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JANUARY 2021

ANNUAL REVIEW & FORECAST

FEATURING:

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Government Officials

NGOs

TOTAL OCEAN MARKET COVERAGE

2021

JANUARY

Annual Review & Forecast

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

MARCH

Electronic Charting/Vessel Management/
Ports & Harbors/Dredging/Homeland Security

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

**AUVSI XPONENTIAL 2021, May 3-6, Atlanta, GA

**OCEANS 2021 Porto, May 17-21, Porto, Portugal

MAY

Communications, Telemetry, Data Processing

**CLEAN PACIFIC, June 28-30, Seattle, WA

**UDT, June 29-July 11, Rostock, Germany

JUNE

Seafloor Mapping/Sonar Systems/Vessels

JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

**Offshore Technology Conference, August 16-19, Houston, TX

AUGUST

Ocean Resources Development

**OCEANS 2021 San Diego, September 20-23, San Diego, CA

**SEG 2021, September 26-October 1, Denver, CO

SEPTEMBER

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**Offshore Energy, 2021 dates TBD, Amsterdam, The Netherlands

OCTOBER

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Embracing Collaboration In 2021

The upcoming year represents an unheralded opportunity for ocean community collaborations. The COVID-19 pandemic has devastated many ocean economy sectors, but the recovery opens doors for new activities and entrepreneurship. Indeed, technology has played a critical role facilitating the global pivot toward working remotely, even creating new ocean community connections and relationships. Every effort should be made for this to continue into the new-normal for a synergized and sustainable blue economy.

The pursuit of a successful blue economy requires the ocean community to collaborate. Oceans and seas are complex and vast. The ocean stakeholder community is as diverse as its biodiversity. The aim for an ocean economy to achieve co-occurring objectives in economic growth, social equity and environmental sustainability is an immense challenge. But it is possible, if stakeholders and sectors work together to identify mutually beneficial actions.

The role of technology is pivotal to culturing such a change in the ocean community. Technology will continue to be instrumental in ocean discovery and understanding. There has never been better resolution or extent of data on the marine environment. Improvements in remote-sensing, autonomous vehicles and wearable devices have improved the ability to monitor the ocean environment and its users. Advanced computer modeling and analytics, such as artificial intelligence, improve the understanding of complex marine systems and prediction of future states. As the understanding of the aquatic world and its economy improves, so should the quality of decisions that impact it.

Perhaps the greatest opportunity technology brings is the creation of new partnerships and collaborations. The impact of the global pandemic has created a proliferation of webinars, workshops and online material. In-person meetings have been replaced by video-conferencing. While the relationship building in the former is difficult to replace, the expansion in audience and removal of prohibitive travel costs has opened knowledge access and community consultation. Technology's ability to drive creation of new collaborative communities has only begun.

Immensely promising is breaking down historical silos through better translation of information. Augmented reality and real-time information access can bring communities and sectors together to address common challenges through shared solutions. The increasing, and welcome, adoption of open-access data is an important step toward the democratization of information for all ocean stakeholders. In as much as technology has revealed the hidden mystery of oceans and seas, it also unlocks community partnerships and collaboration.

As difficult as 2020 has been, the global pause it has created presents the ocean community with an opportunity to reflect and continue pursuing transformative, positive change in how it operates. One way this can occur is the pursuit of ocean-centric governance that reflects the unique challenges and opportunities of the oceanscape and its community. Blue governance is an emerging concept combining good governance and sustainable principles specifically in the context of economic growth in oceans and seas. It strives for interactions to be evidence-based, inclusive, transparent, accountable and equitable.

A commitment to these principles by the entire ocean community will maximize the opportunities in the upcoming year. Institutional and legal frameworks, while vital components of ocean governance, can be slow to respond. Instead, a conscious effort by all stakeholders, combined with the benefits of new, more accessible technology, will create a more agile and adaptive ocean community. The critical question is: How do we value this more open, collaborative way of working forced by the pandemic? How will we behave when travel restrictions ease? Technology only facilitates collaboration. People reach out. **ST**



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)) International Polar Agreement. The International Cooperative Engagement Program for Polar Research Memorandum of Understanding (ICE-PPR MOU) is now in effect. The MOU establishes general provisions that apply across basic research to development, testing and evaluation to improve partners' capabilities for successful and safe operations in Polar areas. Participants include: the Department of National Defence of Canada, the Ministry of Defence of the Kingdom of Denmark, the Ministry of Defence of the Republic of Finland, the New Zealand Defence Force, the Ministry of Defence of the Kingdom of Norway, the Government of the Kingdom of Sweden, and the U.S. Department of Defense. The ICE-PPR effort, which covers the Southern Ocean as well as the Arctic region, creates a collaborative forum in which the seven participating nations can initiate, conduct and manage polar research projects, as well as arrange supporting material and equipment sharing. The ICE-PPR MOU will enable the exchange of information to harmonize participants' defense and national security requirements and better define future cooperative efforts. The ICE-PPR Executive Steering Committee will gather representatives of each participating nation to evaluate past efforts, consider current focus areas, and examine projects and exercises of interest for future collaboration. To advance shared goals, initially there will be four ICE-PPR working groups to explore, study and report on issues related to environmental, human performance, platforms and situational awareness focus areas. The ICE-PPR MOU is to remain in effect for 25 years.

)) Homeland Security Startup Studio Launch. The U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T) will launch its first Homeland Security Startup Studio this month. The innovative program is a partnership with FedTech, aimed at commercializing federally funded breakthrough technologies to support homeland security missions. This effort will focus initially on S&T-funded technologies, with plans to expand in the future to include technologies from other agencies and laboratories. The program will form teams of entrepreneurs and match them with innovative technologies to assess their commercialization potential. They will work with lab scientists and inventors, then explore forming companies around those technologies to solve the real-world problems of government and commercial customers. "The goals of the Homeland Security Startup Studio are to build the foundational entrepreneurial knowledge and skill sets for teams to quickly assess the potential for DHS and commercial use cases and to build start-ups and spin off companies quickly so they can successfully license technology and directly impact the security posture of the U.S.," said Megan Mahle, director of S&T's Office of Industry Partnerships.

)) Transatlantic Subsea Cable Launch. Aqua Comms DAC, the operator of Ireland's first dedicated subsea fiber-optic network interconnecting New York, Dublin and London, has announced the successful launch of AEC-2 (America Europe Connect-2), the company's second transatlantic subsea cable system. The new system complements Aqua Comms's existing AEC-1 (America Europe Connect-1) cable which was ready for service in 2016. AEC-2 directly connects New Jersey to Denmark, doubling fiber connectivity between North America and Denmark. It is the first new subsea system directly linking North America to Denmark and the Nordic region in 20 years. AEC-2 leaves North America from NJFX, a carrier-neutral cable landing station and Tier Three colocation facility in New Jersey, providing the option to bypass New York City. The new AEC-2 cable offers complete diversity from traditional landing points in the United Kingdom. It delivers the latest technology and offers wavelength services ranging from 10, 100 and 400 G to further support the burgeoning demand for data services on the world's busiest trans-oceanic route.

)) EPA Turns 50. In the 1960s, the deterioration of America's environment, and its impacts on human health, were at the forefront of public discourse. To address these concerns, then President Richard Nixon proposed a plan to Congress in early 1970 that would consolidate federal environmental research, monitoring and enforcement duties into one agency, the Environmental Protection Agency (EPA). The EPA recently celebrated its 50th anniversary. It was established with William Ruckelshaus as its first administrator. "For many decades, the EPA has been known for its commitment to science as it worked to protect America's environment and our public health," said U.S. House Science, Space, and Technology Committee Chairwoman Eddie Bernice Johnson (D-Texas). She argued that under the new administration, "we must reemphasize the important role of high-quality science, research and development, and innovative technologies in the EPA's work to protect the environment, address climate change and safeguard human health."

)) RV Refit Complete. RV *Roger Revelle* is back at work after a midlife refit involving upgrades from top to bottom, bow to stern. Its service life has been extended by 15 to 20 years, with improvements to systems crucial to the vessel's operations, scientific capabilities, habitability and environmental footprint. The ship is owned by the U.S. Office of Naval Research and has been operated by Scripps Institution of Oceanography at the University of California San Diego since 1996. It is one of the largest ships in the U.S. Academic Research Fleet and vitally important to U.S. oceanographic research due to its range, payload, duration and ability to safely conduct scientific operations in remote areas around the globe. **ST**

Annual Review & Forecast

For the 55th year, leaders in ocean technology, research, business and policy give their perspectives on promising new developments and critical changes in the ocean world.

Review&Forecast

NOAA Delivers Data and Science To Boost US Blue Economy

By Nicole LeBoeuf
Acting Director, National Ocean Service
NOAA

NOAA marked its 50th anniversary in 2020 and demonstrated how our unique science missions power long-term growth in the American blue economy and deliver the world's best weather, ocean and coastal forecasts to protect American lives and livelihoods every day. Roughly 126 million people live in U.S. coastal counties; that's 40 percent of our nation's population living in just 10 percent of our land mass. In 2018, the U.S. blue economy contributed nearly \$373 billion to our nation's GDP and grew at a faster pace than the nation's economy as a whole. It is nearly impossible for most Americans to go a single day without eating, wearing or using products that come from or through the marine economy.

To support this highly influential part of our nation's economy we launched six new science strategies in the past year to guide transformative advancements in the quality and timeliness of NOAA science, products and services. These strategies include harnessing the power of uncrewed systems, artificial intelligence, cloud computing, citizen science, big data, and advanced methods to analyze DNA, RNA and proteins, called Omics.

We established a new Uncrewed Systems Operations Center in order to support the rapidly expanding use of uncrewed systems, applying them across NOAA missions. We advanced new observing satellites and accelerated weather modeling through NOAA's innovative community modeling initiative, the Earth Prediction Innovation Center.

We invested in aircraft and ships to support NOAA's missions of weather prediction, fisheries management, seafloor mapping, and ocean and atmospheric research that informs weather, climate and ecosystem forecasting. We are acquiring new aircraft to support accurate hurricane track and intensity forecasts and atmospheric research missions, as well as to measure the water content of snow and soil for flood, river level and water supply forecasts. NOAA is also bringing on two new oceanographic ships and is expanding its use of underwater gliders to better understand conditions ripe for hurricane intensification.

These and other investments in science, world-class satellites, increased supercomputing capacity and technology help NOAA advance the five areas of our Blue Economy initiative: seafood competitiveness, marine transportation, tourism and recreation, ocean mapping, and exploration and coastal resilience.



Seafood Competitiveness and Economic Growth

In order to close a long-standing seafood trade deficit, the White House issued a groundbreaking Executive Order on Promoting American Seafood Competitiveness and Economic Growth. The order enables NOAA to build on our existing efforts to foster sustainable marine aquaculture while also improving economic opportunities for coastal communities and industries, including through Aquaculture Opportunity Areas (AOAs). We recently selected areas off of southern California and the Gulf of Mexico for focused scientific evaluation to identify locations where aquaculture potential is high to create the first AOAs. NOAA is also making great strides in the emerging field of fisheries genetics, or Omics research, that may ultimately improve sustainable fisheries management. We're also using artificial intelligence to process imagery from fish surveys and electronic monitoring to improve fishery management. Through our web-based Ocean Reports Tool, NOAA provides the aquaculture industry and other ocean planners with high-level analyses for avoiding potential conflicts associated with multiple users in a given area. Ocean Reports provides users specialized "ocean neighborhood analyses" including maps and graphics by analyzing more than 100 ocean data sets instantaneously.

Marine Transportation

Our nation's ports are powerful engines of a growing U.S. blue economy. NOAA strengthens marine commerce and the movement of \$1.8 trillion in cargo by increasing vessel safety and efficiency in major U.S. ports through our world-class navigation services. Working with local partners, NOAA expanded its Physical Oceanographic Real Time System (PORTS) program, using NOAA electronic navigational charts, high-resolution hydrographic survey data, and expertise in geodetic and tidal control. With PORTS, we've reduced ship accidents by more than 50 percent, increased the amount of cargo ships can carry, reduced transit delays for commercial traffic, enhanced recreational activities, and improved hazardous spill response. NOAA estimates as much as a \$300 million annual benefit from an expanded PORTS system.

Tourism and Recreation

A clean and healthy ocean and Great Lakes are the foundation of the U.S. blue economy, and they fuel vibrant tourism and recreation. In October, NOAA, the Environmental Protection Agency and the Department of Energy announced a new federal strategy to address the global issue of marine debris, complementing NOAA's Marine Debris Program's achievements to date. NOAA aids coastal communities by forecasting harmful algal blooms and providing information to cities and local governments that depend on tourism and fisheries. NOAA's information also helps to treat and safeguard drinking water.

Ocean Mapping, Exploration and Characterization

NOAA's ocean mapping and exploration missions received a major boost with the 2019 Presidential Memorandum on Ocean Mapping, setting ambitious targets for our nation. In response, NOAA is strengthening its partnerships with the Navy and other federal agencies, as well as forging exciting new partnerships with ocean research institutes, private industry, and academic and nongovernmental organizations. Accomplishing the memorandum's goals will undoubtedly yield economic and ecological benefits, including enhancing our understanding of unmapped U.S. coastlines, the discovery of new sources of critical minerals, marine-derived medical treatments, energy, and areas of important conservation value.

“To support this highly influential part of our nation’s economy we launched six new science strategies in the past year to guide transformative advancements in the quality and timeliness of NOAA science, products and services.”

Enhancing Coastal Resilience

American prosperity depends on the long-term health and resilience of our ocean and Great Lakes communities. In addition to weather forecasts, NOAA provides many tools to help mitigate coastal hazards, including our new Coastal Inundation Dashboard, which provides real-time forecast and historical water-level information to support coastal decision makers. The online tool gives decision makers, boaters, fishermen, coastal residents and visitors information about water levels, storm surge, and historic flooding patterns that can be used to understand both short-term risks such as an approaching hurricane or nor'easter, as well as longer-term risks like high-tide flooding and sea level rise into the future.

As we look to 2021, NOAA is making a wide range of targeted investments in improving access to marine and coastal data for decision makers, enhancing service delivery and leveraging partnerships with private industry to facilitate the development and use of enabling technologies and information to grow all sectors within our nation's powerful blue economy. **ST**

Review & Forecast

Leading Discovery and Innovation In the Oceans

*By Stacy Aguilera-Peterson
Ocean Policy Specialist
U.S. National Science Foundation*

*Terry Quinn
Division Director, Ocean Sciences
U.S. National Science Foundation*

The National Science Foundation (NSF) Division of Ocean Sciences (OCE) is unleashing discovery and innovation in the oceans. Communities worldwide benefit from the sustainment, acceleration and transformation of the NSF-funded ocean research ecosystem. In fiscal year (FY) 2020, OCE funded over 380 new awards and approximately \$393 million dollars for basic research and education.

NSF has been a global leader in basic ocean science since its establishment. Four of NSF's first 100 awards made in 1952 were ocean-science related. NSF's infrastructure and support of critical assets such as the *Regional*-class research vessels and the *JOIDES Resolution*, and NSF's support of programs such as GEOTRACES and Long-Term Ecological Research (LTER) sites, are essential to advancing fundamental science and discovery at scale.

This year, NSF welcomed Dr. Sethuraman Panchanathan as its 15th director. Through Dr. Panchanathan's leadership, NSF is looking to enhance the nation's global competitiveness and harness innovation to drive national prosperity and well-being.

GO-BGC Array

NSF announced a \$53 million investment to create a global fleet of robotic floats, transforming how we observe the ocean. The Global Ocean Biogeochemistry Array (GO-BGC Array) will release a network of 500 robotic floats into the global ocean to collect chemistry and biology data from the surface down to a depth of more than 1 mi. This investment aims to drive a momentous shift in our ability to observe and predict, at the global scale, the effects of climate change on ocean metabolism, carbon uptake, and living marine resource management.

Five research institutions will work with industry partners to construct the floats. Researchers, educators and decision makers worldwide will have free access to the collected data in near real time. The award supports an



outreach program that aims to diversify the blue workforce through undergraduate, graduate and postdoctoral programs, scientific-training workshops, and building curricula with educators.

Responding to COVID-19

The COVID-19 pandemic has resulted in direct and detrimental impacts on the entire research ecosystem. OCE held two town hall sessions in May 2020 to discuss pandemic impacts on projects.

OCE program officers are closely communicating with researchers about canceling and rescheduling research cruises, human capital impacts (especially on students and postdoctoral researchers), and time line adjustments to account for decreased access to facilities. Many researchers were unable to go to sea due to social distancing requirements and the need to have single-occupancy staterooms.

OCE provided higher internet bandwidth for cruises, allowing for telepresence and greater participation from shore.

The U.S. Academic Research Vessel Fleet (ARF) paused operations from March to June 2020, and only essential work has been carried out since July. Once risk mitigation procedures are implemented on each vessel, NSF plans to carry out approximately 167 weeks (1,168 days) of work among all classes of ships by the end of the calendar year. To date, there has not been a breach of COVID on board the vessels.

Due to the closing of university housing and laboratories, 11 (37 percent) of the OCE Research Experiences for Undergraduates (REU) sites canceled their summer 2020 programs. The remaining 19 sites continued in person or converted to online programming.

OCE supported the rapid development of three additional virtual REU sites and a virtual professional development program. In total, the 2020 REU sites hosted 234 interns, and 52 percent of these students were from underrepresented groups. Virtual REU programming was highly successful, and OCE will encourage additional virtual REU sites in the future.

Flexibility has proven more important now than ever before. The OCE Biological Oceanography Program eliminated target dates and will accept proposals for consideration at any time. This action is aimed to reduce the burden on investigators, reviewers and submitting institutions.

Building the Blue Workforce

An inclusive STEM-literate blue workforce that is prepared for the future is fundamental to ocean innovation. The impact of COVID-19 on the blue workforce is acute, especially for graduate students and early-career scientists.

OCE announced the development of a Postdoctoral Research Fellowship (PRF) program to provide opportu-



nities for early-career scientists to work within and across traditional disciplinary lines, develop partnerships, and avail themselves of unique resources and facilities. The program emphasizes mentoring skills, and it encourages the engagement of fellows in activities that are focused on increasing diversity in STEM.

OCE is also participating in the Mid-Career Advancement Program, which offers an opportunity for researchers at the associate professor rank (or equivalent) to enhance and advance their research through synergistic and mutually beneficial partnerships.

To celebrate National Oceans Month, OCE hosted a Frontiers in Ocean Sciences Symposium to highlight seven early-career scientists whose transformative research is advancing ocean science and technology to new bounds.

OCE recognizes that technology enables inclusion. NSF-funded programs such as the Ocean Observatories Initiative (OOI) embrace community engagement and make data freely available.

The closure of facilities during the pandemic has illuminated the growing importance of freely accessible and easily usable data.

Think Blue: A Convergence Approach to the Oceans

The NSF Coastlines and People program released a solicitation to support Coastal Research Hubs. These centers apply a convergent science approach at the nexus between coastal sustainability, human dimensions, and coastal processes to transform understanding of interactions among natural, human-built, and social systems in coastal, populated environments.

NSF announced a \$20 million award for the University of Oklahoma-led Artificial Intelligence (AI) Research Institute for research on trustworthy AI in weather, climate and coastal oceanography.

This convergent, multi-sector institute brings together researchers in AI, atmospheric science, ocean science, and risk communication to develop AI that addresses the data and research needs of pressing environmental concerns.

The NSF-funded Smart Oceans 2020 workshop explored ongoing challenges and emerging opportunities in ocean innovation, exploration and utilization, including how to implement the November 2019 Presidential Memorandum on Ocean Mapping.

Looking Forward

OCE looks forward to joining the global community to build off the global focus on oceans with the kickoff of the Ocean Decade next year.

NSF is committed to supporting the research community in overcoming the coronavirus pandemic's impact and recognizes the importance of leveraging partnerships in revitalizing our ocean research and education enterprise. **ST**

Review&Forecast

USGS is a Critical Partner in Ocean Exploration and Mapping

By Dr. Jim Reilly
Director
U.S. Geological Survey (USGS)

The ocean is a source of tremendous biological diversity and economic wealth, but exploring it presents enormous technological challenges, mainly due to the pure physics of operating at extreme depths and pressures, and in remote locations. These challenges have limited our ability to access, map and describe significant parts of the Earth's deep-seafloor regions. In fact, we have better maps of the surface of the Moon and Mars than we do for much of Earth's ocean floor. This lack of information limits our ability to adequately and sustainably manage these unique ecosystems and their resources. Exploring and mapping the deep sea will improve our understanding of marine hazards; energy, mineral and biological resources; large-scale Earth systems; and help us build the knowledge to sustainably manage and use ocean resources.

For example, the Outer Continental Shelf of the U.S. is roughly 2.5 billion acres of seabed, which is roughly equal to the land area of our nation. When you consider the U.S. seafloor area combined with the land area, the U.S. nation nearly doubles in size. The U.S. Exclusive Economic Zone (EEZ), where the U.S. has sole rights to fish, drill and conduct other economic activities, extends up to 200 nautical mi. (370 km) from the coastlines of the mainland U.S., the commonwealths of Puerto Rico and the Northern Mariana Islands, and U.S. overseas territories and possessions. The EEZ can include both the geologic continental shelf as well as the continental slope and rise, with 70 to 75 percent of the included seafloor at water depths that reach 9,843 to 16,405 ft. (3,000 to 5,000 m).

However, the challenges of exploring areas such as the EEZ present us with some incredible opportunities. In order to map subsurface areas around the globe, we must collaborate with domestic and international government and private partners, leveraging their respective expertise and resources, to identify priorities for exploring and characterizing them appropriately. Similarly, exploring our ocean depths also presents the opportunity to drive the development of new and emerging science and technologies through critical partnerships across industry, academia and nongovernmental organizations.

The USGS is the world leader in characterizing the geology and geologic processes at and beneath the seafloor. We have experienced and diverse teams dedicated to advancing ocean science with expertise spanning earth- and life-science disciplines. The teams are armed

with technological capabilities for characterizing deep-sea minerals, gas hydrates, tectonics and related geohazards, ocean ecosystem function, biodiversity, and the connections between these deep-ocean and coastal areas and associated human activities. USGS experts also specialize in assessing hazards and risks, as well as developing, managing and integrating data with geospatial information to better visualize, measure, describe and monitor the resources in ways that can be easily transferred to and used by partners and other stakeholders.

In 2019, the USGS participated in a variety of research expeditions to explore new frontiers in the Atlantic and Pacific oceans. The missions ranged from pure exploration and mapping of unknown areas to development of specific technologies to sample, measure and map the deep sea. Partner organizations and agencies provided research vessels that could accommodate laboratories and their staff, remote- and human-operated vehicles, and sampling and mapping capabilities. In addition, these research vessels used video capabilities to connect to shore-based experts and live communication feeds that allowed the public to share and engage in the exploratory excitement.

For these kinds of open-ocean missions, no agency can do the work alone. The USGS has worked with many partners, including: NOAA's Office of Exploration and Research, the Pacific Marine Environmental Laboratory, the National Marine Sanctuary Program, and other offices and programs at NOAA, as well as sister agencies at the Department of the Interior, such as the Bureau of Ocean Energy Management and the U.S. Fish and Wildlife Service. The USGS strives to bring together diverse expertise in research teams that can make the most of limited ship time to accomplish multiple research missions. Recent partners outside of the federal government have included the British Geological Survey, GEOMAR, Global Foundation for Ocean Exploration, National Oceanographic Partnerships Program, Schmidt Ocean Institute, South Atlantic Fisheries Management Council, and University of North Carolina-Chapel Hill.

In each of these endeavors, there have been exciting new discoveries, new research collaborations, advancements in technology and unprecedented public engagement. We have collected great quantities of data and samples, and we are steadily gaining understanding and filling knowledge gaps. As we address these gaps, we continue to characterize our nation's submerged lands more completely with each deep-sea mission.

In June 2020, the White House's Ocean Policy Committee released the National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone, directing federal agencies and U.S. partners to collaborate in exploring and characterizing our nation's ocean areas. The USGS has provided leadership in developing the plan along with more than 20 federal agencies and participates on the Ocean Exploration Advisory Board, a federal advisory committee that



provides guidance on this topic. Within this strategy, the USGS and its partners are well situated to continue comprehensive exploring of deep-sea environments now and well into the future.

Partnerships and collaborations are central to meeting the challenges of deep-sea exploration and characterization. USGS expertise and capabilities complement the roles of other federal agencies and partners in filling knowledge gaps, fulfilling a range of missions while spurring each other on to develop the capabilities to allow us to explore and characterize the farthest reaches of our ocean frontier.

To learn more, visit: www.usgs.gov/special-topic/deepsea. **ST**

Review & Forecast

Taking an End-User Approach To Tomorrow's Marine Energy Tech

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Our understanding of the ocean is improving, and with that, our relationship with it is evolving.

As a foundation for local, regional, national and global economies, the ocean is a source of food, energy and recreation, as well as an enabler of global trade. The seemingly endless expanse of oceans that covers 70 percent of our planet remains largely unexplored, with some estimates suggesting that we have mapped less than 10 percent of it.

The ocean's potential is nearly as limitless as its expanse.

The term "blue economy" is gaining traction as a term that captures the interplay between the economic, social and ecological sustainability of the ocean. The blue economy is a powerhouse sector of the global economy—and it is growing. According to the Organization for Economic Cooperation and Development, the global economic value attributable to ocean-related activities is projected to grow from \$1.5 trillion in 2015 to \$3 trillion by 2030, at twice the rate of the rest of the global economy.

To realize the tremendous value of the ocean and its ability to sustainably meet the energy needs of the burgeoning blue economy, the U.S. Department of Ener-

gy's (DOE's) Water Power Technologies Office (WPTO) launched the Powering the Blue Economy (PBE) Initiative in 2019. With a focus on removing the power constraints from blue economy industries, the initiative aims to promote economic growth and understand and satisfy the power requirements of emerging coastal and maritime markets through the integration of marine renewable energy technologies.

Erasing the Energy Barriers

The vast potential of the blue economy is fueling excitement and robust investment in next-generation, ocean-focused technologies. This includes everything from autonomous vehicles and ocean exploration to desalination and water treatment for coastal and island communities.

And energy is central to the advancement of these next-generation technologies.

Ocean industries, such as aquaculture, for example, are moving further offshore to take advantage of the scale of the ocean, yet this move requires access to consistent, reliable power untethered to land-based power grids. Oceanographic research increasingly relies on autonomous sensors and vehicles that function with limited human intervention. Pushing these systems further offshore and staying on mission longer requires new approaches to onboard energy generation, reliable remote recharging and energy storage. Marine energy resources, such as wave, tidal and ocean currents, could be well poised to address these blue economy power constraints.

Deepening Connections, Understanding Communities' Needs And Transforming Industry

Understanding the requirements and needs of the people and organizations that will use and benefit from these marine renewable energy technologies is critical to the PBE Initiative. When WPTO initially scoped the initiative, national lab partners investigated the potential for incorporating marine energy into blue economy sectors via extensive analysis and stakeholder engagement. They conducted foundational research to identify near-term use cases with high potential, while keeping an eye on the availability of the marine renewable energy resource.

And as we move forward with PBE, the need for continuous engagement with the end-user communities becomes more and more evident. Having a deep understanding of end-user needs helps us evaluate demand to establish next steps in developing new technologies and applications, as well as integrating the new tech into existing systems.



“WPTO partnered with the U.S. Economic Development Administration to provide \$4 million in funding to pilot an inaugural industry challenge, Innovation in the Blue Economy.”

The newly launched Energy Transitions Initiative Partnership Program (ETIPP) is an example of how we will engage with communities. The program will provide resources and on-the-ground support for remote and island communities in the United States and seeks to transform their energy systems and lower their vulnerability to energy disruptions. This will include the evaluation of the role of marine energy in the future energy and water systems of these communities, and it will combine the technical assets of the local community while engaging with the national labs to achieve energy transitions.

Additionally, to strengthen relationships with stakeholders, industry, investors and entrepreneurs in the blue economy, WPTO partnered with the U.S. Economic Development Administration to provide \$4 million in funding to pilot an inaugural industry challenge, Innovation in the Blue Economy. Seven awards were made to organizations nationwide to support entrepreneurship and accelerate company growth in their community, region or combination of regions to help expand the blue economy.

**Forming Competitions and Prizes:
Consumer-Centric by Design**

As part of PBE, WPTO launched a collection of prizes and competitions, such as the Ocean Observing Prize, the Waves to Water Prize and the Marine Energy Collegiate Competition. Boasting more than 400 applications to date, these prizes challenge innovators to dream up

groundbreaking technologies to address our most pressing marine energy challenges.

The rules and scoring requirements for the prizes are structured around an overarching goal of soliciting submissions that will meet end-users' needs. For example, in the Ocean Observing Prize DEVELOP Competition, competitors are judged on categories such as impact and innovation, end-user market potential, and technical feasibility.

To that end, WPTO held a public workshop, conducted informal surveys, and consulted with partner organization and prize co-sponsor NOAA's Integrated Ocean Observing System (IOOS) program to further refine and define the mission for the competitors.

Additionally, the prize development team employed a user-centric engineering design methodology, Quality Function Deployment. We employed this consumer-focused process to ensure that the prototype design requirements for competitor submissions meet the needs of prospective customers.

Focusing on the Fundamentals

Understanding key functional requirements and end-user needs extends beyond our work on prizes and with industry to our lab research. This year, DOE National Laboratory researchers initiated work on 10 different foundational R&D topics across all of our PBE markets and applications to support fundamental research in marine energy, all of which were informed through custom-



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er discovery and analysis. One of these focus areas is small-scale desalination.

Similar in scale and concept to some micro-grids, small-scale desalination creates a high-value resource, as water is typically a large energy consumer for target customers. To better understand the device requirements, the researchers are engaging would-be end-users to determine whether this technology could be useful and how it might be used, as well as to assess the demand for it.

This information will guide future research on how to incorporate marine energy into such devices and will engage Waves to Water Prize participants in their quest to develop the small-scale, portable, marine energy-powered desalination devices of the future.

Championing the Cause

WPTO serves a critical role in bolstering the evolving blue economy—as a research organization, a nexus point among other federal agencies, a primary funder of energy technologies and solutions, and as a collaborator among federal and other blue economy stakeholders.

Uniquely positioned to champion this underserved research area, WPTO is opening the doors to advancement and innovation, providing the support to help tomorrow's marine energy innovators set sail. **ST**

Review&Forecast

A Focus on 'Novel Modernization'

By Mark Vaccaro

Chief Development Officer, Undersea Warfare
U.S. NAVSEA Warfare Centers

With a focus on “Today’s Navy,” the “Next Navy,” and the “Navy After Next,” the Naval Sea Systems Command (NAVSEA) Warfare Centers, which include both the Surface and Undersea Divisions, continuously invest in enabling technologies for advanced naval capabilities. The rapid pace of technological change has led to direction from Navy leadership and Congress to “go faster” in adopting new technologies and getting them into the hands of the fleet more quickly. “Novel Modernization,” which emphasizes rapid prototyping and warfighter-driven challenges, has become a new mantra for the Navy’s research development enterprise. The Warfare Centers are implementing this through rapid design sprints that provide ready-to-field capabilities intended to augment traditional military capabilities.

The current National Defense Strategy (NDS) notes that “many technological developments will come from the commercial sector,” which will ultimately impact society and the character of war. The wide array of advanced technologies available to anyone, including state

and nonstate actors, “risks eroding the conventional overmatch our nation has grown accustomed to.” The NDS also discusses the need for forces to be prepared to confront technological surprises on the battlefield.

To address these concerns, the NAVSEA Warfare Centers have identified a set of knowledge points that are central to focusing their science and technology investment strategy. These knowledge points span a number of emergent technology areas. Advanced autonomous systems are fundamental to this effort, so the Warfare Centers continue to invest in the military applications of autonomy, artificial intelligence and machine learning, incorporating commercial breakthroughs, as applicable, to gain military advantages. Other high-interest research areas include intelligent autonomous systems, modeling and simulation capabilities, as well as reliability, durability and maintainability for low-cost and expendable systems.

Integrated power and energy sciences represent a broad technical area that is fundamental to nearly all systems but particularly important for long-endurance unmanned systems. Specific research areas include power generation, distribution, high-density power-systems protection, energy storage, controls, thermal management, and assessment of phenomena associated with these areas, both physically and via modeling.

Ocean sciences and sensing is an additional knowledge point that the NAVSEA Warfare Centers continue to invest in to better understand and predict the dynamic evolution of ocean phenomena and processes as they impact the performance of naval systems. Applying ocean science research to maritime operations requires rigorous interdisciplinary efforts that integrate evidence-based, multimodal analyses and effectively employs systems thinking to understand complex processes. Partnering with the Office of Naval Research, the NAVSEA Warfare Centers seek to increase the number of technical personnel with advanced degrees and training in both oceanographic sciences and naval systems.

A recent addition to the set of knowledge points is the emergent application of quantum sciences to naval capabilities. Recent breakthroughs in quantum computing are beginning to show applications beyond the research laboratory. Research areas of interest to the Navy include: quantum cryptography and communication; quantum algorithms and computing; quantum sensing; quantum metrology; and quantum energy transport and heat engines.

Future threats and future opportunities will come from the synergistic combination of many of these emerging technologies. Providing a framework to maintain awareness of potentially relevant technologies and fostering discussions about the application of these technologies, the NAVSEA Warfare Centers developed the Long Range Research and Development Plan (LRRDP). The LRRDP identifies emerging technologies that may impact the detect, command and



control, and engage sequence, and further investigates their potential future impact on each warfare area (surface, undersea, mine, etc.) and foundational technical areas, such as platform design and platform mobility. Additionally, consideration is given to which combinations of new technologies will reveal new and perhaps game-changing warfighting capabilities. To facilitate discussions among the Warfare Centers' scientific and technical community, and engagements with industry and academia, technologies are organized into "Technology Domains," including computational sciences, autonomous/intelligent systems and bio-sciences.

The LRRDP process has evolved into a tool that serves several purposes: it highlights emerging technologies that impact future warfare and warfighting capabilities; helps serve as a guide for science and technology investments; informs workforce development by identifying required skills; and helps inform investments in facilities and infrastructure. The LRRDP process has become a key tool in developing a long-term strategy to maintain the NAVSEA Warfare Centers' scientific and engineering excellence, and provide new and potentially game-changing warfighting capabilities. **ST**

Review&Forecast

Climate Change, Security and Maritime Environmental Science

*By Dr. Bryan Wells
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NATO*

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NATO STO CMRE*

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NATO recognizes how climate change effects have the potential to significantly affect Alliance planning and operations. In a speech in September 2020, the secretary general stated: "There is no doubt that climate change affects our security. So it is essential that NATO monitors and tracks what is happening much more closely. And that we fully integrate climate change into our military planning and exercises."

The Centre for Maritime Research and Experimentation (CMRE), based in La Spezia, Italy, is the sole NATO maritime research center of the NATO Science and Technology Organization (STO). It has been a customer-funded entity since 2012. CMRE has been developing world-class and proven defense S&T capabilities for more than 60 years, a success

achieved by a close and unique link between science, technology and seagoing capability with NATO military commands.

Historically, CMRE has gained considerable expertise and capabilities to understand and forecast the maritime environment, and it is currently in a privileged position to deal with maritime climate change and its implications for the defense sector.

Starting in the late 1980s, CMRE has helped NATO navies collect environmental data in the North Atlantic in order to populate databases and build the ocean climatology needed to assess sonar performance in strategic regions, such as the so-called Greenland-Iceland-United Kingdom (GIUK) gap and Nordic Seas. This was also made possible by the NATO Research Vessel (NRV) *Alliance* that conducted several sea trials dedicated to assessing the oceanographic and acoustic properties of the area.

Following the end of the Cold War, CMRE researchers focused on new maritime domains of interest for NATO, such as the Mediterranean Sea and littoral zones, and pioneering research activities on how physical characteristics of the oceans were changing as a consequence of global warming processes, which were and still are affecting the hydrosphere.

More recently, following geopolitical changes in 2014 and the increasingly large impacts of climate change in the Arctic Ocean and Nordic Seas, CMRE returned to investigate. By exploiting its capabilities in conducting high-level research with autonomous marine systems and networks, CMRE contributed to demonstrating how these areas are exhibiting the most extreme global climatic changes. As an example, in the Arctic region, air and sea surface temperature increased several times more than in the rest of the world, while the September sea ice cover has declined during the last four decades.

Recent CMRE activities include the 2017 Nordic Recognized Environmental Picture (NREP17) sea trial, during which CMRE returned to the GIUK gap to investigate ocean-acoustic changes and test equipment and techniques developed for marine environmental characterization. For the NREP18 sea trial, CMRE expanded investigations in the GIUK gap and started to work in the western Barents Sea/Svalbard Islands offshore area. CMRE also participated in the French campaign NARVAL19, conducting oceanographic and acoustic re-



search in the western Barents Sea/Svalbard Islands area.

Among other results, NREP17 and NREP18 revealed relevant changes of water mass characteristics in the GIUK gap area causing significant modifications of the sound channel and acoustic convergence zone compared to the previous investigations conducted in the 1980s and 1990s.

Results from NARVAL19 data show that a dramatic change in temperature occurred in the western Barents Sea during the last four decades, and the implications on acoustic propagation are still to be fully quantified.

Overall, the amount of recently collected data enabled analysis of the large variations of ocean properties during the last decades and their significant and surprising impact on acoustic propagation.

Climate projections indicate that the warming trend would continue and that the sea ice cover could almost disappear within the next few decades, exacerbating significantly future climate, security, defense and geopolitical challenges. To respond to this trend, CMRE, in coordination with other stakeholders, recently defined an Arctic science and technology strategy aimed at developing environmental support for anti-submarine warfare (ASW) in the rapidly changing region. CMRE science will then be used to identify the critical environmental aspects of Arctic transformation that need to be monitored and forecasted for ASW decision making.

Because CMRE is already dealing with aspects associated with climate change in relation to NATO defense

and security missions, it is capable of providing immediate help to NATO for understanding and adapting to new conditions.

By exploiting its established expertise across many emerging and disruptive technologies (EDTs), CMRE programs are aiming at better identifying and defining threat assessments, informed by a deep understanding of environmental and military science and monitoring of environmental changes.

In addition, in the near future, CMRE is well positioned to further increase its value to Allies in maritime environmental science and the experience gained during recent years through support funding, namely on big data, artificial intelligence (AI) and autonomy, which could represent an ideal focus for NATO maritime environmental change activities.

Data sets, continuously updated and validated by recent and future acquisitions through AI, can provide analysis of climate scenarios from the perspective of NATO defense in the maritime domain (e.g., expected future changes and possible future impacts of sea level rise and extreme weather on naval infrastructures and littoral operations).

To complement all this, CMRE maintains a visiting researcher program that hosts scientists from universities, research centers and defense laboratories to facilitate the exchange of information and expertise in maritime environmental science.

CMRE has a significant track record in providing envi-

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ronmental expertise and capabilities and creating international partnerships that support NATO environmental research. CMRE can rapidly extend its expertise and capabilities, establishing itself as a focal point for NATO maritime environmental change. **ST**

Review&Forecast

Investments in Ocean Observations Enable Prosperous, Sustainable Economy

By Rep. Eddie Bernice Johnson (D-Texas)
Chairwoman

U.S. House Committee on Science, Space, and Technology

Our oceans are vast, as vast as the value our of our oceans to our nation's economy. Even as a representative of the landlocked 30th Congressional district of Texas, which includes much of the city of Dallas, I recognize the immense impact our oceans has on our nation as a whole and on our economy in particular.

The United States has an ocean economy, or blue economy, that is growing faster than the nation's economy as a whole. Since the seas give so much to us, we must do better at understanding what impacts humans and climate change are having on it.

As chairwoman of the House Science, Space, and Technology Committee, I have worked with my colleagues to support and advance ocean science and technology at our federal agencies, including key partnerships with our universities and the private sector, and will continue to support significant investments to strengthen our Earth and ocean observation systems.

Ocean observations, and the technology and enterprise sustaining them, are key enablers for the blue economy and our prosperity as a nation. Ocean observations rely on many different types of technologies and infrastructure, from space-based satellites to sea-surface buoys to deep-ocean Argo floats and gliders, to name just a few. Ocean observations help us understand Earth-system processes, build resilient coastal communities, prioritize protection and sustainable use of ocean resources, and contribute to economic growth.

Examples of the benefits of a robust ocean observation capability are numerous. For example, we have seen how increasing ocean observations, such as deploying a fleet of ocean gliders in the Gulf of Mexico, has helped improve the accuracy of Atlantic hurricane forecasts. In addition, our records of key ocean variables such as sea surface and subsurface temperatures, sea surface height, and dissolved oxygen and carbon dioxide levels have revealed alarming rates of sea level rise, ocean acidification, and biodiversity changes, providing key insights into the impacts of climate change.

Science Committee agencies, including NOAA, the National Science Foundation, NASA and the Department of Energy (DOE), play key roles in ocean monitoring, research and observations. As chairwoman, I am making it a priority again for this Congress to support the ocean-related science and research happening at agencies within the Committee's jurisdiction.

Interagency partnerships have also played an important role in supporting ocean observations in recent years. The interagency National Oceanographic Partnership Program led to the creation of the critical Integrated Ocean Observing System. And DOE and NOAA's Powering the Blue Economy Ocean Observing Prize will support the development of marine renewable energy-powered ocean observing platforms.

The 2020 Atlantic Hurricane season, which was the most active season on record, has shown how warmer ocean temperatures, driven by climate change, are having a direct impact on communities across the United States and its territories. Hurricane forecasting depends on an array of observing systems to inform the models, forecasts, and hurricane watches and warnings. The data collected from these observing systems contribute to the improvement of the hurricane track prediction models, which are vital to warning the public about a hurricane's probable path. Additional observations for parameters such as ocean surface temperature are needed to improve understanding of rapid intensification, which occurs when hurricanes rapidly increase in strength as they approach land, a very dangerous and difficult-to-forecast phenomenon.

The World Meteorological Organization's "Statement on the State of the Global Climate in 2019" confirmed that the last decade has been the warmest on record. It highlighted rapid ice melt and glacial weakening in Antarctica, which are increasing the risks of flooding and eventual submersion of islands and coastal communities. Remote observations have been crucial for monitoring ice sheet and mountain glacial melt to understand large-scale patterns and regional changes. They have shown that Greenland lost more ice this year than any other year on record and created stunning images that track the decline of major Antarctic ice sheets over time. This science sheds light on large-scale risks to human society from climate tipping points that can trigger climate events ranging from rapid sea level rise to water supply imbalances for mountain communities.

The Committee held hearings last Congress that examined climate change impacts on our oceans and coasts, such as glacier and ice-sheet melt and marine biodiversity loss. In addition to our hearings, the House passed five bipartisan Science Committee-led ocean-related bills which addressed the threats of ocean acidification and harmful algal blooms.

Despite all that we have accomplished so far, there is so much more work left to do. The U.S. must chart a



strong and steady course both in conducting research to better understand our oceans and in developing innovative technologies to ensure that we can remain competitive globally in the blue economy. Despite the disruption that the COVID-19 pandemic has caused to certain ocean research and observations, it is imperative that we ensure continuity of measurements. We must also ensure that ocean observing systems have built-in resiliency to prevent disruptions from future pandemics and disasters.

In the 117th Congress, the House Science, Space, and Technology Committee will continue our work to strengthen the robust network of Earth and ocean observation infrastructure to ensure the provision of continuous, actionable data for decision makers at all levels, and I look forward to working with the ocean research community to make progress on our common goals. **ST**

Review&Forecast

21st Century Energy Policy Solutions

By Rep. Salud Carbajal (D-Calif.)
Member
U.S. Congressional Oceans Caucus

I started my tenure in Congress the same year the Trump Administration began, and since then, it's clear President Trump's energy agenda is intended to take us back to the 20th century in terms of our energy goals. But the Central Coast of California knows we must look to the future to meet our energy needs and strive for bold, innovative ways to build a 21st century economy and simultaneously fight climate change. Our oceans can be key in meeting both these challenges.

The Central Coast of California is no stranger to environmental disasters and devastation. From the 1969 oil spill to the Thomas Fire and subsequent Montecito Debris Flow, it's clear that protecting our environment doesn't only make economic sense, it is integral to protecting the health and safety of where we live.

As we grapple with the coronavirus and its economic impact, it's more important than ever to invest in renewable energy and transition away from fossil fuel energy sources that jeopardize our health and cost our communities millions in environmental damage and job losses. We can reach our 21st century energy goals by moving away from new oil and gas drilling in our oceans, tackling ocean acidification, and harnessing the power of offshore wind energy technology.

The Trump Administration's antiquated energy agenda has green-lit oil and gas leasing across this country, posing a direct threat to coastal economies, which are undeniably linked to clean coasts and healthy ocean ecosystems. Our ocean and coastal economies help sus-

tain lucrative tourism, fishing and recreation industries in the Pacific, Atlantic and eastern Gulf of Mexico. Together they support more than 2.6 million jobs and generate roughly \$180 billion in gross domestic product (GDP) every year. Expanding offshore drilling would jeopardize the livelihoods and economic security of coastal communities across the country.

The Central Coast of California has seen firsthand the devastating effects that climate change and oil spills wreak on our environment, fishing communities and ecosystems. First, in 1969, when 3 million gallons of oil from an offshore oil rig gushed into the ocean, marking the largest spill in our nation's history at the time and sparking broad environmental action—Earth Day was a direct result of the public outcry following this incident.

Then, in 2015, the Plains All American oil spill spewed nearly 143,000 gallons of crude oil along the coast. The cleanup costs reached \$92 million. It is clear oil drilling is costing millions and jeopardizing sustainability. That's why my first bill in Congress was the California Clean Coast Act, which prohibits future oil leasing off California's coastline, protecting our health, safety and economic well-being.

Moreover, we now must contend with ocean acidification, due to warming waters as a result of climate change. We are seeing the harmful impacts climate change and ocean acidification can inflict on our fisheries, tourism, marine biodiversity and local economies. For instance, in the United States, the supply of oysters, clams and scallops are valued at \$400 million each year. If we fail to act and stop the impacts of ocean acidification, a decreasing supply of shellfish is projected to cost about \$480 million in annual consumer losses.

This issue transcends party lines. I worked across the aisle with Rep. Don Young from Alaska and introduced H.R. 2448, the Ocean Acidification Research Partnership Act to further research the impacts of ocean acidification on the fishing industry. This legislation would create a research grant at NOAA to investigate the effects of ocean acidification. The projects supported through this grant program must be done in partnership between the seafood industry and academia. Enacting this bill into law would raise awareness to help address the issue of ocean acidification and find solutions for industries that rely on our oceans.

The coronavirus crisis has created many new challenges, but I believe we can stimulate the nation's post-pandemic economic recovery by investing in burgeoning economic sectors such as offshore wind. The impending decommissioning of the Diablo Canyon Nuclear Power plant in San Luis Obispo County, and its shoreline infrastructure connection to the California grid, provides us with a unique opportunity to invest in offshore wind and create good-paying jobs. I've held countless meetings with the Offshore Wind Working Group I helped establish to bring together federal, state and local stakehold-



ers; passed an amendment to the House-passed FY2021 National Defense Authorization Act (NDAA) directing the Department of Defense to brief Congress on its efforts to identify areas that are compatible with our national security and energy independence goals; and coordinated with the Navy and Department of the Interior to advance offshore wind off California's Central Coast.

I believe this industry holds significant promise. Not only does offshore wind provide a reliable source of energy, but it would bring new job opportunities to our region, as well as bring energy security to our country, which is critical to military readiness. We need resilient, sustainable and economically sound energy sources. Offshore wind checks off all those boxes.

Building a sustainable future will take work and dedication, but I believe that together we can work to create meaningful change and strive for a sustainable renewable energy future. I think of my kids and grandkids, and the world I envision for them. I want them to be able to grow up and appreciate the natural beauty of our oceans off the Central Coast of California and what the rest of the world has to offer, and we can do that by unlocking our renewable energy potential.

The climate is changing, and our approach to harnessing energy must change too in order to tackle the climate crisis head on. My time in Congress so far has been marked by an administration whose energy policies are not forward-thinking. This has provided me with a difficult but important opportunity to highlight what we must do to secure a clean and renewable energy future that will create 21st century jobs and continue to grow our local coastal economies while also addressing climate change. **ST**

Review&Forecast

Offshore Energy: From Challenges To Opportunity

*By Erik Milito
President
National Ocean Industries Association
(NOIA)*

Unprecedented is a word that can often be overused, but it is an accurate descriptor of 2020, especially for the offshore energy industry. Between collapsing energy demand due to the coronavirus pandemic to an ill-timed oil price war that oversaturated a weakened market with state-produced oil from Russia and Saudi Arabia, the energy industry faced a one-two punch.

But while 2020 was an unprecedented year and what will happen this year remains anybody's guess, the energy security, economic opportunity and environmental stewardship the offshore energy industry provides will

remain a driver of human progress. 2020 was anticipated to be a marquee year for offshore oil, natural gas and wind. Then COVID-19 struck. Almost overnight, social distancing and work-from-home orders went into effect as governments around the world worked to stop the outbreak, bottoming out energy demand. Simultaneously, the depressed market conditions were made worse by the fallout from the price war between Russia and Saudi Arabia. An artificial glut of oil generated by state-backed companies flooded the market, cratering prices below the break-even price for American oil and gas producers.

Prior to the coronavirus pandemic, the Gulf of Mexico offshore oil and gas industry was producing at near-record levels. More than 345,000 men and women went to work every day in support of homegrown, American energy. Production in the Gulf had reached record levels at more than 2 million barrels per day, under some of the strongest safety and environmental rules in the world. This production, along with supporting jobs in every U.S. state, provided a bounty of benefits. More than \$5.4 billion in government revenues was generated in 2019. These revenues, which avoid burdening individual taxpayers, go into vital government programs. Virtually the entire funding for the Land & Water Conservation Fund—more than \$1 billion—was generated by Gulf of Mexico oil and gas revenues.

For offshore wind, the regulatory foundation of a generational energy opportunity was taking shape. Recent reforms to regulations like the National Environmental Policy Act (NEPA) and the Migratory Bird Treaty Act (MBTA) were providing greater clarity and certainty for the offshore wind industry. While still ensuring thoughtful environmental analysis and protection, NEPA and MBTA reforms made a path for critical projects to escape endless bureaucratic red tape and lawsuits and get to work with their shovel-ready jobs.

NOIA, along with the American Wind Energy Association, the New York Offshore Wind Alliance (NYOWA) and the Special Initiative on Offshore Wind (SIOW), commissioned Wood Mackenzie to write a paper on the opportunities that possible 2020 to 2022 offshore wind lease sales could provide. Wood Mackenzie estimates that lease sales offshore New York, North and South Carolina, Maine and California could end up generating 28 new GW of clean energy and \$1.7 billion in U.S. Treasury revenue by 2022. More than \$166 billion in offshore wind investment and 80,000 in annual jobs could be a reality by 2035.

However, while the innovation, ingenuity and determination of the offshore energy industry can solve virtually any engineering or technical challenge, policy changes from Washington, D.C., can be a different story.

Offshore oil and gas were a political target during the presidential election. During one Democratic debate, former Vice President Joe Biden's energy policy fact sheet includes "banning new oil and gas leasing on



public lands and waters” as one of his first priorities. In addition, Biden’s climate plan involves “banning new oil and gas permitting on public lands and waters, and modifying royalties to account for climate costs.”

Last summer, NOIA commissioned the firm Energy & Industrial Advisory Partners (EIAP) to look at this exact scenario: What would happen if Gulf of Mexico leasing or permitting bans were enacted?

By 2040, the Gulf of Mexico energy industry could support 367,000 jobs, create \$31.1 billion in annual gross domestic contributions, provide \$30 billion in annual industry spending, and generate \$6.7 billion in annual government revenue.

But these tremendous benefits could be locked away with the wrong policies. An offshore leasing ban would reduce the economic and employment outlook by 50 percent to 60 percent, while a drilling ban would cut them by 75 percent to 85 percent—outsourcing jobs, economic growth and energy security to countries like Russia and China.

President Trump also signed a pair of executive orders in the fall of 2020, locking away an offshore area that stretched from the Eastern Gulf of Mexico to the northern top of North Carolina’s offshore areas. Should the executive order stand, there will be no energy development, be it oil and natural gas or wind, between 2022 and 2032 in these waters.

With an incoming Biden administration and new Congress, the political outlook of Washington, D.C., is murky. However, the benefits and opportunities the offshore energy industry provide Americans remain constant. The offshore industry provides a foundation of homegrown energy, jobs, economic opportunity and billions of dollars of government revenue.

These benefits are provided with a focus on safety and environmental stewardship, precluding many issues associated with environmental justice, as production occurs many miles from onshore populations. With the lowest carbon intensity of almost any source of oil, the deepwater Gulf of Mexico provides the region of choice for our energy needs.

The offshore energy industry is leading the transition to a lower carbon future and is finding solutions that address pressing environmental challenges, including climate change.

Everything from machine learning, augmented reality and artificial intelligence to subsea sensors and space satellites are driving innovation and efficiency while lowering emissions. The offshore industry is uniquely positioned not only to solve problems like climate change but to also scale and deploy solutions in a meaningful manner.

While partisan schisms generate headlines, the world needs nonpartisan solutions.

The offshore energy industry presents an incredible opportunity for alignment and real-world solutions that will benefit every American, regardless of party.

2020 was a rough year for everyone, but the offshore energy industry remains excited about the opportunities we can uniquely provide society. **ST**

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Review&Forecast

Tackling Our Ocean's Challenges Through Innovation

By Janis Searles Jones
CEO
Ocean Conservancy

Our ocean means many different things to many different people. It is a source of food and livelihoods, it is a place of sanctuary and peace, its wildlife inspires awe and wonder, and it provides a sense of home and grounding of culture. It is an inescapable part of all of our lives, no matter where you live. If you breathe air, the ocean matters to you. If you enjoy a livable climate, the ocean matters to you. If you want a flourishing economy, the ocean matters to you. Because of all this, we must protect the ocean from further harm, if not for the ocean's sake alone, then for our sake.

Right now the ocean is enduring the compounding effects of plastic pollution, environmental degradation, overfishing and carbon pollution. It's going to take all of us from every sector to maintain a thriving ocean—and build back what we've lost. We will need political will and action, industry reforms, investments in science, and the advancement and implementation of new, blue technologies. That list may seem daunting; however, the good news is that we know what we need to do in each of those arenas to protect our ocean, and opportunities for innovation abound.

To stem the flow of plastics into the ocean we must reduce plastic production, drastically reduce single-use plastics and reimagine waste management and recycling systems. Recently, Ocean Conservancy and our partners published a study in *Science Advances* that found the U.S. may be up to the third largest contributor of coastal plastic pollution. For years, we have outsourced our problem to developing countries. We need to ramp down the production of plastics while simultaneously developing and scaling up the production of sustainable alternatives.

The other existential threat to our ocean is the climate crisis, which is increasing the ocean's temperature and acidity and reducing its oxygen. The ocean has already absorbed over 90 percent of the excess heat we've produced by burning fossil fuels and about one third of our carbon dioxide emissions, which is what causes acidification. The effects of increasing temperatures and acidity threaten coastal communities, livelihoods and entire ocean ecosystems.

But the ocean is more than just a victim of climate change. It is also a powerful source for solutions. Ocean Conservancy released a report detailing all of the ocean-based solutions available to the U.S. administration, including responsibly sited offshore renewable energy,

natural carbon storage in coastal ecosystems and reducing emissions from ocean industries such as maritime shipping. Altogether, ocean-based solutions can contribute up to 21 percent of the emissions reductions we need to limit climate change.

The shipping industry alone provides us with a big opportunity to cut a significant amount of greenhouse gas emissions. Currently, the shipping industry emits the equivalent amount of greenhouse gases as the sixth biggest emitting country. The industry and its emissions are only expected to grow in the future.

We already have commonsense measures we can enact today that would reduce shipping emissions, such as slow steaming. If ships reduced their speed by around 10 percent, that would reduce their greenhouse gas emissions by roughly 13 percent. That's a fix we can make tomorrow, if it's implemented. Ships also need to phase out the use of heavy fuel oil; it's already banned in the Antarctic. This is the dirtiest type of fuel that not only emits carbon pollution and other greenhouse gases; it also poses a major threat to our ocean if there's an oil spill.

The ultimate goal for reducing shipping emissions isn't just a 13 percent reduction or leaving behind heavy fuel oil for a different form of fossil fuel.

What we need is a zeroing-out of greenhouse gas emissions from the entire shipping industry. That means a 100 percent reduction in emissions by the year 2035, if we want to keep on a trajectory that would limit warming to 1.5° C, which the Intergovernmental Panel on Climate Change says will limit the damage caused by climate change the most. At first it might sound like a moonshot to reach 100 percent emissions reductions by 2035, but we already have the technology to do so.

To reach the 2035 goal, we need to transition ships away from fossil fuels and toward green, carbon-free electrofuels, as well as electrify our port infrastructure. Carbon-free electrofuels are synthetic fuels derived from hydrogen or ammonia and produced using renewable energy. These fuels already exist. Shipping fleets need to expedite their adoption of these fuels so that we can transition the global fleet away from dirty and dangerous heavy fuel oil and other fossil fuels.

Port infrastructure will also need to be revamped to provide additional fueling and bunkering locations for ships using electrofuels, while also eliminating their own emissions. Ports will need to transition their power grids away from drawing on fossil fuels and toward clean, renewable energy sources such as solar, wind or tidal. Reduced emissions from ports will have additional health benefits for port workers and nearby communities, many of which are marginalized or communities of color.

During Climate Week NYC 2020, Ocean Conservancy released a new report, *Zero-Carbon for Shipping*, which presents South and Central American case studies that demonstrate how these existing technologies will zero-out shipping emissions. The report also dives into



how the shipping industry's transition can also benefit local communities and industries where port or shipping infrastructure is either built or retrofitted by providing access to clean, renewable energy and alternative fuel sources.

The technology we need to transition the shipping industry away from fossil fuels so that it can help avoid the worst of climate change and help us get a handle on some of the ocean's other threats—such as plastic pollution—is already available. Together with advocating for drastic policy changes, by advancing our understanding of the ocean and transforming ocean industries, we can help protect our ocean, climate and planet. We must take hold of this opportunity for the sake of us all. **ST**

Review&Forecast

Start-Ups Offer Innovative Tech Solutions To Modernize Port Operations

By Tarun Mehrotra
Director of Trade and Transport
Rainmaking

Many attempts have been made to break down traditional silos and facilitate the sharing of data within the shipping industry, but there are not yet any workable solutions that are widely embraced. Much of this comes down to the inherent conservatism of shipping, a sector that is historically resistant to change, wary of collaboration and slow to adopt new technological solutions.

The International Maritime Organization has called for ports to institute a uniform standard for data exchange, and workable tech solutions do exist. Nevertheless, ports and shipping companies remain steadfastly independent, resisting the adoption of data sharing and standardization.

Inefficiencies in port orchestration have serious effects on the global economy and society at large, as some 80 percent of the world's trade is carried by sea. Bringing the fault lines in the traditional model into stark relief, the COVID-19 crisis has led to a drop of around 10 percent in port calls internationally, affecting the resilience of operations, which parallels environmental impact.

While shipping resists change, airfreight companies, airlines and airports embrace technological advances and benefit from the greater efficiency, cooperation and coordination they bring. The complex air-traffic management delivered by Eurocontrol provides one excellent example.

We need not begin from a blank slate, as many of the solutions that have been adopted by airlines and airports could easily translate to shipping. The big problem is that skepticism and hesitance remain the dominant mindset

within our industry. It is not only the shipping industry that is adversely affected but also asset owners, the trade finance industry and land-based logistics operators, which ships must effectively interface with when in port. Most land-based logistics organizations, meanwhile, are open to modernization and would be delighted to see more efficient interactions with their shipping partners.

With the streamlining of port orchestration, shipping's estimated 3 percent contribution to global greenhouse gas emissions could be greatly decreased. That is why Rainmaking has set out to identify innovative start-ups that are working toward that goal and the decarbonization benefits it entails.

Through its Open Innovation Platform, Rainmaking is able to bring together various stakeholders to collaborate in designing, building and potentially scaling solutions of this sort.

Inefficiencies in port orchestration cannot be solved with a "magic pill." Changes in this area not only impact port operations, but have a trickle-down effect on the dependent ecosystems adjoining the maritime industry.

Many start-ups addressing these problems are focused on tech that will smooth the interface between the various actors in play when a ship is in transit, when it comes to port, and during the onward progress of its cargo.

Singapore-based Portcast is one such start-up. Portcast is creating a software-as-a-service (SaaS) platform utilizing AI to make logistics more efficient and data-driven, helping improve productivity, reduce costs and cut carbon emissions. Co-founder Nidhi Gupta believes there are three key elements that must be better coordinated in order to increase the efficiency of port operations: in-ship, pre-arrival and in-port.

"Firstly, improved turnaround time of the ship through automated processes for crew to depart early, as well as communication with the shore operations team on relevant clearances," Gupta said. "Secondly, pre-alerts and notifications of delays and risks in arriving at any port in the voyage, as well as the final port, at least five days ahead of arrival. And thirdly, ensuring just-in-times operations at the port"—for instance, linking ship arrival times to truck gate-in times, she explained.

"Data standardization and sharing is critical for efficiency in maritime," she said. There are many parties involved in the proper execution of port operations. As such it is vital that information be effectively distributed to all stakeholders, Gupta argued. "It's about time that we, as an industry, can agree on common standards of data, common definitions and also enable sharing of data."

Improved data sharing and reduced opaqueness in airlines and trucking have boosted customer satisfaction and competitiveness. Portcast aims to help the shipping industry achieve similar success.

"The shipping industry as well as the port authorities and terminal operators must be willing to share data and



show the willingness to collaborate and interface via a common data-sharing standard,” said Dr. Mohd Shahrin Bin Osman, regional manager, Maritime Advisory for Southeast Asia, Pacific and India at DNV GL. He agrees with Gupta that shipping operations need to become more transparent.

Bin Osman believes that greater shared visibility of information such as vessels’ scheduled arrival, berth availability at terminals, cargo operations and terminal productivity, and synchronization with ports’ marine and ancillary services would benefit the industry as a whole.

While a healthier bottom line is always a potent motivator, the industry is also coming to acknowledge the importance of reducing carbon emissions. Stakeholders, including shipping lines and terminal operators, recognize tech’s potential to assist in that regard, insofar as data sharing goes.

Bin Osman said, “If vessels are informed well in advance on the optimal arrival schedule [time to arrive at anchorage], with the vessels being tracked throughout the voyage prior to port arrival, then this will smooth out fluctuations in speed for the entire trip, as well as minimize the time at anchorage and awaiting for berth.”

Furthermore, “Speed management contributes to a

“Improved data sharing and reduced opaqueness in airlines and trucking have boosted customer satisfaction and competitiveness. Portcast aims to help the shipping industry achieve similar success.”

significant component to reduce carbon emissions from shipping.”

Reducing vessel dwell time and better coordinating scheduling will have a number of direct and indirect benefits—notably, in minimizing carbon emissions. Reducing the number of ships waiting at berth and cutting congestion at port can produce significant decarbonization impact, with fewer trucks waiting and the slow steaming of ships that arrive early.

The COVID-19 crisis has brought the need for wide-reaching solutions into sharp focus, highlighting the impact to overall supply chains if just one element in the fragmented ecosystem fails.

These concerns, coupled with pressure from lawmakers, shareholders and customers to increase sustainability, are forcing change.

As a result, despite the maritime sector’s longstanding conservative outlook, mindsets are indeed shifting. Many observers predict large-scale adoption of technol-

ogy and data sharing within the industry during the next five years.

At Rainmaking, we are confident that there is enormous potential for AI and other tech-enabled solutions to help break down silos and create a smarter, safer and greener industry. Together, we can achieve that goal. **ST**

Review&Forecast

Students Become Climate Change Entrepreneurs

By Steve Weinstein
Hacking4Oceans

Climate change had an enormous impact on our oceans in 2020.

As part of the entrepreneurial ecosystem, I felt it was time for the tools being used by start-ups, entrepreneurs and venture capitalists to be targeted directly for the environment by creating a class that marries entrepreneurs, engineers and environmental science students working on the hard problems.

Last spring, a group of students from the University of California (UC) at San Diego became the latest to develop a possible solution for this growing problem. In a new class called Hacking4Oceans, engineering students Andrew Bilan, Julia Doan, David Sharp and Seth Litman developed a low-cost, durable flooding sensor and data acquisition system that can provide critical alert information for vulnerable coastal communities. The technology is so promising that the students, known as Team Proteus, are in talks with NOAA and the Environmental Protection Agency (EPA) about its wider use.

The group said they joined the class to learn how to combine entrepreneurship with their passions to do something different from their usual engineering curriculum and for the environment. They came away from the experience feeling they can make a real difference in the world.

On a Mission to Protect the Oceans

Hacking4Oceans is the first of its kind academic course focused on solving critical environmental issues related to the oceans. Taught last spring at UC San Diego and at UC Santa Cruz, the classes attracted more than 50 students. We focused on creating solutions to complex social and environmental issues, addressing climate change through the lens of oceans and their interdependencies with land, air and energy systems, using the Lean Startup method. One of our main goals for the class was to have students learn lean innovation while coming up



with new and creative ways to solve ocean problems.

Hacking4Oceans is part of a mission-driven entrepreneurial movement at more than 50 universities worldwide, representing a new form of national service.

Sister courses in the “Hacking for” model apply the same tools and processes to local municipal issues, such as the need for affordable housing and access to mass transit (Hacking for Cities), social issues (Hacking4Impact) and State Department issues (Hacking for Diplomacy).

The classes use Lean Startup creator Steve Blank’s experiential Lean LaunchPad curriculum. In 10 weeks, students work with sponsors and mentors to test their solutions for specific, real-world problems. For the duration of the course, students interview stakeholders and beneficiaries weekly to better understand the problem they’re trying to solve and how it affects people.

Students must also create and test minimal viable products (MVPs) to see if they have a workable solution, validate those MVPs with stakeholders, and figure out how they can get their solution into the hands of those who would benefit from it.

It is a lot of work and, for many students, an eye-opening experience.

Bringing Stakeholder Knowledge Together

Team Proteus worked under the auspices of UC San Diego teaching team Sophia Merrifield, Eric Terrill and myself. They began by researching the problems and pending solutions around coastal flooding.

Through research and by conducting interviews with hundreds of stakeholders—from businesses to nonprofits to government—they honed in on a new type of detection system.

“Going through the class was a cool experience because we got people from [across] the industry and various research fields to talk about what they’re working on,” said Bilan, citing illustrative conversations with Internet of Things and flooding industry experts about what is working and what isn’t.

The group said the structure of the program—and the ability to connect with people they otherwise may not have—allowed them to see the problem from different angles, which helped generate viable ideas for solving it.

“We combined that advice to find what communications protocols and what monitoring systems we’d want to use,” Litman said. “From there we ordered parts and started putting stuff together.”

Bridging Gaps

The prototype uses LiDAR sensing technology to measure water levels, and a low-power wide-area network wireless module to communicate to a gateway, which uploads data on flood levels in real time. Powered by rechargeable Li-ion batteries, the mechanism turns itself off to conserve power in the absence of water, extending the battery life by months.

Once testing is completed, the device will be hermetically sealed, which will enable it to be fully immersed in water.

Team Proteus’s creation bridges two critical gaps in current flood detection: geography and budget.

Right now, the team explained, monitoring is high in hurricane-prone areas but lax in other areas that are also prone to flooding. For example, Imperial Beach near the UC San Diego campus floods often. As the effects of climate change worsen, the region is expected to see annual flooding. However, the community budget doesn’t allow for a massive sea wall—which is ultimately what the area needs. So for now, temporary measures like levees and sandbags can stem the damage. The key, the team says, is knowing when and where to start frontloading those resources. This is where Team Proteus’s sensor can help local leaders more effectively make those decisions.

“We’ve been in communication with Imperial Beach specifically, as well as beach communities along the coast of California, Washington and Oregon,” said Sharp. “These coastal cities and towns flood as well and will need a monitoring system so they know where the ocean has gone onto land, onto roads, so they can close them and redirect emergency resources. We found there’s not a lot of infrastructure for that.”

Bilan adds that because NOAA monitors tide levels while the U.S. Geological Survey (USGS) monitors inland water resources, there is little coordination between systems that measure ocean rises and river, lake and groundwater rises. This is a particularly complicated problem in coastal communities that do not fall exclusively into either category and instead experience a combination of the effects.

Looking Toward the Future of Flood Warnings

While NOAA, USGS and the EPA have expressed interest in the technology, for now, Team Proteus is taking it one step at a time.

The team is currently running tests within different environments, with a focus on coastal flooding and areas where tidal influx is the main issue. They also plan to work with the Center for Climate Change Impacts and Adaptation at Scripps Institution of Oceanography, Georgia Tech and other groups that deal with hurricanes’ effects on barrier islands.

Once their solution is ready to deploy, the team will pursue sponsors, early adoption customers and funding opportunities, Sharp said.

In the meantime, they continue to advocate for Hacking4Oceans, the conduit for bringing their idea to life.

“We got a lot of what we don’t get to see in college—an outside perspective, and an entrepreneurial one,” said Bilan.

“The class provided an opportunity to meet people outside of the university and make connections. It was a great experience learning how to do these cold-call interviews. In college, they don’t teach things like how to talk to people.”

For more information about Hacking4Oceans, visit: commonmission.us.

If you are interested in offering the class at your university, please contact me at: sweinstein@commonmission.us. **ST**

international

Sea Trials for World's First LPG-Fueled VLGC

Sea and gas trials for a very large gas carrier (VLGC) featuring Wärtsilä's pioneering liquefied petroleum gas (LPG) fuel supply system have been successfully completed. The *BW Gemini*, owned and operated by BW LPG, is the world's first VLGC to be fueled by LPG.

The use of LPG as fuel reduces emissions of sulphur oxides (SOx) by some 97 percent and is an important step toward the decarbonization of shipping.

Help Accessing R&D Funds

Subsea UK has joined forces with Scottish Enterprise to launch a program of practical support and workshops to help underwater engineering companies secure funding for research and development and innovation.

Funding from UKRI (UK Research and Innovation) is worth around £6 billion per year, but subsea companies often miss out on securing funding support because they don't know it exists, or they believe the process for applying is too complex. The "Securing Funding for Innovation" program will help companies increase their chances of adding thousands to their R&D budgets.

Teledyne Optech Opens European Hub

Teledyne Optech, a specialist in advanced LiDAR sensors, has opened a new customer service center dedicated to the service of equipment for its European clients.

Located in the Netherlands, the new service center will be a European hub for clients to have their airborne, mobile and static 3D sensors serviced, augmenting its existing in-field service and providing quick turnaround on repairs.

Joint Paper Touts BioLNG

The European Biogas Association (EBA), Gas Infrastructure Europe (GIE), Natural & Bio Gas Vehicle Association (NGVA Europe) and SEA-LNG have published a joint paper that demonstrates the benefits of BioLNG to decarbonize transport sectors. The paper illustrates how BioLNG can help the EU reach its 2030 climate targets and become climate neutral by 2050.

Funding for #WomenInSAR Initiative

The International Maritime Rescue Federation (IMRF) has launched the next stage of its #WomenInSAR initiative, supported by a generous grant from Trinity House, a maritime charity and one of the U.K.'s statutory general lighthouse authorities. The second element of the initiative will focus on inspiring the next generation of women to consider a career in maritime SAR (search and rescue) through an online #WomenInSAR STEM event and a dedicated web page and resources highlighting the breadth of potential opportunities available.

The #WomenInSAR initiative supports the International Maritime Organization's (IMO) Empowering Women in Maritime initiative, which seeks to address the sector's huge gender gap in all roles and sectors.

Rolls-Royce Acquisition

Rolls-Royce has acquired Servowatch Systems, a U.K.-based international supplier of integrated marine automation solutions for navies, commercial vessels and large yachts. The new subsidiary's open automation systems will be fully integrated into MTU's product range.

Diving Supervisors' CPD Mandatory Scheme

In launching the fourth knowledge unit for its app-based diving supervisors' continuing professional development (CPD) scheme, the International Marine Contractors Association (IMCA) has issued a reminder that the scheme will be mandatory from early 2021.

The app incorporates the latest in training techniques to support diving supervisors in keeping up to date with current safety information and guidelines from IMCA.

Exploration Vessel to Convert for Training

After nearly six decades servicing the Norwegian coast, *MS Lofoten* is slated to leave the Hurtigruten fleet. From 2021, the Hurtigruten classic will become a training ship, educating future generations of seafarers.

Hurtigruten has signed a letter of intent with the Norway-based educational foundation Maritim videregående skole Sørlandet (Sørlandet's Maritime High School) for the sale of the vessel. The 151-bed ship is due to welcome its first students in August 2021.

Sea Machines Robotics Investment

Boston-based Sea Machines Robotics, a developer of autonomous systems for ocean-going vessels, has accomplished its full \$20 million investment goal with a second close of \$5 million. The company announced the first close of \$15 million in July.

TE Connectivity Acquisition

TE Connectivity has completed the acquisition of DRI Relays Inc. DRI, founded in 1954, with operations in the U.S. and India, is a specialist in the design and manufacturing of electromechanically, hermetically sealed relays, time-delay devices and sockets for applications that require high reliability and long life in harsh environments.

Schmidt Ocean Institute Names Advisory Board

Schmidt Ocean Institute has named a 10-member advisory board of international experts in science, maritime operations and communications. The board members, who will serve three-year terms, will provide feedback and guidance on Schmidt Ocean's strategy and operations as the organization expands its work advancing oceanographic research and broadly sharing discoveries and information about the ocean.

Newmar Power Turns 50

Newmar Power is celebrating five decades of providing reliable power solutions for marine, telecom, public safety, rail, traffic and industrial applications.

Newmar's story began in 1970 with electronics engineer Wess George, who stocked parts to service boats at the Newport Beach, California, marina. Eventually,

George designed and built his first product, a voltage converter for a radio company. In this humble fashion, Newport Marine Engineering was born as a side project in George's garage.

Five decades later, Newmar retains the DNA of the original company, maintains a manufacturing plant in the U.S., and has established a strong reputation as a trusted brand in marine and other markets it serves.

In 2017, Newmar was purchased by Windjammer Capital and joined the Mission Critical Electronics family, which includes Xantrex and ASEA Power Systems. The marine product portfolio has since expanded to include shore power converters, battery chargers and inverters/chargers. Today, Newmar is headquartered in Huntington Beach, California, and is under the leadership of former Xantrex vice president Richard Gaudet.

Funding to Develop Remote Ops Survey Software

Teledyne CARIS has received significant funding from Canada's Ocean Supercluster award to develop software for remote operations survey processing. This is in alignment with the company's AI strategy.

Teledyne CARIS's project aims at three targeted deliverables: enhancement of its desktop-based product line to leverage the cloud to deliver consistent access for global users in every possible circumstance; support for remote mapping operations to underpin advancements in ocean robotics; and inspiring future ocean mappers with virtual training through the CARIS cloud platform.

Bahamas Maritime Authority 25th Anniversary

The Bahamas Maritime Authority has turned 25. To commemorate the occasion, it has rebranded, made improvements to its website and added an extension to its comprehensive online services, the Bahamas On-line Registration Information System (BORIS). BORIS is now available both directly and via the website. Users can check and reserve a vessel name, complete a registration application, invoice a payment and verify certificates.

Operation Arctic Shield Wraps Up

The Coast Guard has concluded its annual Arctic Shield operations with the seasonal closure of its Forward Operating Location in Kotzebue, Alaska.

Air Station Kodiak air crews and two MH-60 Jayhawk helicopters were forward-deployed to Kotzebue to provide better response times and coverage to remote regions of Alaska during increased summer boating traffic.

In addition, the crews of Coast Guard cutters *Kukui* and *Healy* patrolled the Bering, Chukchi and Beaufort Seas in support of maritime domain awareness, search and rescue, community relations, partnership building, and scientific research.

Coast Guard crews deployed in support of Operation Arctic Shield responded to 10 search and rescue cases, saving 25 lives.

Operation Arctic Shield is the Coast Guard's mobile and seasonal presence to ensure maritime safety, security and stewardship. It is an annual operation that began in 2009. **ST**

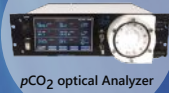
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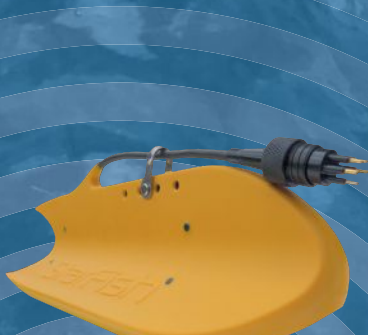
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HD-IP/HD-SDI Camera



Manta HD is a small underwater camera capable of a resolution of 1,920 x 1,080 at 30 fps (1,080 p 30 full HD). It features a 30x optical zoom and onboard recording to an SD card. An additional connector is offered to provide power and control for an external pan and tilt or light. Arctic Rays LLC.

Digital Routing Service Updates

My Route Appraisal (MyRA) provides vessels and onshore personnel with a proposed ECDIS-ready voyage plan based on a route network, port databases, bathymetry from ENC's, weather forecasts and the relevant ship model. Version 1.4 includes: further simplification of installation; advanced routing algorithm, considering vessel air draft for voyage calculations; and new data services for weather routing. ChartWorld GmbH.

Asset Integrity Management

This digital full-life-cycle solution allows companies to manage, predict, plan and optimize their asset integrity management programs. Features include: automation, operational tracking and a communications hub for digital collaboration. OMNI Integrity.

Emissions Reduction System

PureCool targets an unaddressed emission source: methane slip, the small percentage of unburned methane escaping via the engine when LNG is the fuel. A cascade exhaust gas cooling system, PureCool cuts methane slip by up to 50%, with a 3% gain in fuel efficiency. Alfa Laval Marine Division.

Nitrate Monitoring

Based on novel LED technology, EXO NitraLED is designed up to 70-times smaller than other lamp-based UV Nitrate sensors, with a size that fits in the palm of your hand. It integrates directly into any EXO water quality monitoring system and collects continuous Nitrate-N data for a deeper understanding of the impacts of nutrient pollution. YSI, a Xylem brand.

Ship Cloud Service



B CONNECT enables real-time monitoring, operation and analysis of machinery data and equipment status information on board ship via the cloud from any location. It has online map view and browser-optimized access. Böning Automationstechnologie GmbH & Co. KG.

Hydrographic Survey System

iHSS-Compact meets the growing demand for shallow-water "gap-filler" marine surveys and simplifies the acquisition of commercial-grade marine data from almost any vessel. The system includes an R2Sonic 2020 wide-band multi-beam echosounder, I2NS inertial navigation system, mounting solution, survey and post-processing notebook, software, and cabling. Subsea Europe Services GmbH.

Chirp-Ready Transducer

CM510L is a cavity mount transducer rated at 3 kW with low-frequency (25-50 kHz) Chirp capabilities. Ideally suited for commercial fishing applications where bottom discrimination and target resolution of bottom-fish species are critical.

to success, the CM510L includes the popular 28-, 38- and 50-kHz fishing frequencies, plus all other frequencies in the band. AIRMAR Technology Corp.

Gyro Stabilization Mount



NSM 400 is a medium-size gimbal, between the smaller RSM 400 and the larger OSM 4000, designed for the stabilization of surveillance sensors on medium (starting from 1.0 kt.) to large vessels. The gimbal applies to infrared search and track and other surveillance systems to ensure 360° protection of naval surface vessels. SOMAG AG Jena.

Subsea Imaging System

3D Recon delivers high-resolution, geospatially correct 3D models and precise positioning. It comprises three high-resolution cameras and a MEMS IMU. It is suitable for metrologies, pipeline surveys, contactless CP, asset integrity monitoring and augmented reality. Zupt LLC.

Sediment Sampling System

Lucky Sampler is based on a Venturi system and a container cylinder set located in a revolver-type mechanism that allows between eight and 12 samples to be taken without returning to the surface. It was designed to operate in salmon farms. Mariscope Meerestechnik.

Aerial Drone Survey

QuickDip is a data collection system that uses aerial drones to carry Valeport Hyperion sensors on pre-planned survey routes to deliver an efficient and repeatable method of gathering highly accurate survey data from inaccessible or dangerous waters. It is ideal for inland and coastal waterways. THURN Group.

Small Work-Class ROV

Phantom Hot T5 features Tecandyn 1020 thrusters modified from the L model to allow acceleration

and faster change of direction with more stability, even in environments with high currents. Deep Ocean Engineering Inc.

Device Control

Universal Gateway enables connection to a much wider range of marine assets. AtoN managers will gain full visibility and control of their devices via the Star2M asset management platform or integra-

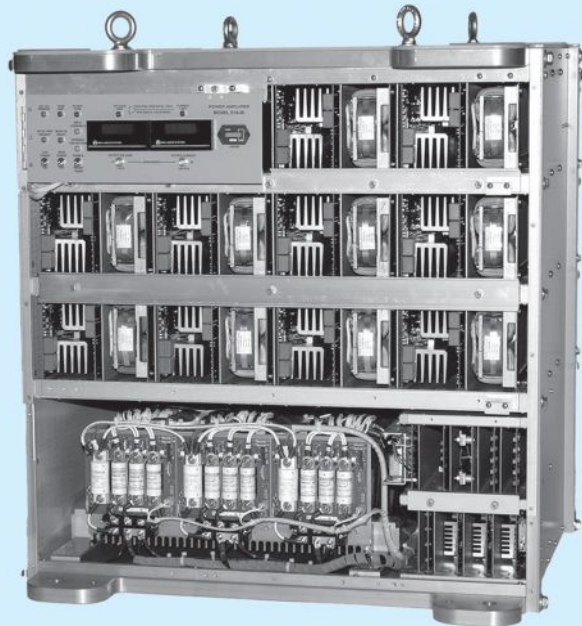
tion into their existing management systems. Sealite Pty Ltd.

USBL Buoy

A fully integrated solution based on S2C USBL devices, the buoy comprises a USBL transceiver with a built-in battery, mounted to a floating unit with an onboard PC, GNSS receiver with dual antennas, and a Wi-Fi access point. EvoLogics GmbH. **ST**

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Kenautics Wins SVIP Funding

The U.S. Department of Homeland Security (DHS) Science and Technology Directorate's (S&T) Silicon Valley Innovation Program (SVIP) has awarded \$157,801 in phase one funding to Kenautics Inc., of Encinitas, California, to provide a more reliable system for marking objects in water, under SVIP's Maritime Object Tracking Technology (MOTT) solicitation.

The MOTT solicitation supports U.S. Coast Guard (USCG) missions by seeking more reliable tracking systems for accurately marking and monitoring objects in the water for recovery. The solution is intended to be used during operational missions to bolster waterway security, drug interdiction, search and rescue, and disaster response.

Kenautics proposes to adapt their hand-held Diver Navigation and Imaging System meant for waypoint navigation, subsea imaging, situational awareness, and information, surveillance and reconnaissance by repackaging the system into a ruggedized buoy deployable from land, air and sea under adverse conditions.

The Kenautics GPS-AIS Navigation and Tracking Buoy will be usable in both overt and covert operations and will be designed to provide tracking and position data, georeferenced forensic data sets, localization capabilities, and interactive functions.

Manual for Deepwater Exploration Mapping

The NOAA Office of Ocean Exploration (OER) has released the NOAA OER Deepwater Exploration Mapping Procedures Manual to describe the office's approach to deepwater ocean exploration acoustic mapping. OER is sharing this manual as a contribution to broader cross-agency efforts to develop standard ocean mapping protocols and to serve as a guide for other interested public and private entities conducting deepwater mapping and exploration.

With less than 20 percent of the world ocean's seafloor mapped to modern standards, seafloor mapping is a national and international priority. As emphasized by the U.S. National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone and Seabed 2030, the monumental task of mapping the seafloor requires a collective, coordinated and collaborative approach.

For more than 10 years, OER has been conducting exploratory mapping operations throughout U.S. waters and in other parts of the world's ocean aboard NOAA Ship *Okeanos Explorer*. Based on this experience, OER produced this first-of-its-kind manual for ship-based exploratory ocean mapping operations deeper than 200 m (656 ft.).

Marine Highway Module to Support Ports

The U.S. Department of Transportation's Maritime Administration (MARAD) has launched a new Marine Highway module of the Port Planning & Investment Toolkit,

which helps U.S. ports plan, evaluate and finance freight transportation projects. This toolkit, which was produced as part of a cooperative agreement between MARAD and the American Association of Port Authorities (AAPA), helps guide ports toward fruitful investments.

The goal of the toolkit is to provide U.S. ports with a common framework and examples of best practices. The analytical tools and guidance contained in this comprehensive resource are designed to aid ports in developing "investment-grade" project plans and obtaining capital for their projects in a variety of ways, including: assisting metropolitan and regional planning organizations and state agencies in qualifying for formula funding or aid; better positioning marine highway projects for federal aid; and assisting ports in obtaining private sector investments.

Ocean-Based Climate Solutions Act

Rep. Suzanne Bonamici (D-Ore.), co-chair of the U.S. House Oceans Caucus and the Pacific Northwest member of the House Select Committee on the Climate Crisis, unveiled the Ocean-Based Climate Solutions Act with Natural Resources Chair Raul Grijalva (D-Ariz.) and Select Committee on the Climate Crisis Chair Kathy Castor (D-Fla.).

The bill is a comprehensive ocean climate package based on the Select Committee's Climate Action Plan. The package includes provisions from Bonamici's Blue Carbon for Our Planet Act, COAST Research Act, Water Power Research and Development Act, and BLUE GLOBE Act, as well as six other bills she co-led.

The comprehensive Select Committee's Climate Action Plan outlines a science-based path to reach net-zero emissions no later than mid-century and net-negative thereafter. It includes a focus on the needs of frontline communities, opportunities to accelerate the transition to a 100 percent clean energy economy, and job creation.

Grants for Coastal Resilience

The National Fish and Wildlife Foundation (NFWF) and NOAA have announced more than \$37 million in new grants from the National Coastal Resilience Fund (NCRF) that will support coastal resilience projects in 25 states and U.S. territories. The 46 grants will generate \$55 million in matching contributions for a total conservation impact of \$92 million. The NCRF grants will contribute to the restoration or enhancement of natural features, e.g., coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, mangroves, forests, coastal rivers and barrier islands. These natural buffers can help reduce the impacts of storms, rising sea levels and other extreme events on nearby communities and habitats.

GE to Power NSMVs

GE's Power Conversion business has been awarded a \$40 million contract to supply the power and propulsion systems for two national security multi-mission vessels (NSMVs). The ships will provide cadets with at-sea training on operational vessels. **ST**

offshore oil & ocean engineering

Optimizing Passenger Logistics in Angola

Bourbon Mobility is working on a pioneering project in Angola to set up new Subsea 7 personnel logistics on the Zinia 2 project, Block 17. BOURBON's scope of intervention covers all passenger logistics, both air (from Paris) and onshore (in Luanda), then offshore, as part of a global service called "airport-to-rig." In the context of the COVID-19 pandemic, the management of quarantine periods and medical inspections in Angola is also fully integrated into this service.

The assignment marks a turning point for passenger transport to the offshore oil and gas business by moving from a traditional charter contract to an integrated service offering. Thanks to a collaborative approach, Bourbon Mobility, Sonasur (Bourbon's JV in Angola) and Subsea 7 are developing an optimized logistics solution enabling end-to-end management of more than 1,000 trips over the duration of the project.

Live Streaming of Inspection, Repair in COVID Era

ROVOP has delivered its first remote, platform-based inspection, repair and maintenance workscope, effectively reducing the number of personnel required offshore.

ROVOP successfully carried out remote visual and NDT inspections of hull sections, flowlines, umbilicals and risers, along with chain inspection, measurement and cleaning, on the *Balmoral* floating production vessel for Premier Oil.

ROVOP worked closely with Premier Oil to develop a robust live video streaming service back to shore. Two-way open communications allowed the inspection and data recording engineers to run the workscope remotely from onshore, resulting in three less people on board the vessel, where accommodation is limited due to COVID-related restrictions.

The cloud-based viewing platform allowed those working from

home to view the inspection work as it unfolded. Data, which would once have taken weeks to return from offshore for analysis, were captured in real time, and those watching onshore were able to influence the operation live, making the campaign much more efficient.

Pilot Test of Hybrid Digital Twin Technology

DNV GL and FPSO specialist Bluewater are undertaking a pilot project to use hybrid digital twin technology to predict and analyze fatigue in the hull of an FPSO in the North Sea. The project aims to validate and quantify the benefits of creating a virtual replica of the FPSO to optimize the structural safety of the vessel and enhance risk-based inspection (RBI), a decision-making methodology for optimizing inspection regimes.

Bluewater's *Aoka Mizu* FPSO, currently in operation in the Lancaster field, west of Shetland, is being used.

To date, the pilot test has shown encouraging results. Termed "Nerves of Steel," the underlying concept permits the use of various data sets (external environmental data or local sensor data) combined with digital models of the asset to develop a hybrid replica model of the vessel's structure. This can be used in real time to monitor the asset's condition, identify and monitor high-risk locations, and plan targeted and cost-efficient maintenance and inspection activities.

Low-Noise Propulsion For Fisheries Vessels

Wärtsilä has supplied specialized propulsion solutions for three offshore fisheries science vessels (OFSVs) built for the Canadian Coast Guard at Seaspan Shipyards in Vancouver, Canada.

Wärtsilä designed the propellers to deliver a high-cavitation inception speed to comply with low underwater radiated noise requirements. The third of these new OFSV-class vessels has been delivered.

The Wärtsilä propulsion solution comprises the custom-designed fixed-pitch propeller, the shaft-line assembly, plus seals and bearings, and the transverse thruster with e-motor and variable-speed drive.

SeaRAY Autonomous Offshore Power System Trials

Columbia Power Technologies, Inc. (C-Power) has commenced six-month sea trials in partnership with the U.S. Department of Energy (DOE) and U.S. Navy to test and validate the technical and economic capabilities of C-Power's SeaRAY autonomous offshore power system (AOPS). The trials are at the Navy's Wave Energy Testing Site off Marine Corps Base Hawaii on Oahu.

Initially conceived during a U.S. Department of Defense project, the SeaRAY AOPS provides in-situ power, energy storage, and real-time data and communications support that will advance the marine economy toward a future of autonomous, connected and resident technologies. It is designed to support unmanned offshore activities, including subsea vehicles, sensor packages and operating equipment. The system supports a wide range of potential applications in defense and security, offshore energy, aquaculture, and science and research.

OGUK Industry Report

OGUK's Economic Report 2020 finds that the U.K.'s carbon emissions fell by an estimated 10.3 percent this year, as the economy contracted by 11.3 percent. OGUK said the figures confirm the scale of the challenge in securing a green recovery, urging governments to act now to ensure the U.K. builds a home-grown transition toward a clean energy future.

The report finds 85 percent of OGUK members throughout the supply chain expect to increase diversification into non-oil and gas activities in the next 12 to 24 months due to current market conditions, underlining the critical capabilities within the sector to accelerate government ambitions to reach net-zero carbon emissions by 2050 in the U.K. and 2045 in Scotland. **ST**

SubC Names Distributor

SubC Imaging has chosen Marine Solutions Underwater Systems as its newest distributor. Based in Cape Town, South Africa, Marine Solutions has been supporting the offshore industry in Southern Africa since 1999 and has since expanded to offer global support.

SubC's ROV Survey subsea camera solution would be ideal for Marine Solutions clients to help them successfully conduct inspections. SubC has designed the ROV Survey subsea imaging solution to combine all video management functions into one suite.

This complete solution includes all the software and hardware required for an effective subsea inspection at a lower cost. It is capable of multiple channels of 4K or HD video recording and overlay, LAN video streaming, blackbox, event logging, and more.

Partnership to Develop Electric Vessels in Japan

Kansai Electric Power Co. Inc. (KEPCO) and e5 Lab Inc. have reached an agreement on a business partnership for the development and promotion of pure electric vessels (EV) for "water urban mobility" in the Kansai bay area.

The Japanese shipping industry has been facing issues such as eliminating greenhouse gas emissions from vessels and a shortage of skilled seafarers. Development of EV technology and autonomous navigation systems for vessels is imperative. There is also high expectation for the development of various mobility platforms in preparation for the Osaka/Kansai Expo in 2025.

In the future, the project aims to propose and sell new mobility services using EV technology and charge/discharge systems to local governments and corporations. Both companies will accelerate the development and diffusion of EV, and contribute to the sustainable management of the Japanese shipping industry and the realization of a decarbonized society.

Digital Twin Guidance

DNV GL has published the oil and gas industry's first recommended practice (RP) on how to build and quality-assure digital twins.

Developed in collaboration with TechnipFMC, DNVGL-RP-A204: Qualification and assurance of digital twins sets a benchmark for the sector's varying approaches to building and operating the technology. It guides industry professionals through: assessing whether a digital twin will deliver to stakeholders' expectations from the inception of a project; establishing confidence in the data and computational models that a digital twin runs on; and evaluating an organization's readiness to work with and evolve alongside a digital twin.

Digitalizing Operations

Canadian software company Helm Operations and Western Australian marine consultant Tiller Technical have signed a new partnership agreement to help vessel operators digitalize their operations.

As part of the partnership, Tiller Technical will use its industry expertise and local knowledge to help companies implement and use Helm CONNECT, Helm's harbor services and fleet management software, to modernize, digitalize and streamline their operations.

This partnership agreement is just the start, as Tiller looks to bring more technology to the industry in the year to come.

BAE Systems Joins Marine Robotics Innovation Centre

The U.K. National Oceanography Centre's (NOC) Marine Robotics Innovation Centre has announced that BAE Systems is joining its thriving technology development community as an affiliate partner.

NOC and BAE Systems have collaborated on a number of marine autonomous systems and oceanographic research projects, and this partnership builds on their joint commitment to investing in science and technology research.

Automated Ship Reporting

The SESAME Solution II project successfully completed a major milestone when the Norwegian Coastal Administration released the first iteration of an automated ship reporting service. The service is hosted on a test environment in SafeSeaNet Norway, the Norwegian Coastal Administration's maritime single window (MSW) and was developed through the SESAME Solution II and STM BALTSafe projects.

While the service supports only mandatory ship reporting systems (MRS) or SRS reporting, other types of reporting, such as pre-arrival and FAL reporting, will be added in future iterations of the service.

SESAME Solution II is owned and managed by Kongsberg Norcontrol. As an international e-navigation testbed project, SESAME Solution II shore stations will differ from country to country.

STR Adds USBL

iXblue's Gaps M5 has been selected by Subsea Technology & Rentals (STR) to offer a practical, easy-to-export and cost-effective USBL solution to its global base of customers.

Broadening STR's existing pool of subsea equipment, Gaps M5 addresses the accuracy and performance needs and requirements for vertical and horizontal tracking applications.

Navis Business for Sale

Cargotec has proceeded in the evaluation of the strategic alternatives for its Navis business, including new ownership structures or a potential sale. Navis provides mission-critical software solutions and services to port and terminal operators, ocean carriers, shipowners and inland logistics operators.

A preliminary call for tenders was conducted. The preliminary offers are not binding, and the possible sale of the Navis software business and the terms of the transaction will only be confirmed once the actual sales process has been completed.

Cargotec aims to complete the sales process during the first half of 2021. **ST**

environmental monitoring

Reef Restoration to Support Fisheries in Saginaw Bay

Saginaw Bay's warm waters serve as nursery grounds for many fish species and support the fisheries of both Saginaw Bay and the main basin of Lake Huron. Historically, inner Saginaw Bay contained rock reefs that provided critical habitats, spawning grounds and juvenile areas for many native fish species. This includes walleye, smallmouth bass and suckers during the spring, and lake whitefish, cisco, lake trout and burbot in the fall.

As human development increased in Michigan, this critical habitat was largely lost due to sedimentation resulting from land use changes such as logging and agriculture. The loss of inner Saginaw Bay's rock reefs contributed to the 1940s collapse of Saginaw Bay's walleye fishery and negatively affected local populations of lake whitefish, lake trout, burbot and other species. The reefs were determined to be in dire need of restoration to bring back the ecosystem that once thrived.

The results of a multi-year assessment found that conditions in the inner bay were suitable for restoration, with the Coreyon Reef identified as a priority restoration site. With financial support from the Environmental Protection Agency and Saginaw Bay Watershed Initiative Network, the collaborative reef restoration team began moving forward with the design, permitting, construction and restoration of the Coreyon Reef.

The project was approved and funded by a Great Lakes Restoration Initiative (GLRI) grant of \$980,000 and a grant of \$25,000 from Saginaw Bay Watershed Initiative Network (WIN). Construction took place in 2019. In the end, 2 acres of reef habitat were restored.

Dr. David Fielder from the Michigan Department of Natural Resources (DNR) and his team contributed to the project. Michigan DNR will evaluate the relative attraction of the new reef to different fishes. One acre was one type of rock, while the

second acre was another type of rock, and the differences in productivity can be measured. Michigan is partnering with Purdue University on the post-construction evaluation of the reef.

JW Fishers' SeaLion-2 ROV was a key part of this project. The ROV was used as a visual aid to ensure that the rocks were placed correctly, and it's being used to monitor the new reef's activity. Fielder used JW Fishers' dual-frequency side scan sonar for additional assessment.

Data Loggers to Monitor Health of Eutrophic Lakes

Over the last three years, ASL Environmental Sciences has provided data loggers to a study being conducted at Swan Lake in Victoria, BC, Canada. In an ongoing monitoring program, Rob Bowen of Diversified Scientific Solutions has been looking at the relationships between dissolved oxygen (DO), nutrients and cyanobacteria blooms.

In 2018, an ASL Environmental Sciences multifrequency acoustic zooplankton fish profiler (AZFP) was used to examine the vertical migration of the cyanobacteria *Aphanizomenon flos-aquae* as this species has the ability to self-regulate its position in the water column by inflating or ballasting elongated gas vacuoles to control buoyancy. This dominant species was largely responsible for dissolved oxygen production through photosynthesis.

Over the last two years, ASL DO loggers have recorded high-amplitude diurnal DO cycling between algal photosynthesis and respiration. By continuing this monitoring program, time series of DO, pH, oxygen reduction potential and nutrients are revealing seasonal patterns and possible explanations of the interrelationship of these parameters and the timing and severity of algal blooms.

Lux loggers were installed this year to measure light penetration. These loggers were deployed within the photic zone and placed at the same depth as the DO loggers with

coincident sampling rates of 20 min. Such research is necessary to provide a science-based approach to improving the health of urban eutrophic lakes.

Maps Show Arctic Currents

Researchers at the University of Alaska Fairbanks College of Fisheries and Ocean Sciences are creating real-time images of ocean current speed and direction in the Bering, Beaufort and Chukchi Seas using high-frequency radar systems along the coast.

This resource is available to the public and can help with marine navigation, search and rescue operations, weather and sea ice forecasting, and oil spill response. Graphical animations are updated hourly at <http://research.cfos.uaf.edu/hfradar> and <http://research.cfos.uaf.edu/hfradar/bstrait>.

Improving Hurricane Forecasts With Direct Storm Research

Hurricane track and intensity forecasting has steadily improved in recent years with data from satellites, buoys and sensors dropped from aircraft flown into a developing storm. But scientists say there is still a big gap in our understanding of the rapid intensification of tropical cyclones and the ocean-atmosphere interactions that provide them energy. What's needed is a way to make direct and simultaneous ocean and atmospheric measurements inside a storm.

Saildrone has deployed a USV equipped with a wing designed to withstand a hurricane. SD 1054's "storm wing" will be tested for four months in the North Pacific in an area of ocean known for intense winds and high seas. The mission is operated in partnership with NOAA's Pacific Marine Environmental Laboratory (PMEL) and Atlantic Oceanographic and Meteorological Laboratory (AOML).

The 2020 to 2021 Pacific Storm Test will take place some 200 nautical mi. (370 km) off the coast of Oregon and Washington, and possibly as far north as the Gulf of Alaska, where winter storm wind speeds can reach Category 1. **ST**

Robot to Fight Coronavirus

A decontamination robot funded by the U.S. Office of Naval Research (ONR) and designed by several local universities was recently tested in Richmond, Virginia. The robot—initially designed for shipboard firefighting and maintenance tasks—has now been enlisted in the fight against COVID-19.

The robot has four wheels and a mechanical arm that uses short-wave ultraviolet (UVC) light to decontaminate surfaces. Its current version requires humans to oversee and “drive” the robot, but the hope is the robot will become fully autonomous.

PowerBuoy and 5G Feasibility Study

Ocean Power Technologies Inc. (OPT) has been contracted by Reston, Virginia-based Adams Communications & Engineering Technology (ACET) to conduct a feasibility study to evaluate a PB3 PowerBuoy and 5G communications solution in support of the U.S. Navy’s Naval Postgraduate School’s (NPS) Sea, Land, Air, Military Research (SLAMR) initiative, which conducts interdisciplinary research in unmanned and robotic systems.

OPT and ACET will review, validate and determine the cost and configuration of integrating OPT solutions as the basis of an autonomous offshore 5G communica-

tions system. The study will detail preliminary operational, deployment and maintenance plans, and regulatory approval requirements to support SLAMR.

India Scorpene Submarine Launch

INS *Vagir* has been launched, representing the fifth P75 Scorpene submarine entirely built by the Indian shipyard Mazagon Dock Shipbuilders Ltd. (MDL), based on years of technology transfer and partnership with Naval Group. This series of six submarines is fitted with equipment built in India by micro, small and medium enterprises (MSMEs).

New Pakistan OPV

The Pakistan Navy has commissioned its new corvette, a Damen OPV 1900, PNS *Tabuk*, at the Port of Constanta, Romania. The ship is part of a two-vessel order with Damen, signed by the Pakistan Ministry of Defence in 2017. Both ships were built at Damen Shipyards Galati in Romania. The first vessel, PNS *Yarmook*, joined the Pakistan Navy’s fleet in February this year.

Propellers for Spain ASW Frigates

Kongsberg Maritime has secured a contract with Spanish shipbuilder Navantia to supply propeller systems for five F110 frigates, currently in construction for the Spanish Navy. These next-generation vessels are designed to follow on from Navantia’s successful F100 frigate, bringing together state-of-the-art technologies for anti-submarine warfare (ASW) operations.

Each vessel will be fitted with twin Kongsberg Kamewa controllable pitch propeller (CPP) systems, specifically developed for minimum noise and vibration throughout the system. Navantia’s selection process for the propellers for the F110 frigates included model-scale tests at Marin in the Netherlands and at CEHIPAR in Spain to verify that the performance targets were met.

ASW Training Targets for French Navy

Two new RTSYS SEMA-MKII training targets have been delivered to the French Navy, for a current total of six. Two other training targets are planned to be delivered in early 2021. The SEMA MK-II targets strengthen crews’ training capabilities in ASW by offering acoustic signature simulation of a submarine, and they respond to latest-generation LFA1 sonars and homing torpedo heads.

London Tech Bridge

The U.K. Royal Navy and the U.S. Navy have partnered to accelerate the adoption of novel ideas and technologies, marking a unique chapter in the historic relationship between the two nations. A newly established London Tech Bridge will serve as a command post for innovation for the two navies as they work toward interchangeability in everything from technology development to deployment and operations.

This Tech Bridge will be a full partnership between the two nations—a first for the Tech Bridge concept. It stems from the recent Future Integrated Warfighting Statement of Intent. **ST**

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contracts

DSIT Solutions Ltd., Givat Shmuel, Israel, has been awarded a contract for the supply of its Portable Acoustic Range (PAR) system to measure the radiated noise of any maritime platform, on or below the surface, allowing navies and shipyards to monitor and control the noise and silence levels of their submarines and ships. Republic of Korea.

Svitzer, Copenhagen, Denmark, has signed a global services agreement designed to increase vessel up-time, drive service efficiency and extend overall service experience. This life-cycle agreement will include coverage for more than 100 Svitzer tugs powered by Cat Marine engines. Caterpillar.

Danelec Marine, Birkeroed, Denmark, has signed a pilot agreement to enable new maritime use cases, combining the strengths of Danelec-Connect's onboard data-capture capabilities and Veracity's ecosystem and platform architecture. Veracity by DNV GL.

Herman Sr. BV, Barendrecht, Netherlands, a tug and workboat company, will add a Sea Machines' SM200 wireless, remote-helm control system to one of its Shoalbuster tugboats, the 23.35-m *Teddy*, to increase productivity and operational safety during offshore operations. Sea Machines Robotics.

Kongsberg Maritime, Kongsberg, Norway, will supply SIMRAD ST94, SN93 and CS90 fish-finding sonars for a new 75-m pelagic trawler to be based in Banff, Scotland. Northbay Fishing Co. Ltd. and Wiseman Fishing Co. Ltd.

MacGregor, part of Cargotec, Helsinki, Finland, has signed a five-year OnWatch Scout Predict agreement. The technology uses machine-learning models to detect potential problems. North Sea Shipping.

Wallem Group, Hong Kong, China, has selected cloud-based simula-

tion to make training for its 7,000 seafarers more accessible and flexible. ARI Simulation.

MIND Technology Inc., the Woodlands, Texas, will supply products and services for a Seemap GunLink 4000 source controller upgrade, including an option for the upgrade of a GunLink 4000 on a second vessel in the future. Undisclosed.

ZeroNorth, Copenhagen, Denmark, has a new strategic product partnership for its vessel optimization software, Optimise, to securely integrate with the Veson IMOS Platform (VIP), allowing a seamless transfer of data for joint customers. VIP is a commercial freight management solution. Veson Nautical. **ST**

meetings

Note: The coronavirus (COVID-19) pandemic could affect event dates. Check event websites for the latest updates.

FEBRUARY

February 2-5—SMM (Shipbuilding, Machinery & Marine Technology), Virtual. +49 40 3569 2445, nora.hirschfeld@ham-burg-messe.de or www.smm-hamburg.com.

February 10—Satellite-Derived Bathymetry Day, Asia and Oceania, Virtual. <https://sdbday.org>.

MARCH

March 1-5—World Ocean Summit, Virtual. <https://events.economist.com/events-conferences/emea/world-ocean-summit>.

APRIL

April 28-30—Waterpower Week (WPW) 2021 and the International Conference on Ocean Energy (ICOE) 2021, Virtual. <https://waterpowerweek.com> and <https://icoe2021.org>.

MAY

May 18-20—Aquaculture UK,

Aviemore, Scotland. +44 (0)1453 836363, www.aquacultureuk.com or carvonio@divcom.co.uk.

May 25-27—Subsea Expo, Aberdeen, Scotland. www.subseaexpo.com.

JUNE

June 1-4—Nor-Shipping, Oslo, Norway. www.nor-shipping.com.

June 15-17—Seawork and Marine & Coastal Civil Engineering Expo, Southampton, England. www.seawork.com and www.mcceexpo.com.

June 28-29—Floating Wind Solutions, Houston, Texas. <https://floatwindingsolutions.com>.

JULY

July 6-8—Ocean Business, Southampton, U.K. www.oceanbusiness.com.

AUGUST

August 16-19—Offshore Technology Conference, Houston, Texas. www.otcnet.org.

August 23-27—World Water Week, Virtual. www.worldwaterweek.org.

SEPTEMBER

September 7-10—SPE Offshore Europe, Aberdeen, Scotland. +44 (0) 1224 253807, gillian.george@bigpartnership.co.uk or www.offshore-europe.co.uk.

September 13-17—London International Shipping Week, London, England. +44 1296 682104, ljacobs@elabor8.co.uk or <https://londoninternationalshippingweek.com>.

September 20-24—NMEA/RTCM Conference & Expo, Anaheim, California. www.expo.nmea.org.

NOVEMBER

November 2-5—Aquatech Amsterdam, Amsterdam, Netherlands. a.koomen@rai.nl.

For more industry meetings, visit sea-technology.com/meetings. **ST**

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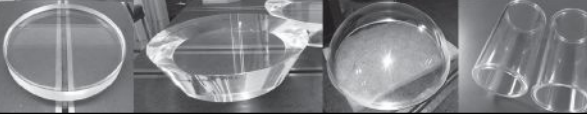
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The Plastics Supply Chain Needs Transparency—Dom Charles and Martin R. Stuchtey

Dom Charles is the director of finance and transparency for Minderoo Foundation's work on plastics. He was previously a partner at McKinsey & Co. He holds degrees from Oxford and Harvard University. Martin R. Stuchtey is a professor for resource strategy and management at the University of Innsbruck. He is also founder and managing partner of SYSTEMIQ, an organization driving systemic change.



A new report has revealed how global efforts to reduce plastic waste are being thwarted by a lack of transparency that extends the length and breadth of the plastics supply chain. Every month, over 1 million tons of plastic enters rivers and oceans worldwide, and billions of dollars are spent by governments in attempting to manage plastic waste. At the same time, plastic producers, users and investors operate under a shroud of mystery.

Global efforts to change industry practices, including producing less plastic from virgin feedstock, collecting more plastic waste and increasing recycling, are all significantly hampered by a lack of data, information and intelligence.

To address this challenge, Minderoo Foundation and SYSTEMIQ have devised a global approach to transparency, titled “Clearing a Path Through the Waste: Transparency in the Plastics Supply Chain,” to inspire the appropriate action from public and private sector stakeholders and from civil society groups.

By 2040, plastic production is forecast to double, plastic leaking into nature to triple, and plastic leakage into the ocean to quadruple. One major obstacle hampering efforts to avert such catastrophe is the lack of transparency across all parts of the plastics supply chain. There is a paucity of quality data and intelligence about the flow of

materials; financial flows; the social, environmental and economic impacts of plastic pollution; and the accountabilities, policies and commitments required of all stakeholders. This lack of transparency undermines any shared understanding of what solutions and success look like, and whether we are making sufficient (or, indeed, any) progress.

In the absence of transparency, activities risk being disjointed and duplicative, rather than integrated and synergistic. The current state of affairs inevitably means resources are being misallocated, and even well-intentioned efforts are falling short of their expectations and potential. Meanwhile, natural ecosystems are increasingly degrading, and the window of opportunity to avert crisis is narrowing rapidly.

Without transparency, companies and investors have only a limited understanding of how they contribute to plastic pollution and of their exposure to commercial, legal and reputational risks.

Equally, pioneering companies that are acting to reduce plastic pollution are neither recognized nor rewarded consistently, and are sometimes even criticized for prioritizing transparency.

Governments and regulators can be found grasping in the dark as they set plastic pollution targets, try to allocate limited public resources efficiently, and draft and enforce policies that must protect health, ecosystems and economies. Consumers and civil society groups struggle to hold companies to account for the plastics being produced and sold, which end up polluting the environment. They do not know if governments are winning or losing the battle, nor which interventions are working (and which are not).

The authors of the report outline three mutually reinforcing approaches that can contribute to greater transparency in the global

plastics system. One is outside-in and shadow reporting based on the collection, analysis and publication of data, knowledge and insights (regardless of the involvement of industry) by academic institutions, nongovernmental organizations, intergovernmental organizations and commercial analysts. Another is increased public and investor pressure for the voluntary disclosure of data and information by industry to better compare plastic producers and users and motivate them to improve. A third approach is increased, regulated disclosure of data and information on plastic use, impacts and mitigation strategies by governments and policy makers.

Finally, the paper identifies seven transparency themes, or workstreams, that together constitute a comprehensive roadmap for progress on all critical fronts.

While supply chain transparency is not a solution in and of itself, it enables all other solutions; with it comes increasing clarity and certainty on how best to clear a pathway out of the plastic waste mire and how to accelerate the circular plastic economy transition. Transparency helps businesses and investors to de-risk decisions, future-proof strategies and drive new business models.

Experience from the global efforts to fight climate change proves that greater supply chain transparency can be achieved. By providing this overview of what needs to be done, by whom and how, the aspiration of the report is to catalyze action, spur ambition and focus multistakeholder efforts to deliver this roadmap, as well as to emulate in the plastics context—over a few years’ time frame—what has been achieved in the climate/carbon context over the last several decades.

To learn more, you can access the report at: www.minderoo.org/flourishing-oceans/reports/clearing-a-path-through-the-waste. **ST**

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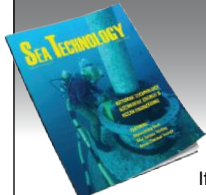
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