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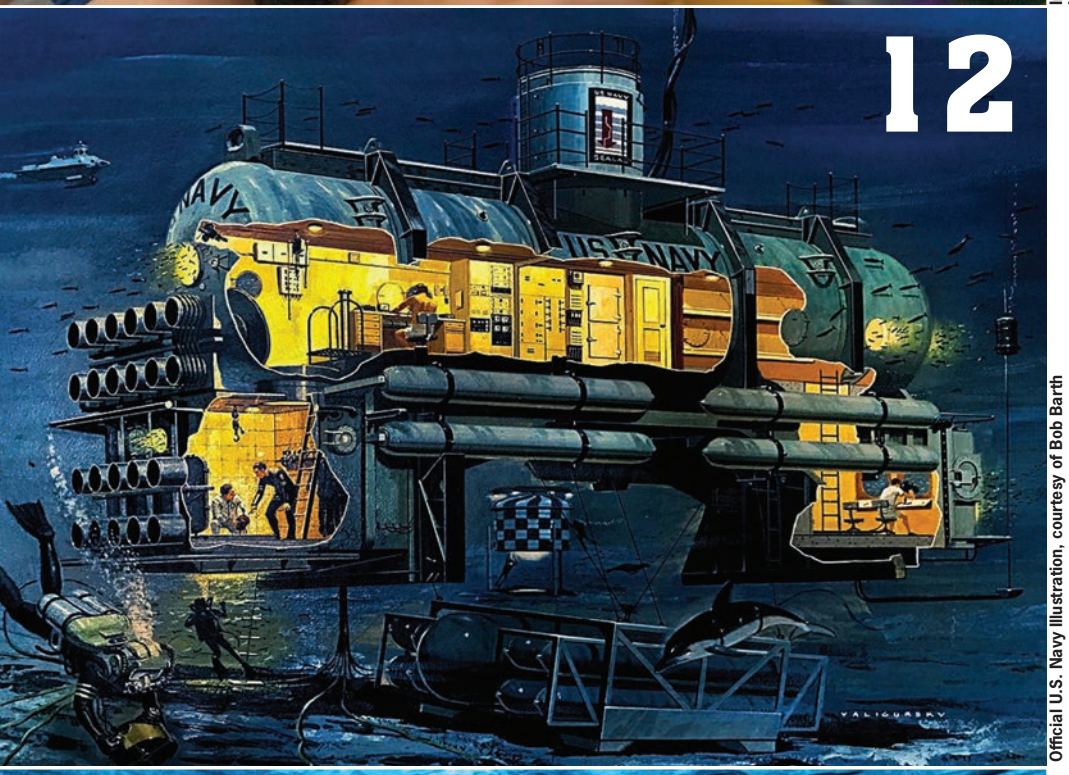

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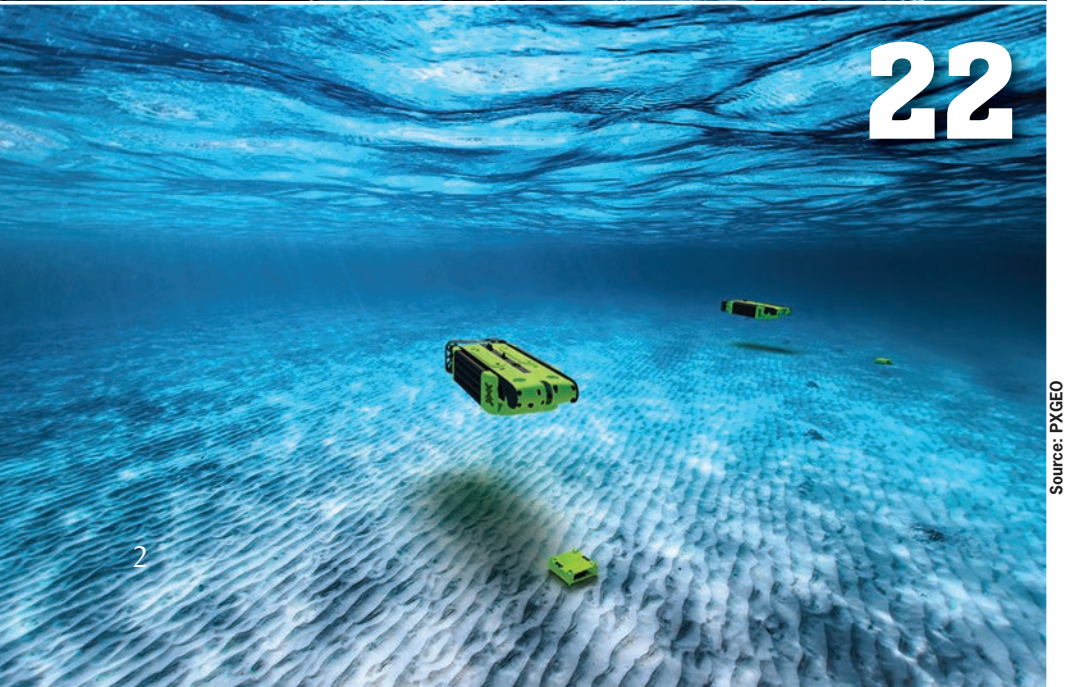
Official U.S. Navy Illustration, courtesy of Bob Barth



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Editorial


Justin Zuure

The first half of 2024 has been a buzzsaw of business travel and activity, and I write this as I am literally flying back from business one trip, stopping home to change suitcases and promptly heading off on another. This flight home from St. Johns, Newfoundland and Labrador, only solidified my contention that the very best stories, the very best business results come from that one-on-one interaction, the process of packing up, shipping out and walking into someone's office/factory/boat and learning first-hand what they're doing, how they're doing it and why.

I first made the trek up to St. Johns nearly 20 years ago, and the thing that has always stood out from that, plus my three subsequent trips, is the overwhelming hospitality and welcome you receive. In this business the word 'cluster' is bandied about with frequency, ease and sometimes misuse, but in the context of this region and the companies in subsea, maritime and offshore energy that power the province's economy, 'cluster' it is in the truest sense. In a scant 50-mile radius is housed a gem of expertise, facilities, leadership and technology, with government, academia and commerce working together lock-step with a common mission: offer their best and brightest to draw in the world's best and brightest serving subsea, maritime and offshore energy. In the coming months you'll be seeing a wealth of coverage on the region from this Innovation Waves event, which included a strong contingent from Innovate UK, as my colleague **Celia Konowe** had unfettered access to the full breadth of the Newfoundland & Labrador wealth of resources, I'm happy to say that on this trip I have again seen dramatic growth and expansion throughout. Speaking of Celia this trip was significant as it gave to me the opportunity to finally meet in person MTR's contributing writer extraordinaire ***(pictured above in the fishing village of Qidi Vidi)***, having only known her from a small, square TEAMS picture since she started as an intern in the summer of 2020. gStay tuned here – as well as in the pages of *Maritime Reporter & Engineering News* + *Offshore Engineer* – for some in-depth reports and analysis on the people, the companies, the technologies coming out of Newfoundland & Labrador.

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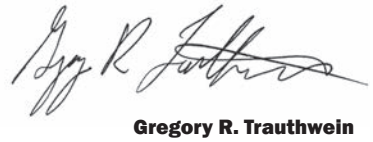

Gregory R. Trauthwein
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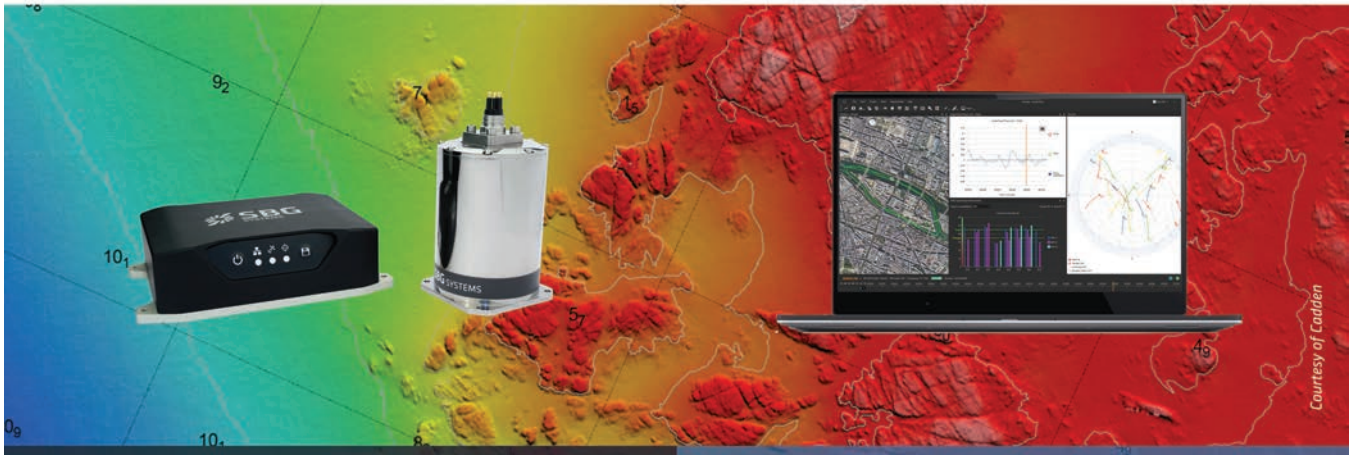

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Gallaudet

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 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. He writes for the *Journal of Diving History* and the *MTR*.

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Wendy Laursen has 20+ years of experience as a journalist. In that time, she has written news and features for a range of maritime, engineering and science publications. She has completed a Master of Science research degree in marine ecology as well as diplomas in journalism, communication and subediting.

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Edward Lundquist is a retired naval officer who writes on naval, maritime, defense and security issues.

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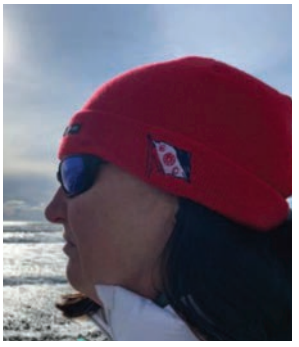
Rhonda J. Moniz is host of Marine Technology Reporter's DEEP DIVE podcast. She is an underwater forensics expert specializing in diving technologies and subsea systems. She has more than 25 years of experience as a ROV pilot, master dive instructor, scientific diver, and dive safety officer. She is the president of the board of directors for the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS).

Race
Julian Race is the IT Manager for R/V Sikuliaq, and founder of Race Maritime Services. Julian has supported oceanographic research projects all over the planet.

Moniz



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SAFEGUARDING THE DIGITAL SEAS:

Inside a Cyber Readiness Drill Onboard RV Sikuliaq

By Julian Race, M.S.

In an era when technology is integrated into every facet of our lives, the maritime industry is no exception. Ships at sea are increasingly reliant on interconnected systems for navigation, communication, and operation. However, with this reliance comes the vulnerability to cyber threats, making cybersecurity a prime concern for maritime safety and security.

The importance of cybersecurity on vessels is often overlooked. Ships are now equipped with sophisticated electronic systems, including navigation, propulsion, and communication systems, all interconnected through sometimes complex networks. While these advancements enhance efficiency and safety, they also present opportunities for malicious actors to exploit vulnerabilities.

Vessels conduct routine safety and security drills to ensure the crew is familiar with procedures to keep a vessel safe from things like pirate attacks or unknown persons sneaking onboard. However, what happens when the threat is virtual? There is no panga (a small fishing boat often favored by pirates) loaded with gun-wielding attackers to fend off, or suspicious packages to find and secure. Cyber threats are amorphous and insidious — and vessels must start preparing for these types of attacks.

One of the most significant threats is the potential for cyber-attacks to disrupt essential ship systems, leading to navigation errors, engine failures, or even complete loss of control. Such incidents not only endanger the crew and cargo but also pose environmental risks, threatening marine life, coastlines, and infrastructure.

Moreover, modern vessels are not isolated entities; they are part of a broader maritime ecosystem that includes ports, terminals, and maritime authorities. A cyber-attack on one vessel could have cascading effects, impacting port operations, maritime traffic management, and supply chains. While the tragic accident in Baltimore in March 2024 that resulted in the destruction of the Francis Scott Key bridge and loss of six lives was likely mechanical failure or human error rather than malicious intent, it is not hard to imagine a similar scenario where a vessel's control systems are compromised via cyber attack. A vessel that has been compromised could be driven off-course or intentionally disabled to cause damage to a port or other maritime facility.

To address these challenges, the maritime industry must prioritize cybersecurity as a fundamental component of vessel safety and operational resilience, similarly to fire prevention or anti-piracy measures. This requires a multifaceted approach encompassing technology, regulations, and workforce training.

First and foremost, vessel operators must invest in robust cybersecurity measures to safeguard onboard systems from external threats. This includes implementing advanced firewalls, security protocols, intrusion detection systems, and regular security audits to identify and mitigate vulnerabilities.

Additionally, regulatory bodies and international organizations play a crucial role in establishing cybersecurity standards and guidelines for the maritime industry. Compliance with regulations put forward by the International Maritime Organization (IMO) and the U.S. Coast Guard (USCG) are essential to ensure a baseline level of cybersecurity across the industry.

To that end in June 2017, The IMO Maritime Safety Committee adopted Resolution MSC.428(98), Maritime Cyber Risk Management in Safety Management Systems, to encourage vessel operators to ensure that cyber risks are appropriately addressed in existing safety management systems. Domestically, the USCG recently requested comments on

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proposed modifications to the Maritime Transportation Act to specifically include cybersecurity as a consideration for all U.S.-flagged vessels.

Furthermore, cybersecurity awareness and training programs are vital to empower mariners with the knowledge and skills to recognize and respond to cyber threats effectively. Crew members should be educated on cybersecurity best practices, such as identifying phishing attempts, securing passwords, and reporting suspicious activities.

Drills are a common method on ships for testing procedures and preparing crew for incidents, and Cyber Incident drills are one way to test a crew's preparedness for a cyber attack. On the Research Vessel Sikuliaq — a 261-foot ice capable research vessel operated by the University of Alaska Fairbanks — a first-of-its kind Cyber Incident drill was carried out during a voyage from Newport, Oregon, to Seward, Alaska, in April 2024.

This CI drill was designed to simulate a so-called cryptolocker attack on one of the engine control system computers. The scenario involved a member of the engineering team using an accessible USB port on the Integrated Automation System (IAS) console to charge their cell phone. The IAS is a central control system that monitors and controls various critical shipboard functions, such as propulsion and power

Image from https://www.upguard.com/blog/ransomware-examples

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generation. Unbeknownst to the crew member, the cell phone was riddled with malware and proceeded to infect the control computer. The system became sluggish and eventually stopped working altogether before showing a Cryptolocker Screen (in this scenario, a printout of the below screenshot was taped over the console in the Engine Control Room).

Engineers quickly realized that a cyber attack was underway and took steps to isolate the threat. The infected computer was disconnected from the IAS network and shut down. Luckily, Sikuliaq is equipped with redundant control systems, and the parallel computer was found to be free of infection. Crew members pulled out the vessel Cyber Risk Management Plan (CRMP) and followed the steps to report a cyber incident. Vessel IT staff were brought in to assess the situation and found the infection to be contained, and no other engineering or other vessel systems had been affected.

Performing a Cyber Incident drill allowed crew members to see just how damaging a cyber attack could be, and gave them an opportunity to test not only the vessel's protocols for cyber security, but also to use their cyber security training in a simulated 'real world' attack. A drill like this also helps highlight areas where the vessel's cybersecurity posture is weak, or where areas in the Cyber Risk Management Plan can use improvement.

These exercises also help identify vulnerabilities within the ship's cyber infrastructure, promoting continuous improvement in security protocols. Additionally, cyber incident drills foster a culture of cybersecurity awareness among the crew, ensuring that everyone understands their role in maintaining the security of the vessel's systems. Such proactive measures are essential for safeguarding both the physical and digital aspects of maritime operations.

Cybersecurity is not merely a technical issue but a critical aspect of maritime safety, security, and resilience. As ships become increasingly digitized and interconnected, and at-sea internet access becomes faster and more ubiquitous, the need to protect against cyber threats becomes ever more pressing. By prioritizing cybersecurity measures, investing in technology and training, and fostering a culture of cyber awareness, the maritime industry can navigate the digital seas with confidence, ensuring the safety and security of vessels, crew, and cargo for years to come.

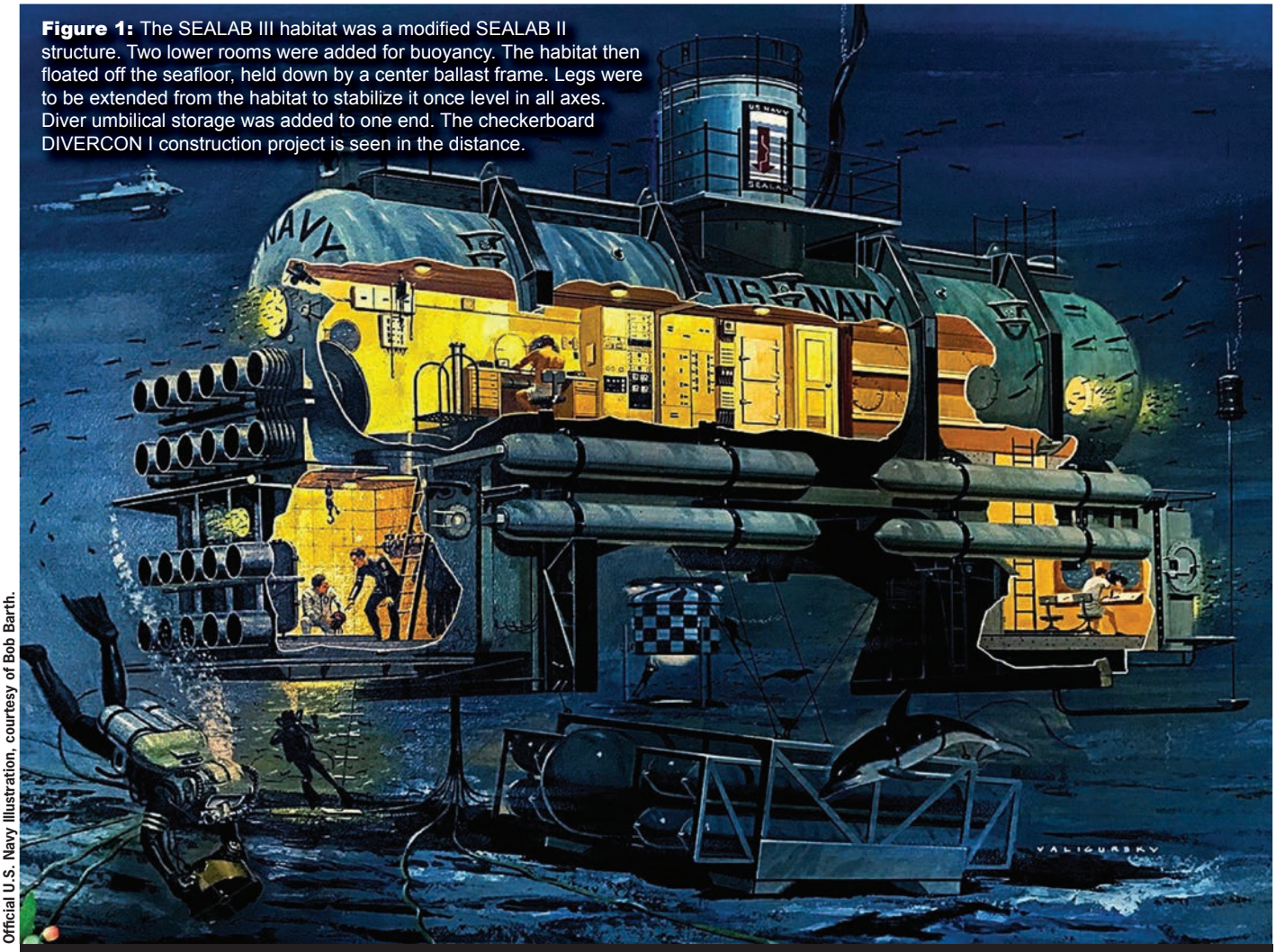


Figure 1: The SEALAB III habitat was a modified SEALAB II structure. Two lower rooms were added for buoyancy. The habitat then floated off the seafloor, held down by a center ballast frame. Legs were to be extended from the habitat to stabilize it once level in all axes. Diver umbilical storage was added to one end. The checkerboard DIVERCON I construction project is seen in the distance.

Official U.S. Navy illustration, courtesy of Bob Barth.

ABSTRACT: SEALAB III, THE DIVERS' STORY

By Kevin Hardy, Historical Diving Society, MTR Columnist

Editor's Note: *This article is a synopsis of a current feature story in the Historical Diving Society's Journal of Diving History, Second Quarter 2024, appearing here with their permission. It is not the story as officially told in 1969. This is the divers' story. A pdf of the full article plus a recorded presentation may be found at* ***https://www.global-oceandesign.com/articles-and-papers.html****.*
We encourage readers to download the full text.

Background

It is to the enduring honor of the U.S. Navy that their medical dive officers first proposed, then advanced the principles of saturation diving. The implications of that breakthrough changed everything about military and commercial diving to this day.

In 1942, Capt. Albert R. Behnke, a USN diving medical officer, first suggested the principles of saturation diving to solve caisson's disease in bridge building.

In 1957, USN Diving Medical doctors George Bond and Robert Workman, Medical Service Officer Walter Mazzone,

began to test Behnke's theories as applied to extended duration deep sea diving. By 1963, Bond boldly began planning a series of open ocean seafloor laboratory experiments. SEALAB was born.

– **SEALAB I** (1964) demonstrated the practicality of saturation diving in the open ocean at 192-ft, while revealing problems of high humidity, temperature control, and verbal communication in a helium atmosphere.

– **SEALAB II** (1965) placed three teams of 10 divers 205-ft for 15 days each, and effectively demonstrated that ocean-floor habitation can enable a wide range of salvage and scientific tasks.

After sophisticated chamber simulations to 1,000-ft, Bond proposed SEAHAB, a permanent manned seafloor habitat at 400-ft. Projects and teams could be rotated when weather and readiness aligned.

The USN chose a different direction, and Bond and Mazzone were moved to advisory positions. Line officers were given command of SEALAB III. Bond lamented, "I had become an observer, chronicler, and occasional adviser to the project."

Bond wrote: "… of the thousand-odd people involved with the new experiment, only two naval officers had previous experience with the habitat and with saturation diving procedures—Walt Mazzone and I. We were vastly outnumbered by well-meaning persons who had acquired sudden intelligence of matters that had taken Walt and I our entire naval careers to develop."

SEALAB III was initially scheduled for summer 1967 using a modified SEALAB II habitat. Now under the Deep Submergence Systems Project (DSSP), budgets were increased 10x.

But progress lagged.

Then the mission depth was pushed to 610-ft. By late October 1968, SEALAB III was floating in the sea off San Clemente Island, tied to the USS Elk River (IX-501). On December 1, 1968, a representative of the DSSP flew out from Washington, DC to assess the situation. They directed deployment be made by February 15, 1969. It didn't go well.

With SEALAB III on the bottom, helium leaks, seen at the surface, increased to 3,000 scf/hour, an unsustainable rate. A half-million cubic feet are lost before salvage dives begin.

In preparation for SEALAB III, 60 divers trained, 45 divers were assigned to 5 dive teams. At sea, 4 men rode the PTC (Personnel Transfer Capsule) to 610-ft twice, 3 emerged, 2 touched the habitat on two dives that lasted between 7-15 minutes, and one of them died.

Image Credit: Scan of personal log, Howard Talkington, Head, Ocean Technology Branch, NOSC-San Diego.

PTC #2 was re-surfaced and at 2045 PTC was mated to DDC #2.

Thru the course of the night a decision was made to return team #1, Barth, Cannon, Blockburn, and Reeves to the habitat.

17 February 1969
Monday

At approximately 0100 commenced PTC check-off procedures for dive.

At 0210 (about) generator watch on IX-501 reported a zero-to-ground warning light on the main switchboard.

Attempt was made to locate ground by isolating shipboard circuits (one at a time). The Mk 2 Diving System circuit and the habitat circuit were not isolated however, because of the critical nature of these loads. After all other sh-ipboard circuits had been isolated the ground was not located which indicated that the ground must be in either the Diving System or habitat circuits.

Figure 2: A portion of a report titled, "SEALAB III Sequence of Events", compiled by NOSC after the event, likely typed from handwritten logs, is shown. The text notes the shipboard effort to locate an electrical short to ground by isolating various shipboard circuits. They conclude the ground is in either the PTC (Diving System) or the habitat. At this point in time, both PTCs are on deck, and PTC-1 is being checked off for the next dive. Therefore, the short must be in the habitat.

Official U.S. Navy photo

Figure 3

U.S. Navy Board of Inquiry

A U.S. Navy Board of Inquiry (BOI) was convened. Ultimately, the BOI cited carbon dioxide poisoning as the official cause of death, and fixed sole blame on an enlisted man, Senior Chief Torpedoman Paul "P.A." Wells, a decorated World War II Marine Corps veteran and fellow diver. That did not set well with the Aquanauts.

Bond wrote in his journal, "Not one of us believed that Paul Wells would ever load an empty canister into a Mk IX rig," a sentiment repeated by every Aquanaut that has spoken to this author about this topic. Warrant Officer Robert A. Barth, Aquanaut #1, wrote, "We lost two good divers that day, Berry Cannon and Paul Wells." Aquanaut Andy Pruna, Team 5, said, "P.A. was the most capable guy, the most meticulous. I'd dive a rig he prepared any day."

In the fullness of time, dive logs, journals, and reports by those directly involved in the SEALAB III habitat have come to light.

Problems Abounded

Helium drained heat from divers, garbled speech, leaked through seals, compromised electronics, hosed up underwater cables and split sheathes.

Several program areas were found lacking:

- Senior leadership's experience, and their trust in those who had it;
- Contractor Oversight and Quality Conformance (QC);
- Breathing systems were never tested at depth. Breathing resistance was high, umbilicals sank, Aquanauts had to continuously press the system by-pass to get gas;
- Training of Aquanauts was never done at depth;
- Thermal protective suits were never fully tested or functional. On site, there was no hot water for the hot water suits, electrically heated suits were pulled for short circuits, and there were no dry suits with insulating long underwear. One Aquanaut bought his own 3/8" custom wetsuit;
- The heater in the PTC did not work. The divers are not told, and discover this only when in the PTC;
- Helium unscramblers never worked;
- Diver communication systems never worked;
- Plans for habitat deployment and recovery were undefined in critical areas, such as the umbilical cable between the habitat and surface support ship had to be connected during lowering. However, it was delivered on a spool with no slip rings, so it had to be unspooled and flaked on deck before lowering;
- The plan to open the habitat entry hatch was not worked out. Positive interior pressure kept the 4-ft square hatch shut as the diver tried to open it with a crow bar on both dives. Topside had a view of a differential pressure gauge, but failed to comprehend its significance. In between dives, the interior pressure fell and the hatch opened itself;
- Critically, power surges and ground-fault alarms on the main power cable to the habitat (440VAC, 3φ, 152kVA) confirm main electrical shorts to seawater. Topside is aware of the hazard before they send the divers down on the second dive. The danger is not communicated to the divers.

The list goes on.

On the second dive, Berry Cannon, Aquanaut/electronics engineer, is electrocuted by 440VAC. He dies outright or suffers ESD "Electrical Shock Drowning".

Responsibility

Paul "P.A." Wells had no involvement or responsibility for any of these problems.

The weight of responsibility rests on those in charge.

Bond stressed, "The Principal Investigator decides where to draw the line between acceptable risk and excessive hazard;

Official U.S. Navy photo

Figure 4

Figure 3: Captain William M. Nicholson, SEALAB III Project Manager, (left) his hand on the model habitat's main umbilical cable. Cmdr Jack M. Tomsky, On-scene Commander, and Cmdr M. Scott Carpenter, Deputy On-Scene Commander are to the right.

Figure 4: Senior Chief Torpedoman Paul "P.A." Wells on deck with his dive buddies. P.A. received a Purple Heart for wounds received as a U.S. Marine in World War II. He spent the bulk of his Navy career working with explosive ordnance and in diving.

the responsibility for the decision belongs to that person alone."

Responsibility for the failure of the SEALAB III experimental habitat rests with Captain William M. Nicholson, SEALAB III Project Manager.

It is reasonable to conclude that Paul "P.A." Wells had no culpability in the abrupt end of SEALAB III.

Conclusions

There is greater evidence that Berry Cannon died from electrocution than CO2 poisoning.

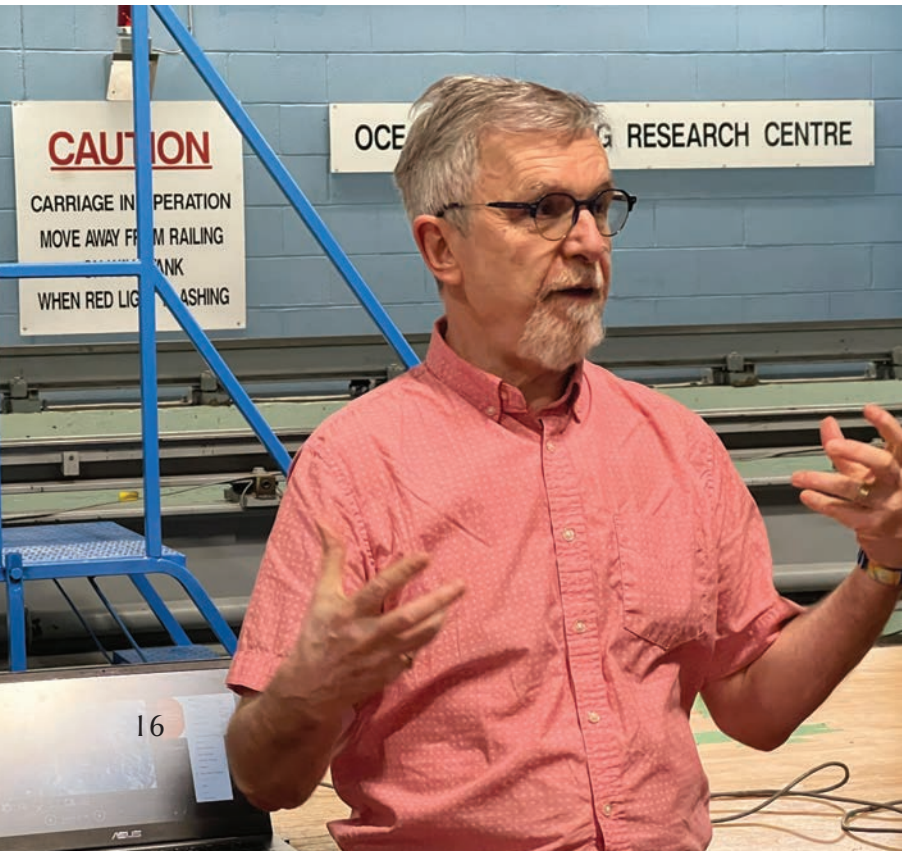
Paul "P.A." Wells should be formally exonerated, now posthumously, by the United States Navy, if only to clear its own name, and restore honor to both.

Epilogue

Following SEALAB III, the U.S. Navy regrouped and considered the applications of saturation deep diving in covert operations. It was carried forward with astounding results, in particular the clandestine projects known as "Operation Ivy Bells" in the Sea of Okhotsk, USSR, 1970's-1981.

A presentation by the author will be made at the SEALAB 60th Reunion, July 2024, at the Man-in-the-Sea Museum, Panama City.

https://maninthesea.org/sealab-60th-anniversary/



The St. Johns, Newfoundland & Labrador cluster is government, industry and academia all moving lock-step to innovate and collaborate across the subsea, maritime and offshore energy sectors. Starting top right and moving clockwise: Capt. Christopher Hearn, Director, Center for Marine Simulation at Marine Institute; Kelley Santos, Director, The Launch; Dr. David Molyneux, Director, Ocean Engineering Center, Memorial University; John Lidstone & Pascal Milord at the additive manufacting facility at the new Co-Innovation Center; and Shelly Petten, Executive Director, Ocean's Advance.

All photos by Greg Trauthwein

The Place ... The People ... The Technology ... The Cluster & Collaboration

St. Johns, Newfoundland & Labrador

Sitting on my Air Canada flight home from Newfoundland & Labrador, a commercial for the Province comes onto the screen – not touting the area's abundent natural beauth and tourist attractions, rather the region's technical facilities and prowess under the banner *"Tech is Making Waves."*

Marine Technology Reporter (MTR) was invited to partcipate in the late May 2024 ***"Innovation Waves"*** event, an invite premised not only on the strength of the *MTR* audience, rather the cumulative depth and breadth of parent company New Wave Media's portfolio of brands serving the global subsea, maritime, offshore energy, ports and logistics sectors. ***Innovation Waves*** was an event that was classic St. Johns, Newfoundland & Labrador, in that it leveraged the personnel, resources and expertise from government, industry and academia.

Set as a precursor to the O2 conference in Halifax, ***Innovation Waves*** drew in too an audience from the UK – 30+ start-up companies in various stages of development, visiting under the InnovateUK banner and seeking to build cross-Atlantic technology ties, partnerships and business opportunities.

It was a whirlwind two-plus days in and around St. Johns, and the photos on the opposite page represent just a small portion of the program and the immense capabilities found in this true cluster of subsea, maritime and offshore energy excellence. In the coming weeks and months, across our pages – print and electronic – in *MTR, Maritime Reporter & Engineering News* and O*ffshore Engineer*, we will profile and highlight the many 'crown jewels' of the region: the people, the organizations, the technology: from the brand new Co-Innovation Center to "The Launch" at Holyrood to Memorial University and the Marine Insitute to the world-class capabilities of the National Research Council Canada (NRC).

– Greg Trauthwein

Image courtesy DSC Dredge

DSC DREDGING HELPS TAKES DREDGE ACCURACY TO A HIGHER LEVEL

Dredging in and around the United States has been on a bull run for the last five years, and business prospects look strong into the foreseeable future, driven by the need for clear, navigable waterways dredged to correct depth – critical to keep commerce flowing. We recently visited with ***Bill Wetta, Senior VP of Product Development & CTO, DSC Dredge****, to discuss the recently delivered CSD Vaneta Marie.*

By Greg Trauthwein

Bill, can you give us a short overview of the company, its capabilities and a 'by-the-numbers' look at the company today.

DSC is a family-owned dredge manufacturer, probably the largest dredge manufacturer currently in the United States. We employ almost 300 employees and more than 50-plus contractors. My dad started a company that became DSC back in the '70s, but my brother and I have been running the company since the 1990s.

Today we've got four mining dredges [under construction] that are all US-based; five navigational dredges under construction, four of which are international; seven reclamation dredges under construction, six of which are international; three contractor general construction dredges, which are all domestic; and a number of upgrades for legacy equipment. In short, we have a workload that's active through 2027.

The dredging market in and around the US has been on a bull run for many years and counting. When you look at your business today and you look down the road, what do you see?

Two big things jump out. One, everyone is concerned with safety and risk. There's a big push to either eliminate or reduce the number of people involved around and on a dredge, which leads to automation and robotic technology. Also, everyone is concerned about making the planet 'greener' and dredging more efficient; there's a move away from traditional fuels to electric systems, hybrid systems, or cleaner burning fuel systems.

You recently delivered the new CSD Vaneta Marie to Muddy Water Dredging. In the press announcing the unit you said, and I quote, "This dredge represents the future of dredging technology."

Vaneta Marie was specifically built for a certain set of projects in the Gulf Coast area, primarily the Calcasieu River, although it will actually did work from Galveston all the way to Pensacola. Most of the contract dredges, if not all that operate in the United States now, were either built as a copy of something or converted.

The market for this dredge is a market where we're doing mostly navigational maintenance-type work, where material is not that deep, but it tends to be more in the corners of the channel, where movement becomes really important.

To start, we met with the client that owns this dredge and they wanted to be able to dig depths to accomodate the new Panamax ships. They wanted the machine to be 'green,' so the machine incorporates the latest Wabtec Tier 4 diesel engines, engines that do not require any diesel exhaust fluid system so they're green right out the box without any add-ons.

The dredge, because it's diesel-electric, can take power from the grid; so this machine could run strictly off of an umbilical cord. Because we're in a hurricane area, it's also designed so we can export

the power off these engines to power a city or a plant. So it's basically an eight-megawatt power plant that becomes a dredge.

The dredge is ergonomic and spacious; it's very simple to operate. The operator runs the whole dredge with essentially eight buttons; there's not a lot of fancy joysticks and controls. The screen that he operates from will flip screens as he activates controls. So he's only looking at the function on the dredge that's being operated at the time.

It's got the fastest swinging and stepping capability of any dredge in North America, and it can reposition on its carriage extremely fast. It incorporates an underwater pump and a carriage on the back, which both are scored as additions for Corps of Engineers contracts. So Muddy Water will get a bonus on a contract because of the underwater pump and because of the carriage.

It's got a sanitation system that can treat sewage and drop it overboard. But it can also go in areas where there's no overboard dumping [courtesy of its hold tanks].

The fuel system is redundant, and it has three big Wabtec gensets, typically only operating on two.

As I mentioned earlier, the control system is simple, and it can be remotely viewed or remotely controlled. This dredge has full cellular and Starlink connectivity; so pretty much anywhere in the world you can view the cameras, the dredge control system, the history, and take control of the machine if you're given permission.

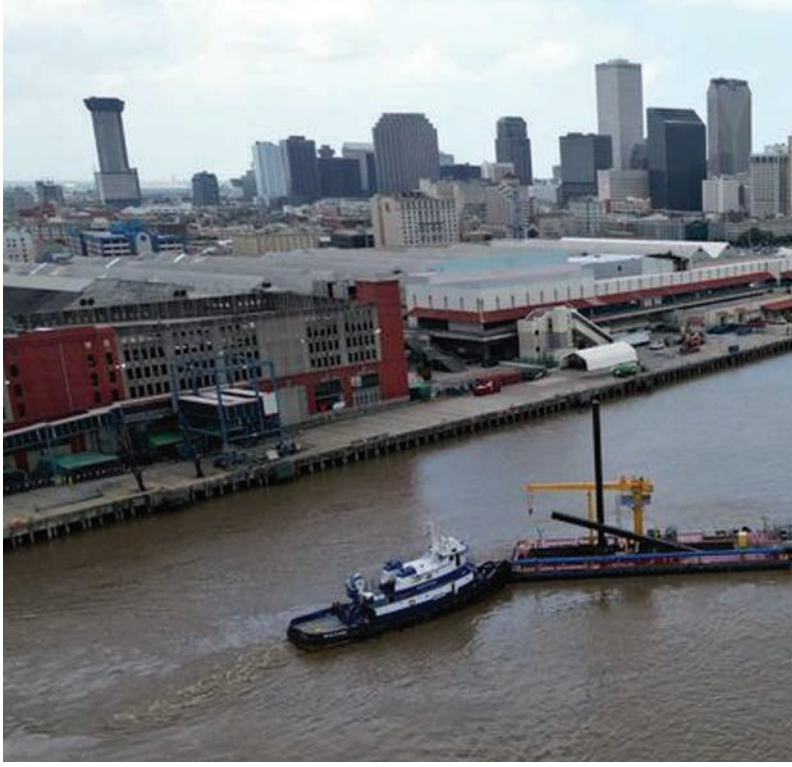
The dredge has 72 void tanks, each monitored for water/fluid levels. So if the dredge ever got hit or had a problem, you would know immediately which tank had a problem. All of the equipment on this dredge is mounted above deck, so there's nothing below deck other than the storage for the sewage and fuel. There's no bilge area that could cause a sinking, and as I mentioned, all tanks are monitored, and because of that the insurance companies give [the owner] a reduced rate.

The dredge has full production monitoring. It includes all the DSC benchmarking tools, and it incorporates our DSC Vision and Dredge Rx systems.

With all of this technology, what kind of efficiencies are they going to gain from this cumulative tech that DSC Dredge delivered?

There are a lot of computers on the dredge, and for traditional dredge operators, that can be scary. But when you sit in the chair of the dredge, there's basically two screens and eight buttons. One screen looks like a video game, and that's DSC Vision: a rendering of what the bottom looks like in a 3D-colored map. The other side [are the] gauges that the operator looks at to control the dredge. The operator doesn't have to be aware of everything around him [as that's] handled with the automation system. If there is a problem, he and the chief engineer will be notified.

The swing speed is automated on the dredge. The cutter



speed is automated on the dredge, too. The dilution control is automated, the dredge pump speed is automated. Then as the dredge goes online and starts working a few jobs, we'll automate the stepping time, the carriage time. The depth, the swing direction will all be automated as well. So we're making it where the operator really needs to just focus on production. He doesn't have to focus on a bunch of auxiliary things; so we're thinking that that's going to make it very productive.

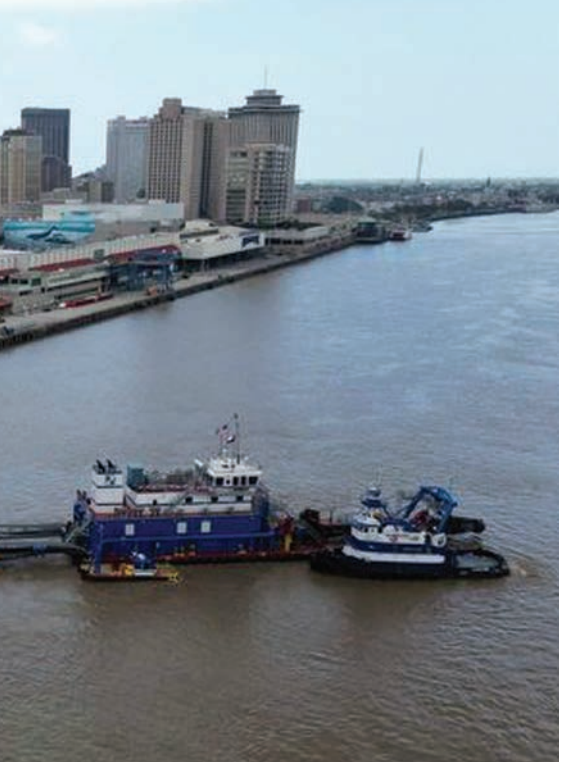
I know we had discussed the Wabtec engines in brief, but can you discuss why the Wabtec engines were chosen for this installation?

These are the only engines in this class that can be [EPA] Tier 4 without a bunch of post-treatment or diesel exhaust fluid. Looking at the exhaust, it's pretty clear you don't get any black smoke with the engines. It sips fuel compared to some of the higher speed engines.

We've run this engine before on a Port of New Orleans dredge, two cylinders smaller, and it's been running for years and been very productive.

Can we take a little bit deeper dive into the DSC Vision and the Dredge Rx remote monitoring system?

DSC Vision is a multi-beam sonar that's attached to the dredge, and sonars typically don't really work unless there's movement. What's been done in the past is there's been rotator arms put on, or you actually run a boat around the dredge,. But we use the motion of the dredge to create the motion for the sonar. So we're looking at a line perpendicular to the center of the dredge, maybe 100 feet forward of where the cutter head is, and all the way back behind where the ladder pivots at the trunnion. We look at that line, and as the dredge pivots from left to right, that line becomes a plane and it paints what the bottom looks like.



Images courtesy DSC Dredge

When an operator shows up on a Corp job, before they start digging, they can make a pass to the left and a pass to the right, and basically they can see everything on the bottom, real time, that's in front of them and behind them and they know if the job that they're going on even resembles what the plan was. Then as they start digging, it's real-time updating so they can see the changes they're making in the channel. They can also see what's caving in behind them. So if the dredge advanced a hundred feet and the whole bank caved in, they would be able to see that real-time, back up and fix that, rather than having to wait for a survey crew to come on board.

Given all that we've discussed, with the incredible technology that's built on this new dredge, perhaps it's a little silly to ask, but what's next?

Broadly speaking, on the mining sector, mostly in inland ponds, I don't think past the year 2025 we'll build a dredge that requires a human. I would imagine that all of those machines will be fully robotic and that's both from a safety and a productivity concern. You can't quite do that on a navigational job where you have ship and boat traffic, but the systems are going to become more and more automated.

I think you're going to see more diesel-electric machines that can run off the grid, and then eventually, you'll see systems that are running ammonia or methanol or even hydrogen to reduce emissions even further.

AUTONOMOUS SUR
CUTTING TH

There is a flurry of development underway to cut seafloor seismic and geotechnical survey technologies free from on-site control.

By Wendy Laursen

Source: PXGEO

VEY TECHNOLOGY:
E UMBILICAL

PXGEO's MantaRay is a hovering autonomous underwater vehicle engineered to deploy and recover ocean bottom nodes with minimal impact to the ocean floor.

The deeper you go, the quieter the ocean becomes. It's something that Kyrre Tjøm is exploiting in his back-to-basics approach to ocean bottom nodes (OBNs). Like his competitors, the CEO and Founder of iDROP, is developing autonomous OBNs that can deploy themselves on to the seabed without ROV support.

The current method for laying the nodes, which catch reflected waves during seismic surveys, involves specialist vessels and specialist crews. It only takes one member of the team to fall sick to disrupt an entire survey schedule, says Tjøm. That's how in-demand the expertise is.

He has caught the attention of Woodside, ExxonMobil and others. Unlike his competitors, Tjøm is avoiding high-tech complexity above and below the surface. One way he is doing this is to exploit the quiet ocean floor to enable his Oceanid OBNs to communicate with others in the swarm and with the ship, using acoustics. This is facilitated by having upright OBNs that aren't obstructed by seafloor topology.

OBN-to-OBN communication is used for navigation and, as a swarm, to produce relatively small but high resolution seismic datasets. In the future, it will enable the swarm to report back to the launching vessel even if the vessel has moved beyond the reach of an individual OBN.

The OBNs are designed to glide to the seafloor without the need for ROV help or DP-positioning mother vessels. As part of their patented autonomy, the OBN's will use flight data to create a current profile as they traverse the water column at a predefined heading, constantly adjusting angle of attack to create the required lift to navigate au-

Ocean Infinity's Armada surface robot vessels only require a skeleton crew because data processing and payload control is conducted from onshore operations centers.

Source: Ocean Infinity

Source: Ocean Infinity

“Geotechnical drilling and sampling will evolve towards fully autonomous operations on the seafloor.”

– Andrew Galbraith,
Managing Director of Ocean Infinity

tonomously into position while the deployment vessel has moved on.

Where other autonomous OBNs use 50% of their battery power for launch and retrieval operations, iDROP's gravity-based OBNs use around 5%. They use their rudders and landing gear to slow their descent prior to landing and correct their vertical inclination before mechanically deploying their payload of sensors into the seafloor. As there's no need for ROVs or umbilicals, if one OBN fails its target spec, it is easy to deploy another.

Each OBN is about a meter long and weighs around 25 kilograms. The whole swarm system is containerized, up to 250 OBNs per container, and suitable for deployment by the deck crew of an OSV without ROV support. "We can scale it down to one OBN or up to 7,000. It doesn't really matter. It's just a number of containers," says Tjøm. "Deployment is 50% faster than with ROVs, and recovery is 50% faster." Along with greater simplicity comes a 95% drop in GHG emissions, he says.

iDROP and some of its competitors expect to move beyond pilot testing this year. His competitors have similar goals, claiming reduced emissions and dramatic reduction in deployment logistics. Last year, Blue Ocean Seismic Services claimed its autonomous OBNs outperformed ROV-positioned OBNs. PXGEO uses hovering autonomous underwater vehicles rather than ROVs, claiming they are capable of deploying and recovering OBNs significantly faster and with better precision than traditional methods.

Ocean Infinity is not removing ROVs from its autonomous processes, but it is removing on-site human supervision. This year, the company signed an agreement with Shell for the provision of lean-crewed and robotic geophysical and geotechnical services. This includes using Ocean Infinity's Armada surface robot vessels of various sizes which only require a skeleton crew because data processing and payload control is conducted from onshore operations centers.

Andrew Galbraith, Managing Director of Ocean Infinity, says that while ROV-based survey operations are integral to the Armada solution, the difference lies in their integration within a comprehensive system. "ROVs are launched, recovered, and operated from a mother Armada vessel, alongside various other payloads like Ocean Drill, SonicCorer, Infinity CPT and AUVs. This consolidated approach optimizes efficiency and coordination in offshore operations."

Ocean Infinity has already entered the offshore wind geotechnical market with its newly developed autonomous cone penetration test (CPT) device, Infinity CPT 250. Last year, for the Ossian wind farm, deep push seabed CPTs, seabed seismic CPTs and vibrocore operations were carried out remotely using over-the-horizon commands sent via a remote-control system.

Recent advancements in AI and in low orbit, low latency satellite communications which have greatly enhanced remote control solutions and real-time data transfer have made it possible to do this. Infinity CPT and other payloads communicate directly with control systems on the mother vessel via a lift umbilical. The vessel's control systems communicate via satellite to the remote control center and the cloud. Infinity CPT can receive mission statements and execute them with minimal supervision. The data is automatically processed and reported to clients.

Galbraith sees a future where geotechnical drilling and sampling will evolve towards fully autonomous operations on the seafloor. This includes autonomous Ocean Drills capable of investigating the sub-seabed independently, retrieving and storing soil samples with minimal human intervention. Intelligent control system software will facilitate this autonomous functionality, requiring only a mission statement for the robot to complete tasks optimally.

Robots such as Ocean Infinity's Ocean Drill or SoniCorer rely on an array of sensors that are used by algorithms to allow the robot to interface with the environment that it encounters during the completion of a given task. The data from the sensors will also be used to supervise or monitor the status of the robot and to allow the human monitor to intervene if needed from a remote location.

As more offshore operations are completed and Ocean Infinity's systems are proven to be effective and reliable, they will require less supervision. For example, part of the control system for Ocean Drill includes a product called Smart Drill which will eventually replace the need for a human driller who makes operational decisions. Smart Drill relies on a training data set relevant to a target borehole to plan and drill it in an efficient way with minimal supervision.

Ultimately, the Amada vessels themselves will operate without any onboard crew. They will use zero emission fuel and perform offshore data acquisition and intervention operations down to depths of 6,000 meters.

Ocean Infinity has entered the offshore wind geotechnical market with its newly developed autonomous cone penetration test (CPT) device, Infinity CPT 250.

Source: Ocean Infinity

iDROP's Oceanid OBNs to communicate with others in the swarm and with the ship, using acoustics.

Source: iDROP

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ON SUBSEA S

All images courtesy Argeo

AD URVEY

*We recently sat with **Trond Crantz**, the founder and CEO of Argeo, a subsea service provider whose offerings span from acquisition to actionable data. Now, a year later, we spoke with Crantz to see what's new with Argeo, as well as gain further insight into the company's recent contract with Woodside Energy, new vessel and technology acquisitions, and AI/ software development for data synthesis and communication.*

By Celia Konowe

> *When we started all of this, we knew that we could choose to be one of the best. That's always a strategy, but we chose to be unique in what we do and to bring something new to the field.*

Trond Crantz,
Founder & CEO of Arego

Trond, welcome back. We did a feature on you about a year ago in our March-April edition. What's new for Argeo since?

It's been a lot, I can tell you. It seems like the last time I spoke with MTR, it was two, three years ago now—that's how much has happened. But at the same time, we're still finding our feet. A year ago, we had just acquired Argeo Searcher, which was one of our first subsea survey vessels and had started our first ultra-deep-water projects. And since then, we've added so much more. The Searcher has completed several hallmark projects for prominent customers like the Norwegian Petroleum Directorate, Shell in Nigeria and the National Centre for Polar and Ocean Research (NCPOR) in the Indian Ocean.

We've rolled out our newest AUV line with Hugin Superiors and bought our newest subsea vessel, the Venture, from Shearwater while also bringing them in as a shareholder. The Venture was used by TotalEnergies for their Namibia development project Venus and is mobilized there, as we speak. We've also commercialized and proven the Argeo LISTEN system for subsea integrity inspections and proven its capability as a deep-sea mineral detection and resource estimation tool. Lastly, the Searcher is active in the Calypso field in Trinidad and Tobago as part of a contract with Woodside Energy.

If someone had told me one year ago that what we would be doing now, I wouldn't have believed it. I'd think it would be impossible, but there's been fantastic teamwork and spirit throughout the company, which has obviously grown. We have now 80 employees, both onshore and offshore, and that continues to grow as we develop more projects and technological advancements.

Out of all those projects you mentioned, is there one that was either your favorite or one that challenged Argeo?

That's the thing—they almost all are because a lot of what we are doing comes from teamwork. And of course, when you're moving into this, you're apprehensive. Will it work as we have tested? Will it give the results that we hoped it would? With NCPOR, we're trying to prove that these sensors can be used for identifying mineral resources at nearly 6,000 meters, which is basically unheard of. We've spent a lot of time developing the sensor system and when something works, it's a special moment for everyone involved, from the technology developers to the operators and so forth.

All images courtesy Argeo

Courtesy Argeo

You've had great successes this far? How will you maintain this drive and uniqueness for years to come?

First, we aren't a company that stands still. We always move on. We have a portfolio of intellectual property that goes in sync with our technology development in three verticals—oil and gas, marine minerals, and renewables. We harness this in new sensors that can open new frontiers in terms of exploration—either in deeper water or in previously mentioned projects like offshore wind. This combination of technology as a service to deliver superior products is really what we're about.

When we started all of this, we knew that we could choose to be one of the best. That's always a strategy, but we chose to be unique in what we do and to bring something new to the field, which is somewhat of a heritage as well. Combining in-house engineering and technology into production systems and doing those types of job ten times faster with superior quality—that's Argeo. And as we became good at that, we also said that, "Okay. I think the customer would like us to deliver our products from our field units to have rapid answers to their questions." That makes us a bit special, I hope.

Let's switch gears to dive into your recent projects, including the contract with Woodside Energy. Can you tell me a little bit about Argeo's role in that, what value it brings to you, and the vehicle being used?

Absolutely. We've known Woodside for some time and we've been talking with them about the Calypso field. Our contribution is the Argeo Searcher with the new Hugin Superior. It's a big project for us as a company; we're positioning ourselves within the oil and gas sector, which is massively important.

We recently purchased two new Hugin Superiors, with all bells and whistles of sensors included. In addition, we fully integrated our own Argeo LISTEN system. The superiority of the AUV lies in the production facility of the vehicle (6000m) dual-HISAS which doubles the swath with and production speed, CathX cameras and laser, and the endurance of up to 60 hrs of real acquisition time. It is the most advanced AUV on the market to date, hands down.

As an expert in the field, what do you see as the future of ocean surveying and subsea sensing?

How long is a rope? There's a huge and very fast cycle of technology, which is ongoing. It never stops. We'll see big changes in terms of the vehicles we use, what they can do, and how they can achieve the things that they do. I think that's what everyone sees. But we're thinking, more specifically, how does machine learning and AI help us interpret data?

To give an example—with all the sensors turned on our Hugin Superior, for say 48-50 hours, we acquire up to 10 terabytes of data. Imagine sifting through all of that. It takes a long time today, but we're working on algorithms to help us pick out important pieces. Another thing we're working on is to make the data live for the client. We're developing a new data platform that allows more live interaction with data for decision making. There's a lot going on the computer side to make things go faster, easier, and to be able to give more sense of what we're seeing.

We have an in-house data platform called Argeo SCOPE that integrates all the data from our LEDs, allowing both our internal employees and our clients to interact with the data. We've also made good use of Elon Musk's Starlink to get data to shore, which has been an enormous step forward in terms of access to our vessels. I can have a Teams meeting with our vessel in the middle of the Indian Ocean today. This was a fantasy 20 years ago.

Trond, do you have a final message to close us out?

What to expect from Argeo: We'll bring out more vessels, more tools, more vehicles, and more sensor systems—and with the pace that we've had so far, it won't take long.

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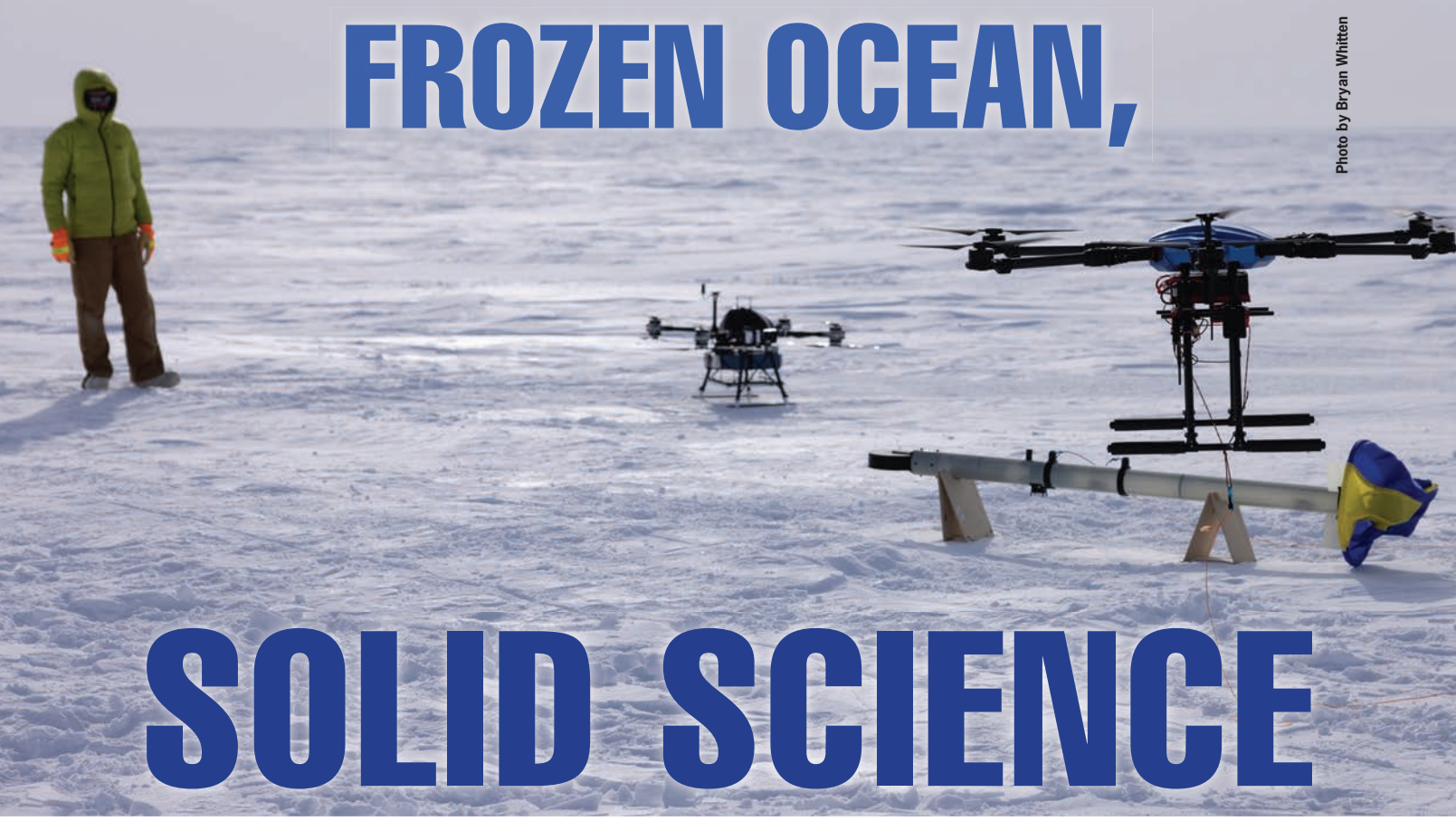


Photo by Bryan Whitten

UAF researchers use drones to test new instrument for measuring sea ice and its snow cover.

By Rod Boyce, UAF Geophysical Institute

BEAUFORT SEA ICE, near Utqiagvik, Alaska — The train of 10 snowmachines snaked slowly across the snow-covered sea ice toward the small tent far ahead, a single drop of yellow paint on a textured white canvas whose edges couldn't be seen.

The collection of University of Alaska Fairbanks scientists and technicians and participants from Boise State University drove in single file past driftwood and whale rib bones poking upward through the frozen Beaufort Sea's near-shore reaches.

This place, just a few miles from the northernmost U.S. city of Utqiagvik, is where the remains of subsistence-harvested whales are brought to keep scavenging polar bears from town. These are the lands and waters of the Inupiat people.

A locally hired polar bear guard shadowed the science team, shotgun strapped to his snowmachine.

The weather was good on this mid-April Wednesday morning just beyond the northernmost tip of the United States, with scant wind and thin wisps of cirrus clouds strung across a nearly empty blue sky. The sun, which rose at 5:56 a.m., had been up for two hours.

A near-perfect day for science. For now.

It was also near-perfect conditions for the two drones helping collect data for the Lightweight Airborne Snow and Sea Ice Thickness Observing System, or LASSITOS, project.

LASSITOS was the main effort on this day on the Beaufort Sea ice, though as often happens during fieldwork some team members were collecting data for other related projects.

The LASSITOS project is funded by the National Science Foundation and led by University of Alaska Fairbanks Geophysical Institute Research Professor Andy Mahoney. He leads the institute's sea ice research team, which had several members on the ice.

Mahoney explained the work a day earlier when the team was working closer to town.

The mini-science camp on the Beaufort Sea ice two-thirds of a mile north of a thin snow-covered spit above Elson Lagoon, about 10 miles east of Utqiagvik.

A drone carries the Lightweight Airborne Snow and Sea Ice Thickness Observing System on April 17, 2024, just off Alaska's Beaufort Sea coast.

Photos by Bryan Whitten

"We are developing an instrument package capable of being deployed by a drone that can measure both sea ice thickness and snow depth at the same time," Mahoney said. "These are two pretty fundamental properties of Arctic sea ice.

"We're really good at telling by satellite how much sea ice is covering the ocean," he said. "Measuring the thickness of that sea ice is more of a challenge. We're developing an instrument that will allow us to make those measurements over large areas with a drone."

The drone work was accompanied by other "ground truth" tasks to validate the data from the airborne instruments: augering ice holes to measure ice thickness, water depth and ocean salinity; and making thousands of snow depth measurements using a device called a magnaprobe, somewhat like a modified ski pole that can measure snow depth and ice topography.

The LASSITOS project fills a knowledge gap. The project's NSF description states that "methods of observing sea ice thickness at regional or basin scales with sufficient accuracy and resolution to capture growth and melt processes, detect hazards, or assess habitat quality are lacking."

The long-term goal is to get ice thickness and snow depth data from a single drone payload. At this development stage one drone carries an electromagnetic induction instrument hanging from a 10-foot tether and another drone carries the snow radar.

The drone carrying the induction instrument belongs to the Alaska Center for Unmanned Aircraft Systems Integration, a unit of the UAF Geophysical Institute.

The Boise State University team provided its own drone and pilot for the snow depth component.

"Over the last three years, we've been working with NASA," Boise State Associate Professor Hans-Peter Marshall said. "This antenna was designed for spaceport applications, but the radar has been custom designed for snow."

Boise State also provided a ground-level snow-penetrating radar attached to a snowmachine to capture additional data and to validate data acquired by the drone-borne radar.

The electromagnetic induction instrument — dubbed LEM, for LASSITOS EM — was in its final testing on this mission to Alaska's Arctic Ocean coast.

Achille Capelli, a postdoctoral fellow at the Geophysical Institute, designed and built the LEM over the past three years. Thimira Asurapmudalige, a Ph.D. student in electrical engineering at the UAF College of Engineering and Mines, has been assisting.

HOW DOES IT WORK?

"The instrument is an electromagnetic sounder that uses induction," Capelli said after Tuesday's first test flight of the year. "It fires a magnetic field and induces currents in the conductive seawater.

"Those inductive currents induce a secondary magnetic field that tells us how far down the water surface is," he said.

The components sit inside a 4-inch diameter 9-foot fiberglass tube, with other parts produced on a 3D printer in the Geophysical Institute Machine Shop. A stabilizing drag skirt at the tail — in UAF's blue and yellow colors — helps keep the instrument level during flight.

The LEM consists of a signal generator with a transmitter antenna and a receiver with antenna, digitizer and data logger. This device measures the distance to the ice-water interface.

The LEM also contains a laser altimeter to measure the distance to the snow or ice surface. The difference between these two measurements corresponds to the total thickness of ice and snow. A microprocessor is used to coordinate the different sensors.

Total weight is about 10 pounds.

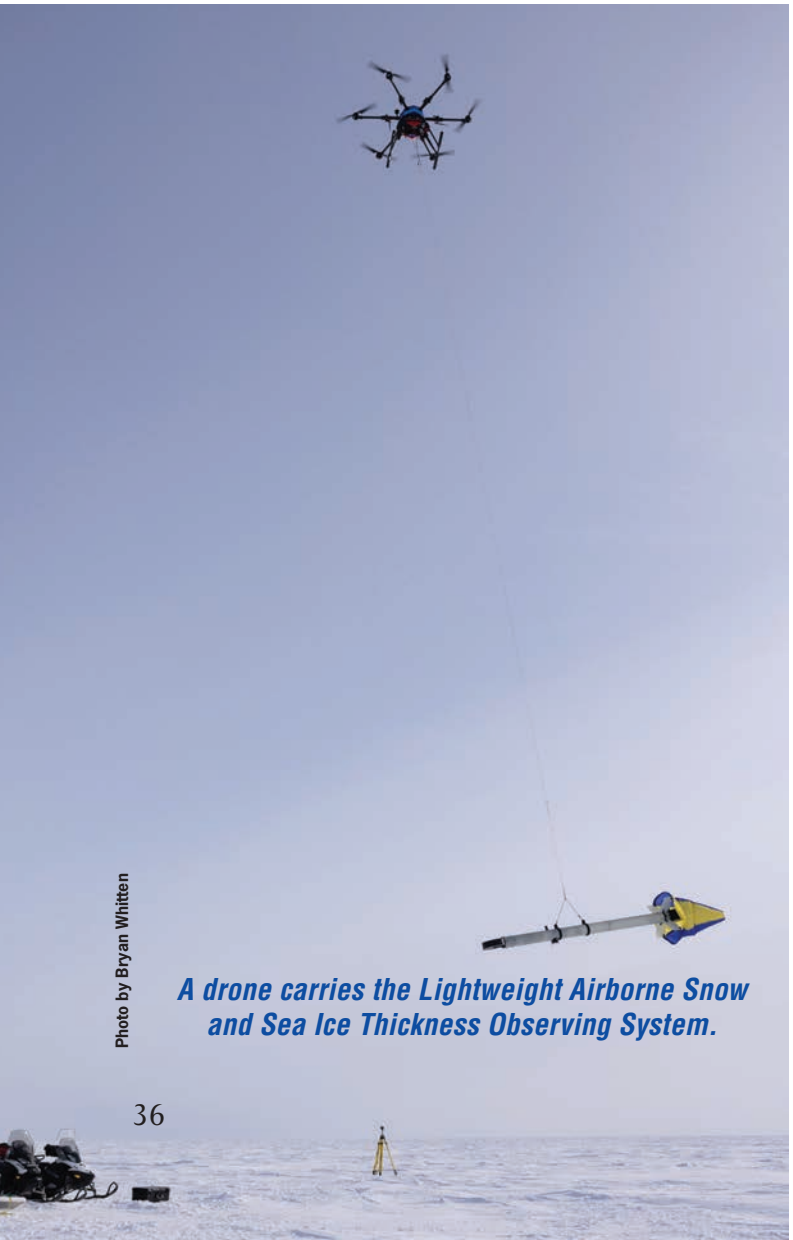
On Tuesday the tethered LEM flew 12 to 15 feet above the ice surface, which drill holes showed was about 3 to 5 feet thick. The drone flew out about three-tenths of a mile on a programmed route diagonally from the bermed-up and ice-jumbled coastline, then returned.

Wind buffeted the drone and its dangling instrument, push-

Photo by Bryan Whitten

Associate Professor Hans-Peter Marshall of Boise State University, left, follows the Boise State drone, which is carrying a radar. His snowmachine is mounted with a ground-penetrating radar. UAF Research Professor Andy Mahoney is at right.

Photo by Bryan Whitten



A drone carries the Lightweight Airborne Snow and Sea Ice Thickness Observing System.

ing the aircraft and instrument to their performance limit. The team knew from forecasts predicting 20 to 30 mph winds that they would have only a short time to fly.

Capelli was nevertheless satisfied with the results.

"That's good because it tells us what our limit is in the wind," Capelli said. "I have to go back and look at the data, but what I have seen now looks good."

"Hopefully we can have a few more flights this week and get to test all the possible combinations of settings," he said.

The forecast was on everyone's mind. High winds were expected Thursday. Wednesday, away from town and on the Beaufort Sea, was looking to be their best shot for another instrument test.

Capelli's science device won't get anywhere without a pilot.

On these testing missions in and near Utqiagvik, that pilot is Matthew Westhoff, a UAF drone pilot veteran.

He's also a veteran of piloting over Arctic sea ice.

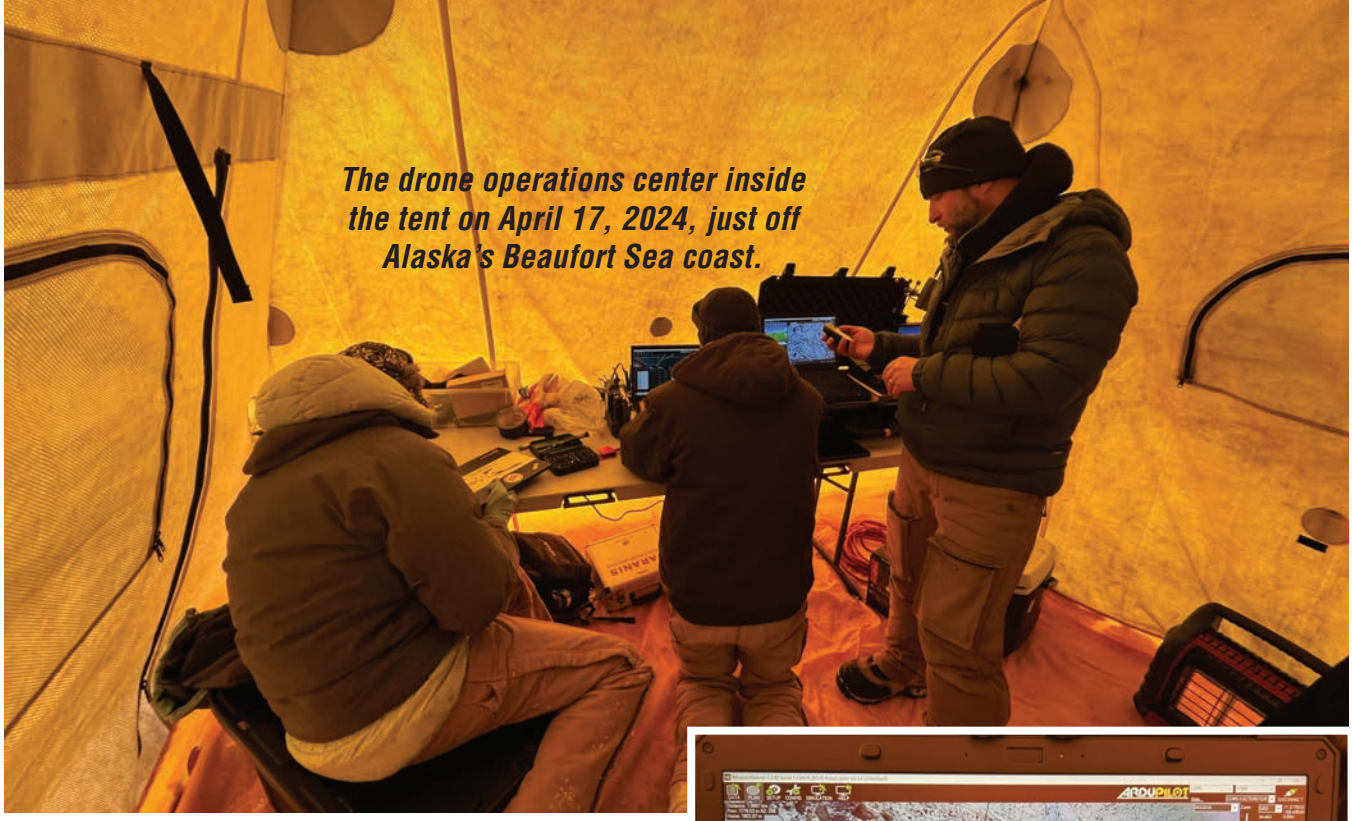
"Even though I've been out here doing similar missions, it's not exactly the same location and same type of flying," he said while entering some drone prepositioning data in a laptop sitting on a black collapsible shipping container.

"Even though the end goal of measuring snow depths or ice depths might be the same, flying-wise it's always a bit different," he said.

The aircraft was operating Tuesday at the edge of its capability in the wind, Westhoff said. It's the occasional gusts of 5 to 10 miles per hour higher than the constant wind speed that are the challenge.

"Our main concern being where we are is the wind and the fact that I have a payload swinging around in significant wind," he said.

On Wednesday, out on the Beaufort Sea ice two-thirds of a



The drone operations center inside the tent on April 17, 2024, just off Alaska's Beaufort Sea coast.

Photo by Rod Boyce

A computer screen shows drone flight information on April 17, 2024.

Photo by Rod Boyce

mile north of a thin snow-covered spit above Elson Lagoon and 10 miles east of Utqiagvik, the two drone pilots set up a control area inside the yellow tent. A generator hummed steadily, providing power for equipment and to recharge batteries.

The two pilots — Westhoff from UAF and graduate research assistant Thomas Van Der Weide from Boise State — worked in tandem. When Westhoff was outside keeping visual contact with the UAF drone, the Van Der Weide was inside on the laptop and calling out altitude and battery charge. They reversed roles for the Boise State drone's flight.

Westhoff is familiar with flying in the far north and the challenges that come with it. He's flown at Utqiagvik a few times.

"I love coming out here to places like this," he said. "There's no other place in the world like it. It's definitely challenging. It keeps you on your toes. You're never really doing the same type of flying."

Mahoney is also simultaneously monitoring work for three other projects that are funded by the Army and part of the Integrated System for Operations in Polar Seas program. Mahoney is the lead investigator for these projects, which involve researchers from the Geophysical Institute and UAF College of Fisheries and Ocean Sciences:

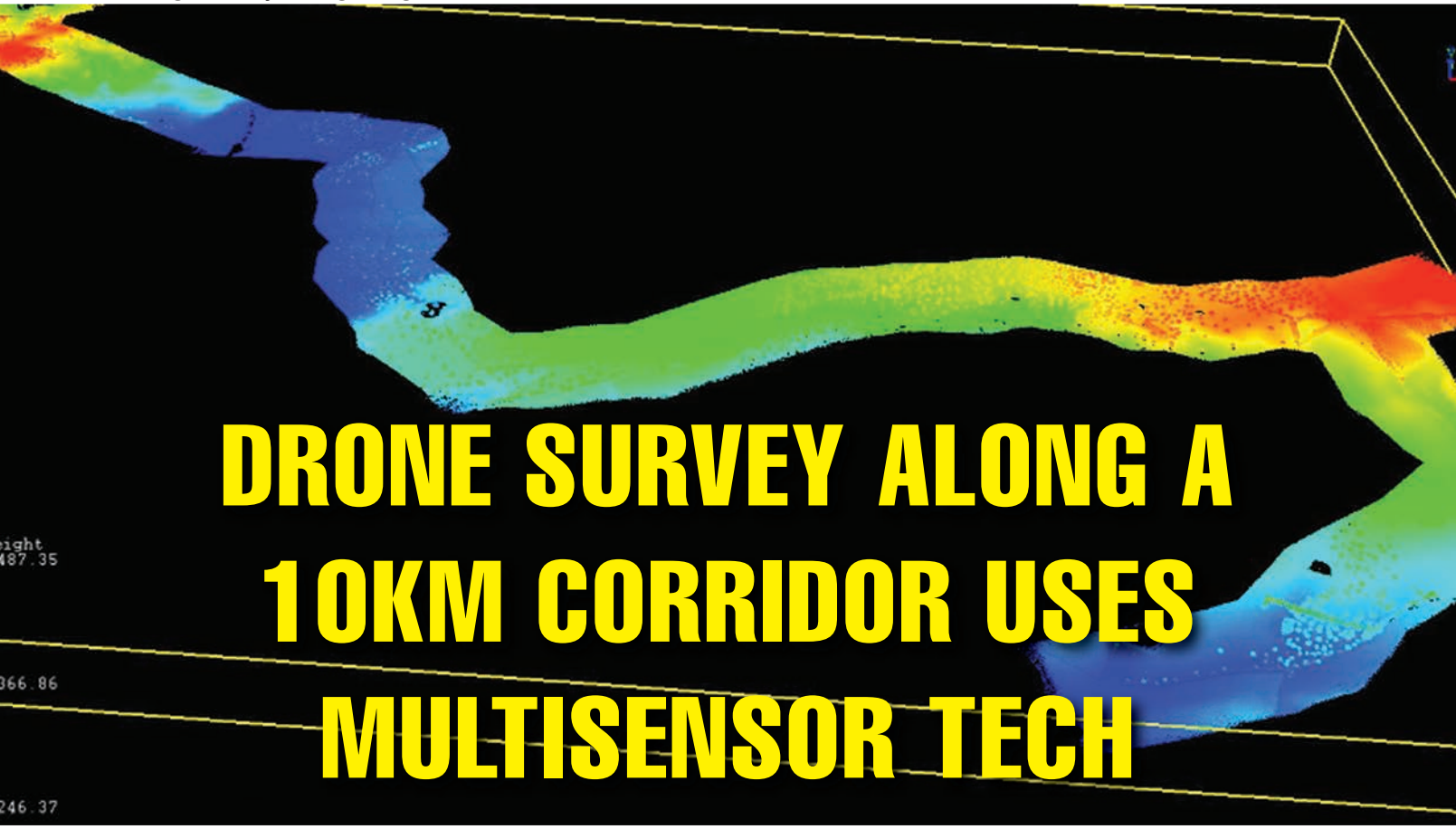
- "Race track" experiments will use satellite imagery and other data to calculate optimum travel routes across sea ice.
- "Ice wave rider" will measure surface waves that may affect the stability of landfast ice, also known as shorefast ice. It is sea ice attached to the shore.
- A Gamma Portable Radar Interferometer will observe small-scale deformation when drifting pack ice interacts with landfast sea ice. This interferometric radar can quickly reveal small changes that could indicate imminent movement or detachment of the ice, which is important as climate change affects ice behavior. The capability could also be useful for near-coastal navigation.

"Those are all looking at the Arctic coastal environment through the lens of logistics-over-the-shore operations," Mahoney said. "The U.S. Army Corps of Engineers is trying to understand what challenges or maybe advantages there are at different times of year in the event that we needed to move material and people across the shoreline from the ocean behind me to the land where we're standing or the other way around."

The mood was good Wednesday as the day unfolded on the Beaufort Sea. The sun was bright on the snow and ice. Team members wearing colorful protective eyewear and face coverings moved around trying to accomplish as much as possible while the weather was cooperating. Snow crunched underfoot, snowmachine engines came alive, drone motors whined, the tent entry zipped open and closed.

"Everyone's pretty upbeat," Mahoney said. "We're cruising along. With the weather forecast, it looks like today may be our only day like this, so we're going to try to make the most of it."

All images courtesy SPH Engineering



DRONE SURVEY ALONG A 10KM CORRIDOR USES MULTISENSOR TECH

Aeromedia U.A.V., S.L., a Spanish company specializing in aerial survey technologies, recently undertook an ambitious project involving a comprehensive survey of a 10-km-long corridor in the reservoir Logrosan-Caceres. The project aimed to showcase the power of integrating multiple survey technologies, including LIDAR, high-resolution photogrammetry, and an airborne echo sounder system developed by SPH Engineering, particularly for mapping terrestrial and underwater terrains.

The work aimed at the topography of a water catchment and discharge area near the Ruecas reservoir in Cáceres. LiDAR+RGB techniques were combined in the terrestrial area and the ECT 400S single-beam bathymetric probe in the reservoir area. The bathymetry of about 9 hectares took one day, and the LiDAR flights took one morning. Our client obtained several cartographic products, such as DEMs and point clouds.

The Challenge

The main expectations regarding drone-based solutions were acquisition speed and the captured data's final reliability. The primary challenge was conducting a detailed survey that accurately covered terrestrial and underwater areas. Traditional methods often require separate systems for land and underwater surveying, complicating data integration and increasing project time and cost. Moreover, the need to survey under vegetation and achieve depths of up to 100 meters underwater demanded a solution that could provide exceptional precision and versatility.

The Multisensor Solution

Aeromedia utilized an innovative approach to address these challenges by integrating three technologies.

This multi-sensor solution enabled the team to measure the Earth's surface seamlessly, capturing accurate information from the Digital Terrain Model (TDM), even in areas covered by vegetation, and extending to underwater environments up to depths of 100 meters.

The first was LIDAR (Light Detection and Ranging) technology to capture highly accurate 3D terrain data along the 10-kilometer corridor. LIDAR is renowned for penetrating vegetation and providing detailed elevation information, making it an ideal choice for this project.

The second solution was high-resolution Photogrammetry: Combined with LIDAR, photogrammetry played a crucial role in capturing detailed surface imagery. This technology enabled the creation of precise 3D models and orthomosaics, allowing for a comprehensive understanding of the area's topography.

Visualization of the photogrammetry data of the corridor, processed with QGIS software.

Last but not least is the airborne Echo Sounder System. The underwater component of the survey was accomplished with an airborne echo sounder system provided by SPH Engineering. This system could capture submerged topography up to 100 meters, enabling the acquisition of valuable data from the reservoir's depths.

Outcome

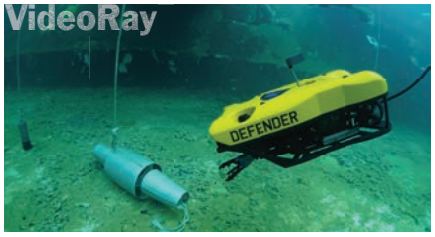
The integration of LIDAR, high-resolution photogrammetry, and an airborne Echo Sounder System on a single RPAS platform proved to be highly effective, offering several key benefits:

Comprehensive Data Collection: The combined technologies allowed for accurate and detailed data collection across land and underwater terrains, providing a holistic view of the surveyed area.

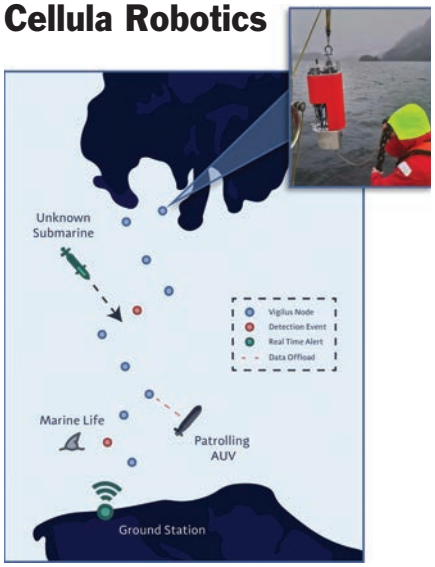
Efficiency and Cost-Effectiveness: The project achieved greater efficiency and reduced operational costs by employing a unified terrestrial and bathymetric surveying system.

Innovative Approach: The successful implementation of this multisensor survey showcased the potential for similar technologies to revolutionize the surveying industry, setting a precedent for future projects.

Single-frequency Echo Sounder ECT400 integrated with DJI M300 drone during the bathymetric survey.



Cellula Robotics



VideoRay Wins $92.6M US Navy Contract

VideoRay won a $92.6 million five-year indefinite-delivery/indefinite-quantity (IDIQ) contract for the continuous production, sustainment, and development of the MK20 Defender Remotely Operated Vehicle (ROV) platform for the US Navy's Maritime Expeditionary Standoff Response (MESR).

The deal provides access to VideoRay's Mission Specialist family of underwater robotics systems to support the Navy's Explosive Ordnance Disposal Underwater Response Vehicle program and the MESR program of record. Administered by Naval Information Warfare Command, Pacific, the contract provides for the delivery and support of the Navy's next-generation remotely operated underwater vehicles (ROV) that will be used to conduct critical undersea missions to support our warfighters.

The MK20 Defender ROV, based on VideoRay's Mission Specialist Defender, is a highly robust, man-portable, expeditionary ROV that offers modularity and an open architecture design that allows for the easy integration of third-party sensors, software applications, and versatile, field-swappable payload options to meet the Navy's expanding needs for expeditionary mine countermeasure operations. Core technology onboard this platform has been developed by industry partners and includes: EOD Workspace control software and autonomy platform by Greensea IQ, Multibeam sonar and USBL positioning system by BluePrint Subsea, Doppler Velocity Log (DVL) for navigation by Nortek, and a 2-function manipulator by Eddyfi.

Cellula Robotics Unveils Vigilus

Vigilus is a state-of-the-art submersible surveillance array, comprising of acoustically-meshed environmental sensor nodes, poised to revolutionize underwater monitoring and security. The Vigilus nodes, positioned on the seafloor multiple kilometers apart from one another, form an interconnected network of listening stations that act as an underwater "trip wire". Notably, these nodes boast a compact, cable-less design, facilitating effortless deployment from small watercraft or covertly via a large Uncrewed Underwater Vehicle (UUV), even in challenging environments such as beneath ice sheets. Each Vigilus node is equipped with sensors designed to seamlessly collect, process, encrypt and respond to acoustic and environmental data. Vigilus offers an additional layer of strategic advantage, as each node can emit acoustic pings to serve as a deterrent while deployed.

Silicon Sensing to Open US Office

Silicon Sensing is to open its first US office, with a dedicated in-country team lead by the new head of sales – Americas, Kevin Swain. This new facility will help ensure the company efficiently supports the growing demand for their rugged, high performance inertial products across North and South America.

Silicon Sensing supplies gyros, accelerometers and inertial measurement units into diverse markets including autonomous vehicles, surveying and mapping, space, defence, aerospace and construction and industrial machinery. Some of these markets will experience double-digit compound annual growth rate (CAGR) for inertial sensors through to 2030, alongside fast-evolving inertial requirements for a new generation of applications.

CSignum's New Wireless Underwater Comms

CSignum launched the EM-2 wireless platform for IoT sensor data and control from above the surface to below. The EM-2 interfaces to many common underwater sensors to wirelessly communicate data from under the water to above the surface or directly on land.

According to the company, the EM-2 remploys electromagnetic fields to pass data through water, ice, concrete, and

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rock to overcome the limitations of traditional wireless technologies. By harnessing electromagnetic field signaling (EMFS), data can be transmitted from below the water's surface or underground to above-surface devices reliably.

EM-2 is intended to serve multiple markets, including: Maritime Security & Defense; Water Quality Monitoring; Offshore Wind & Energy Applications; and Underground Applications.

Unique Group Acquires Subsea Innovation

Unique Group acquired subsea technology and equipment manufacturer Subsea Innovation. Headquartered in the United Arab Emirates, Unique Group has a global workforce of more than 600 employees across 18 locations with experience in subsea technologies including Survey Equipment, Diving & Life Support, Buoyancy & Water Weights, Unmanned Surface Vessels, and Lifting & Mooring solutions. This new acquisition transforms the UK into a major engineering hub for Unique Group.

King Opens MARIN's Seven Oceans Simulator Center

His Majesty King Willem-Alexander of The Netherlands opened the Seven Oceans Simulator center (SOSc) of MARIN, the Maritime Research Institute of the Netherlands, on May 28, 2024.

The opening program takes place in the Shallow Water Basin, one of MARIN's test facilities for ship models. Experts from the maritime research institute, the NL Coast Guard, Search & Rescue Institution KNRM and maritime service providers talk about shipping safety, about working in increasingly busy seas and about involving the crew in the design of new ships. The new simulators are also used for research into the application of virtual reality techniques and the monitoring of unmanned ships. Crews can be trained at the simulator center for maritime operations that are becoming increasingly complex as container ships become larger, maritime traffic increases and weather patterns become more unpredictable. All simulators can be linked together to simulate situations with multiple ships operating under difficult conditions at sea.

Exail Enhances Ops Octans AHRS Tech

Exail secured a contract with Bourbon to supply several units of Exail Octans Attitude and Heading Reference Systems (AHRS) for integration into Bourbon Subsea Services subsidiary's fleet. These units will be installed on multiple Bourbon Evolution 800 Series multi-purpose support vessels (MPSVs) dedicated to subsea operations at depths down to 3,000 meters.

The Octans AHRS will enhance Bourbon vessels' efficiency in installation, maintenance, and repair tasks for the oil and gas, and offshore wind industries. Providing highly accurate measurements for roll, pitch, and heave, Octans will serve as a survey-grade surface gyrocompass and motion sensor, seamlessly integrated into the vessels' Class 3 dynamic positioning (DP3) system. This integration will ensure precise positioning and stabilization over underwater structures.

Eelume Partners with Exail

Exail was selected by Eelume to supply its Phins Compact C3 Inertial Navigation System (INS) for Eelume's new S-Series all-terrain Autonomous Underwater Vehicles (AUVs). The Eelume S-Series is a new generation of all-terrain AUVs specifically designed for mapping and operating in challenging underwater terrains. Unlike traditional AUVs, they boast 360° of maneuverability in roll and pitch, offering versatility and sustainability in accessing previously unreachable environments.

Providing highly accurate and robust navigation data, the Phins Compact C3 INS will enhance Eelume AUVs' capabilities for efficient exploration, inspection, and monitoring in complex environments such as hillsides, under-ice areas, vessels, and harbors. Its compact OEM form factor will ensure easy integration into the AUVs, facilitating swift deployment and streamlining operations.

Balmoral Comtec Expands Workforce

Balmoral Comtec, a Balmoral Group company and a major provider of buoyancy, protection and insulation services to the global offshore energy market, has secured a multi-million-pound contract from TechnipFMC to supply more than 600 buoyancy modules for Equinor's Rosebank project. This contract award is already supporting the recruitment of over 50 new employees at its Aberdeen base.

Balmoral Comtec, which has over 40 years' experience providing buoyancy equipment for offshore industries, including oil and gas and fixed and floating wind, will provide engineering, design and manufacture of buoyancy modules from its base in Aberdeen, Scotland. The modules will be installed on flexible risers and umbilicals.

MARINE TECHNOLOGY REPORTER

2024 Editorial Calendar

January/Februay 2024

Ad close Jan.31

Underwater Vehicle Annual

- Offshore Wind: A Floating Future
- Subsea Defense
- Manipulator Arms & Tools
- Autonomous Navigation
- Battery Technology

Event Distribution:

Oceanology International,
London, UK
Subsea Expo
Aberdeen, UK
Floating Wind Solutions
Houston, TX, USA
Europe Offshore Wind
Bilbao, Spain

February 2024

Ad close Feb. 4

Digital Edition

MTR E-Magazine Edition:

Oceanographic

March/April 2024

Ad close March 21

Offshore Energy

- Oceanographic Instrumentation & Sensors
- Subsea Defense: The Hunt for UXO
- Inspection, Repair & Maintenance
- Underwater Communications
- Cables & Connectors

Event Distribution:

Offshore Technology Conference (OTC),
Houston, TX, USA
UDT
London, UK
IPF Wind Conference
New Orleans, LA, USA
AUVSI Xponential
San Diego, CA, USA

May/June 2024

Ad close May 21

Dredging Technology

- Hydrographic Survey
- Scientific Deck Machinery
- Workclass ROVs
- Seismic & Geotechnical Surveys
- Sonar, Telemetry & Data Processing Software

Event Distribution:

WEDA Dredging Summit & Expo
Las Vega, NV ,USA

July/August 2024

Ad close July 21

Autonomous Vehicle Operations

- Underwater Tools & Manipulators
- GPS, Gyro Compasses & MEMS Motion Tracking
- Subsea Defense
- Deck Machinery & Cranes
- Battery Technology

Event Distribution:

Oceans 2024, Halifax
Halifax, NS, Canada

August 2024

Ad close Aug. 4

Digital Edition

MTR E-Magazine Edition:

Hydrographic

September/October 2024

Ad close Sept. 21

MTR100

Focus on 100 Leading Companies, People and Innovations in the Subsea Space

November/December 2024

Ad close Nov. 21

Ocean Observation: Gliders, Buoys & Sub-Surface Networks

- Instrumentation: Profilers, Samplers & Sediment Corer
- ADCPs & DVLs
- Subsea Defense: The U.S. Navy
- Subsea: Electrification
- Underwater Imaging: Lights, Cameras & Multibeam Sonar

December 2024

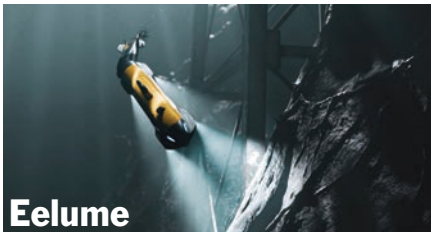
Ad close Dec. 4

Digital Edition

MTR E-Magazine Edition:

Subsea Vehicles


Exail


Eelume

Balmoral

Gary Yeoman, Sales Director at Balmoral Comtec, said: "Rosebank signifies an exciting shift for the future of offshore field development in the UK, with its ambitions to be one of the first UK fields powered with renewable electricity. We're delighted that as a result of this project we're actively recruiting for many roles here in Aberdeen and across the UK. While this recruitment effort is driven by our recent award win, the addition of valuable, transferable skills will continue to heighten our expertise and strengthen our position as a leader across offshore sectors in both traditional and renewable energies."

OSIL Dredge Monitoring Buoy Network

Ocean Scientific International Limited (OSIL) supplied a network of 1.2m data buoys to offshore construction company Van Oord to monitor turbidity and dissolved oxygen levels in the location of dredging operations. A total of nine data acquisition systems have been produced for Van Oord, and the fully integrated multi-discipline data buoy networks will support dredging operations by providing continuous real-time information about the dredge plume and surrounding environmental conditions. The buoys are equipped with water quality sondes provided from Van Oord's existing equipment pool, and relay collected data via GSM with an Iridium satellite Short Burst Data (SBD) back up.

eoapp AQUA: Monitoring Water Quality from Space

Authorities and industry can gain comprehensive satellite-based information on coastal and inland waters with a few mouse clicks: The cloud-based solution, eoapp AQUA, offers a wealth of data and a panoptic view of many water bodies. Users can conduct data generation for a specific region, after defining required parameters, observation period, area, and satellite sources according to their needs. For visualizing and analyzing these results, eoapp AQUA includes an intuitive data viewer, a long-term analysis tool enabling users to look +40 years back in time, a monitoring feature to identify both the status and recent developments in water bodies, plus an alert function based on individual thresholds.

All these features support a physics-based approach to water quality applications, such as bathing waters surveillance, environmental impact monitoring, or climate change studies.

'Following 'SDB-Online' for hydrographic or 'HYPOS' for hydropower stakeholders, eoapp AQUA is the third in EOMAP's series of online solutions. These eoapps all have one common target: To provide decision support through fast and simple access to satellite-based information.

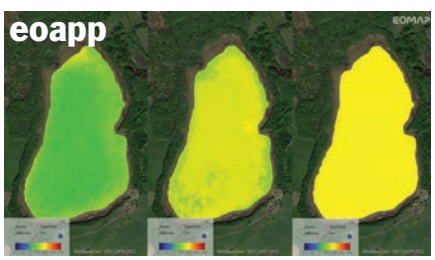
OceanAlpha Delivers USV to Hong Kong University

OceanAlpha delivered a L12E USV, dubbed The Clear Water Bay, to Hong Kong University of Science and Technology (HKUST), to bolster the school's technology R&D initiatives, underscoring its commitment to advancing robotics education.

The final recipient of the unmanned vessel is Cheng Kar-Shun Robotics Institute (CKSRI) at HKUST, a multidisciplinary platform dedicated to fostering research, development, and education in robotics. The Clear Water Bay USV will directly support the Institute's innovative technology research and development efforts, enabling secondary development activities and expanding the horizons of scientific exploration at HKUST.

Seatools Deploys Equipment at Offshore Wind Farm

Seatools delivred its pre-piling template equipment to CSBC-DEME Wind Engineering (CDWE) for the Hai Long Offshore Wind Farm project. Seatools, in close collaboration with CDWE, was responsible for the comprehensive design of the pile template's metrology and control system, encompassing all mechanical, electrical, hydraulic, and soft-ware components. This scope also included hydraulic and mechanical systems dedicated to template leveling and precise pile positioning. The advanced metrology system ensures that pile installation is achieved with exceptional accuracy, meeting stringent tolerance requirements.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OceanAlpha


OSIL

Illuminating The Unknown: Making RMS Titanic's Digital Twin

One year after Magellan's public release of this incredible expedition, we shed some light on the making of the RMS Titanic Digital Twin. Voyis, a provider of underwater imaging systems, joined forces with Sonardyne and EIVA to provide sensor systems to Magellan for its survey that captured the first complete Digital Twin of the RMS Titanic wreck site. This effort resulted in an extraordinary scaled digital twin of the entire bow and stern of the wreck, along with the surrounding debris field, enabling researchers and scientists to start to re-explore the vessel with greater levels of detail. This 3D model showcases the site as if the ocean had been drained away, offering a snapshot in time of this iconic historical asset before it degrades beyond recognition (Magellan Digital Twin). The survey was completely non-intrusive.

The Titanic, resting at a depth of approximately 12,500 feet in the Atlantic Ocean off the coast of Newfoundland, Canada, has long been a subject of fascination and mystery since its sinking in 1912. The aim of this project was to shed new light on the circumstances surrounding the sinking and use cutting-edge underwater optical technology to record the current state of this iconic wreck. In summer 2022, Magellan was provided with Voyis' underwater imaging sensors to complement its own systems and conduct the extensive optical survey.

Voyis' Observer Subsea Cameras and Nova LEDs

Voyis provided its Observer & Nova subsea imaging system in support of this endeavour, with an actively cooled high-dynamic range camera and more than ½ million lumens of flash lighting. More than 700,000 images were captured during the multi-day survey of the region, recording millimetric details of every aspect of the site. At 3,800m below the sea, the Observer Pro delivered clear, accurate images that were automatically corrected for both color and lighting. This

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delivered the image quality and consistency needed to produce Magellan's seamless Digital Twin.

Support from Covelya Group

Delivering images and an accurate 3D model requires more than great cameras, and trail laser scanners. Precise and accurate positioning throughout the survey is essential to ensure that complete coverage is achieved and to provide an accurate flight path for 3D model processing. As a provider of innovative underwater positioning and navigation technologies, Sonardyne supplied Long BaseLine (LBL) equipment and an acoustically aided SPRINT-Nav Hybrid Navigator. Sonardyne and Magellan have worked extensively together to develop and refine these systems since Magellan invested in SPRINT-Nav across its fleet of 6k rated work class ROVs, with the result that the advanced INS/DVL/LBL technology ensured reliable and robust subsea navigation in the challenging operating conditions at the Titanic site. Also critical to mission success is real-time feedback to the surveyors at the surface, and here EIVA contributed its advanced navigation and survey software capabilities to the project. EIVA's NaviSuite software solutions facilitated the efficient collection and visualization of the vast amount of image and navigation data collected during the survey.

Image captured with Voyis Observer & Nova subsea imaging system.
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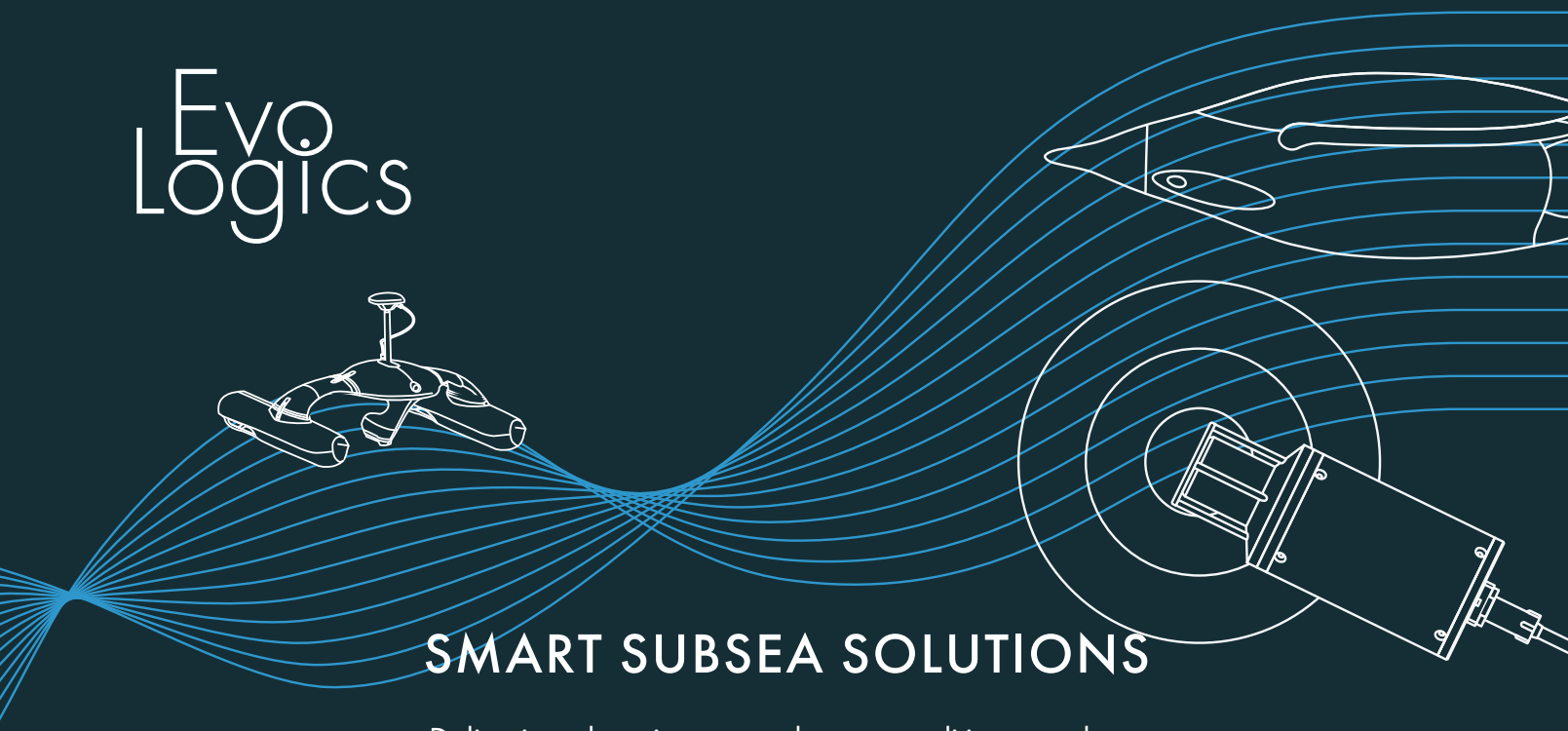

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