MARINE TECHNOLOGY REPORTER

May/June 2023
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The 29th Underwater Technology Conference

Securing Global Energy

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UTC
Underwater Technology Conference

WHY YOU DO NOT WANT TO MISS UTC 2023!

01 UTC 's role in the subsea community. Technology development networking arena

UTC started more than 40 years ago to boost technology development in the subsea field. Ever since it has provided a platform for industry professionals to share their expertise, knowledge, and experience. UTC helps to drive innovation and improve the efficiency and safety of subsea operations. The conference attracts more than 500 visitors annually, all relevant to underwater technology.

UTC is hosted by the foundation UTF and GCE Ocean Technology.

02 UTC 2023 topic: Securing Global Energy

Within the extensive technical conference, the key themes are: Solutions for new energy transition, Carbon Capture, Utilzation and Storage, All Electric, Renewable energy, Offshore wind, Piping for CCS and Hydrogen, Subsea Processing, Leak detection, wave and storage and Subsea HV Power.

These topics will be covered by some 40 high quality presentations which has been selected from more than 100 abstracts submitted. The UTC Conference has always been known for its high technical quality – this year is no exception to this!

03 What you can expect in this year's program

Top-level keynote speakers already include Karl Johnny Hersvik, Chief Excecutive Officer, **AkerBP**. Hege Skryseth, EVP Technology, Digital & Innovation, **Equinor**. Maiza Goulart, CEO R&D, **Petrobras**. Suen Marcet, CEO Subsea, **Petrobras**. Ingrid Sølvberg, EVP Technology, drilling and subsurface, **Vår Energi**.

They will be discussing key topics, such as priorities in the energy trilemma, CCS/CCU and how technology drives the energy transition.

04 Mingling, icebreakers and social events!

The Icebreaker on Tuesday 13th is an informal mingeling session and an excellent opportunity to socialize and meet colleagues, exhibitors and conference delegates. It is always a very popular event at UTC, that rounds up Day 0. This year we have arranged a cruise to visit OneSubsea at Horsøy and Aker Solutions at Ågotnes as a networking field trip.

The UTC conference dinner will take place in the foyer under the thousand light bulbs in Grieghallen in the evening of Day 1, 14 June. There will be live entertainment, speeches and the announcement of the prestigious UTC Award.

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May/June 2023
Volume 66 • Number 4

Bayonet Ocean Vehicles

Anna Flam

Greg Trauthwein

On the Cover

An OTN Teledyne Webb Research Slocum glider. © Nicolas Winkler Photography

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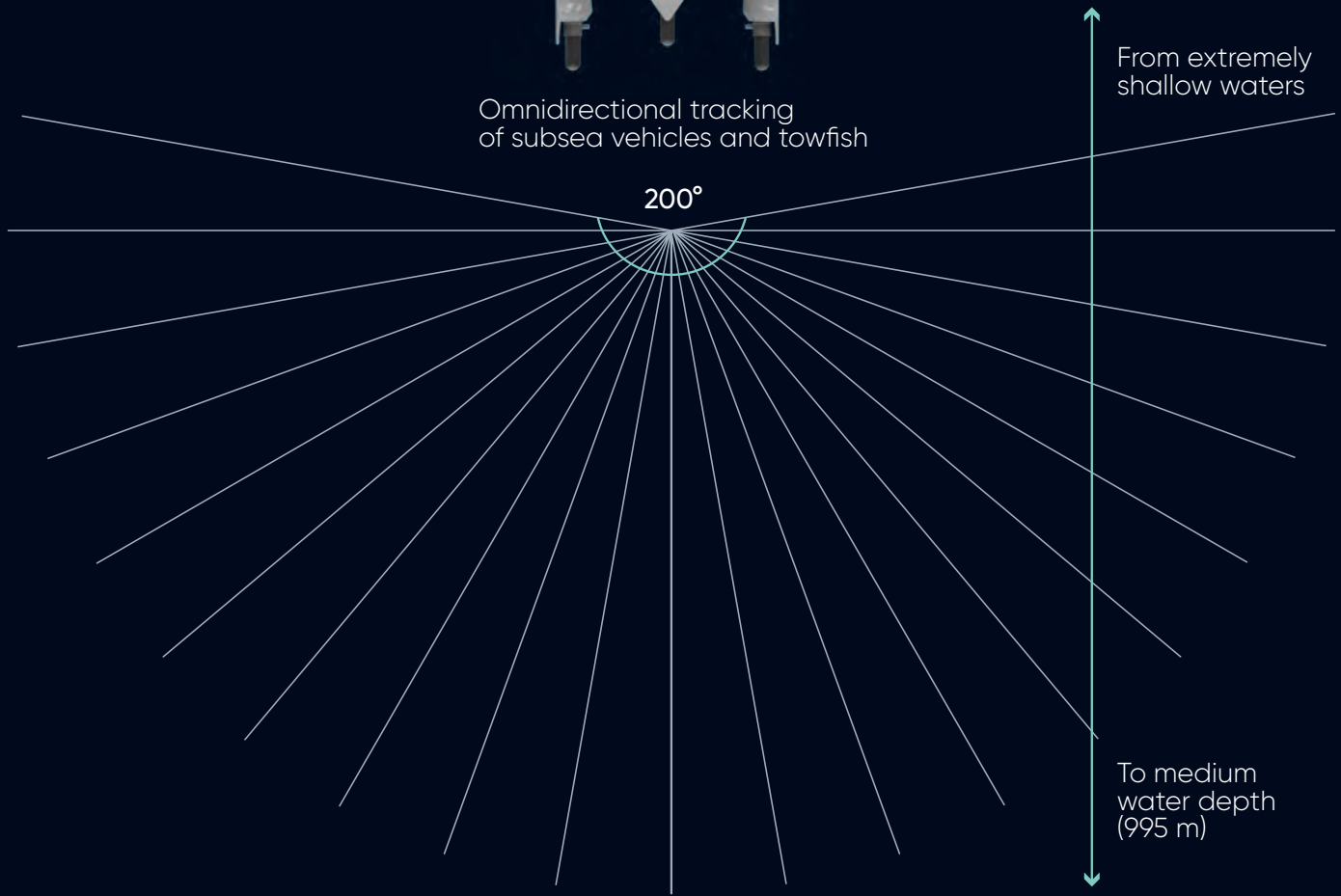

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Editorial

Traveling to visit companies and organizations where they work is one of the things I missed most in the nearly three years of restricted travel during Covid. Don't get me wrong, I thoroughly enjoyed being off the road after nearly 27 years of consistently being on the move, but the return of the ability to be out again – when and where I wanted to go – reminded me that the absolute best stories come from making that personal connection.

Earlier this year I was in Florida on another piece of maritime business, a 'bucket list' trip to watch a SpaceX rocket launch deliver a new Inmarsat satellite to orbit. Since I was in the neighborhood, I requested a visit to **FAU Harbor Branch Oceanographic Institute**, and was welcomed to the facility for an interview with **Jim Sullivan, Executive Director**.

Having been in this seat for many years, I 'knew' Harbor Branch – or at least I thought I did – courtesy of receiving regular press notices on the works that it does. But upon spending a couple of hours with Sullivan, in his office and touring the facilities, my eyes were opened wide to the rich history and the promising future of the institute and all that it encompasses, driven by Sullivan and his team.

Our interview starts on page 34, but I'll give you the 'cheat sheet' version here. Sullivan is a long-tenured and well-regarded scientist and researcher, one who never wanted nor saw himself in the top leadership spot at an academic institution. But then a funny thing happened when he had the opportunity to take the perch on an interim basis. He saw the view, he liked it, and the leadership of FAU liked him.

Nearly four years later, Sullivan is entrenched not only in FAU community, but in the circle of leadership across academia, government and business to help define and address some of the most pressing matters that affect our oceans and waterways. While Sullivan does miss certain aspects of being in the lab, he sees his role as a conduit to facilitate science on a much broader scale.

Gregory R. Trauthwein
Publisher & Editor

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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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BLUEFIN ROBOTICS LOOKS BACK ON 25 YEARS WITH AN EYE TO THE FUTURE

By Edward Lundquist

Mike Guay, director of autonomous undersea systems for General Dynamics Mission Systems, and Dr. Laura Hooks, General Dynamics Mission Systems vice president and general manager for maritime and strategic systems, discuss Bluefin Robotics 25th anniversary at the 2023 Sea-Air-Space Expo.

General Dynamics Mission Systems

It's been 25 years since MIT engineers Dr. James Bellingham and Frank van Mierlo started their entrepreneurial underwater robotics company in a former auto-parts warehouse a few blocks from MIT. Eventually the company moved into a large waterfront facility in Quincy, Massachusetts.

Today, Bluefin Robotics, a business segment within General Dynamics Mission Systems, is building upon its legacy of autonomous unmanned underwater vehicles (UUVs) with integrated sensors and processing.

"Bluefin Robotics vehicles have evolved and continue to improve to provide more persistent presence; deliver more power to conduct complex on-board processing; and operate with even greater reliability in the toughest of environments," said Mike Guay, director of autonomous undersea systems at General Dynamics Mission Systems.

Since the company's beginnings, its vehicles have featured a free-flooded design with open architecture that permits integration with a variety of sensors and payloads to be adapted to any mission. The open architecture allows for data collection devices and batteries — such as the company's Removable Data Storage Module (RDSM) and removable 1.9 kWh Li-ion battery — to be readily swapped out for long missions and short turn-arounds. That modularity also permits the vehicles to be disassembled for rapid shipment to anywhere they may be required around the world.

The team has also always published its interface specifications, making it easier for partners to ensure their sensors and systems can work with the Bluefin architecture.

While the company has recently introduced updated 12-inch and 9-inch vehicles, the Bluefin-21 has been the flagship system for over two decades, and is the basis for a number of unique vehicles, as well as programs of record, such as the Knifefish surface mine countermeasure (SMCM) UUV.

One of the company's first efforts was the Battlespace Preparation Autonomous Underwater Vessel (BPAUV) for the Office of Naval Research (ONR). MIT has adapted a Bluefin-21 called Macrura for autonomous under-ice operations. Fugro Seafloor Surveys, Inc., uses an air-transportable Bluefin-21 UUV called Echo Mapper for search and survey missions. The Physical Acoustics Branch at the Naval Research Laboratory (NRL) in Washington, D.C., has configured a pair of Bluefin-21s, called Reliant and Black Pearl, to develop and test NRL's low-frequen-

cy broadband (LFBB) sonar. LFBB's capabilities have been operationalized on the Navy's Knifefish system, which is a critical element for the Littoral Combat Ship's mine countermeasures mission package. The NATO Science and Technology Organization Center for Maritime Research and Experimentation (CMRE) in La Spezia, Italy, has also modified a pair of autonomous Bluefin-21 UUVs)— the Minehunting UUV for Shallow Water Covert Littoral Expeditions (MUSCLE) experimentation platform and "Black CAT"—for CMRE's Distributed and Decoupled (D2) Collaborative Autonomy Framework (D2CAF) system. Phoenix International Holdings Inc., used a Bluefin-21 known as "Artemis" to search for the missing Malaysia Airlines Flight 370 Boeing 777 that disappeared in 2014.

"The Bluefin-21 strikes an optimal balance between size, speed, endurance, payload capacity, and price," said Guay. "Its modular design allows it to be broken down into transit cases, rapidly air shippable to hotspots across the globe in a matter of hours. Add in its full-ocean-depth operating capability and you have a truly worldwide asset, deployable from any number of vessels of opportunity."

The new Bluefin-9 and Bluefin-12 "clean sheet" UUV designs, are being currently evaluated by the Royal Australian Navy's SEA1778 expeditionary mine-countermeasures program.

Like the Bluefin-21s, the smaller UUVs also have a free-flooding design and can accommodate a broad spectrum of sensors and power options.

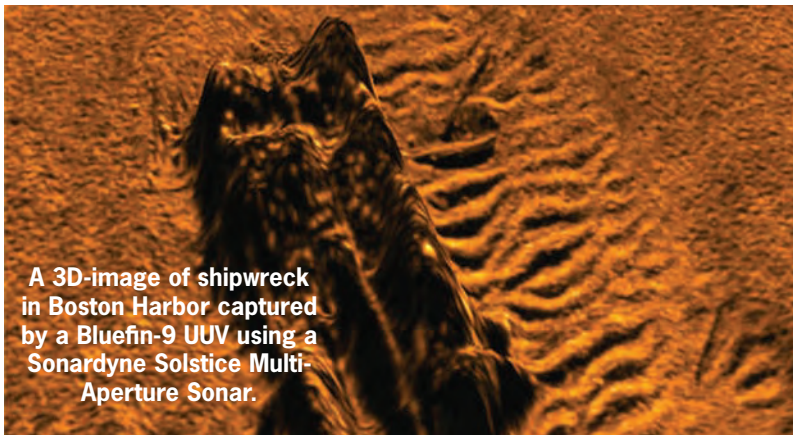
"While Bluefin-9 and Bluefin-12 are very adept in that expeditionary context, they and other small UUVs simply lack the physical volume to practically address the requirements of larger scale operations – requirements like endurance, operating depth and payload capacity," Guay said. "The performance of a single Bluefin-21 obviates the need for several smaller systems, and one or two Bluefin-21s can accomplish the same mission as much larger platforms with less complexity, at a fraction of the price."

As Knifefish production ramps up, the company has moved the assembly line from Quincy to its new UUV center of excellence at Taunton, Mass. Guay said the waterfront facility in Quincy is now exclusively dedicated to advanced research and development and rapid prototyping of UUVs and other novel, autonomous maritime systems.

"We've totally modernized our production capabilities to meet the increasing demands for our unmanned systems today and in the future," Guay said. "These complementary centers

At ICEX 2020, MIT partnered with General Dynamics to demonstrate new navigation technologies by deploying the Bluefin-21 Macrura UUV under a six-foot-thick sheet of ice.

Dan McDonald, General Dynamics Mission Systems



A 3D-image of shipwreck in Boston Harbor captured by a Bluefin-9 UUV using a Sonardyne Solstice Multi-Aperture Sonar.

General Dynamics Mission Systems

MUSCLE Autonomous Underwater Vehicle Deployment

CMRE

at Quincy and Taunton enable us to deliver exceptional speed-to-market and the capacity required to meet the scale of tomorrow's needs. As we look forward, we are still pushing the envelope. General Dynamics Mission Systems continues to make substantial investments in this vital class of technology."

According to Dr. Laura Hooks, General Dynamics Mission Systems vice president and general manager for maritime and strategic systems, the pace of unmanned systems development has steadily increased over the last decade and is approaching a pivotal inflection point that will see unmanned maritime systems integrated across naval operations—in the air, on the surface and undersea.

"The development of autonomous capabilities, networks and major platforms that support distributed unmanned assets, and common processes and policy that underlie their adoption and operation, will allow unmanned systems to serve as the necessary force multiplier our nation needs to face its current threats," she said. "UUVs represent the necessary extension of this transition to our most critical military differentiator in undersea warfare capabilities. As the technology and threats evolve, it's important that we invest in next generation technology and rapidly mature and deploy these capabilities to pace the threat and maintain our undersea superiority."

MIT students deploy the Bluefin Robotics-built MACRURA Unmanned Undersea Vehicle at the U.S. Navy's Ice Exercise (ICEX 2016), a five-week exercise designed to research, test and evaluate operational capabilities in the Arctic region.

MIT, General Dynamics

Photo courtesy UTC

UTC '23 SET FOR NORWAY

Global subsea energy leaders will convene in Bergen, Norway at the Underwater Technology Conference (UTC) in mid-June to meet, greet and exchange ideas on the crucial underwater technology topics. Stig Instanes, TechnipFMC and Rune Vesterkjær, Aker Solutions, helped to shape a vibrant and diverse program.

By Greg Trauthwein

The scenic west coast of Norway is the place for the Underwater Technology Conference (UTC) 2023, scheduled for June 13-15, 2023, Grieghallen in Bergen, Norway.

UTC 2023 is estimated to attract 500 to 800 attendees and nearly 40 technical papers. But what the UTC lacks in size it compensates for in stature, as the event regularly attracts a broad array of leading executives from global companies working in the offshore energy and subsea space, including a dozen keynote speakers from key operators like Petrobras, Equinor and Shell, as well as the main suppliers in the subsea space.

"Many of us have been around for a lot of conferences over the years, and I would say that UTC is one of the few conferences where you see that the operators are taking a big part of the conference, both as presenters but also as regular delegates," said Stig Instanes, BD & Sales Manager, TechnipFMC, who serves as the Board Chairman of the Underwater Technology Foundation. "There is a very high probability that you'll meet your end client, the operator, at UTC."

"Networking is the main thing," said Rune Vesterkjær, VP – Subsea Energy Transition & Low Carbon Solutions, Aker Solutions, who serves as UTC's Program Committee Chair, agrees. UTC allows those who have developed the technology to meet and collaborate with colleagues and clients; "this is the magic happening, where you find even better solutions and you discuss other areas of application."

As the world emerges from the effects of the Covid shutdown, Vesterkjær argues that the social aspects of business are more important than ever, particularly to connect the younger people in the industry with the senior members of the industry, so each can gain from the others insight, experience and expertise.

The UTC Conference Program

While the UTC maintains its strong commitment to traditional oil and gas, it too sees the writing on the wall regarding energy transition, and the conference program is a repository of knowledge and insight on how companies in the space can leverage their own experience to broaden – not replace – their work in discovering a and recovering fossil fuels. "We still have a lot to do when it comes to traditional oil and gas subsea developments, and that will be covered," said Instanes. But increasingly, too, there is a push to leverage traditional offshore oil and gas subsea technologies for 'new' energy and systems, from floating wind to hydrogen to carbon capture and storage. "More and more we see that carbon capture and storage is relevant for subsea. I think all of us in the supply chain are ramping up for that, and there are quite a few technical presentations on that theme" together with the other emerging technologies.

"This conference is dedicated to underwater technology within the energy space, and right now there is an energy crunch," said Instanes. "This year's topic, securing global energy, is highly relevant for all of us."

With energy security and the environment competing as the prime topics, Instanes said "we need to harvest energy in the ocean space if we are going to succeed with this energy transformation. We are now looking into how traditional oil and gas

underwater technology can enable renewable technology within the ocean space."

"The technical program is always what's been the key to the UTC," said Vesterkjær. "Learning what's been going on in the industry, learning about breakthroughs and the projects."

UTC attracts participants from around the world, and Vesterkjær sees this as a positive, allowing all to learn from the experiences, triumphs and failures from colleagues half a world away.

"In Norway and Europe you have a lot of incentives and focus on how we can have a more sustainable energy production," said Vesterkjær. "But for it to be sustainable, it's important that we address the topics that we have of the trilemma; where you have energy security, energy affordability and energy sustainability, and see that it's also a profitable business."

By its very nature, the subsea sector must invent, engineer and deliver products and systems that are robust and reliable, traditionally focused on the offshore oil and gas sector. The solutions that exist are not exclusively for oil and gas production, but also for methods of installation; methods to handle the high pressures; and understanding how to minimize impact on the surrounding environment. As energy evolves to include renewables, as well as budding industries like carbon capture and storage, Vesterkjær sees UTC as the platform to bring together the traditional industry with the new player to share information and help devise new energy solutions and businesses.

"I think our focus on robustness, reliability, and our proven technology is a good example of what we can achieve as a subsea industry," said Vesterkjær, "to see how we can help out on the other [emerging] industries to come.

In total there will be 36 technical papers, all focused on the trilemma: energy security, energy affordability and energy sustainability. The presentations will meld traditional oil and gas with renewable and 'clean' energy topics:

offshore wind, hydrogen, wave energy, carbon capture and storage, as well as decarbonization topics in regards to subsea processing, including electrification on the sea bed.

Vesterkjær was also keen to point out that eight of the 15 keynote speakers – 53% – are female keynote speakers, but regardless of gender all are "highly skilled, eager and talented people who will give us their insights."

In addition to the traditional conference highlights, there will also be a field trip on the first day of the event – so dubbed day zero of the UTC – to OneSubsea's facilities in Bergen and also to Aker Solutions' facilities at Ågotnes.

The full conference and keynote program can be found online at **https://www.utc.no/agenda/**

All photos courtesy Bayonet Ocean Vehicles

SURF ZONE CHALLENGES: BRIDGING THE GAP WITH BAYONET CRAWLERS

Picture a world where the tumultuous surf zone, with its strong currents, pounding waves, and poor visibility, no longer poses a challenge to environmental monitoring or oceanic operations. Enter the Bayonet crawlers, the newest line of amphibious robots launched last year by Bayonet Ocean Vehicles and Greensea Systems Inc, designed to venture where Autonomous Underwater Vehicles (AUVs) and Remotely Operated Vehicles (ROVs) falter, making them a game-changer for coastal survey and monitoring.

By Kira Coley

In April, Bayonet Ocean Vehicles and Greensea Systems co-hosted a live demonstration of their Bayonet 250 autonomous underwater ground vehicle ahead of Ocean Business, taking its name from its 250 lb. (113 kg) deck capacity. This first-ever UK. demonstration took place along the River Itchen, Southampton.

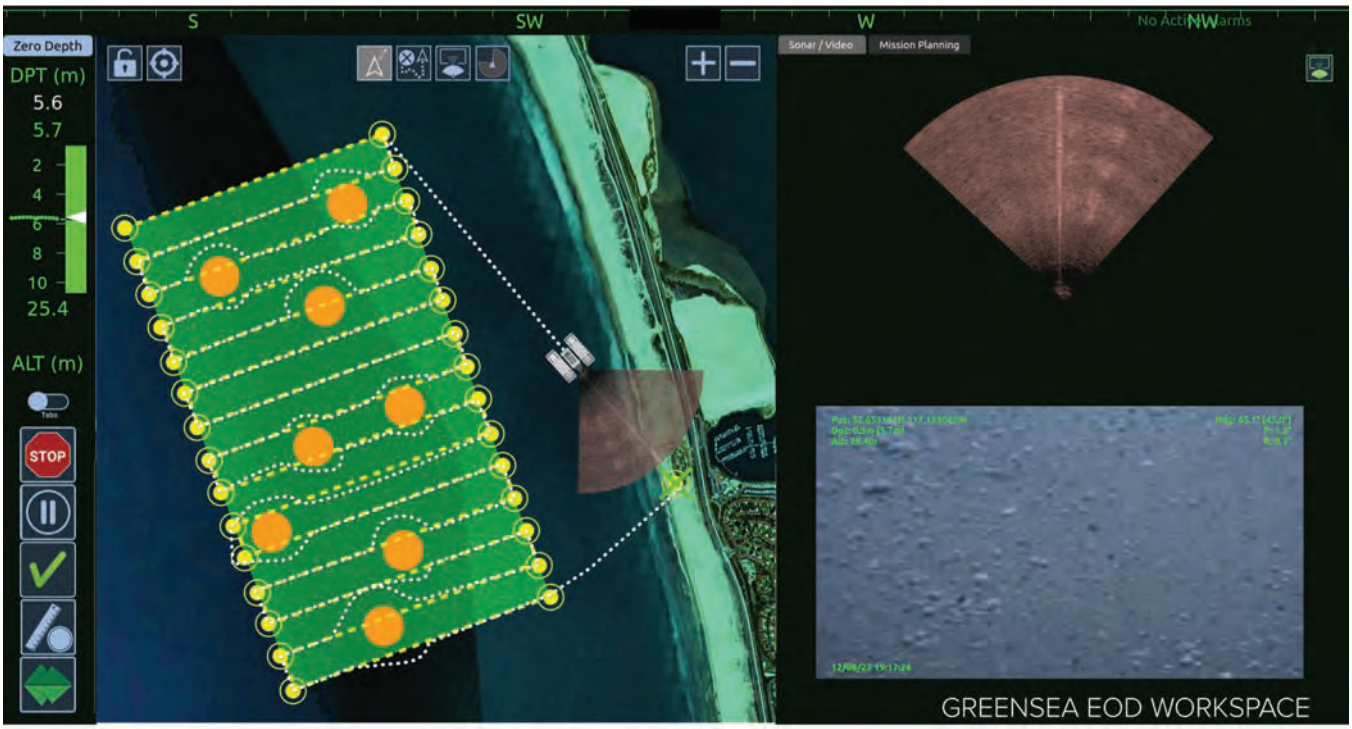
Nick Hartman, VP Strategy and Growth, and General Manager of Bayonet Ocean Vehicles was delighted with the interest in this first UK demonstration: "We have had an unbelievable week here in the UK during Ocean Business. We have demonstrated and matched Bayonet's capabilities with requirements sought by representatives from offshore wind development, specifically for geotechnical inspections and survey of the sea-to-shore interface."

Offered in three sizes, the Bayonet 150, 250, and 350, these crawlers have a modular setup that allows users to customize their configurations with a wide range of sensor payloads. As a result, the vehicles can support an impressive array of applications, including offshore oil and gas survey and maintenance, renewable energy sector operations, maritime security and salvage, and environmental data collection for monitoring toxic algal blooms, beach erosion, and water pollution. Their unparalleled ability to operate in shallow water, heavy surf, and poor visibility makes them a crucial asset for Explosive Ordnance Disposal (EOD) missions, where they deftly navigate treacherous subsea terrain to detect hidden threats.

"Defense continues to be a primary driver and need of the Bayonet crawlers for mine detection and UXO detection. The strength of attendance at these events shows the need for these capable vehicles. We stand poised to offer solutions today for multiple subsea and surf zone data collection challenges, far beyond the initial defense industry references," says Hartman.

The Bayonet crawlers' unique ability to be deployed from land or water, independent of weather conditions, and to transit along the ocean floor and on land, make them the ultimate surf zone explorers. Bayonet crawlers' versatility is further highlighted by their ability to operate in three distinct modes: completely autonomous, tether-operated, and supervised autonomy. These different modes open up a world of possibilities for users, allowing them to adapt to various data-collection scenarios and applications with ease.

In the completely autonomous mode, the Bayonet crawlers can navigate and execute tasks without direct human inter-



vention. This mode is particularly beneficial for hydrographic surveying or mapping coastal zones, where the vehicle can cover large areas efficiently while collecting high-resolution bathymetric data, even in challenging surf zone conditions.

In the tether-operated mode, users maintain real-time communication and control over the vehicle through a physical link, making it the perfect companion for wind farm survey and maintenance. The Bayonet crawlers' ability to provide live video and sensor feeds allows operators to inspect underwater structures such as foundations and cables, making informed decisions on the spot.

The supervised autonomy mode strikes a balance between the two, enabling the Bayonet crawlers to perform tasks semi-autonomously while still granting human operators the power to intervene when necessary. This mode is particularly useful in littoral warfare scenarios, such as mine detection and clearance, as operators can closely monitor and guide the vehicle, ensuring safe and effective operations.

Beyond these applications, the Bayonet crawlers can support coastal dredging support, environmental monitoring of the seafloor, beach zone, rivers, and marshes, and wharf inspections. They can even be deployed to monitor harmful algal blooms, commonly known as red tides, which pose severe threats to marine ecosystems and human health. In this context, the Bayonet crawler can autonomously navigate and collect water samples, while operators supervise the mission and adapt the vehicle's route based on the real-time data received. This ensures efficient monitoring and early detection of red tide events, helping to mitigate their impacts.

"What's next for Bayonet? We'll be looking at refining our battery solution and sensor integration scheme,' says Hartman. 'In the next six to twelve months, we are particularly excited to explore the integration of manipulators. Imagination sparks the rest."

All photos courtesy Bayonet Ocean Vehicles

MARINE TECHNOLOGY TV

Image courtesy Covelya Group

Covelya Group Chairman

Simon Partridge & Building Brands for the Next Generation

More than 50 years ago, ***John Partridge*** *started Sonardyne in the family home, with 'a test tank in the garden, a workshop in the garage and an electronics lab in the spare room.' Much has changed since 1971, and today his son* ***Simon Partridge*** *serves as the chairman of Covelya Group, an umbrella organization for its growing family of brand names in the subsea space, including:* **Sonardyne**, **Wavefront**, **Chelsea Technologies**, **EIVA**, **Voyis** *and* **Forcys**. *MTR interviewed Simon Partridge recently to discuss the future pace and direction of growth for the organization.*

By Greg Trauthwein

John Partridge & Rangemeter Mk.1 on trials at Cwm yr Eglwys, Pembrokeshire 1968

Image courtesy Sonardyne

The story of Covelya Group is a familiar one in subsea circles, the story of a man with a dream and the gumption to start his own company operating from his home.

The man was John Partridge and the company he started was Sonardyne in 1971, a company which began as an underwater acoustics consultancy in a small town in southern England. Partridge's vision was to make operations beneath the waves safer and more efficient, and in the ensuing 50+ years that vision has become reality, as Sonardyne has made numerous technological innovations in the offshore, scientific and marine industries.

From humble beginnings, the organization has grown organically and via acquisition, and today Covelya Group is still headquartered in the UK with six trading companies, boasting 520 staff and total annual sales of about $120 million.

The Family Table

"[Sonardyne] really started off in the family home," said Simon Partridge. "We had a test tank in the garden and lathes and mills in the garage. It was a small house and so the spare room was an electronics lab. And my uncle came and lived with us and he was one of the early technologists, working with my father."

Only four years later, Sonardyne had its own premises, manufacturing transponders in Fleet, a town 40 miles southwest of London, where the company would call home for the next 20 years.

According to Partridge, the company built up a solid reputation for underwater positioning systems on ships and ROVs. It developed through-water communications capability, eventually branching out into Doppler inertial systems. "So we have a system called SPRINT now, which has been very successful," said Partridge. "Despite the name, 'Sonardyne' didn't really get into imaging sonar. We had a couple of attempts, but it didn't work particularly well."

That failure to self-produce an imaging sonar eventually led to a connection that, years later, would put the Partridge family on the acquisition path.

Fast track to 2006, when Sonardyne's cooperation with Wavefront Systems resulted in the development of a sonar system called Sentinel, an intruder detection system that is "kind of like an underwater radar," said Partridge. "We had really good complimentary skills; Sonardyne was great at hardware design and manufacturing, with a good sales network. Wavefront was brilliant at the sonar software and signal processing."

The partnership worked out so well that Sonardyne acquired Wavefront, but it wasn't until much later – 2018 – that Covelya was born.

"We went out into the marketplace actively looking for companies in the underwater domain, companies that had good heritage and a good technology base," said Partridge.

The next acquisition was Chelsea Technologies, which provides a host of environmental measurement and monitoring systems for the defense, ocean science and maritime markets. "They also do acoustics for underwater tracking ranges and echo repeaters," said Partridge.

Following that Covelya acquired EIVA, a Danish company that is very well known in the subsea industry. "[EIVA has a] great heritage," said Partridge. "They make navigation software – NaviPac – that acquires sensor data, GPS and sidescan, multi-beam data, and processes that and allows you to visualize it, report it."

EIVA also makes towed underwater vehicles, a system called ScanFish, and today it's doing a lot of work around autonomy for underwater vehicles and vessels.

During COVID Covelya acquired 2G Robotics, a small company in Canada that subsequently changed its name to Voyis. "They're all about visual imaging sensors, so using cameras and lasers to provide imaging systems, predominantly for ROVs and AUVs; they're like the eyes of the vehicles," said Partridge.

The newest company is Forcys, a company not acquired rather grown organically out of the other companies. "Forcys brings

everything together under one umbrella so that a customer can see all the different disparate systems and products that the other operating companies make, all around the themes of communications, navigation, imaging and sensing," said Partridge.

Forcys also have some integration capabilities, enabling it to pull together different bits from different companies, both inside and outside of the Covelya organization.

Covelya's philosophy is to acquire companies, allowing them to keep their name, brand reputation and "to a large extent" their own corporate culture. Covelya does not trade, rather it is the backdrop of support, from finance to governance, risk and compliance, and legal support, among other things.

"Our aim is that each company is pretty autonomous," said Partridge. "We want them to be great on their own. We are aligning them, but I would say that's a fairly soft approach. We don't want to force them to clash together, but rather steer them to understanding the benefits of greater cooperation. So that's a relatively natural approach."

But Partridge admits that Covelya, as a group, is still in its infancy, and the individual companies are just now coming to a reckoning on where the synergies lie.

"The important thing is to listen very carefully to people, to fundamentally understand the business," said Partridge, in regards to understanding their customers business as much as understanding the synergies available through the Covelya group of companies; to see the big picture and deliver a solution.

"I think honesty is really key," said Partridge, "being realistic about capability and about technology in the markets. True transparency is a big part of that."

Understandably, Partridge was not forthcoming on potential future acquisitions, but said future consolidation in the sector is reasonable. "I'm quite inquisitive, but at the moment we are investing hard internally. We've got some new technologies and products to deliver and that's our main focus. But we're always opportunistic. If something came along that fit perfectly, we would take a look; but we are not acquisitive for the sake of being acquisitive."

Future Tech

In times good and bad, the Partridge philosophy is to invest in Research and Development to ensure a steady stream of new technology and capability is the offer. But it's not simply about investing new technology for the sake of introducing new technology.

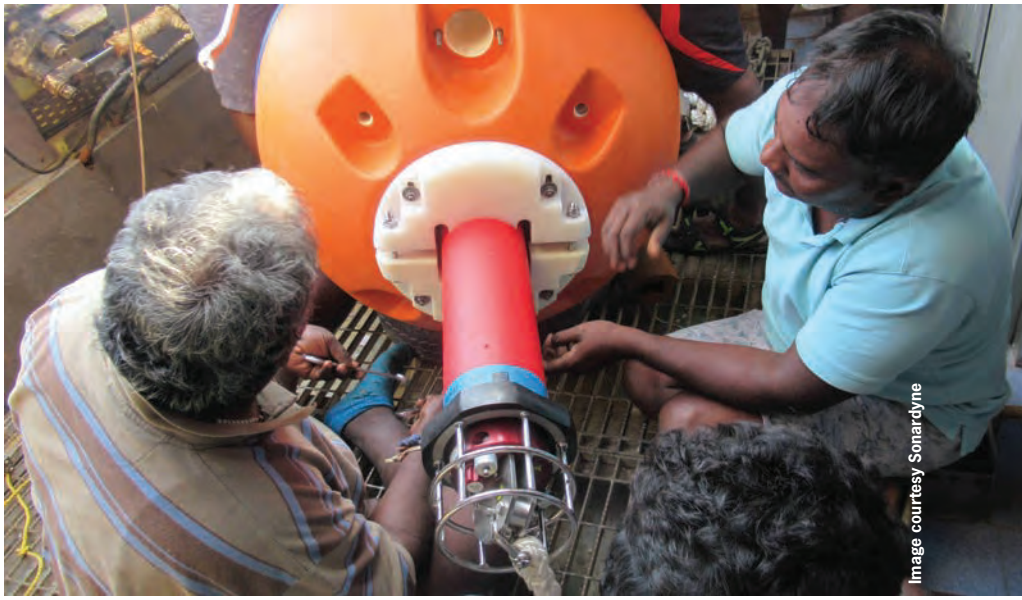
"It's about focus and priority," said Partridge. "I'm an engineer, and I'd love to spend all of our money on clever new technology, but you have to focus it on the things that really add customer value. Everything we do is associated with

LEFT: Simon Partridge Transition zone transponder testing 1997 Plymouth.
BELOW: John with Rangemeter Mk.1 in loft lab at 9 Wickor Way, Emsworth, 1970.
RIGHT: Sonardyne Rangemeter Mk.2 Surveying pipeline early 70's

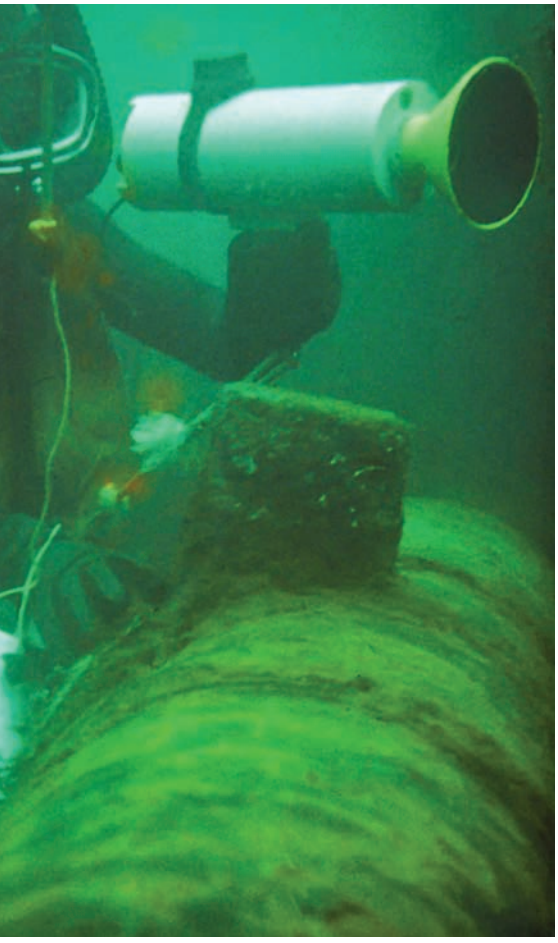
All images courtesy Covelya Group

automation or underwater drones, so communication and navigation sensing are key, as well as trying to do it more seamlessly and taking less power [delivered] in smaller packages with more capability. Hybrid systems, edge computing, machine learning or AI, call it whatever you want."

He said a good example is the recent launch of Origin from Sonardyne. It's an Acoustic Doppler Current Profilers (ADCP) that has integrated hybrid capability. "It has communications built in and edge computing, so you can have this running on the seabed, collecting a huge amount of data," said Partridge. "The customer can put their own Edge application on the instrument subsea, process all of that data, decimate it down to something that's really small with only the critical information required. And then that can be communicated through the acoustic communication link back to a surface ship or a USB. That's a great example of hybrid capability and edge computing."



ABOVE:
A Bottom Pressure Recorder (BPR) being prepared for deployment in the Indian Ocean.



Covelya Group Debuts New Tech in Southampton

Origin 65 being deployed during trials.

Voyis' Discovery Vision System

All images courtesy Covelya Group

• Sonardyne Origin ADCP

Sonardyne launched the Origin Acoustic Doppler Current Profilers (ADCPs) which is designed to be simple to operate with class leading data results, integrated communications and positioning.

The Origin ADCPs feature several innovations: an integrated modem for communications and positioning; edge processing capability and ecosystem where customers can write their own apps for projects; and, as well as the industry standard PD0, Sonardyne's new and exclusive A-gram and B-gram proprietary data formats offer up to 10 times greater spatial resolution. There are two introductions for the new Origin ADCP family:

- Origin 600 has a five-beam configuration with a central vertical beam. Paired with a maximum sampling frequency of 4Hz on all beams, it's suitable for waves and turbulence applications, as well as mean currents. Combining field proven transducers with an integrated modem, internal rechargeable battery and Edge processing, Origin 600 expands ADCP capability for acquiring mid-range current profiles.
- Origin 65 boasts a unique acoustic design that increases robustness, reduces cost, and all the while maintaining outstanding current profiling performance. The integrated modem allows for remote actions, while the PIES functionality delivers high-precision time-of-flight and average in-situ sound velocity data.

• Voyis' Discovery Vision System

Voyis Imaging Inc. seeks to advance ROV vision systems with the goal of creating a vision platform that could capture both low-latency enhanced video for piloting while simultaneously capturing high quality stills images for 3D modelling – a solution that could generate 3D reconstructions without specialized technicians or 3rd party processing. The result is the combination of computer vision technology with edge processing to unlock new ROV piloting and inspection capabilities, embodied in Voyis' new product line, the Discovery Vision Systems. Discovery is a vision platform built to deliver 4K piloting video together with 3D data.

Voyis offers two versions of the Discovery: The Discovery Camera optimized for small ROV platforms with a compact imaging and lighting payload; and the Discovery Stereo, designed to bring true depth perception and real-time 3D modeling to ROV platforms operating at up to 4000m depth.

• EIVA's New ROTV ViperFish

EIVA launched a new remotely operated towed vehicle (ROTV): ViperFish. This all-in-one sensor platform is tailored for autonomous unmanned surface vehicle (USV) systems. Compact, streamlined with precise 3D control, ViperFish is designed to safely survey narrow, hard to reach areas, with stable sensors close to the seabed for optimal data collection. ViperFish uses the same electronics and flight control as the UXO survey sensor platform, ScanFish. This means that many of ViperFish's components are proven with thousands of hours documented in the field. In addition, the 3D towed platform is integrated with several high-quality sensor options: Wavefront Solstice MAS, EdgeTech 2205 SSS, R2Sonic MBES, OFG Hypermags Sonardyne SPRINT-Nav Mini and more.

• Chelsea Technologies Expands Tech

Chelsea Technologies announced the launch of two new biological sensing products at Ocean Business: the new high biomass algae assessment tool, LabSTAF HB, and an underwater spectral PAR sensor, S-PAR. The LabSTAF HB high biomass model of the instrument makes assessment of phytoplankton primary productivity accessible to industrial algae growers. With an extended upper limit of detection 10 times higher than the standard LabSTAF and a dynamic range suited to high concentrations of algae, LabSTAF HB is an invaluable tool to help assess culture growth and optimize harvesting.

The new S-PAR sensor is a compact spectral PAR sensor for detailed analysis of underwater light. The new sensor goes beyond traditional measurements of underwater light by measuring the irradiance across the visible spectrum rather than providing one universal value. With a resolution of 10 nm and a range of 360 – 760 nm, the S-PAR sensor provides a wealth of data to inform biological studies. The S-PAR sensor is


Chelsea Technologies LabSTAF measuring phytoplankton primary productivity

currently available as an accessory to the STAF family of instruments but will be available soon as a standalone sensor.

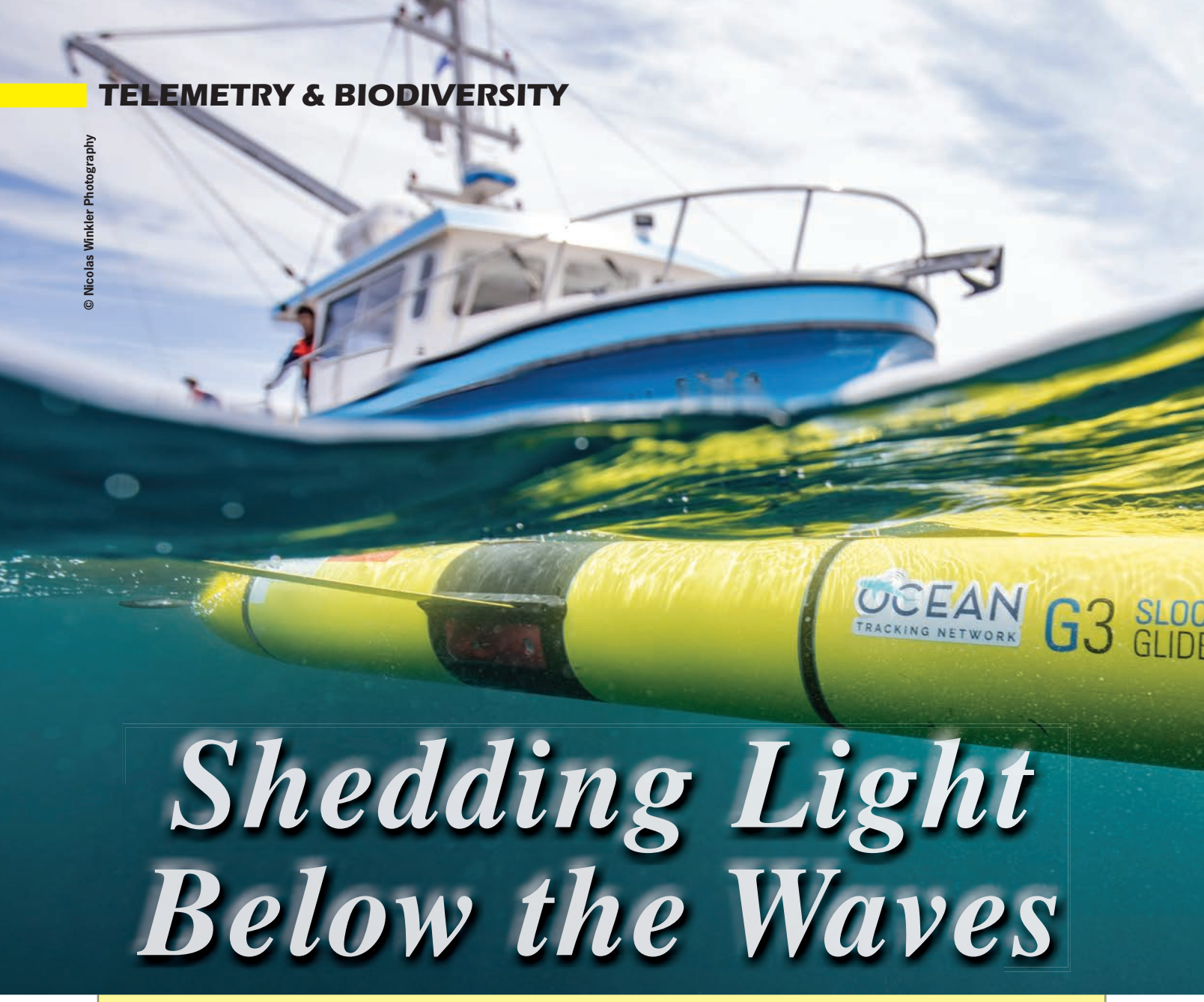
• India Upgrades National Tsunami Detection Network

A network of deep-water acoustic sensors that provides India's coastal communities with an early warning of tsunami waves is being upgraded by Sonardyne. Deployed at key locations in the Bay of Bengal and the Arabian Sea, the network of Sonardyne's Bottom Pressure Recorders (BPRs) is owned and operated by India's National Institute of Ocean Technology (NIOT) as part of the country's Tsunami Early Warning System (TEWS).

The BPRs were first installed in 2007, as part of NIOT's national tsunami detection system, which was conceived following the deadly Boxing Day Tsunami of 2004. The BPRs detect the characteristic changes in water pressure (as little as 1 cm in 4,000 m depth) caused by an earthquake in the deep ocean. If a tsunami wave is detected, an alert message is transmitted up to a satellite buoy on the surface. From there, it is relayed to the national Tsunami Warning Center onshore for comparison with recent seismic activity. If validated, a widescale alarm is raised to alert vulnerable communities.

Following a 10-year life refurbishment in 2017, the BPRs are now being upgraded to Sonardyne's 6G hardware and Wideband 2 communications standard. The installation of low power electronics. new lower power consumption pressure sensors and doubled battery capacity of these maxi BPRs will significantly reduce maintenance visits and costs. Additionally, the acoustic telemetry signals used to transmit data to the surface will also now be fully digital, providing greater resilience to noise interference in the water column, as well as increasing bandwidth by ten-fold (from 600 bps to 6000 bps).

The first batch of upgraded BPRs arrived in India in 2022, with further batches planned for shipment in 2023. In addition, Sonardyne are also supplying a large pool of spares to maintain a continuously available TEWS capability. These include floats and fittings for the larger Maxi BPRs being supplied, as well as transceivers for the surface buoys to communicate with the BPRs. NIOT are planning to use the upgraded capability to extend the number of permanently occupied stations.



Shedding Light Below the Waves

MARINE TELEMETRY CAN HELP SPECIES CONSERVATION AND MANAGEMENT IN A CHANGING CLIMATE

By Celia Konowe

An OTN Teledyne Webb Research Slocum glider.

The end of 2022 marked a potentially significant time for climate activists, scientists, and policymakers worldwide with two United Nations climate conventions — the 27th Climate Change Conference (COP27) in Egypt and the 15th Biodiversity Conference (COP15) in Canada. While neither represented the pivotal change that many hoped for — and argued was necessary — widespread dissatisfaction served as a sore reminder of the action still required from many major-polluter nations. Despite a lack of intergovernmental commitment, environmentalists globally are still working to understand the impacts of climate change on oceans and biodiversity.

In the face of a warming climate, biodiversity is declining as organisms lose habitat to anthropogenic and natural destruction; many try to migrate to more comfortable climates. Species that are unable to adapt face local extinctions and the subsequent decrease in genetic diversity places many organisms at risk of disease—including those the human population rely on for sustenance. In the oceans alone, climate change impacts sea levels, acidification, currents and temperatures. As such, it is increasingly important to better understand and manage marine biodiversity trends on a global level. And while mass oceanic data collection was once thought too difficult to rely on, scientists now have an answer: marine telemetry.

Tracking the Truth

Marine wildlife telemetry takes two common forms: acoustic and satellite. Acoustic tags are predicated on a system of transmitters, either implanted in or attached to an animal. As the organism comes within range of a previously placed receiver, their acoustic signal is recorded, and researchers can then identify which animal was tagged, as well as data like depth or temperature (if the tag is equipped with those sensors). Mark Jollymore, president at Innovasea Systems, an aquatic solutions company that specializes in aquaculture business and wild fish tracking, identified two factors to consider with acoustic telemetry. First, acoustic tagging is limited to the number and placement of receivers in a smaller, more defined area. Second, transmitter size dictates which species are tagged and how long the technology operates for.

"Our largest transmitter, as big as one of your fingers, would be put into something like a shark, tuna or large salmon," he explained. "The smallest transmitter would be a fraction the size of a Chiclets gum, for instance, and be put into a salmon smolt. The largest transmitter maybe operates 10 years or more, but the smaller transmitter would only last maybe four to six months."

Satellite tags, on the other hand, are attached to the animal externally and transmit collected data upon breaching the surface—either as the animal comes up for air (if it's a mammal), or when the tag eventually falls off and floats to the surface. While an important technique, and sometimes used in tandem with acoustic telemetry to broaden the scale of data collection, satellite tags are also significantly more expensive and likely to fall off as they can only be attached externally.

Innovasea is also working on a novel type of fish tracking—tag-less detection technology that combines "optical cameras, imaging sonar and artificial intelligence to detect, count and classify fish in real time," according to a recent blog post. Recent testing at White Rock Dam in Nova Scotia monitored alewife migration patterns and resulted in a strong efficacy rate.

Additional Innovasea projects include tracking sharks along human-populated coastlines and beaches to provide real-time data of shark activity to lifeguards and monitoring fish activity within marine protected areas (MPAs) to determine if their placement positively impacts species.

It's Manta Be

MPAs are an essential conservation tool for protecting migratory species, biodiverse-rich waters and vulnerable ecosystems from anthropogenic pressures like resource extraction and development. However, questions have arisen about where future protections should be put in place, and if current MPAs have

had positive impacts on their species and habitats, especially in areas that are data deficient and have sparse management.

"You know, we have no idea where marine species are spending most of their time. We have no idea if marine protected areas are working. That was kind of the motivation behind it," said Nakia Cullen, a research manager at Megafauna Foundation and PhD candidate at Dalhousie University in Halifax. Cullen lives and works in Zavora, Mozambique, an area rich with sharks and manta rays, but also data deficient and lacking the extensive management necessary. While her research started as underwater visual surveys, Cullen has been able to delve into telemetry in the past few years, inspired by other

© Innovasea

A mobile app to track the fish detection activity as a part of Innovasea's tagless tracking project at White Rock Dam in Nova Scotia.

Innovasea's HR2 receiver.

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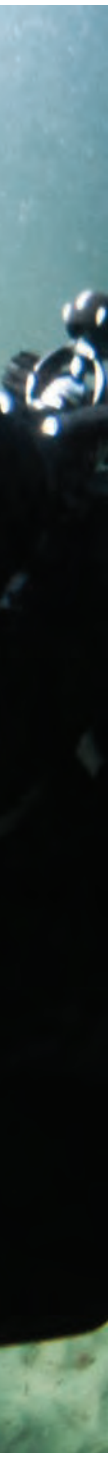


southern African marine researchers.

Cullen utilizes both acoustic and satellite telemetry to increase understanding of species movement. Satellite tags provide a wide range and more data, while acoustic tracking enables researchers to hone in on an important area to track finer scale movement during a longer period. Furthermore, each species requires a different telemetry method and archival satellite tags are particularly beneficial for manta rays, who don't breach the surface often. Between these periods, the tags can collect and store significant amounts of data regarding the manta ray's movements.

"I'm finding really interesting things and I think it's a great tool to highlight these critical areas," explained Cullen. "In South Africa, for example, the mantas are hanging out in the sanctuary and they seem to be quite safeguarded there. Whereas in Mozambique, we don't have much marine protection and our mantas are declining rapidly. So, it's important to be able to show this information to the government and be like, 'Look, this area is really, really important.'"

Seize the Data

As the oceans change due to unprecedented anthropogenic stresses and aquatic species struggle to adapt (or fail to do so altogether), telemetry becomes an increasingly important tool to understand the unknown and how to procced with conservation and management efforts. Beyond gathering information on wildlife movement, telemetry also captures environmental conditions.

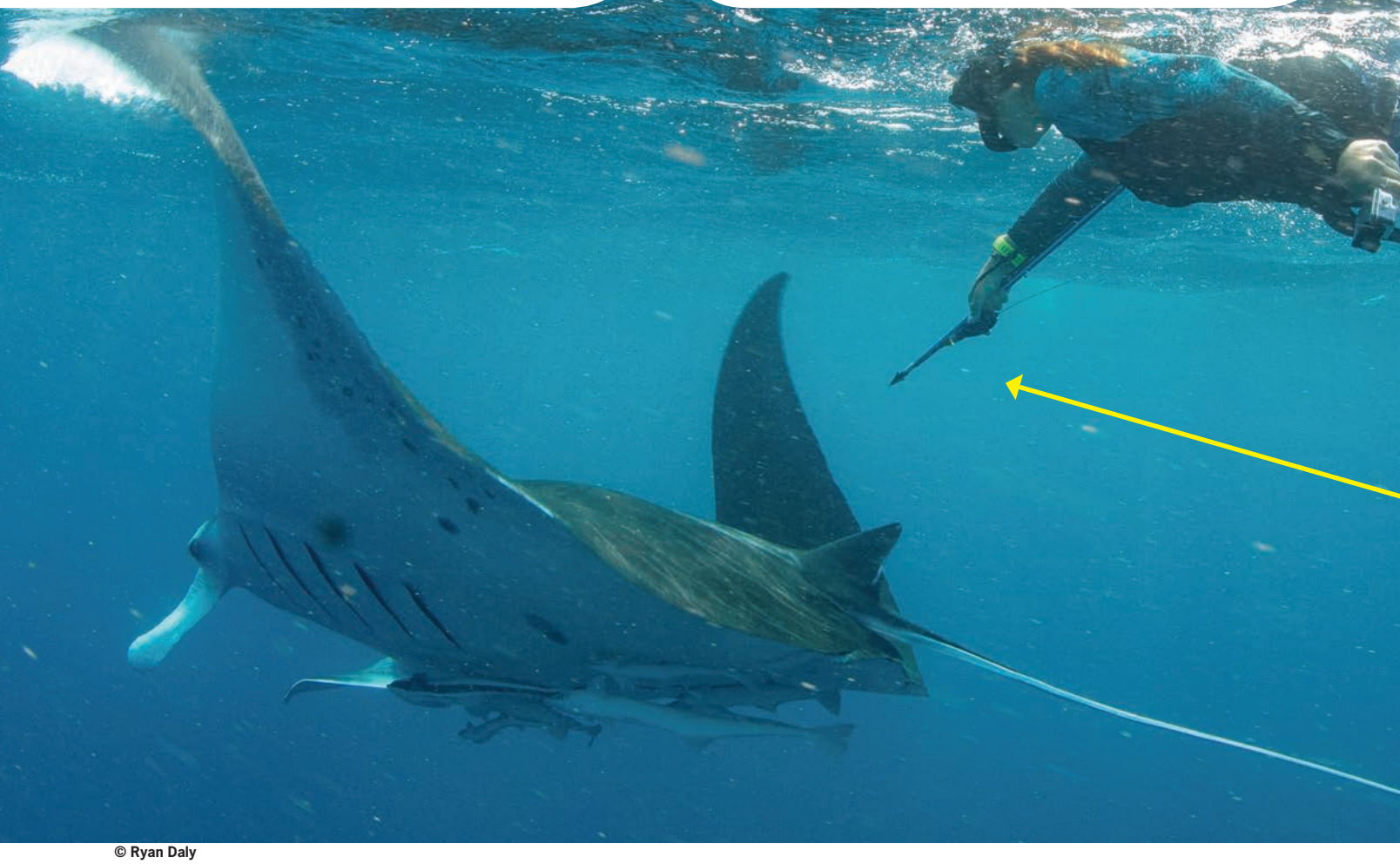
The Ocean Tracking Network (OTN), a global aquatic research, data management and partnership platform headquartered at Dalhousie University, operates a fleet of autonomous vehicles — 10 Teledyne Webb Slocum gliders and four Liquid Robotics Wave Gliders. The former are electrically powered and collect physical, biological and chemical information, while the latter are solar and wave powered, gathering data on weather and sea surface conditions. Additionally, OTN maintains a loaner pool of Innovasea Vemco acoustic receiver units for use by those in academia, government, non-profits and industry.

The organization is also home to the OTN Data Center (OTNDC), which connects a global community of researchers, trains others to use open-source data analysis tools and contributes to the development of global data standards, stated communications manager Anja Samardzic. "OTN partners with several acoustic telemetry networks around the world that work in concert to maintain

© Anna Flam

Cullen checking an acoustic receiver.

© Cullen



© Ryan Daly

inter-compatible data nodes," she explained. "An OTN node is a replica of OTN's acoustic telemetry database structure, which allows for direct cross-referencing between the data holdings of each regional telemetry-sharing community." As a migration data repository, the OTNDC aids in the collection, aggregation, preservation and dissemination of aquatic telemetry—both globally and in collaboration with regional tracking networks.

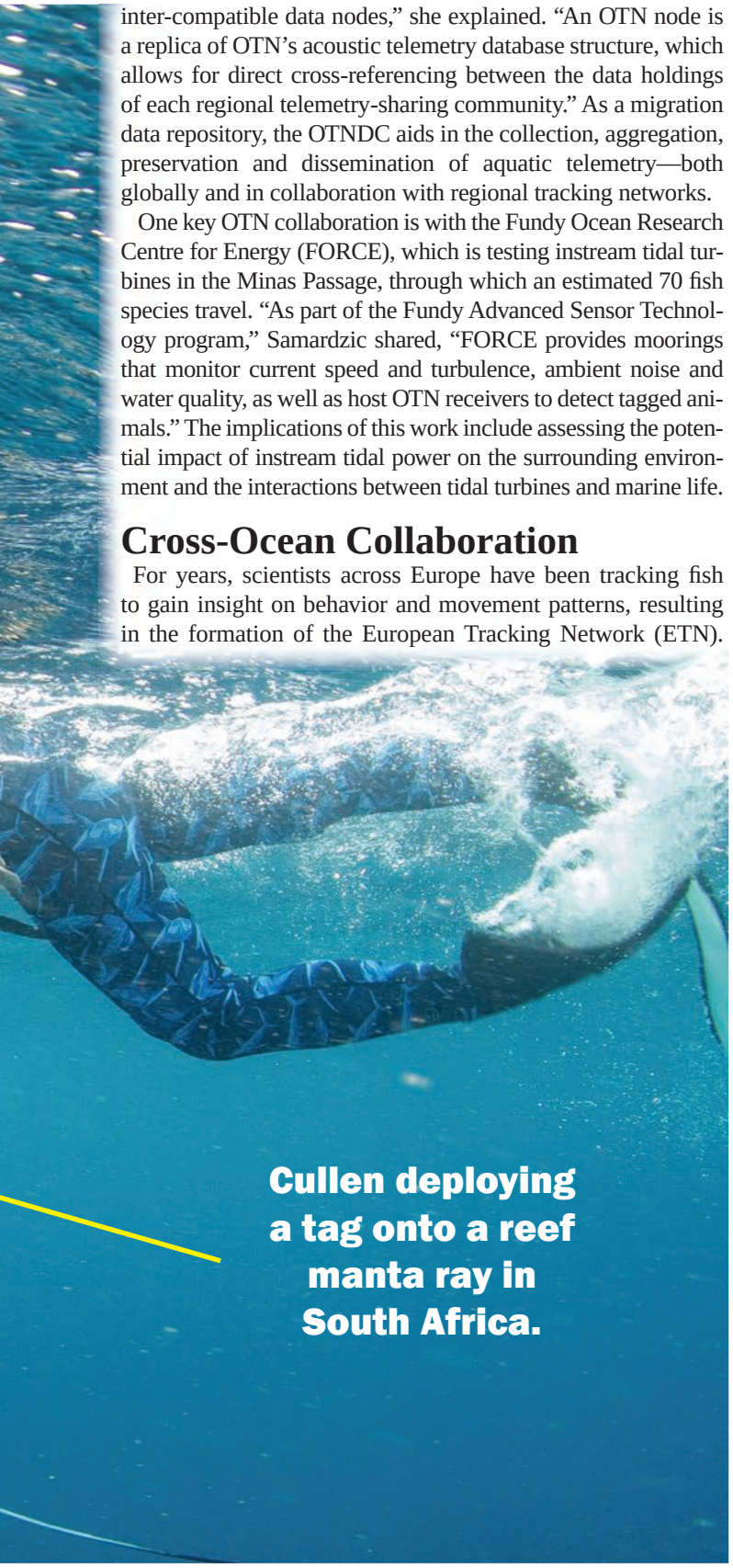
One key OTN collaboration is with the Fundy Ocean Research Centre for Energy (FORCE), which is testing instream tidal turbines in the Minas Passage, through which an estimated 70 fish species travel. "As part of the Fundy Advanced Sensor Technology program," Samardzic shared, "FORCE provides moorings that monitor current speed and turbulence, ambient noise and water quality, as well as host OTN receivers to detect tagged animals." The implications of this work include assessing the potential impact of instream tidal power on the surrounding environment and the interactions between tidal turbines and marine life.

Cross-Ocean Collaboration

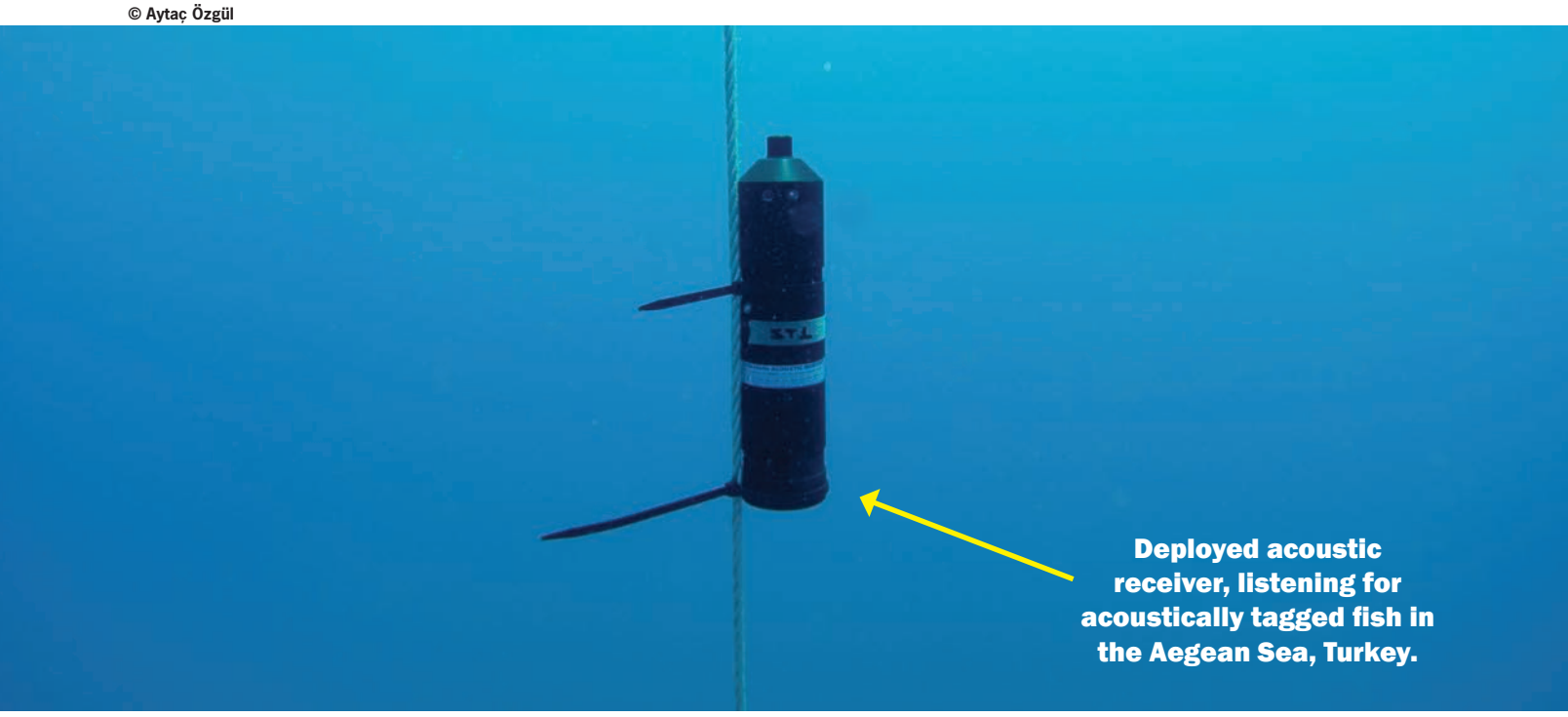
For years, scientists across Europe have been tracking fish to gain insight on behavior and movement patterns, resulting in the formation of the European Tracking Network (ETN). ETN's newest collaboration takes the form of the Strategic Infrastructure for Improved Animal Tracking in European Seas (STRAITS) project. STRAITS aims to "instrument all four corners of Europe, covering the movements of aquatic life across some of the most important swimways on the continent," noted Kim Birnie-Gauvin, researcher at the Technical University of Denmark and science communicator for ETN and STRAITS. The "four corners" were identified as areas between different seas (and thus, management regions) and with varied habitats.

The STRAITS infrastructure will consist largely of two components—first, acoustic receivers to detect tagged fish, operating within 63-77 kHz. Secondly, passive acoustic receivers, like C-PODs and SoundTraps will listen for cetaceans. "C-PODs monitor the presence and activity of toothed cetaceans by detecting and analysing trains of echolocation clicks," explained Birnie-Gauvin. "With the help of an automated data analysis software, C-PODs can identify dolphins, porpoises and echolocating cetaceans (except sperm whales) from quite a distance. SoundTraps are underwater sound recorders that can listen for sounds made by cetaceans but also noise pollution, including boating activity, seismic surveys."

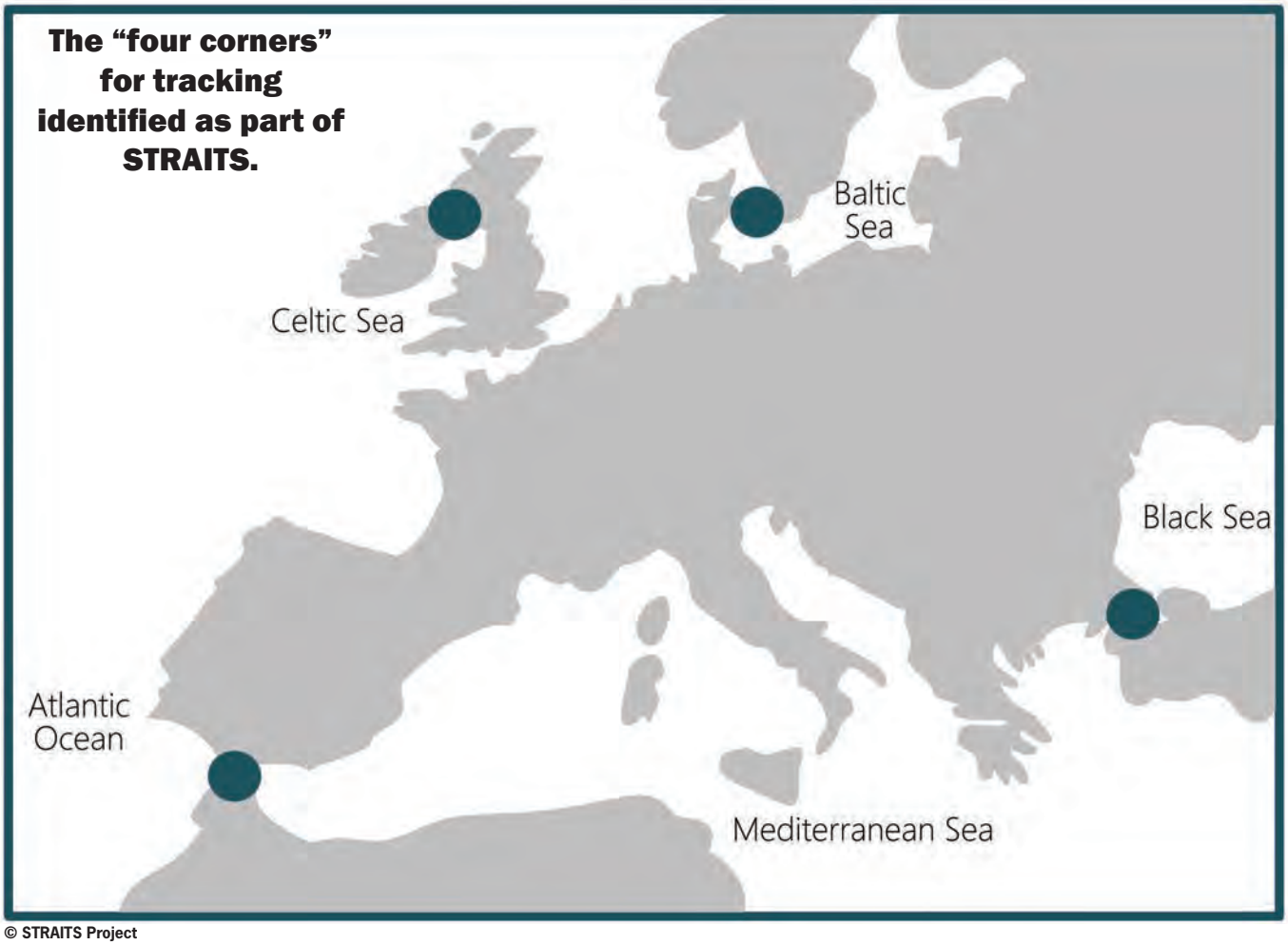
"Fish and cetaceans aren't constrained in their movements —



Cullen deploying a tag onto a reef manta ray in South Africa.



Deployed acoustic receiver, listening for acoustically tagged fish in the Aegean Sea, Turkey.



The "four corners" for tracking identified as part of STRAITS.

they don't see borders. They roam the wide ocean and tracking their movements in such a vast area comes with challenges," said Birnie-Gauvin. "If we are to really assess both the needs and threats that these species face, we need to monitor them over much longer timescales and larger spatial scales. We can also combine movement information with environmental data and anthropogenic threats like fishing pressure, or pollution events, to understand how they respond to these factors." In addition to combining data on different trends and factors, STRAITS works closely with other global tracking networks (OTN included) to share data, but to also identify what they call "orphan tags" — detections from outside their respective regions.

Solving the Puzzle

Aquatic animals, as Samardzic put it, support global food security, contribute billions of dollars in socioeconomic benefits and ecosystem services, and have public and cultural significance. As the climate warms and oceans change, species are forced to migrate and adapt, and their subsequent behaviors and movement patterns hold critical importance in conservation and management. "I think it's an amazing tool, at least for migratory species," said Cullen excitedly. "We're getting so much insight into what these animals are doing, like going to 500 meters at night to feed and then traveling 800 kilometers down the coast for god knows why. It's like piecing a puzzle together."

Telemetry is a solution to this challenge, and to that of large-scale data collection. "I think the future is going to be about getting more information from more spots in the oceans, rivers and lakes," said Jollymore. "We have to figure out ways of getting data through the water and into the hands of the resource managers, the researchers, the regulators and the public."

Birnie-Gauvin emphasized, "We'll always have some surprises — wildlife is wild after all — but we need more permanent infrastructure if we are to get a fuller picture of the oceans. Given the state of the planet, and the rate at which it's changing, doing so is imperative."

An acoustic tag implanted in a European seabass (Dicentrarchus labrax), Belgium.

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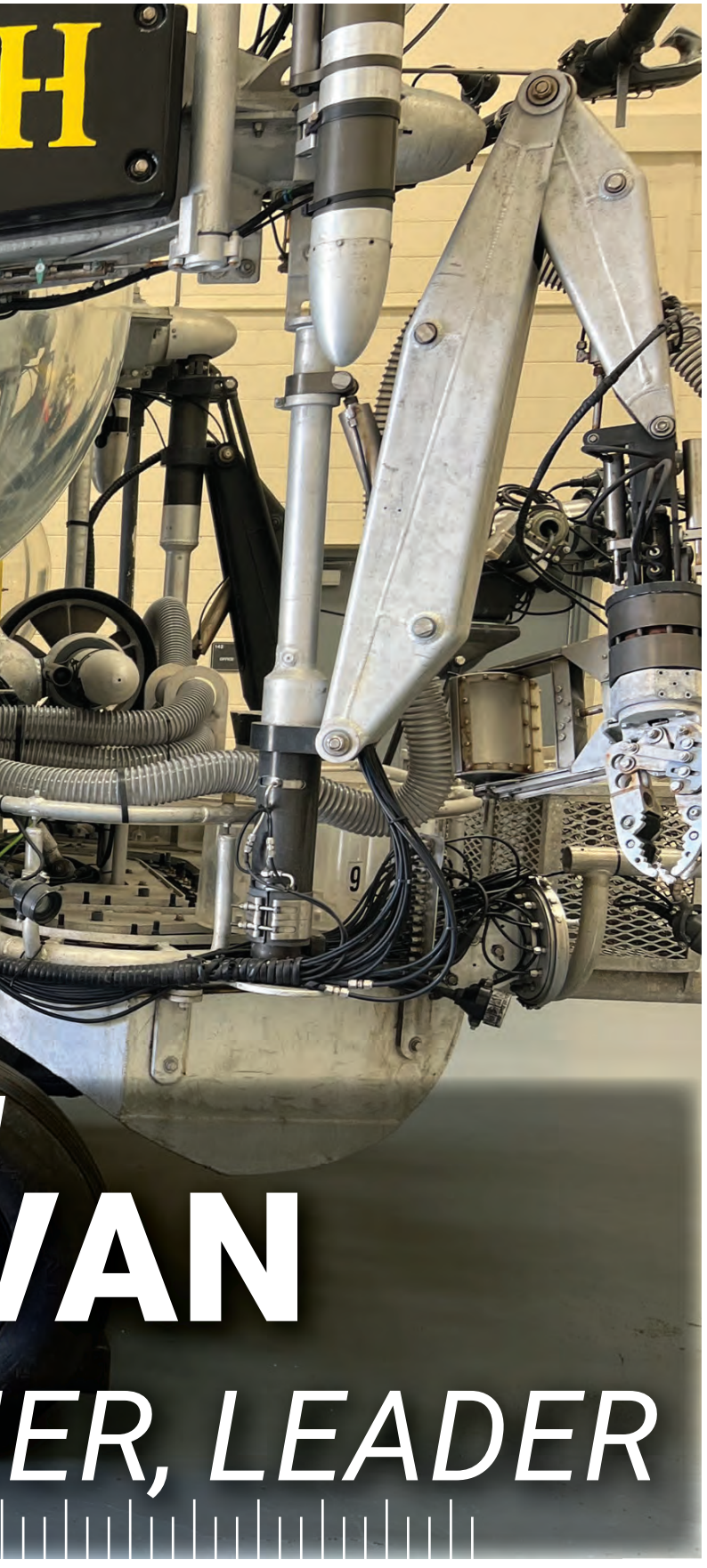
ONE-ON-ONE WITH

JIM SULLIV

SCIENTIST, RESEARCH

Photo Greg Trauthwein



VAN

ER, LEADER

__MTR__ recently traveled to visit with __Jim Sullivan__, Executive Director, FAU Harbor Branch Oceanographic Institute, to discuss the work he has done and the work left to do to have this venerable facility's name become synonymous with the world's top echelon of ocean research institutions.

By Greg Trauthwein

James M. Sullivan, Ph.D., was named the Executive Director, FAU Harbor Branch, three years after joining the organization. In his heart, Sullivan is an engineer and a scientist, an internationally renowned researcher and oceanographer, with a long history engaged in deep study of the world's waterways.

"I earned my masters and PhD at the University of Rhode Island in biological oceanography," said Sullivan. "My specialty was in phytoplankton physiology and ecology, and specifically harmful algal blooms, which is always a topical problem."

Sullivan was a pioneer in the study, but in the early days the instrumentation and resulting data was lacking, particularly when compared to the level and depth of study available today.

"We had very simple sensors when I started out: chlorophyl flowmeters that would tell you there's chlorophyl in the water, and you'd see where it's distributed. And that was pretty much it," said Sullivan. He sat at the crux of technology development in the field, and he was driven by his own scientific curiosity. "I always wanted to get it, vet it, learn how it actually worked. I didn't like numbers just coming out of an instrument. I wanted to actually understand it's bias, it's precision."

Part of this technical inquisitiveness came from engineering training when he grew up with his electrical engineer father; eager for as long as he can remember to "dig in and trying to understand how instruments were built and how they worked."

After earning his doctorate, Sullivan held senior positions in both academia and industry at the University of Rhode Island, as research faculty at its Graduate School of Oceanography, and then an R&D position with Wet Labs, and then as a senior oceanographer for Sea-Bird Scientific (which acquired Wet Labs), which manufactures instruments for measuring and monitoring ocean activity. Early on he was able to meld his scientific and engineering brain for product development, including an autonomous vertical profiler.

During his career, Sullivan received funding through most of the major federal science agencies including the National Science Foundation, National Oceanic and Atmospheric Administration, National Oceanographic Partnership Program, Office of Naval Research, National Aeronautics and Space Administration, and the National Institutes of Health. He has received more than $11 million in grant funding from these agencies.

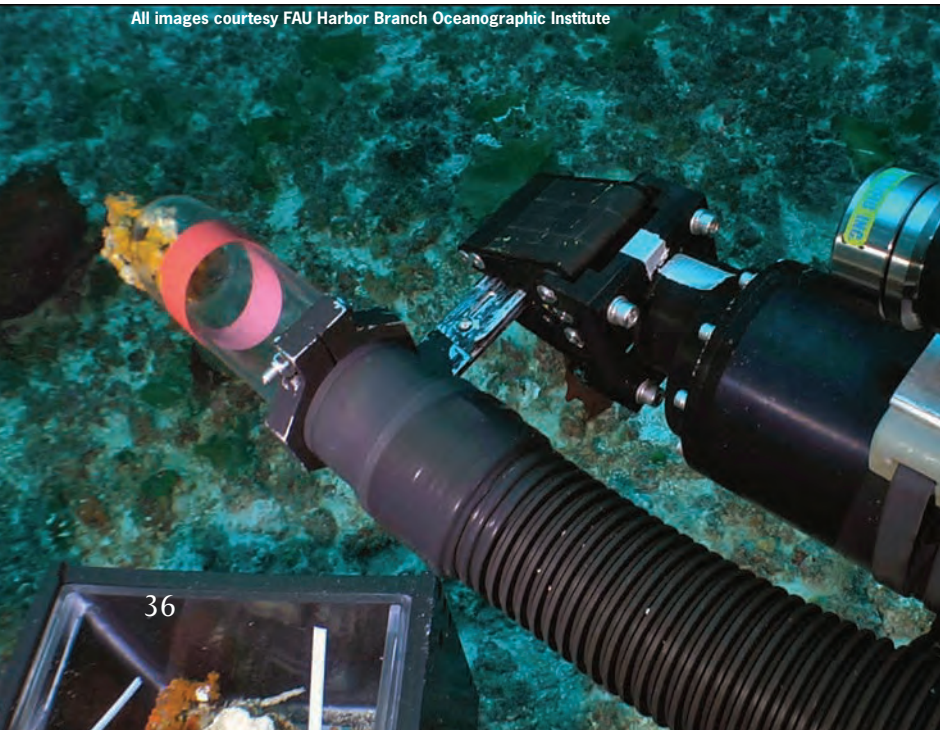
"As a part of Wet Labs, we (with some folks at Johns Hopkins University) wrote a grant to the Navy for an in situ holographic free stream microscope system. So that we could image, in 3D, an entire parcel of water, reconstruct it, and see how organisms relate to the flow of the water and, and how they relate to other organisms in a volume, a cube of water. That was the last major instrument I helped build."

This was an interesting time for both Sullivan and the subsea technology industry as a whole, as in the early to mid-2000s there started a wave of corporate consolidations, and Wet Labs was acquired by Sea-Bird, which had been acquired by Danaher Corporation.

"When we were an independent company, we were very nimble; we were all about R&D and developing new instrumentation," said Sullivan. But as happens across industries, smaller companies with a keen focus get scooped up by larger organizations, and sometimes the focus begins to change. "It becomes about maximizing profit and putting investment into your most productive lines of instruments and really focusing

FAU Harbor Branch Oceano

network to support and enabl



All images courtesy FAU Harbor Branch Oceanographic Institute

on just making those as best you can and pumping them out. That's how business works; I get it. But if you're a scientist who's really into developing novel instruments for the community and using them for yourself, it's less attractive."

With that, he decided it was time to move on.

Sullivan embarked on the search for his next position, applying for and getting a position as a research professor at FAU Harbor Branch.

"I had a nice startup package through FAU, my own offices and lab, as well as the excellent facilities here," said Sullivan. "I was really attracted to Harbor Branch because this place, for research scientists, is one of the better gigs you can get in the country, with the support and the facilities; it was far beyond what I had seen at other places."

In his new FAU home Sullivan got back to writing grants, engineering instruments and studying harmful algal blooms, which are a prevalent and growing problem across Florida.

Establishing a strong lab and reputation, Sullivan was asked: "if I was nominated to become vice chair of our faculty assembly, would I take it?"

Though he'd never done academic administrative work before, he agreed to the nomination and was elected to the vice chair position, becoming chairman a year later. "So I found myself as chair of the faculty assembly and dealing with leadership down on our other campuses. Boca is our main campus, with most of the leadership and the president."

***graphic Institute** has a broad*

e world-class ocean research

Little did Sullivan realize that shortly thereafter, the executive director spot at FAU Harbor Branch would become vacant.

THE RELUCTANT LEADER

A scientist and researcher at heart, Sullivan never possessed the ambition to enter the administrative part of academia, let alone the top spot. But as luck had it, he was deemed the most viable candidate, and acquiesced when asked to take on the executive director role as an interim position.

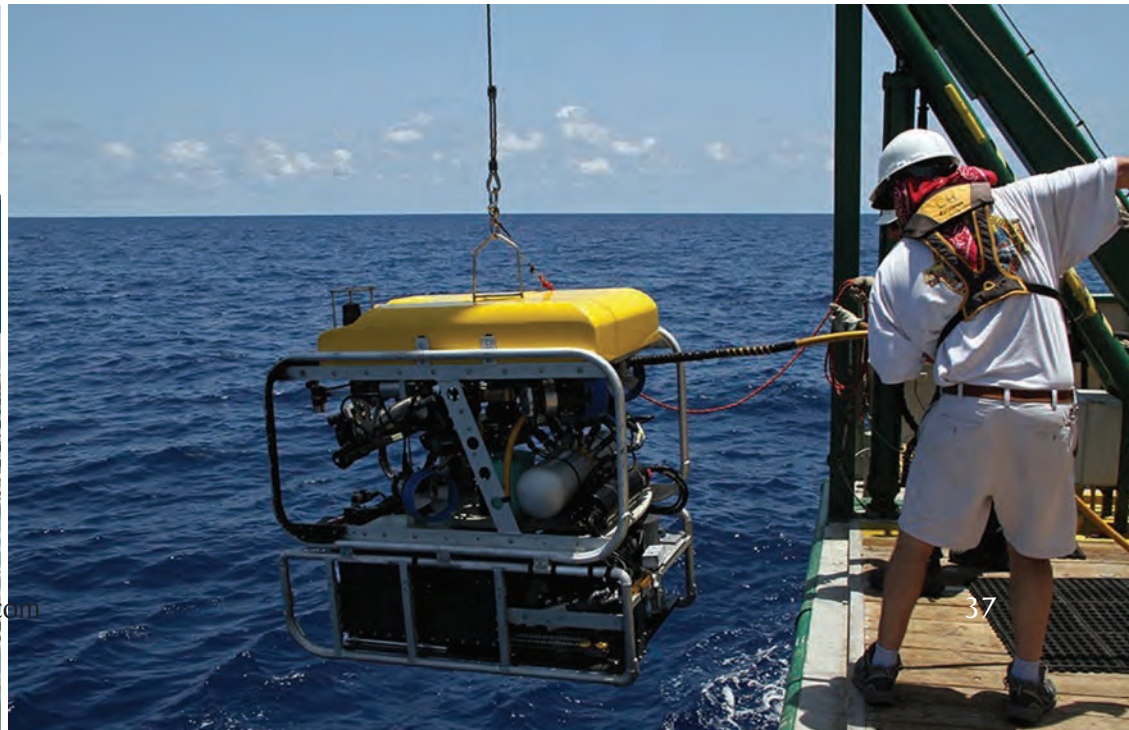
"I had no interest whatsoever in the position, but was asked 'will you be interim executive director while we do a national search.'" Sullivan agreed, in part because he realized that there were a number of issues at the Institute that he could help rectify in the new role.

"There were substantial changes [that I could help facilitate] ... I'm going to go back to the faculty, and I want this stuff fixed."

With an eye on making substantial, constructive changes, Sullivan set about the job with a vigor. Then a funny thing happened. "I guess I did too good of a job because three months after I was interim, they asked me to become the permanent director … and here I am."

While Sullivan misses some aspects of his former research position – physically engineering new products and systems; and the "eureka moments" … making that rare, first find – he is well-suited for success in his leadership role, and understands that in the Executive Director seat he can effectively enable a much greater impact of change than he could as a scientist/engineer alone.

"I have a lot of responsibilities in my current job, and I work 12-14 hour days routinely," said Sullivan. "But I would not trade it for what I can do now, which is facilitate science on a much broader scale for all the scientists here and throughout FAU."



While Sullivan misses some aspects of research, he said "I would not trade it for what I can do now, which is facilitate science on a much broader scale for all the scientists here and throughout FAU."

– Jim Sullivan, Executive Director, FAU Harbor Branch Oceanographic Institute

Photo Greg Trauthwein

It is the "throughout FAU" portion that is key, because while Sullivan sits at the head of FAU Harbor Branch, his role is incumbent to facilitate research and engineering cooperation and collaboration among the other colleges across the FAU system. "I can drive science a lot more in this position than I could just working in my lab on my own projects," Sullivan said, who as the figurehead of the institute interfaces with politicians, outside organizations and community groups to help influence how funding is made to ocean sciences. "It's a different level, but really it's all the same thing; we're trying to improve science and facilitate research," guided by the university's four core pillars: Biomedical Research, Aquaculture, Marine Conservation Research, and Ocean Engineering.

TECH EVOLUTION

Courtesy of his age and experience, Sullivan has had a seat – front and center – to many of the tectonic shifts in technology which has changed the way in which oceanic researchers conduct their studies. In assessing the changes he has seen, from the time he started his career to today, he is succinct in his thought on the three that have the greatest impact.

- **Autonomous Measurement Systems:** "Drifters, drifting profilers, buoy systems, autonomous buoy systems, underwater autonomous vehicles, flying vehicles that carry sensors. All of that infrastructure, which is part of the global ocean observing system, is a huge part of us having a much more synoptic picture of how the oceans work.
- **Sensors:** "Advances that have been made in microelectronics, optics, acoustics and visualization that you can put on autonomous system is amazing." In particular, the wide array of new autonomous systems and advanced sensors plays into a topic near and dear to Sullivan's researcher heart: water quality. "We're starting to find so many negative things affecting our water quality — plastics, algal bloom – and we need to get a grip on what they are and what levels they're at." Sullivan sees a next generation of microsensors that can start doing more advanced analytical measurements, helping to save additional time and money from traditional lab water sample analysis. "Developing sensors that can automate that (process) … is Nirvana for tech development.
- **Big Data Analytics:** With new autonomous platforms and enhanced sensors comes terabytes of additional data; effectively, efficiently processing and analyze this data to create actionable intelligence is the mandate across industries.

FAU Harbor Branch: By the Numbers

- The second largest (144 acres) campus in the FAU system.
- 250 people on campus, including 70 graduate students.
- 40 research faculty members. We have both straight research professors who are not tenure track. We have joint appointments with colleges, so we have tenure track, um, professors as well as kind of a, a mix of what our faculty are like. Uh, we used to maintain about $9 million a year in an external research dollars coming in. Here we are now in 2021, we had almost
- $ 18-20 million in external research funding (1/3 of all the external research dollars that come into FAU run through Harbor Branch) "We have a very large appropriation with the Office of Naval Research."

As our time with Sullivan wound down, we asked the ubiquitous question: What's your biggest challenge?

"Hmm ... I have more than one," he said with a laugh. "The biggest one is budget, always trying to have enough budget to grow infrastructure, to keep maintenance going and to grow what you're doing. In our case, Harbor Branch is 100% committed, we're at capacity. In other words, we don't have a lot of extra lab space or office space. The only way for us to grow is new buildings, and the request for putting up buildings in this state right now through universities is 'get in line.' It could take 10 to 20 years, but holding back our growth for decades is not something I want to do. So my challenge is how do I find alternative ways to get investment in our institute that will help us grow?"

And growth is the mandate, as Sullivan and his team evolve the offer of FAU Harbor Branch so that it's in the same conversation with the Woods Hole's and the Scripp's of the world.

So much of Sullivan's time is spent exploring – exploring differently from his research days, but exploring still – finding a path of growth through corporate sponsorships, shared joint use facilities and philanthropy … exploring all channels outside of but including regular state funding.

"To put up buildings, to build our infrastructure. That is my biggest challenge."

Subsea Fiber Optic Cable Systems for Offshore Energy Projects: Q&A with Pioneer Consulting's Austin Shields

Pioneer Consulting, a subsea fiber optic telecommunications consulting and project management company, was last year awarded a contract by Zemax-Planova Consortium to provide expertise related to the Petrobras Malha Óptica fiber optic system project, offshore Brazil. The project will link 13 FPSOs and one platform with two cable landing stations in Praia Grande, São Paulo, and Rio de Janeiro. ***MTR*** *interviewed Pioneer Consulting's Director of Client Solutions,* ***Austin Shields****, to learn more about the project and the subsea fiber cable trends in offshore energy in general.*

By Bartolomej Tomic

What is Pioneer Consulting, and what is your offer in the offshore energy sector?

Pioneer Consulting is an international telecommunications consulting, engineering, and market research company that advises clients on the planning and implementation of submarine fiber optic cable networks during all phases of system development. Our accurate, insightful, and thorough advisory services provide clients with objective and independent guidance in support of their projects and strategic goals. Pioneer's capabilities range from market analysis and feasibility study to system design and engineering and supply, in addition to providing full-scale project implementation and management.

Within the offshore energy sector, Pioneer offers all consulting services applicable to other telecommunication projects, while leveraging over 20 years of experience in navigating the complexities of the oil and gas and offshore energy sectors. Pioneer provides clients with the project knowledge and planning they need. This is accomplished through deep understanding of the nuances related to the special products and rigorous requirements that are associated with offshore energy projects, which often include strict offshore asset restrictions, health and safety specifications, special powering and optical design principles, and the unique subsea equipment designed specifically for these types of projects.

What are some trends and practices you are seeing today when it comes to the adoption of subsea fiber optic cable technology in the offshore energy industry?

Recent trends in modern fiber optic communication systems point towards a growing need for robustness and reliability. Current systems are being designed and manufactured with redundancies in mind, both with respect to transmission paths (i.e. mesh networks) and at the component level. Not surprisingly, the main goal of any fiber optic communication system is to facilitate reliable communications, however, owners have been pushing for networks that also increase safety, automation, and monitoring -- specifically in the oil and gas sector. Expanding the usage of these networks on different fronts is also a recent trend in the industry, with suppliers working to provide more than just communication applications for their cable products. Suppliers and purchasers are looking to incorporate additional sensing capabilities into their networks, such as permanent reservoir monitoring and downhole applications to name a few in the oil and gas sector.

Can you talk about the technical aspects of subsea fiber optic cables? How do these cables differ in diameter, capacity, length, material, cost etc.? How is this technology evolving?

Much like standard telecommunication systems, offshore energy cable systems typically consist of a backbone or trunk section that connects major onshore sites to the offshore assets. This backbone cable typically consists of the same type of cable, repeater, and branching unit products found in standard telecommunication projects, which provides the benefit of using off-the-shelf products in place of bespoke, specialized products. Moreover, existing cable protection products such as URADUCT and mattressing are used extensively to protect both the optical cable and the offshore energy assets that the cable crosses.

Beyond the backbone, however, are where the specialized products come into play. In order to facilitate connections to floating production platforms, specially designed umbilical and riser cables are required. These umbilicals are typically large enough to encompass multiple standard subsea telecommunication cables and thus average between 80-120mm or greater in outer diameter, depending on the application. These umbilicals are designed with similar strength steel wire members, and polyurethane and armor layers, compared to the optical cable that they house, and can also support a wider range of applications, including power cable, electrical monitoring, and hydraulic and injection hoses. Umbilicals provide connectivity between subsea assets and offshore assets, such as floating oil platforms, via a specially designed catenary or free-hanging section of cable. This catenary is suspended in the water column using buoyancy and ballast modules affixed to the umbilical cable.

Evolution in optical umbilical products is expected to follow similar design trends as standard optical cable regarding increased fiber count and a potential shift towards cheaper power conducting materials, though not much detail in that regard has been shared lately. As a specialty product, these umbilical cables are often sold a premium and can generally be expected to cost more than commercial subsea cable products.

What are some of the main benefits for oil and gas operators who chose to go the subsea fiber optic cable route?

The main benefit of fiber optic cables for oil and gas applications is the advantage of direct fiber connectivity between onshore sites and offshore facilities and assets. Having direct, high-capacity traffic connectivity to floating oil platforms provides all the benefits of reliable communication that any standard telecommunication system would likewise provide. Considering the harsh operating environment and remoteness of these production platforms out in the ocean, a stable and reliable line of communication and data flow are critical.

Additional benefits of fiber optic cables unique to oil and gas include increased automation and controls, along with the ability to process high volumes of data generated through emerging fiber optic technologies such as downhole sens-

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"Petrobras is highly motivated in increasing capacity and security in the transmission of real-time data from offshore platforms. This increase in capacity opens up a range of possibilities, such as live video support from suppliers via video transmission, adoption of digital technologies on a large scale, and real-time remote monitoring of production facilities."

Austin Shields,
Director of Client Solutions,
Pioneer Consulting

ing and permanent reservoirs monitoring. Fiber optic cables also help to create a safer operating environment with a more connected workforce and more flexibility and reliability compared to satellite connections that can be severely impacted by weather and other natural events.

Are there any distinct differences between commercial subsea fiber optic projects and those in the offshore oil and gas industry?

As mentioned previously, the oil and gas industry often presents unique design constraints that require specialized products to overcome. Specific requirements include OADM traffic flexibility to/from multiple offshore production platforms, while simultaneously restricting the use of powered equipment on the cable segments leading to these platforms.

Other differences in oil and gas projects include a particular attention to installation operations and health and safety. It is not uncommon for an entire project to be put on hold due to a crew member on a vessel not wearing the correct PPE, and vessels and their crew often have strict requirements for training and approach protocols when entering the "exclusion zone" surrounding the floating production platforms. Additionally, cable installation operations often have requirements not typically found in commercial subsea fiber optic projects, including live touchdown monitoring and cable protection when crossing pipeline assets, strategic placement of cable between pipeline anodes and electrical constraints, and unique shipboard representative accommodations.

Lastly, a major difference in oil and gas projects comes from the subsea technology products needed to facilitate connectivity to the floating platforms. Since many aspects of oil and gas are dynamic and consist of moveable production facilities, the optical network must be flexible enough to support new connections to offshore assets. The Subsea Umbilical Termination Assembly (SUTA) and other similar products are unique to the oil and gas industry which adopt highly specialized components to allow for such flexibility. SUTAs utilize wet-mate connector technology and advanced fiber termination assemblies to allow for direct connections to be made undersea via an ROV. These SUTAs connect the offshore assets via umbilicals to the fiber optic backbone, allowing for multiple connections to existing and future oil and gas assets without the need to install additional fiber optic backbone cable or recover and splice into pre-installed branching units or OADM units.

You were recently awarded a contract to support Brazilian oil giant Petrobras' Malha Óptica project. Can you tell us about the project in general and what it aims to achieve?

Currently under construction, the 1,200 km Malha Óptica makes use of a traditional, two-fiber pair (2FP) repeatered trunk and branch architecture with 13 power-switched branching units (PSBU). The network will initially connect 13 floating production and storage offloading (FPSO) units to the trunk via branching units with OADM technology to deliver 200 Gb/s of bi-directional communications to each cable landing stations (CLS) – one located at Praia Grande, state of São Paulo and the other at Praia da Macumba, state of Rio de Janeiro.

Petrobras is highly motivated in increasing capacity and security in the transmission of real-time data from offshore platforms. This increase in capacity opens up a range of possibilities, such as live video support from suppliers via video transmission, adoption of digital technologies on a large scale, and real-time remote monitoring of production facilities.

What exactly is your scope in the project, and what do you believe was the key factor that contributed to the company winning the contract?

Pioneer has been hired by a consortium between ZMAX Blue Marine Telecom and Planova Planejamento e Construções, both Brazilian companies, which is responsible for the integration of the Malha Óptica system. Pioneer has been hired to help bridge the "language" gap between oil and gas and commercial telecoms. Our role in this project is to provide expertise, experience, and advise on all aspects related to oil and gas telecom equipment, marine survey, and installation activities. Since we started working on the project in April 2022, we have taken on an active role coordinating various subcontractors, providing our expertise in installation planning and procedures, supporting on-site factory acceptance testing, and assisting with other roles as needed to help move the project forward.

We believe that there were a few key factors that contributed to our winning the contract. Our general knowledge of the project based on years of planning by Petrobras, coupled with decades of installation and planning experience in oil and gas were likely distinguishing factors. We also had more general experience working in Brazil on telecom projects through the past two decades.

It's now been several months since the contract was awarded. Can you give us an update on the status of the project?

As of January 2023, the entirety of the trunk cable, repeaters, branching units, and branch cable has been manufactured, with system assembly and test (SAT) ongoing.

Manufacture and integration of the SUTAs and umbilicals will be completed during the second quarter of 2023, the same as installation begins for the trunk.

The 13 initial FPSO umbilical connections are scheduled to occur throughout 2023, and the entire Malha Óptica is on schedule to be completed by late 2023.

What makes the Malha Óptica project unique compared to other subsea telecom projects Pioneer Consulting has worked on?

In addition to the various nuances described above, Malha Óptica is unique in its somewhat "disaggregated" approach to design and implementation.

Many aspects of this project are being handled by separate manufacturers and installers, each with expertise relative to the oil and gas sector. The ZMAX-Planova consortium is acting as the integrator, pulling all of this expertise together to deliver a completed network for Petrobras.

Of course, this approach creates unique challenges in the coordination of materials, equipment, and subcomponents between suppliers and installers.

Although Pioneer is very familiar with a disaggregated approach to system construction for commercial telecom systems (for example having just completed the CrossChannel Fibre system using this approach), this level of disaggregation is unique because the disaggregated scopes are much larger than they would be for a commercial system.

Of course, this approach is quite common in the oil and gas industry, but not so much in commercial telecoms, at least at this scale.

Finally, are there any drawbacks to using subsea fiber optic cables in the offshore industry? How is the cable's structural integrity, cybersecurity, and data safety ensured? And what can operators expect in terms of maintenance costs?"

Drawbacks to using fiber optic cables in the oil and gas industry are similar to the drawbacks of using fiber optics for commercial use, which include challenges in installation and repair operations, potential issues in permitting and regulatory hurdles, and the high cost of developing these types of systems. The oil and gas industry introduces additional challenges during installation, and repair operations due to the restrictions associated with nearby offshore energy assets, and, occasionally, the need for specialty equipment can drive up the development costs.

Cable structural integrity is ensured through typical cable protection requirements, which are aligned with the International Cable Protection Committee's (ICPC) recommendations.

Leveraging existing transmission equipment, and network management services, the offshore energy sector sees all the same benefits in cybersecurity and data safety as the commercial sector. One unique aspect of these types of oil and gas networks is that they are generally private. Malha Óptica will be 100% owned by Petrobras, so they're able to decide if and how the data may be connected outside to public networks. At that point, security is the same as any other communications system.

Regarding maintenance costs, offshore operators experience similar costs as commercial operators. There is no difference in terms of ongoing operational costs. However, depending on proximity to offshore assets, if cable repairs are required, they may require more precise and specialized operations compared with commercial telecom systems.

This is to ensure the integrity of the abundant infrastructure deployed on the seabed. But, as mentioned earlier, what might be seen as a more challenging operation for the commercial telecom industry is seen as "business as usual" in the offshore oil and gas industry.

New Products

Partners Aim to Unlock More Value from Hydrographic Data

QPS and TrueOcean have teamed up to develop digital workflows that they say can optimize the journey of hydrographic data from ping to cloud, by improving on traditional data sharing practices including the use of hard drives or standalone cloud services. The partners are working together to take the next steps in digitizing the data value process in offshore projects. Their focus is on building seamless integration between QPS software solutions and the new TrueOcean Marine Data Platform (MDP), with the shared objective of eliminating friction and accelerating data exchange. The goal is to get information to end users faster by making it possible to directly upload QPS proprietary data to the TrueOcean MDP without data conversion and including valuable meta data from the QPS format. Data can be viewed directly within the platform and extracted into other QPS products for additional analysis.

Balmoral

Balmoral Launches Scour Protection System

Balmoral has unveiled a new scour protection system that integrates seabed protection and flow reduction to minimize operational costs and potential cable failure in the offshore wind industry. The new HexDefence structure eliminates the requirement to dump rock, instead providing a non-invasive approach to protecting the monopile and the immediate surrounding area, Balmoral said. The lightweight advanced composites construction and streamlined installation method makes it easy to install without the need for additional vessels. Additionally, the system is capable of use with antifouling coatings and does not require special equipment for end-of-life recovery.

Fraser Milne, the company's engineering and projects director, said, "We believe Balmoral HexDefence represents a significant step forward for scour protection, offering highly cost-effective performance enhancement across installation, management and maintenance."

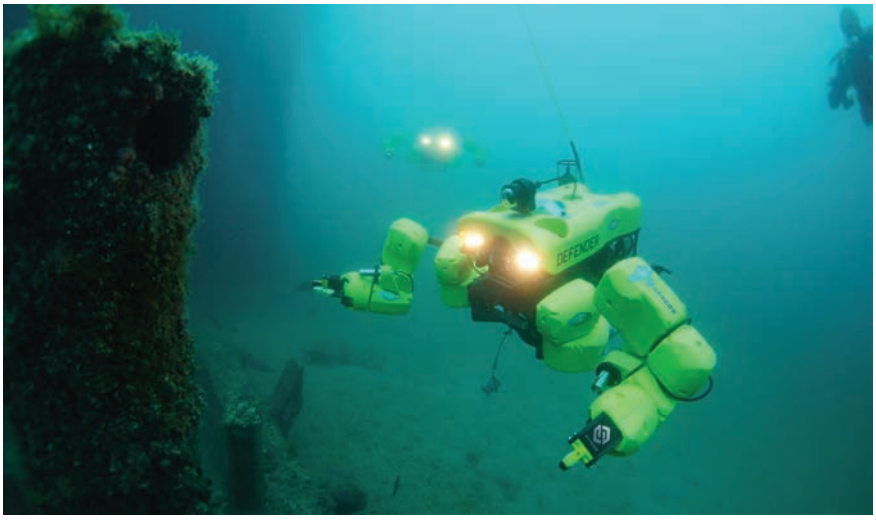
The interlocking panels are generally 10m long and custom-sized to fit varying monopile diameters and feature integrated lifting and access points. In simple terms, the installation process involves sinking the foundation, sleeving it with HexDefence, fitting the transition piece and assembling the pylon and blades.

"The system is also suitable for retrofitting to existing monopile structures."

Sarcos, VideoRay Partner on Integrated Underwater Robotic Systems

Sarcos and VideoRay signed an agreement to offer integrated underwater robotic systems combining VideoRay remotely operated vehicles (ROVs) with the Sarcos Guardian Sea Class robotic system including its dexterous arms.

Sarcos and VideoRay will each be able to sell an integrated underwater robotic system and their respective products and provide replacement parts, repair services, and support. Sarcos Guardian Sea Class robotic system has a modular design that will easily integrate with VideoRay's lineup of one-person portable ROVs. VideoRay systems can operate in currents up to four knots. In August 2022, VideoRay announced that the U.S. Navy had standardized on the use of the VideoRay Defender system and had placed a large order of the remotely operated vehicles, due to its superior capabilities, flexibility and upgradability. The Guardian Sea Class system can be operated with one or two six-degree-of-freedom arms and performs in depths of up to one kilometer (1,000 meters) for up to two hours at a time. It can be teleoperated or operated via supervised autonomy. As the system is electronically driven, the Guardian Sea Class eliminates the added weight, size and expense of hydraulic power unit systems, lowers maintenance costs and reduces the risk of system downtime due to failure, Sarcos aid.



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"VideoRay has designed our remotely operated vehicles to perform critical jobs in the harshest environments," said Chris Gibson, CEO, VideoRay. "Our ROVs are a natural fit with the Guardian Sea Class system and, when combined, we believe that the packaged solution offers the most advanced underwater inspection capability on the market today."

Subnero, Popoto Unveil New Underwater Acoustic Modem

Subnero and Popoto Modem have joined forces to create a new underwater acoustic modem, the S1000-N. The modem combines the best from both companies, bringing together the power of the Popoto's S1000 series modems and Subnero's underwater network stack (UnetStack), enabling advanced underwater networks for a variety of underwater applications, such as current and temperature measurement, pollution tracking and other multi-node uses. With the S1000-N, users can see a data rate of up to 10240 bps over a range of 3+ km. Subnero's technology integration allows users to take full advantage of UnetStack, an underwater networking stack with features such as multi-hop routing, fragmentation and reassembly, contention-free communication, and much more, providing users with a more reliable and efficient way to send data underwater. With a fully functioning network stack out of the box, the S1000-N offers users a powerful and affordable solution for underwater communications, according to Subnero and Popoto. One of the key features of the S1000-N is its ability to operate at a low power draw, while still offering the benefits of a software defined modem. The S1000-N supports multiple computer languages for interfacing (e.g. Java, Python, Groovy, Julia, C, JavaScript), and allows for customization at various levels. These features provide users with the ability to build and customize their applications. The S1000-N provides the ability to transmit and record unique waveforms, allowing the unit to act as an acoustic data logger or general acoustic source.

The S1000-N is suited The S1000-N is available at a starting price of $6,750.

Subnero

Exail Launches All-in-One INS and DVL System

Exail launched the Rovins 9 DVL, a new all-in-one system for subsea vehicles that combines the best of inertial navigation and Doppler Velocity Log (DVL) technologies in one tightly integrated system. Described as highly compact for easy vehicle integration, the Rovins 9 DVL all-in-one design combines, in a single housing, Exail advanced Fiber-Optic based INS with a Nortek DVL. This tight integration of raw sensor data from both INS and DVL provides operators with highly accurate position, velocity, and attitude information, even in challenging subsea environments, Exail said. This new all-in-one system is suited for subsea companies looking to maximize efficiency, and allows for higher levels of reliability, with a position accuracy of up to 0.02%TD and a heading accuracy of up to 0.01°RMS, according to the manufacturer.

Exail

Maxime Le Roy, INS Product Manager at Exail, said "the Rovins 9 DVL greatly simplifies the work of subsea operators in the field. The system can be easily integrated into a variety of subsea vehicles, including ROVs, AUVs and tow fishes, thanks to its unique compact horizontal design and plug-and-play feature."

Exail

Exail Launches New Compact USBL Positioning System

Exail launched Gaps M3, a new compact subsea ultra-short baseline (USBL) acoustic positioning system for permanent vessel installation.

Gaps M3 is a USBL positioning system with no embedded Inertial Navigation System (INS), making it a cost-effective choice for operators who can rely on existing onboard navigation systems. Intended for permanent USBL installations, Gaps M3 can indeed be coupled with navigation systems already on board to provide users with continuous access to high-level precision meeting any operational requirement for survey and Dynamic Positioning (DP) operations. Deployments from opportunity vessels are still possible thanks to Gaps M3 integrated MEMS Attitude and Heading Reference System (AHRS).

Benefitting from the existing Gaps Series renowned features, the Gaps M3 is equipped with a 3D, 4-hydrophone acoustic antenna which provides maximum 200° aperture, along with new telemetry features, enabling advanced acoustic communication capabilities. It offers true horizontal tracking and communication capabilities in shallow and deep water, especially when multiple vehicles need to be located simultaneously at 360°.

The Gaps M3 is available in an export-free version with a 995m maximum operating range and in an extended range version for operations to depths over 4000m.

Tech Files

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DWTEK Showcases Underwater Technology

DWTEK, a Taiwanese local brand that focuses on underwater technologies and solutions development, showcased its customizable ROV I90 solution, connector, and thruster at the Ocean Business in Southampton. "The marine technology development started in 1976 in Taiwan; back then, it was mainly focused on the pelagic fishery. The Taiwanese government set a goal to increase 20% of renewable energy power by 2025, and with the Taiwan Strait providing a wind speed of 11.94 – 12.02m per second, it became the first location for renewable wind power energy construction," the company said in a statement. "Foreign investors have already put more than 220 billion NTD [currently around $7.19 billion] in the [offshore wind farms] in Taiwan," DWTEK said. Thanks to the offshore wind power development, the demands on underwater construction [in Taiwan] increased, and DWTEK has taken part in the country's offshore wind development by providing self-designed and built ROV, underwater connectors, thrusters, and components, alongside IMCA ROV Pilots, assisting in OWF inspection and the maintenance, and foundation, marine growth, and scour inspections. In recent years, DWTEK also assisted National Geographic in 2019 with ocean wreck research, also collaborated with a Denmark energy company to implement a wind farm project.

CSignum

CSignum Demos Electromagnetic RadiEM Modem

CSignum demonstrated its new RadiEM Modem at Ocean Business. The company touts RadiEM as the first platform to use low-frequency electromagnetic (EM) fields to transmit more data wirelessly. According to CSignum, RadiEM is the only technology that can transmit data through the water-air boundary, water column, seabed and subsea structures, as well as connect digital devices in networks below the water with those networks on land and in the air. "EM signals are resilient sustaining their integrity where sound and light scatter: at the surface; in shallow splash zones; aerated, turbid and bio-fouled waters; and, anywhere ambient light, line of sight and noise interference is an issue. Because EM fields are also silent and invisible, they are more secure as well as safer for the environment and marine life," CSignum said. "We expect RadiEM to become the cable-free gateway for marine data through the surface of the water," said Chris Brooks, CEO of CSignum. "RadiEM is already successfully deployed in a multitude of use cases from AUV/ASV (HESS and Ocean Aero) and tidal water data recovery to offshore structural and met ocean data transmission to real-time ADCP data. RadiEM has reliably sent data at a range of 28-30m via underwater modems to topside receivers transmitting at 200bps.

CoastAware BuoyCam Enters Beta Testing

MarineLabs Data Systems, a B.C.-based ocean technology startup, launched its new BuoyCam service, designed to be a scalable, end-to-end ocean camera data product. The service, which is currently in 16 beta testing locations along Canadian coastlines, aims to provide subscribers access to 360-degree, real-time views of ocean conditions through images from sensor locations along coastlines. The $1.1M trial with the Canadian Coast Guard is being funded through the Innovative Solutions Canada (ISC) Test Stream for a year.

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