents

By Celia Konowe

© Claudio Robustelli Test, IODP JRSO

The world's oceans, still largely unexplored, remain a treasure trove for scientists and researchers alike. Physical, chemical and biological features of the ocean interact with each other and in turn, influence oceanic, meteorological, atmospheric and even geological events. Drilling below the ocean floor for cores is a critical tool in the race to learn more about the Earth's history, current environmental dynamics, as well as their relevance for climate change and a rapidly warming future.

A leader in paleoclimatology, the study of understanding the climate and environmental change through Earth's history, is the JOIDES Resolution or JR for short. The name stands for Joint Oceanographic Institutions for Deep Earth Sampling and pays homage to Captain James Hook's HMS Resolution. The seagoing research vessel is currently embarked on "Expedition 395: Reykjanes Mantle Convection and Climate," running from June 12 through August 12. The project has three main goals, the first of which is to determine how the V-Shaped Ridges (VSR) and V-Shaped Troughs (VST) in the area along the Reykjanes Ridge (the area of the Mid-Atlantic Ridge just south of Iceland) were formed. These distinctive ocean crust patterns stretch over hundreds of kilometers on the seabed and are thought to be shaped by the mantle plume under Iceland, which is formed by hot rocks rising from deep within the Earth's interior. The second objective is to identify how the plume affects the circulation of deep cold water from the Norwegian Sea into the Atlantic Ocean (possibly through plume activity that contributed to changes in the height of oceanic gateways between Greenland, Iceland and Scotland). The third goal would determine how the structure of sediments and bedrock on the ocean floor influences how hydrothermal fluids change chemically over time.

Locations around the region were identified for sampling based on the expedition goals, seismic reflection surveys performed in the area, past expeditions and opportunities to observe and collect unique data. Site U1564, for example, is the most eastern site and located on both a perpendicular ridge and in the Gardar Drift. The drift sites are important, explained Jennifer Field, onboard outreach officer for Expedition 395, because sediments are deposited by cold-water currents from the Norwegian Sea and will indicate if the mantle plume causes an uplift and slowing of the flow. U1564 is also located away from VSRs and VSTs and will thus be used as a control site. Another promising site—and a new addition, at that—is hole U1602, which is located on an ancient VSR under the Eirik Drift, about 200 miles off the east coast of Greenland. The location is not only unexplored but may provide sediments that are millions of years old.

Full Steam Ahead

Expedition 395 builds on previously collected data from 395C, which was originally scheduled for 2020 and whose objectives were partially completed in summer 2021 with only one scientist and a team of marine technicians on board. With its complement restored, Expedition 395 has a full cohort of researchers and marine technicians, allowing for preliminary conclusions to be drawn at sea. Cores revealing the age, composition and history of sediments and basaltic rocks from both expeditions will inform the scientists and aid in forming a more accurate picture of the provenance of the sediments and formation of the bedrock, explained Field. This, in turn, will help each researcher identify what types of samples they need for their individual projects. Co-Chief Scientist Anne Briais

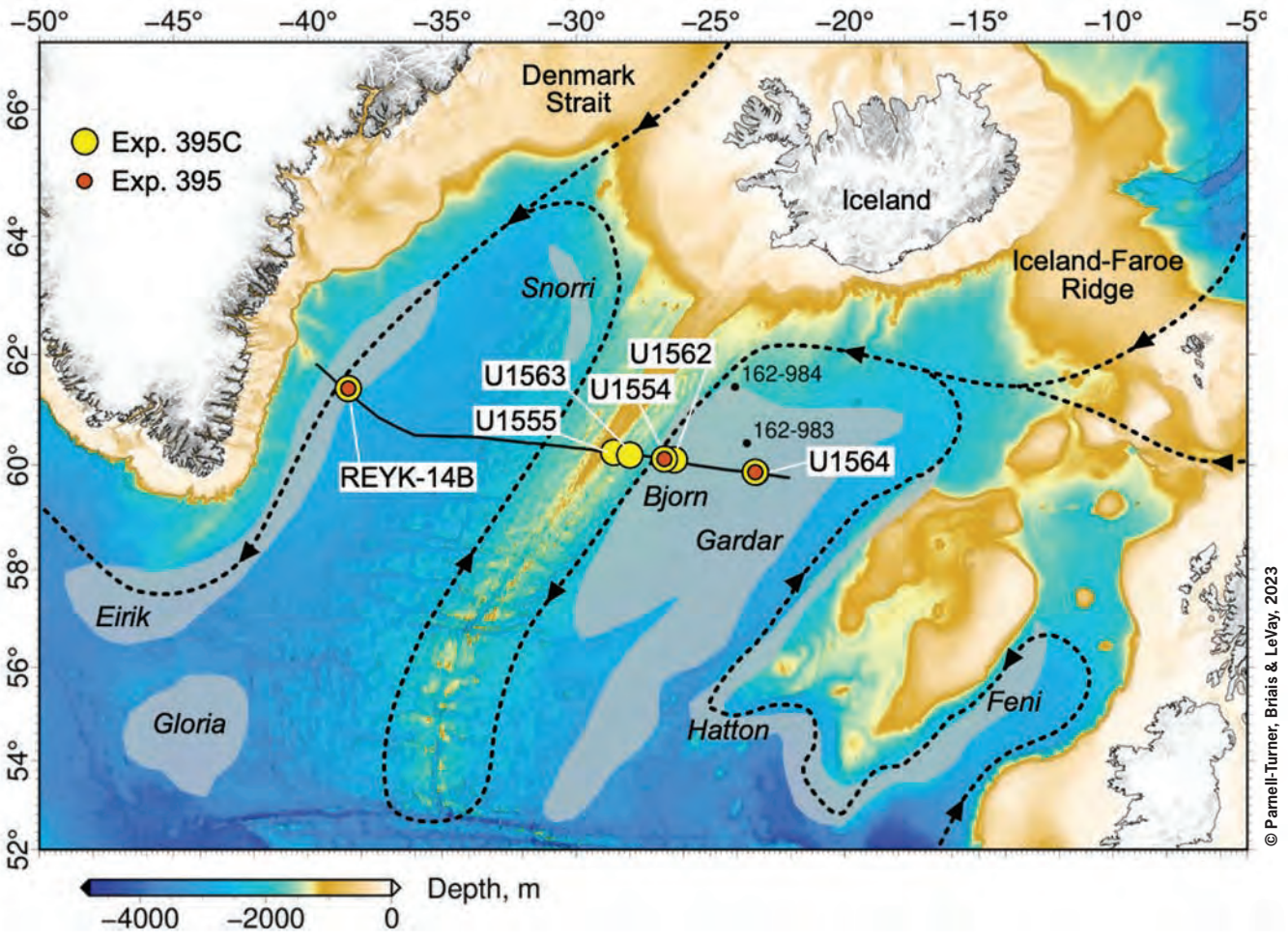
of the Centre National de la Recherche Scientifique and the Institut Universitaire Européen de la Mer at the Université de Bretagne Occidentale shared that her research is focused on basalt and the comparison between ridges and troughs. "I'm comparing the morphology of lava flows and correlating them to areas of the ocean floor further from the mantle plume. The three hypotheses of the creation of VSRs and VSTs and the role of the hot spot are crucial to understanding how mid-ocean ridges are working to build ocean crust."

Drilling Deeper

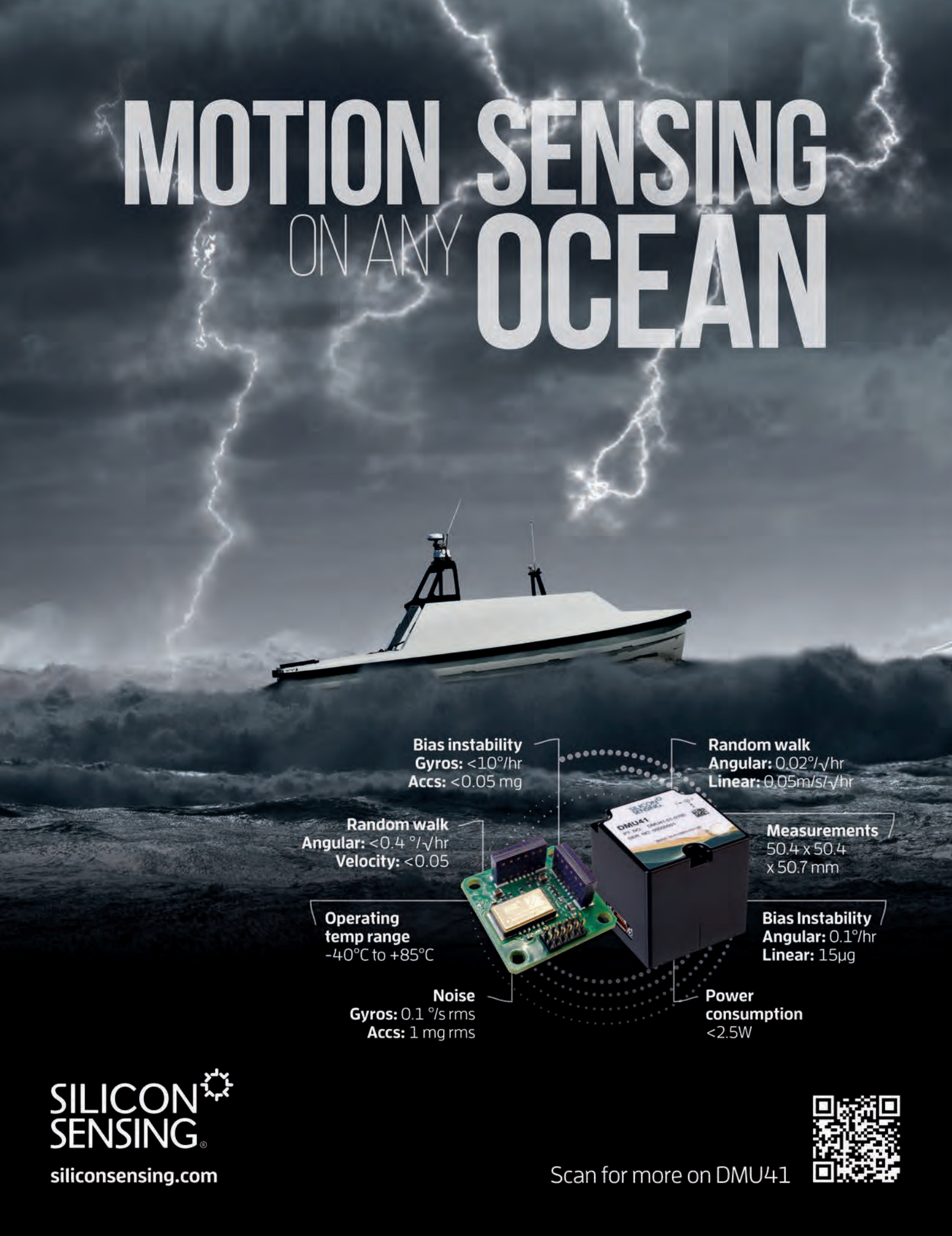
The JR is well-equipped with the advanced technology necessary to champion its role as a paleoclimate research vessel. Field shared that key features include a 3D x-ray scanner to see inside sediment cores, a scanning electron microscope to examine minerals inside rocks, and an inductively coupled plasma-optical emission spectrometer (ICP-OES) to measure the composition of fluid trapped in sediment. Most notable is the vessel's 60-meter derrick, which has the capability to lift more than 6,000 meters of drill string. As such, the JR is unparalleled in its use of a riser-less drilling system as the only globally operating research ship with this deep-water coring ability.

After the onboard coring technology is employed, samples go through preliminary examination to gather initial data. The cores enter a whole-round multi-sensor logger (WRMSL) and special task multi-sensor logger (STMSL), which measure properties like density and magnetic susceptibility, and then are sent into the whole-core x-ray machine. Cores are then split lengthwise, with one half set aside for archival purposes and one for onboard analyses. Samples are taken from the working half to test for physical properties such as moisture, density and magnetism, plus minerals and biological composition are examined under a microscope. Each scientist will conduct further analysis based on individual research needs. The archived half is imaged using a section half imaging logger (SHIL) and a section half multi-sensor logger (SHMSL), which record a photographic image and properties such as re-

Bathymetry, deepwater currents (dashed lines), contourite drifts (gray shading), Seismic Profile JC50-1 (solid line), and Expedition 395 and 395C sites.



MOTION SENSING ON ANY OCEAN



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Core on deck!
A full core arrives on the catwalk.

© Jennifer Field & IODP

flected light and magnetic susceptibility. The intensity and orientation of magnetism is measure and a description of the core is entered into a database. Archive halves are boxed and stored in a refrigerated space onboard and moved into a repository post-expedition for further research.

Uncharted Territory

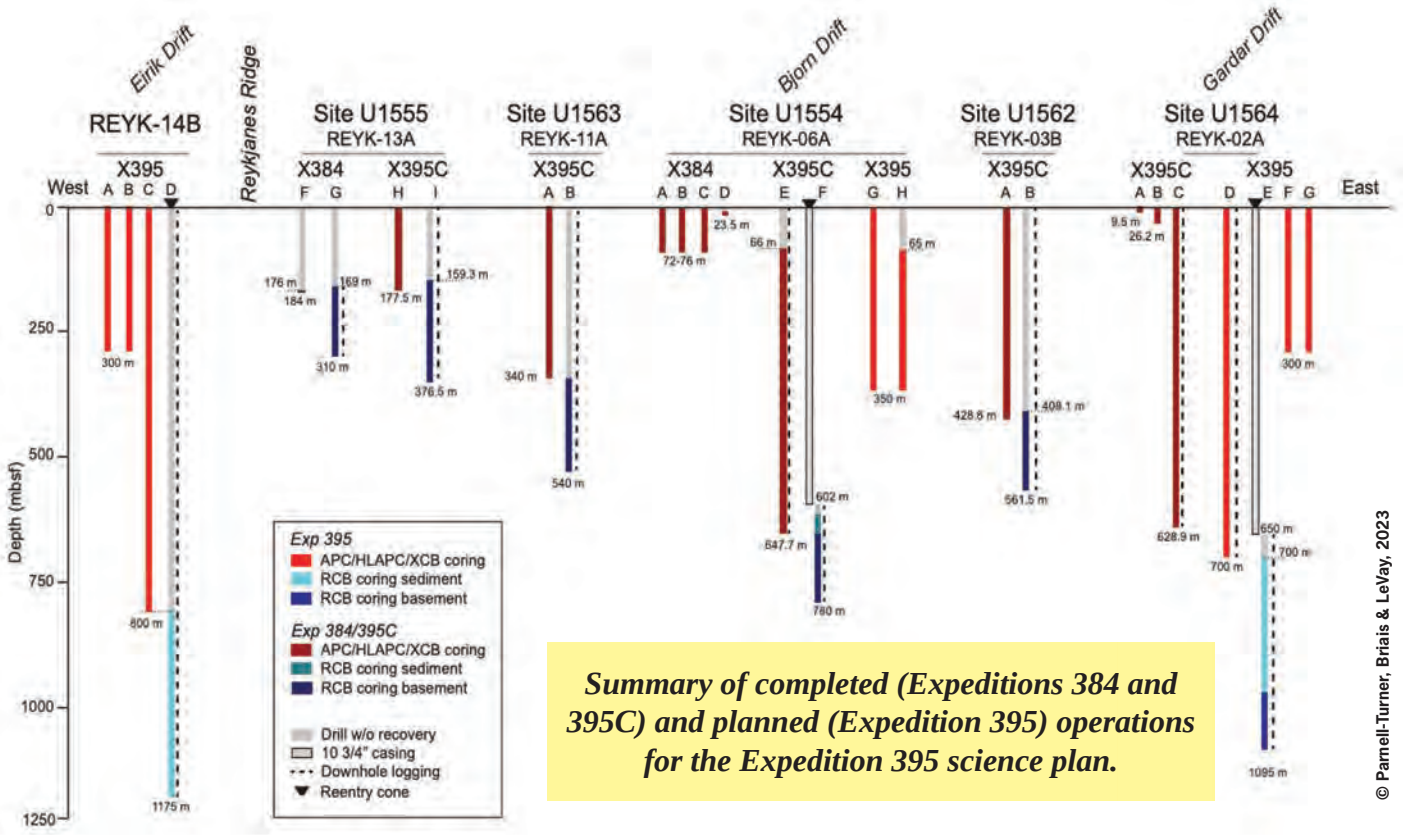
By coring through sediments in the drifts, Expedition 395 has the potential to reveal what the oceans were like during periods when the Earth was warmer, and in turn, what to expect in the current era of global warming. The team is also enthusiastic about findings from U1602, the new site on the Eirik Drift, as cores haven't been taken from that area before. "We are seeing patterns in the cores that indicate much change through geological history and we are hoping to reach sediments that are about 48 million years old," Field said.

Yet as is the cliché, all good things must come to an end. Expedition 395 marks one of the JR's last research trips with the International Ocean Discovery Program (IODP), a platform provided by the U.S. National Science Foundation (NSF) that focuses on the history and structure of the planet as recorded in seafloor sediments and rocks. The final year of full JR operations under the current arrangement will be Fiscal Year 2024, noted the NSF in a press release. The vessel is owned by Overseas Drilling Limited (a subsidiary of Siem Offshore AS) and operated by the JR Science Operator (JRSO) at Texas A&M University. The JR began working for the Ocean Drilling Program in 1985 until the IODP (then under the name of Integrated Ocean Drilling Program) began in 2003.

Despite not renewing its agreement with the JR due to rising operational costs, the NSF intends to continue supporting the U.S. scientific ocean drilling community through research investments and plans for future activities. "Scientific ocean drilling has significantly contributed to understanding the broader Earth system and NSF recognizes the importance of these contributions," the organization stated. "By ending support for the JR now, funds and resources can be directed towards ensuring a sustainable future for the scientific ocean drilling community."

At the time of writing, the JR was exactly halfway through Expedition 395, with a month left on data collection and countless mysteries of the deep ocean and Earth's past to uncover. With the groundwork set in 2021, scientists at sea can build on previous research, make informed decisions in the field, and cohesively assemble a detailed history like never before. "We are really excited to be able to continue drilling in sites that were previously drilled in 395C as this has given us a reliable image about both dates and conditions back through the Miocene," said Field.

The sediment cores from Expedition 395 will provide unprecedented insight into mantle dynamics and how these influence changes in the planet's interior, oceans and climate. The relationships between Earth's natural processes is a complex one, as well as a precursor for future climate mitigation and adaptation. With each core the JR collects, one more piece is added to the deep-sea puzzle.



Summary of completed (Expeditions 384 and 395C) and planned (Expedition 395) operations for the Expedition 395 science plan.

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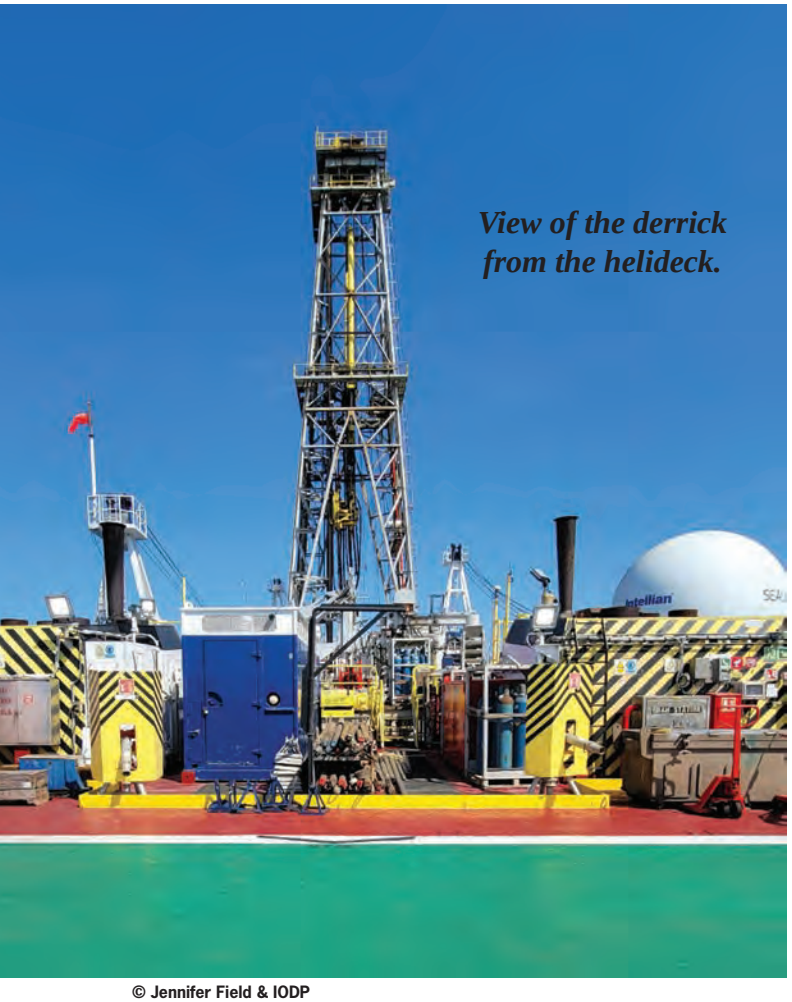


View of the derrick from the helideck.

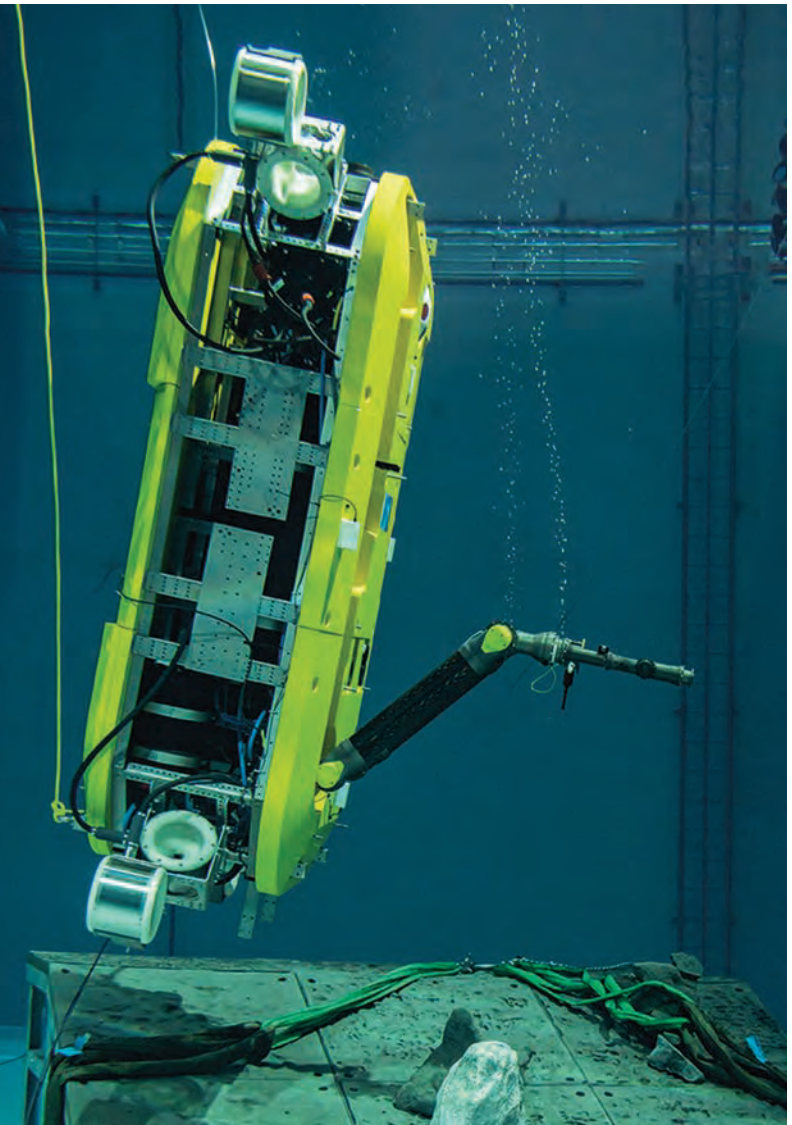
© Jennifer Field & IODP

THE HUNT FOR UXO

Detection and remediation of unexploded ordnance (UXO) certainly fits the bill when talk turns to removing the diver from dirty, difficult and dangerous situations. Here's a look at a few systems that are making waves.

Greensea Systems demonstrated its capabilities on a mission to locate buried munitions in the surf zone. This UXO survey demonstrated the value of OPENSEA to integrate and deploy a new sensor suite for the task while showcasing the capabilities of the Bayonet 250 AUGV, which was selected as a finalist in The Defense Innovation Unit's (DIU) Autonomous Amphibious Response Vehicle (A2RV) program's rapid prototyping phase. Out of 67 proposals, the Bayonet 250 crawler prototype, developed in partnership with Greensea, was chosen for its performance and potential to detect, identify, and neutralize naval mines and other explosive hazards in the surf and beach landing zones. Operating over eight days and covering 18 sq. km in depths of up to 10 ft., amidst wave heights of 4-6 feet in the challenging surf zone, the Bayonet 250 provided a stable and reliable platform for conducting the survey that included a towed sled equipped with White River Technology's (WRT) marine APEX technology, integrated into Greensea's software platform, OPENSEA. "We are very excited about the recent success of crawler-based 3DEM sensing for advanced geophysical classification of munitions in the most challenging environments like surf zones", said Greg Schultz, CTO for WRT. "The combination of autonomous amphibious crawlers, like the Bayonet units, and the WRT APEX dynamic electromagnetic classification arrays, appear ready to go where divers and towed systems have not been able to in the past".

The rapid integration of the sensor sled facilitated the detection and classification of objects, with a buried depth of up to three meters based on material composition. Throughout the mission, the Bayonet 250 successfully identified buried targets based on burial depth and signal signature, highlighting its ability to detect and identify explosive hazards in both the surf and on beach landing zones.



DFKI AI

By some estimates, more than one million tons of munitions dumped in the North and Baltic Seas during and after the two world wars still today poses a threat to humans and the environment. Technologies designed to enable robots to identify and mitigate UXO are being developed by the Robotics Innovation Center of the German Research Center for Artificial Intelligence (DFKI) headed by Prof. Dr. Frank Kirchner in the current CleanSeas project.

The German Federal Ministry of Education and Research (BMBF) is funding the CleanSeas project, aiming to create the technological basis which enables robots to autonomously detect and handle critical infrastructures underwater. To that end DFKI's Robotics Innovation Center is developing AI solutions for the following three areas:

1. Precise navigation in the close range of critical objects,
2. 3D reconstruction of objects using various sensors, and
3. Whole-body control for (partially) autonomous object manipulation.

The AUV performs manipulation tasks on an underwater mockup in an upright position. Photo copyright DFKI, Thomas Frank

Clearing the beach with the Bayonet 250. Photo Bayonet

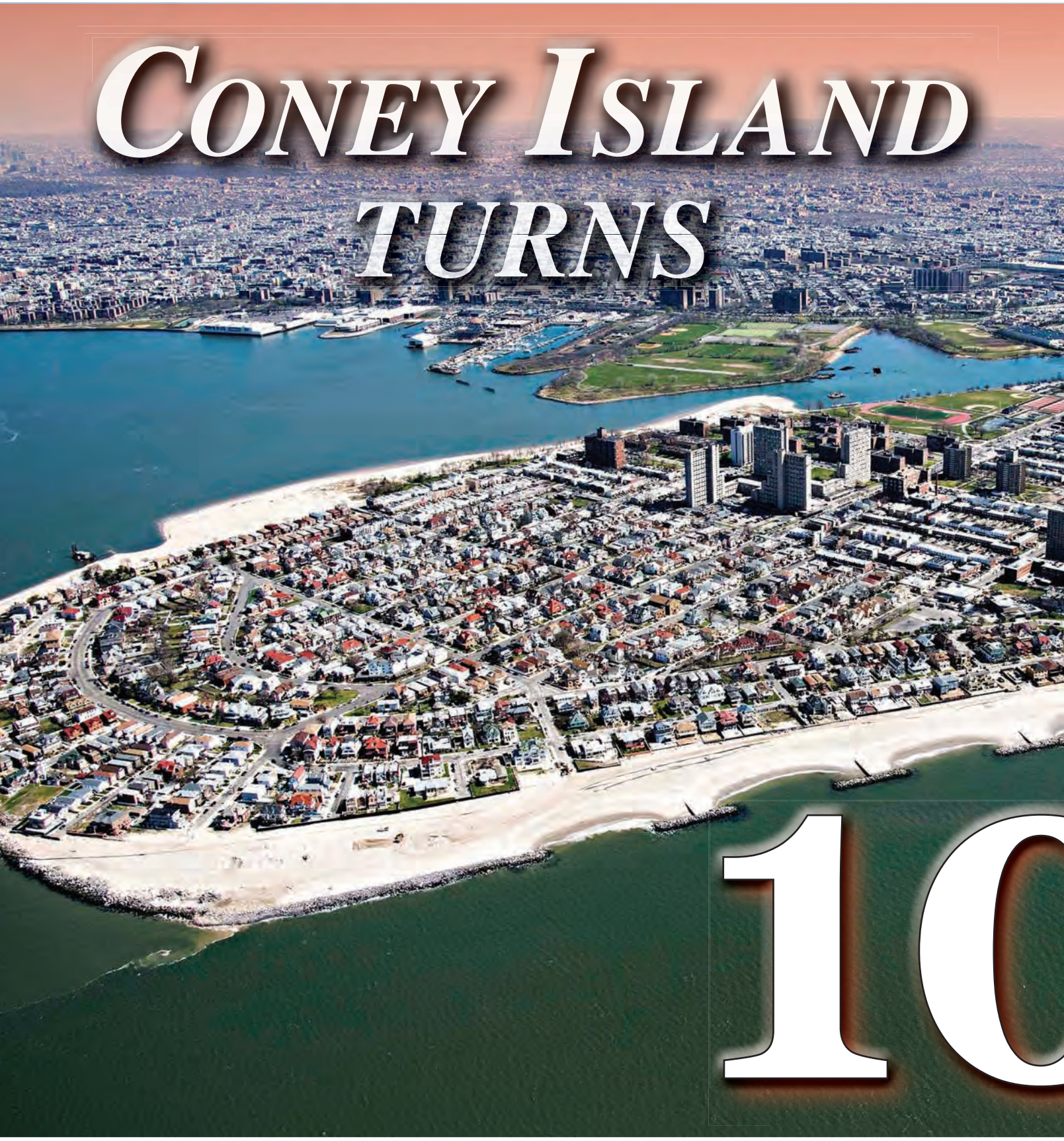
The autonomous underwater vehicle (AUV) Cuttlefish, developed at DFKI, serves as the robotic test platform. The AUV has two deep-sea capable gripping systems for flexible handling of objects underwater. Thanks to its design and AI-based control, it can change its center of gravity and buoyancy during a dive and assume any orientation. Comprehensive environment perception thanks to sensor fusion and generative AI In the case of recovering munitions from oceans, the AUV must be able to approach its target object without colliding with it. For this purpose, the vehicle is equipped with a variety of sensors such as sonars, cameras, laser scanners and magnetometers.

However, due to the highly variable environmental conditions underwater, the robot can only partially sense its surroundings at a low resolution, impeding navigation and object detection. So the scientists combine acoustic and optical sensor data using probability-based sensor fusion. Thus, the quality of the high-resolution camera data especially depends on the prevailing light and visibility conditions. Acoustic sensors, however, are independent of visibility conditions, but only provide data with significantly lower resolution. In addition to that, their functionality is limited at close range. To close the gaps in object detection, the researchers are also relying on the use of generative AI algorithms. This involves training a neural network so that it can generate camera-like images based on low-resolution sonar data. That way, a comprehensive reconstruction of the target object in 3D is possible. To enable precise arm movements, the entire vehicle, including the arms, must be included in the control. Therefore, the scientists are resorting to modern approaches of whole-body control, which they combine with learned behavior. A deep neural network-based algorithm learns how the vehicle behaves under different conditions. Thanks to the learned hydrodynamic model, the AUV can precisely readjust its pose automatically at runtime. To avoid arm collisions, the researchers are also developing software that coordinates arm movements in real time. Tactile force sensors on the robotic grippers allow sensitive and, in case of doubt, compliant handling of ammunition residues. The aim of the manipulation is to attach lifting gear to the casings of old ordnance in order to lift and transport it.

Seamor UXO Detection System

Seamor Marine's Chinook ROV is making waves in the field of UXO detection after a successful compact magnetometer integration with subsea engineers at Ocean Floor Geophysics. ROVs hold promise to subsea engineers designing magnetometer scanning systems, however, technicians have been challenged by the electro-magnetic interference created by the electrical systems of these smaller units. Earlier this year, Seamor Marine was contracted at the request of a private client through Ocean Floor Geophysics for a third-party integration of their magnetometer with the Chinook ROV. "Seamor's Chinook is compact, maneuverable, and reliable," said Nathan Ehrenholz, subsea robotics engineer at Ocean Floor Geophysics. Most ROV pilots make use of the built-in, movable camera during inspections and scans, but that was not an option for this trial. The solution was to fix the camera in place, using the Chinook's quiet thrusters to reposition the magnetometer while mapping rather than the pan/tilt feature of the built-in camera.

Coney Island Turns 10



Credit: USACE

Preserving an iconic beach for future generations

By JoAnne Castagna, Ed.D.

When Rifat Salim came to the United States from Pakistan as a young girl with her mother and siblings to reunite with her father after years of being a part, one of the first places he suggested they visit is Coney Island, a famous beach and amusement park destination in Brooklyn, New York City that's visited by more than 5 million people annually.

She said, "Me and my brother and sisters were excited to go to the beach. We were wearing our ethnic clothes because we don't wear bikinis. When we got there, we ran towards the beach and put our feet in the cold water. I remember to this day the feeling of water and sand slipping away from my feet. It was a wonderful experience."

Coney Island was Salim's first impression of America and would continue to play a role in her life. After getting her citizenship, she became an engineer and now works for the U.S. Army Corps of Engineers, New York District, an agency that's helped to preserve this beach for future generations, including her own children.

The Army Corps does this not just because the beach is historic, but more importantly because it plays a role in protecting the community from coastal flooding and sea level rise.

Coney Island, is a peninsular neighborhood of around 115,277 residents and is located on the southwestern section of the New York City borough of Brooklyn. The area is about 4 miles long and a half a mile wide and includes Coney Island Proper with Brighton Beach and Manhattan Beach to its east and Sea Gate, a private gated community, to its west.

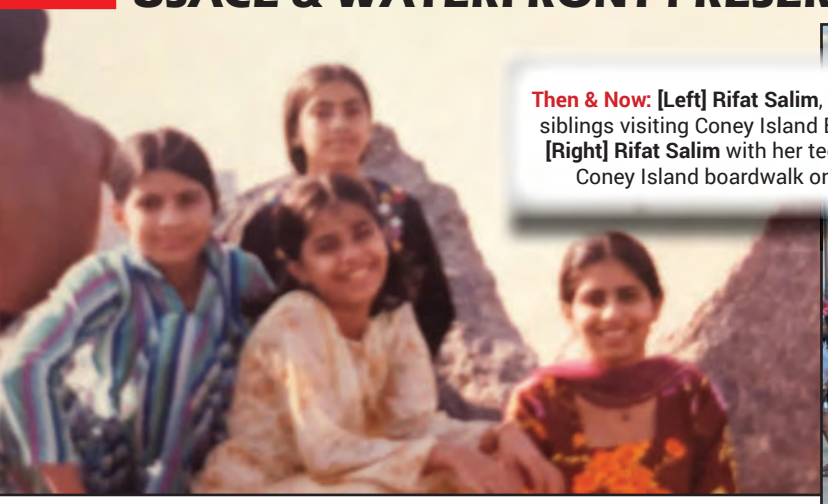
The waterways in and around the peninsula include the Atlantic Ocean and Lower New York Bay to the south and west and the Gravesend Bay and Coney Island Creek to the northwest.

Coney Island Beach extends 2.7-miles along the south shore of the peninsula and has a boardwalk that extends from Coney Island Proper to Brighton Beach.

The beach turns 100-years-old this and year and for the past century, the Army Corps has played a significant role in preserving it in collaboration with partnering agencies. Following is a brief history of the famous destination and the work the Army Corps has performed and continues to do today.

THAT WAS THEN

It the late 19th Century, Coney Island was America's biggest



Then & Now: [Left] Rifat Salim, far left, and some of her siblings visiting Coney Island Beach for the first time. **[Right] Rifat Salim** with her teenage daughter on the Coney Island boardwalk on the Fourth of July.

Source: Rifat Salim

and most visited seaside resort and amusement park destinations, boasting some of the largest and most luxurious hotels in the country, fancy fish houses and racetracks. It was so internationally famous that it was compared to the Eiffel Tower in Paris and the Pyramids of Egypt.

The destination attracted millions of visitors annually to its several competing amusement parks that included Steeplechase Park that had mechanical horses that carried guests around the grounds, Luna Park, that was considered a genuine fantasyland with large towers and camel and elephant rides, and Dreamland. In addition to many independent amusements.

Some of the attractions were so large that immigrants arriving from Europe on ship could see them from the water during the years before the Statue of Liberty was built.

Coney Island was also a place that showcased innovations. For example, it was the first place that many people experienced lightbulbs for the first time. In fact, Luna Park had 1,300,000 electric lights that enabled visitors to have fun for hours after dark.

The public's amazement of the park's lights even continues today. Salim said of her first visit there, "In the evening, it got so bright from all of the lights from the amusement park. It felt so festive."

Coney Island is also where modern American amusement was invented and was the first place to have rides, including having the very first roller coaster in the United States named the Switchback Railway.

In addition, Coney Island had the Wonder Wheel, a 150-foot-tall steel Ferris wheel, the Cyclone, a roller coaster with an 85-foot, 58-degree drop, and the 262-foot-high Parachute Jump. All of these attractions still exist today and are historic landmarks.

At this time, the beach at Coney Island was owned by adjacent landowners, but in 1923 it officially became a public beach and was expanded.

The New York City Department of Parks and Recreation increased the size of the beach by pumping sand onto the shore to build up the existing bathing area.

In addition, a boardwalk was constructed and named in honor of then Brooklyn borough president Edward Riegelmann. This was done by erecting concrete piles and pile caps out in the water and laying timber stringers and decking.

This new boardwalk, as well as new subway service in the 1920's helped to draw more visitors.

During this time, the park started to feature many sideshows and entrepreneurs, such as Nathan Handwerker, started selling hot dogs for a nickel, which would eventually turn into the Nathan's Famous hot dog chain known today.

From the mid-20th Century to the 1970's, Coney Island experienced a slowdown in its popularity but work still continued on maintaining the beach.

During the 1940's - 1950's, the Parks Department constructed boulder jetties off the beach to extend wooden ones already there to slow down erosion of the shore.

Jetties are long, narrow structures that protect the shoreline of a body of water by acting as a barrier against erosion from currents, tides, and waves.

Sand erosion of the beach is a natural occurrence. Beaches naturally lose sand over time due to wave action and longshore currents. When hurricanes and coastal storms occur, breaking waves and elevated water levels can change the width and elevation of beaches and accelerate erosion, which can make a beach community vulnerable to storm risks.

During this time, the Parks Department also altered the boardwalk to accommodate the New York Aquarium that was relocated from Battery Park in Manhattan.

The aquarium still exists today, and Salim takes her children there often. She said, "My kids love to visit and observe sea animals, such as sharks, stingrays, dolphins, whales, and various fish."

Salim isn't the only Army Corps employee that has a connection to Coney. Years ago, Steve Weinberg lived in Coney Island and worked for the aquarium before he became an en-

gineer for the Army Corps.

He said, “In the 1980’s I was responsible for feeding the aquarium’s Osborne Laboratory tanks and cleaning them on the weekends and during the summer.” He’s has worked for the Army Corps for 35 years and today is the Chief of Civil Works Section, New York District, U.S. Army Corps of Engineers.

Weinberg added that they were expanding the aquarium while he worked there and during the construction that took place on the old Dreamland property, a lot of history was uncovered.

He said, “I’ve always loved the history of Coney and during the construction many interesting things were unearthed including old cups and bowls, a giant compressed gas tank that required calling the bomb squad, the foundation of one of the park’s towers, and perhaps most mysteriously - a small boat found in the middle of the beach! Was it buried by rum runners? I eventually learned that most of the beach was artificial and constructed in the 1920’s. Presumably the boat had sunk in the ocean and was buried when the city had built the beach.”

After Hurricane Sandy in 2013, the U.S. Army Corps of Engineers, New York District placed roughly 580,000 cubic yards of sand on Coney Island Beach to replace sand lost during the hurricane and also to restore the Coney Island Project to its original design profile from when the coastal storm risk reduction project was originally constructed in the 1990’s.

Credit: Chris Gardner, Public Affairs

EXPANSION

Expansion of the beach continued in the 1960’s, when the Parks Department extended the bathing area and boardwalk further east into the Brighton Beach area and constructed a public restroom. Several years later more public restrooms, new lifeguard stations, and a shade pavilion were established.

Brooklyn borough president Howard Golden began replacing the boardwalk’s decking in phases in the 1980’s and this work continued over the next two decades.

In the early 1990’s the Army Corps began working on the beach in collaboration with the Parks Department and the New York State Department of Environmental Conservation. They started the Coney Island Shoreline Protection Project to restore the beach that was eroding and was putting the coastal community at risk.

The Army Corps restored approximately 3-miles of the beachfront with dredged sand, increasing its height and width and created dunes.

Replenishing sand and creating dunes on a beach can help to reduce future coastal storm risks. A beach’s size, shape and sand volume help determine how well the beach can reduce risk to a developed community during a storm. Sand and dunes act as a buffer between the waves and storm water levels and structures landward of the beach.

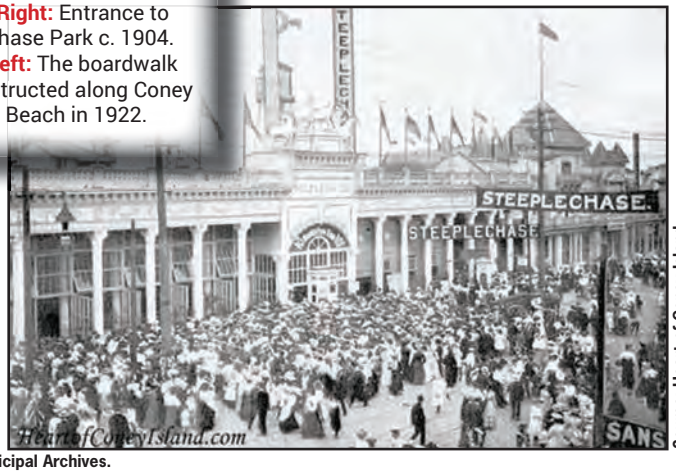
To slowdown future beach erosion, the Army Corps placed 600 tons of stone and approximately 35,000 cubic yards of sand adjacent to a groin located on the western portion of the Coney Island peninsula in Sea Gate.

Groins are shoreline structures that are perpendicular to the beach that are designed to retain sediment from moving along the shore and help maintain the wide beaches by minimizing or slowing down erosion.

Placing stone and sand adjacent to the groin will help prevent storm induced waves from reflecting off the sides of the groin sideways along the shore, causing the shore to erode further.

Source: Heart of Coney Island

Above: The original Luna Park in 1903.
Bottom Right: Entrance to Steeplechase Park c. 1904.
Bottom Left: The boardwalk being constructed along Coney Island Beach in 1922.



Source: Heart of Coney Island.

Photographer: Edward E. Rutter. Source: Borough President Brooklyn Collection. NYC Municipal Archives.

In 2001, a stone revetment was constructed near this groin to further slowdown beach erosion. A stone revetment is a wall that protects against erosion caused by wave action, storm surge and currents.

From the mid-20th Century on, Coney Island went through some ups and downs, much like the rides it's famous for, that included World Wars, the Depression, and urban change.

Even so, Coney Island, has proven to be resilient and in the early part of the 21st Century was experiencing a revitalization that included constructing many new businesses and attractions including a new Luna Park on the grounds of the original amusement park and a new baseball stadium.

AND THEN THERE WAS SANDY

However, just as things were picking up for the historic park, it faced a new challenge in October 2012 – Hurricane Sandy, a storm like no other. Sandy's intense winds created an unexpected storm surge that created 14-foot-high waves that pushed sand and water up and over the boardwalk, merging with water from Gravesend Bay and Coney Island Creek, inundating the entire peninsular from every direction.

Almost every establishment was flooded with water and sand including the amusement park, aquarium, the subway system, the Coney Island Hospital, as well as many houses and high-rise apartment buildings.

The most destructive storm to arrive in New York City in recent history, left 43 New Yorkers dead and many without power, heat and hot water for months.

Immediately after the storm, the Army Corps was on the ground responding, both through its own response authorities and providing disaster response assistance for the Federal Emergency Management Agency.

Sandy's devastation also included extreme erosion of the shore putting the Coney Island community vulnerable to future storms. Coney Island Beach lost 600,000 cubic yards of sand.

The Army Corps received funding and authority to restore Coney Island with the Hurricane Sandy Disaster Relief Appropriations Act of 2013 or "Sandy Bill."

The bill authorized the Army Corps to not only repair engineered beach projects by replacing the sand lost during Hurricane Sandy, but also to restore them to their original design profiles.

Anthony Ciorra, Chief of coastal restoration & special projects branch with the New York District, U.S. Army Corps of Engineers said, "In 2013, approximately 580,000 cubic yards of sand was placed onto Coney Island Beach, to repair damages caused by Sandy and to restore the project to its authorized design condition." Ciorra was the project manager for the Coney Island Shoreline Protection Project from 1995 to 2004.

After Sandy, the Army Corps examined its beach nourishment projects across the northeast United States, to identify what projects were more effective in reducing storm risk to the shore communities.

Ciorra said, "The analysis showed that the communities located near beaches that had previously received beach nourishment and dune construction sustained less damages and saved billions of dollars in avoided damages."

Coney Island Beach was one of these beaches. The beach's sand was elevated to protect against storm surge and erosion. Hurricane Sandy's surge pushed sand and water up and over the beach's boardwalk, but the impacts behind the constructed project were not as bad as they could have been. "The beach's higher elevation avoided an estimated $494 Million in damages to houses and structures," said Ciorra.

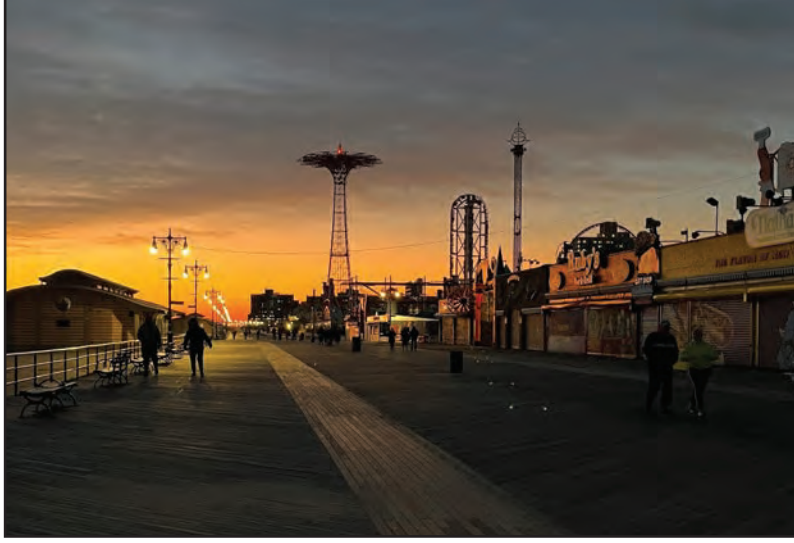
In 2016, the Army Corps performed additional measures in Sea Gate, to further reduce erosion. This work included constructing four stone groins and placing 75,000 cubic yards of dredged sand around them, as well as placing stone near an existing groin.

In addition, an existing dike received additional stone armoring. A dike is an onshore structure that protects low-lying areas against flooding. They are usually built as a mound of fine material with a gentle seaward slope in order to reduce the wave runup and the erodible effects of the waves.

Lastly, accumulated sand was removed from in front of several bulkheads or retaining walls along the water. A retaining wall helps to stabilize a shoreline.

After Hurricane Sandy, Coney Island bounced back, and the parks were able to reopen the following year, making that year's annual Mermaid Parade and Nathan's Hot Dog Eating Contest, extra meaningful for visitors.

However, the Army Corps' work has not ended. It wants to make sure that the area can better withstand the wrath of future Sandy-like storms and sea level rise, so it's created the New York and New Jersey Harbor and Tributaries Coastal Storm Risk Management Feasibility Study. The study provides a full range of coastal risk reduction measures for communities to contemplate and provide feedback on to the Army Corps.



Credit: JoAnne Castagna, Public Affairs

The Coney Island Beach community has provided its feedback on the study that would affect every part of the peninsula. On the northside of the peninsula, sea walls, flood walls, and levees would be tied into a mechanical tide gate storm surge barrier to close off Coney Island Creek to prevent flooding. On the southside of the peninsula, the boardwalk would be raised five feet by adding a concrete walkway to prevent flooding from storm surge.

THE CENTURY MARK

This year, Coney Island Beach turns 100-years-old and with the Army Corps' work it's sure to continue to be an iconic destination for future generations and most importantly a safe place to live with the reality of more frequent stronger storms and sea level rise.

Ciorra said, "The most rewarding part of working on Coney Island for me was restoring an historic beach that benefits the local traditionally underserved communities in terms of providing coastal storm risk management measures to reduce the threat to life and property, as well as provides recreational opportunities."

Weinberg said, "Part of the honor of working for the Army Corps is how quietly and anonymously we do so much to preserve peoples' lives and property. My father, who lived in Coney Island was also proud of our work. He's watched the Army Corps work from his terrace and called me every day with progress reports. My hope is that the beach continues to help protect people, and that it remains a place where a teen brings their date for day of fun and where a mother takes her children body surfing."

Today, Salim is one of those mothers. She takes her children to Coney Island every summer. She said, "There's so much to enjoy – the beach, rides, and the aquarium. On the beach, the kids love to dig in the sand and pull-out mole crabs. In fact, because of our frequent visits to the beach and aquarium, my teenage daughter has developed a strong passion for marine biology and is ecstatic about the possibility of volunteering for the New York Aquarium this summer."

She added, "Something we never miss during the summers is Coney Island's annual fireworks show on Independence Day, the Fourth of July." For a first-generation American who was greeted to this country by Coney's waves washing up and over her feet, this seems appropriate.

Ørsted Invents, Patents New USV

Source: Ørsted

Ørsted has designed and developed and patented an uncrewed surface vessel (USV) dubbed Hugin USV for offshore met-ocean measurement campaigns. The USV has a built-in navigation system, which enables it to transit from shore at various degrees of autonomy, and it can be controlled both in line-of-sight or from a beyond-line-of-sight remote control center. The USV is designed as a generic sensor platform and can collect large amounts of data. The prototype was built by Tuco Marine Group, and the control system was delivered by Maritime Robotics AS. The prototype vessel has been tested in Danish and Norwegian waters and has been operational during hurricane conditions, where it experienced waves up to nine meters in the North Sea. Hugin USV has also achieved type validation as a floating LiDAR system by DNV, enabling it to be used for commercial operations related to wind farm development. The results are so good that Ørsted has started a serial production of a new class of USVs. The plan is to produce five new USVs by the end of 2023.

Austal USA inks Deal to Design, Build Ocean Surveillance Ships

Austal USA won a contract potentially worth more than $3 billion for the detail design and construction of new TAGOS-25 class ocean surveillance ships for the U.S. Navy. The $113.9 million fixed-price incentive (firm target) and firm-fixed-price contract includes options for detail design and construction of up to seven T-AGOS 25 class ships which, if exercised, would bring the cumulative value of the contract to $3.195 billion. Austal, as the prime contractor for the TAGOS program, has teamed with L3Harris Technologies (L3Harris), who will serve as electronic and propulsion systems integrator. Other contractor partners include Noise Control Engineering (NCE), TAI Engineering (TAI) and Thoma-Sea Marine Constructors (TMC). Operated by Military Sealift Command (MSC), T-AGOS ships provide a platform capable of passive and active anti-submarine acoustic surveillance for the Navy's Atlantic and Pacific Fleets. The 110-meter, steel 'small waterplane area twin hull' (SWATH) vessels support the Navy's Integrated Undersea Surveillance System (IUSS) by gathering underwater acoustical data using Surveillance Towed-Array Sensor System (SURTASS) equipment.

Source: Austal USA

Cource Freire Shipyard

IFREMER to Build New RV

Freire Shipyard signed a contract with IFREMER - the French national institute for ocean science - for the construction of a new 40.3-m vessel for the French oceanographic fleet. It will be designed to deal with all disciplines of oceanography in Atlantic coastal areas: geosciences and paleoclimatology, physical oceanography and biogeochemistry, biological oceanography, and ecosystem functioning, from the coastline to the continental shelf. It will also perform duties related to fishery on the continental shelf and will accommodate a crew of 12 people and 10 scientists, allowing for training campaigns with teachers and students on board.

The oceanographic research vessel stands out for the wide range of energy savings technologies and low-consumption solutions implemented: from the hull design, the design of the power plant, the power distribution system, the heat recovery system, the level from thermal insulation to the efficiency of air conditioning.

The diesel electric propulsion system will combine three main variable speed generator sets (suitable for operation on biodiesel), two shaft lines driven by electric motors and a DC electric distribution system, which together with a battery pack will offer great performance of the power plant, optimization of consumption, good redundancy, and outstanding acoustic performance (not only in terms of compliance with BV COMF 2 class notation but also with DNV SILENT-F standard). The dynamic positioning system and the electric bow thruster facilitate the maneuverability of the boat.

It will have an oceanographic marine telescopic main crane at the stern for marine use designed to launch and to recover scientific equipment (corer, buoys, etc.) and general handling on the aft part of the vessel. In addition, she will have a type A stern gantry, a T-type lateral gantry and a telescopic rail beam for CTD maneuvering. For fishing operations, this boat will also have two trawling winches and a removable net drum.

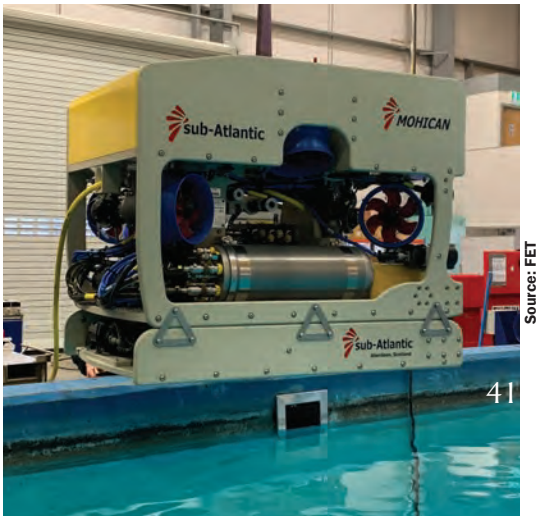
Source: SMD

Indonesia's Basarnas Buys SMD Atom ROV

Indonesia's national search and rescue agency, Basarnas, purchased a Hydraulic Atom ROV from Soil Machine Dynamics (SMD). The ROV has been acquired to support the organization's rescue teams reach deeper waters. Where divers were previously limited to 100 meters maximum, SMD's equipment will be used to facilitate rescue missions at 1,000 meter depths. The deal was facilitated by independent agent, PT Kindah Abadi Utama, and SMD will deliver the ROV to Basarnas in 2024.

FET ROV for Memorial University

Forum Energy Technologies (FET) won a contract from the Memorial University of Newfoundland to supply an electric observation-class remotely operated vehicle (ROV) to its Fisheries and Marine Institute (MI), School of Ocean Technology. The primary function of the Sub-Atlantic Mohican ROV system will be to support ocean research, while it will also be used for pilot technician training. For ocean research operations, the ROV will be required to carry a payload skid for navigation, equipment and sensors, as well as be capable of manipulation and intervention. The Mohican is equipped for inspection tasks, non-destructive testing, (NDT), light intervention, pipeline/cable/seabed survey, diver assist/safety, harbor and port security, scientific survey and data collection, renewable energy projects, civil engineering, long tunnel excursion and for inland waterways.



Source: FET

Hydromea, Unplugged Team

Hydromea partnered up with Unplugged, a Norwegian provider of inductive charging and data transfer technology, to develop a resident underwater drone system for continuous inspection and monitoring of underwater assets. The partnership received $2.2m in grant funding, and the project will take 30 months to complete.

Source: Hydromea, Unplugged

The partners aim to develop a robust, resident drone solution with the initial focus on the aquaculture industry.

Oceanbotics Debuts SRV-8X Optimus ROV

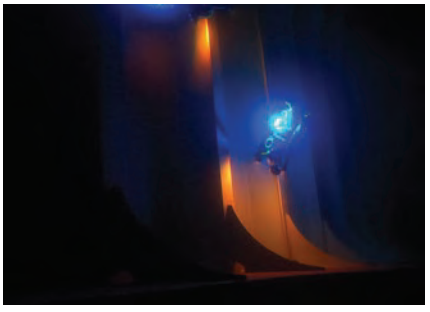
Oceanbotics launched its new, larger, underwater ROV, the SRV-8X Optimus which the company said is a larger and more powerful version of its SRV-8 ROV. The SRV-8X Optimus offers offering significant payload capabilities and an increased number of sensors for more demanding and deeper underwater missions.

Source: Oceanbotics

The ROV is battery operated, permitting improved range and ease of movement (down to 500m depth). It also offers data synchronization with SubNav-X software for seamless integration of optional accessories and a “plug-n-play” installation.

Type-Approval for Underwater Inspection Robot

Air Control Entech (ACE), a remote technology specialist headquartered in Scotland, received class approval from DNV for Hydromea’s EXRAY underwater inspection robot for Visual Remote Inspection Technology (RIT), paving the way for certified inspections of flooded spaces at offshore floating platforms. EXRAY, developed by Hydromea, is an underwater inspection robot specialized in inspecting submerged areas. With the DNV class approval, ACE can now offer its clients certified inspections of flooded spaces at offshore floating platforms, ensuring compliance with industry regulations and enhancing operational integrity.



Source: AirControl Entech

Blue Venture In-Water Equipment Demo Day

Patrick Pasteris holding a profiler.

Images: Blue Venture Forum/Maggie Merrill

A Jaia Bot being thrown into the water.

At the Blue Venture In-water Equipment Demo day earlier this year, the Blue Tech ecosystem located in Southeastern New England was on full display. Companies were given a platform to introduce their products to the standing-room-only audience in the upper level of the Roger Williams University Sailing Center followed by in water demonstrations off the docks facing Narragansett Bay.

To kick things off, **Kevin Rosa** founder of **Current Lab**, provided a high resolution forecast of the current conditions around the in-water demo area. Its proprietary ocean modeling system generates predictions of currents, temperature, and salinity at up to 50 times finer detail than conventional global ocean models.

Walter Schulz, founder of the **STEC Reactive Cyclical Induction (RCI) system** for marine diesel engines, gave an impassioned pitch about the impact of marine diesel engine pollution. His passion for eliminating or reducing marine diesel toxins drove him to develop a the RCI system to reduce NOx by 80%, and other harmful emissions by up to 50%. STEC's RCI can be installed on newbuilds as well as for retrofitting existing diesel engines.

In an early spring Nor'easter, attendees lined the upper gangway to see equipment in the water. Three JAIA Robotics' JAIA Bots, were literally thrown off the dock to show how fast they can gather data and get back using an RF link to a handheld tablet. The Bots are used for environmental monitoring, surveying, payload delivery, and reconnaissance operations.

The **Aurelia Upper Ocean Profiler,** was set up in the water to track water velocity near the dock. It is touted as an inexpensive, lightweight and user-friendly vehicle for scientific data gathering and surveying. **Patrick Pasteris**, founder, explained they are transitioning out of research and development and will be looking for partners to move forward into design for manufacturing and commercialization.

The day was not just about getting wet, there were presentations by up and coming start-ups and several RWU students who had a chance to strut their stuff, in front of a group of investors who showed up purely to "shop" Blue Tech.

Blue Venture Forum is known for bringing people, technology and funding together for networking and the Demo Day was no exception. At the end of the day the entire group attended a closing reception that was sponsored by RWU President Dr. Ioannis Miaoulis who talked about RWU's participation in the blue economy via their engineering, law and marine biology departments.

As Blue Venture Forum Founder and Director **Dr. Tobias Stapleton** said, "dozens of blue tech companies have formed up around the world, over the last five years. Climate and clean tech investors are now looking at blue tech because they see growth opportunity in the sector and they compare the trajectory of "blue" tech today with where "clean" tech was 10+ years ago. And it is widely recognized that the oceans play a critical role to the planet's climate, so we need to develop technology to better understand our oceans. More than $20 billion dollars has been raised or allocated towards blue tech via private, philanthropic, and governmental investors."

The 9th Blue Innovation Symposium takes place February 26-29, 2024 at the Wyndham Newport Hotel in Middletown, RI. For more information visit: www.blueinnovationsymosium.org

New Subsea Power Cable Cutting, Clamping Tool

Credeblug and Tecnalia have joined forces to improve the maintenance and repair operations carried out on underwater power cables. The end result: the manufacture and validation of the first cutting and clamping tool, which makes it possible to secure one end of a cable after it has been cut, aiming to save time and money.

"This functionality has been called for by offshore cable repair teams all over the world since such operations began in the 19th century," said Joannes Berquè, a TECNALIA researcher. "To this day, current cutting tools mean that the ends of the cable drop off after they have been cut. The repair operation then requires an additional search for the end of the cable with another tool, usually a cable clamp, which gropes around the seabed in poor visibility, which is challenging even for the best equipment. In rough seas, this additional search and lift operation can take several hours, with a knock-on effect on the entire repair operation. The repair vessel that is mobilised can cost more than 100,000 euros per day".

"The Cabletool project is a new step in Credeblug's strategy to develop specific loading tools for the Offshore sector," said Asier Susaeta, GM Credeblug.

"We already have technology capable of handling large loads up to 1000 meters deep, so this new development is a step forward in terms of functionality. We believe that by reducing submarine cable mooring, cutting and recovery times, we offer differentiating technology in the market and certainty in this type of operation."

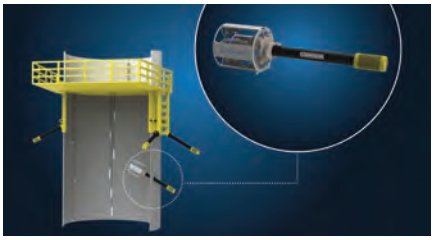
Credeblug's tool combines a cable grip and a cutter in a single hydraulic tool. The grab also includes lighting and vision systems for cable tracing and a better grab positioning. Compared to existing cable cutters, the long arms of the grab make it easier to locate and retrieve cables from the seabed, as the arms make it possible to probe much deeper into the seabed where the cable is normally buried. Once the cable has been grabbed and secured under water, the guillotine cutter is activated. The most critical feature is that the grab hangs firmly onto the cable after the cut, rather than dropping the ends onto the seabed. The cut end is then safely raised by the grab and immediately handed over to the deck crew to prepare it for the splicing team.

After three years of development and testing at the Credeblug plant in Azpeitia, in March 2023 they were successfully able to carry out their validation at sea, in the port of Bermeo (Bizkaia), as part of an R&D project supported by the Basque Government's Hazitek Programme (WIND2GRID). The gripping, cutting and clamping tool is now available for fully shielded underwater power cables up to 270 mm, and larger sizes can be manufactured on request.

Source: Credeblug, Tecnalia

Boosting Ultrasound Inspection

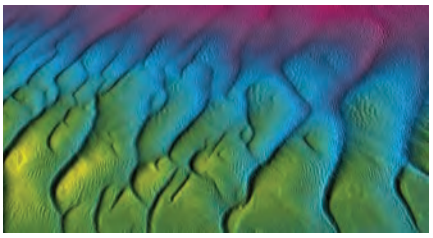
FORCE Technology introduced a new generation of its P-Scan ultrasound scanner for subsea inspections. P-Scan 5 is designed to be easier to configure for a wider range of geometries and asset integrity applications, including regular inspection of submerged pipelines, flowlines, subsea templates, manifolds and offshore wind turbine subsea structures. Whether deployed by divers or ROV, FORCE Technology can now deliver more complete reports on a submerged structure's condition. Improved data quality and classification also pave the way to using AI and Machine Learning for data analysis and interpretation, helping to optimize reporting workflows.



Monopile Corrosion Protection

Corrosion and BlueStream launched 'ICCP-SAM', touted as sustainable corrosion protection of XX(X)L monopile foundations. ICCP-SAM is designed to remotely install ICCP anodes on monopile foundations of all sizes, anywhere on the foundation and even in the roughest ocean conditions.

The ICCP-SAM (Subsea Assembly Method) is compact and can be transported and deployed with minimal resources from the topside of the offshore foundation. It is operated remotely and maneuvers the anode underwater into the designated foundation entry hole. The anode is then secured to the foundation using the same tool.



AI-powered Data Processing

GeoAcoustics released GS4 software v1.0.25 for GeoSwath bathymetric sonars, adding upgrades including an AI data processing system developed in collaboration with the University of East Anglia. The software update is available free for customers already operating GS4 software v1.0.24. The new AI processing augments the existing automated filtering in the GS4 software by removing surplus and undesired data autonomously; during acquisition, the system is designed to log clean data, without any user intervention in the cleaning process, enabling better operational agility and decision support, while cutting the time to final data in post-processing.

DSP Acoustic Telephone

The NewtComm DSP Acoustic Telephone is a through-water communication system. Built with a digital signal processor, the NC-50S is a surface station that can communicate with other phones that use the same frequency. The subsea unit, NC-50S-S, is available for direct integration into submersible vehicles, bells or habitats. The standard frequency for the NewtComm NC-50S and NC-50S-S is 25khz upper single side band with a voice channel bandwidth of 6kHz (other frequencies available upon request). The NC-50S-S Subsea Unit has a 10W speaker for optimum sound in subsea vehicles.

miniDOT Logger Product Range

In 2023, Precision Measurement Engineering (PME) increased the miniDOT Logger measurable depths to 300 meters; tripling the device's original logging limits of 100 meters. The miniDOT Logger is a completely submersible instrument that logs dissolved oxygen and temperature measurements for applications such as lakes, rivers, streams, estuaries and coastal waters, as well as oceanographic research. The oxygen sensor is an optode that measures dissolved oxygen concentration in water through a fluorescence method. Data are recorded to an internal SD card. Operation of the miniDOT Logger can be accomplished via the USB cable.

Teaming for New LARS

Fairbanks Morse Defense (FMD) finalized an agreement with Caley Ocean Systems to pursue launch and recovery, and other naval mechanical handling opportunities. This collaboration expands FMD's capabilities to provide marine technologies while strengthening Caley Ocean Systems' presence in the U.S. Caley Ocean Systems has established itself as a manufacturer of offshore handling systems catering to international markets. The company specializes in engineering design, assembly, testing, installation and onsite support. It also provides A-frames for submersibles and oceanographic research vessels, winch systems, and dive handling systems.

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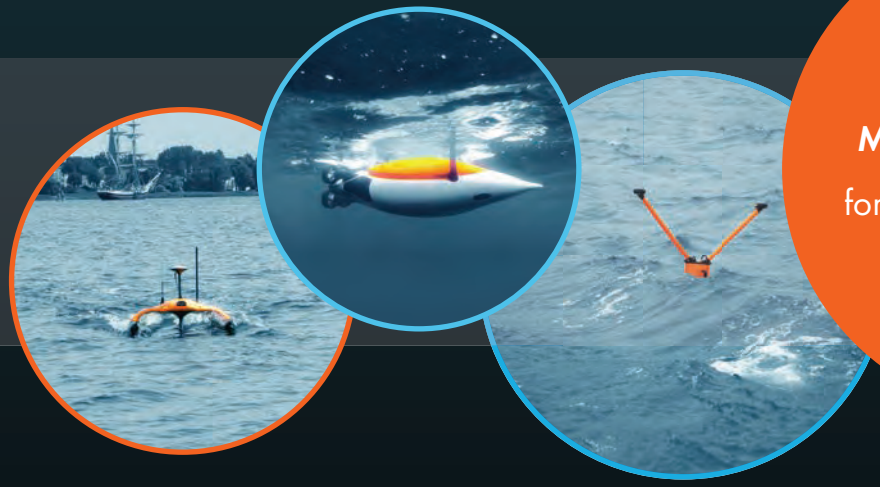

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