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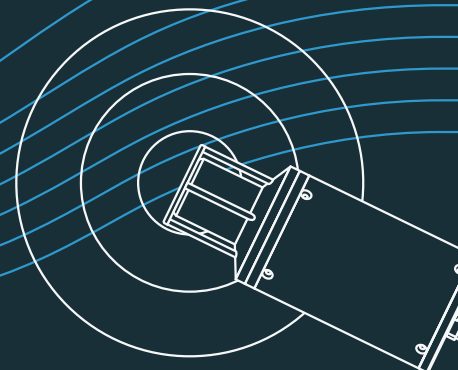
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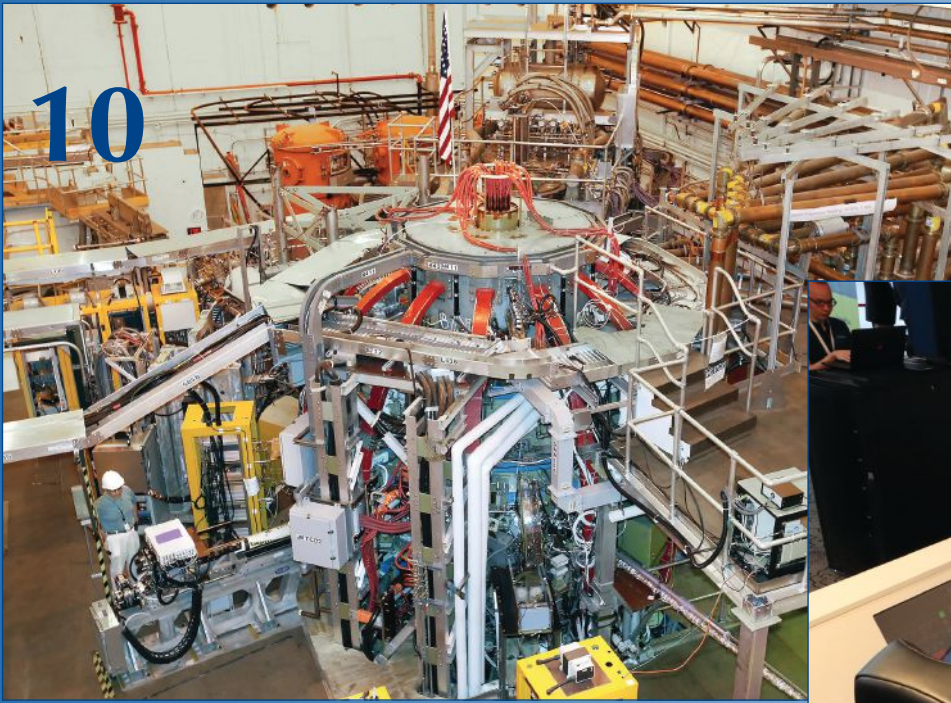
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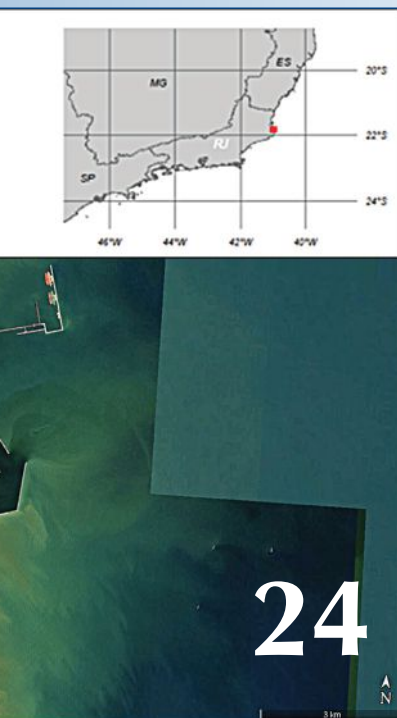
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)) Market Demand for Alternative Fuels Rises. The latest stats from DNV's Alternative Fuels Insight (AFI) platform found that a total of 298 ships with alternative fuel propulsion were ordered in 2023, an 8 percent increase year on year. The year also saw methanol go mainstream, with a sharp increase in orders (138) putting it neck and neck with LNG (130). Additionally, 2023 marked a breakout year for ammonia, with 11 orders for vessels run on this fuel and more in the pipeline. Faced with increasing pressure to reduce greenhouse gas emissions, including stricter targets set by the International Maritime Organization (IMO) in July 2023, the maritime sector is considering a range of decarbonization options. Through its AFI platform, DNV registers the industry's efforts related to newbuild vessels and retrofitting, with 298 orders for vessels able to run on alternative fuels logged in 2023 and a total of 1,281 ships overall. By a small margin, methanol proved the most popular alternative fuel choice in 2023, with 138 ships ordered (excluding methanol carriers), a steep increase compared to the 35 ordered to run on this fuel the year before. The dominating segment for this fuel was container ships (106), followed by bulk carriers (13) and car carriers (10). The second alternative fuel of choice in 2023 was LNG, with 130 vessels ordered, down from 222 in 2022. However, when looking at newbuilds alone, LNG would be in the lead as a considerable proportion of methanol orders were for retrofits. The year also saw the first orders for vessels due to run on ammonia (11) come through. With just five orders, hydrogen was a less popular choice compared to the previous year (18).

)) Printed Circuit Board Fuel Cell Powers Hydrogen-Electric Boat. Bramble Energy has launched the world's first hydrogen-electric boat powered by a printed circuit board fuel cell (PCBFC). The company is the lead partner in the HyTime project, working alongside custom engine builder Barrus. In a maritime first, the 57-ft. narrow boat was launched from Sheffield, U.K., where it has successfully completed testing, emissions-free. The fuel cell system has the potential to provide the vessel with approximately 600 mi. of range using the 14 kg of hydrogen stored on board, as well as additional power supplied by solar panels on the boat's roof to the 22-kWh battery system. The boat's powertrain technology has the potential to save up to 12 tonnes of CO₂ per year. The Bramble Energy team will analyze the boat's data and the fuel cell's performance under real-world conditions to support the future development of PCBFC systems for wider maritime applications.

)) Industry Creates Sustainable Marine Fuel Confidence Index. The Sustainable Marine Fuel (SMF) Confidence Index has launched to indicate how confident shipping and marine fuel industry stakeholders are that the key components required for maritime's energy transition, such as technology and infrastructure, are already in place. The inaugural index was created at the SMF Fest, which brought together stakeholders from across the marine fuel value chain who stress tested and then populated the SMF Confidence Index, which includes input from technology providers (Wärtsilä, GTT); a class society (Bureau Veritas); an industry association (The Society for Gas as a Marine Fuel); a marine energy supplier (Peninsula); and a shipowner (Hapag-Lloyd). This first index provides a baseline from which to chart and compare changes in industry confidence in shipping's energy transition according to four key criteria: technology, infrastructure, commercial and environmental credentials. The index uses five deep-sea vessel segments: containerships, dry cargo, gas carriers, passenger vessels and tankers. These criteria/vessel segments are considered in relation to the use of 12 marine fuels, including gray/blue/green variants). Contributors to the index are cautious about the commercial and operational readiness of most of the new fuels, and they perceive significant gaps and challenges to be resolved in the development of these fuels. The SMF Confidence Index is a working document to investigate what has moved the needle for a particular fuel(s) and apply those learnings to other fuels, thereby accelerating the energy transition.

)) Funding for US Regional Ocean Projects. NOAA has announced \$9.6 million in funding is available through four established Regional Ocean Partnerships and five Integrated Ocean Observing System (IOOS) Regional Associations. This funding, provided by the Bipartisan Infrastructure Law, will allow NOAA to increase the ability of Regional Ocean Partnerships to address priorities specific to their regions, such as offshore wind planning, monitoring ocean conditions to coordinate management regionally, and advancing shared tribal priorities. The majority of this funding will be invested in Regional Ocean Partnerships. The remaining funds will enhance the ability of Regional Ocean Partnerships and Regional Associations to manage and share ocean and coastal data. This knowledge sharing will enable coastal communities to better plan for future challenges, such as climate change. Applications for established Regional Ocean Partnerships are due April 12, 2024, and applications for Regional Associations will be due this summer. A separate funding opportunity to support tribal engagement in Regional Ocean Partnerships will open later in 2024. Separately, NOAA and the Smithsonian Institution have made a new memorandum of understanding at the Ocean Biodiversity Summit to advance collaborative efforts to understand and conserve the biodiversity of the world's ocean ecosystems, including, but not limited to: marine biodiversity; resilience of fisheries and marine resources; habitat restoration; coastal blue carbon; marine protected areas; marine and coastal monitoring; marine scientific and cultural heritage; and environmental justice. **ST**

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NOAA Takes Major Step Forward in ENC's

Nautical charts are among the mariner's most fundamental tools. They have provided known shoreline configuration, seafloor bathymetry, water depths, locations of navigational hazards, aids to navigation, anchorages, and many other features essential for safe navigation since the first U.S. chart was published in 1845. NOAA's Office of Coast Survey (OCS) creates and maintains both paper and electronic navigational charts (ENCs) of U.S. coastal waters, the Great Lakes, and the waters surrounding U.S. territories, freely available to the public: <https://nauticalcharts.noaa.gov/charts/noaa-enc.html>.

While paper nautical charts provide a wealth of information for mariners to travel safely in U.S. waters, the latest and most up-to-date information is found in electronic nautical charts.

In late 2019, OCS began a five-year program to end production and maintenance of paper charts and focus on producing high-quality ENCs with several key improvements: enhanced chart coverage to create more than 7,200 new charts covering U.S. coastal waters and the Great Lakes, often with greater detail; the ability to view depth values in feet, fathoms or meters; and increased density of depth contours, providing a more detailed view of the seafloor and thereby improving vessel draft automated alarms on navigation systems.

Customers who prefer a paper chart can use the NOAA Custom Chart application to create a custom paper chart from the latest ENC data: <https://devgis.charttools.noaa.gov/pod/>. This site produces a paper nautical chart as a PDF file, which can augment navigation with NOAA ENCs, enhance overall situational awareness, and be used as a planning tool or as a backup for ENCs.

Moving beyond traditional navigation products, NOAA provides other ways to access and use its ENC data. The NOAA ENC Viewer and the NOAA Chart Display Service (<https://nauticalcharts.noaa.gov/NCDSviewer/>) provide simple interfaces through which users can integrate the display of ENC images into online and offline applications for non-navigation uses. These services are often used to provide a base map for emergency response planning or marine spatial data infrastructure. The underlying data are updated weekly and rendered from the latest NOAA ENC data. Depending on which display service is used, ENC data can appear as they would on an electronic chart display and information system or in a format similar to a traditional chart.

NOAA's ENC Direct to GIS web page allows users to display, query and download foundational data in a variety of formats: <https://nauticalcharts.noaa.gov/data/gis-data-and-services.html#enc-direct-to-gis>. Users may select all or specific data sets to download across any ENC within the same display scale. Three pre-built theme layers are available for the entire country—Coastal Maintained Channels, U.S. Maritime Limits and Boundaries, and Shipping Lanes and Regulations.

Going forward, NOAA's focus is on products and services for precision marine navigation, including centralization of NOAA's vast array of marine navigation data—specifically, oceanographic, weather and bathymetric—to maximize efficiency and data accessibility for all users. This will allow mariners in U.S. coastal waters and the Great Lakes to use foundational data and real-time observations to optimize routes and safely maneuver while approaching and within congested ports and harbors. Precision marine navigation will also support data needs for coastal management, disaster preparedness, rescue and recovery, fishing, environmental protection, and other activities in U.S. waters. You can submit questions or comments and report problems to OCS at <https://nauticalcharts.noaa.gov/customer-service/assist/>. **ST**

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JANUARY

Annual Review & Forecast

****EUROMARITIME 2024**, January 30-February 1, Marseille, France

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

****Oceanology International 2024**, March 12-14, ExCel, London, U.K.

MARCH

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

****UDT 2024**, April 9-11, ExCel, London, U.K.

****OCEANS 2024 Singapore**, April 14-18, Singapore

****XPONENTIAL 2024**, April 22-25, San Diego, CA

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

****Offshore Technology Conference**, May 6-9, Houston, TX

MAY

Communications, Telemetry, Data Processing

JUNE

Seafloor Mapping/Sonar Systems/Vessels

****Sea Technology supports these shows**

BONUS INFORMATION

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4 EDITORIAL CALENDAR

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JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

****IMAGE 2024**, August 25-30, Houston, TX

AUGUST

Ocean Resources Development & Coastal Zone Management

****OCEANS 2024 Halifax**, September 23-26, Halifax, Canada

SEPTEMBER

Geophysical Exploration/Seafloor Engineering

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

****EURONAVAL 2024**, November 4-7, Paris, France

****CLEAN GULF**, November 18-20, San Antonio, TX

****MAST Australia 2024**, November 19-21, Adelaide, Australia

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Nuclear Propulsion

Exploring the Potential of Thermonuclear Energy for Shipping

By Vittorio Lippay

The current discussions on reducing carbon emissions in shipping pay little attention to the progress in controlled thermonuclear energy. In a forward-thinking report, only DNV concluded in 2021 that fusion is an “additional pathway for reaching IMO GHG targets while removing business uncertainty due to fuel costs.”

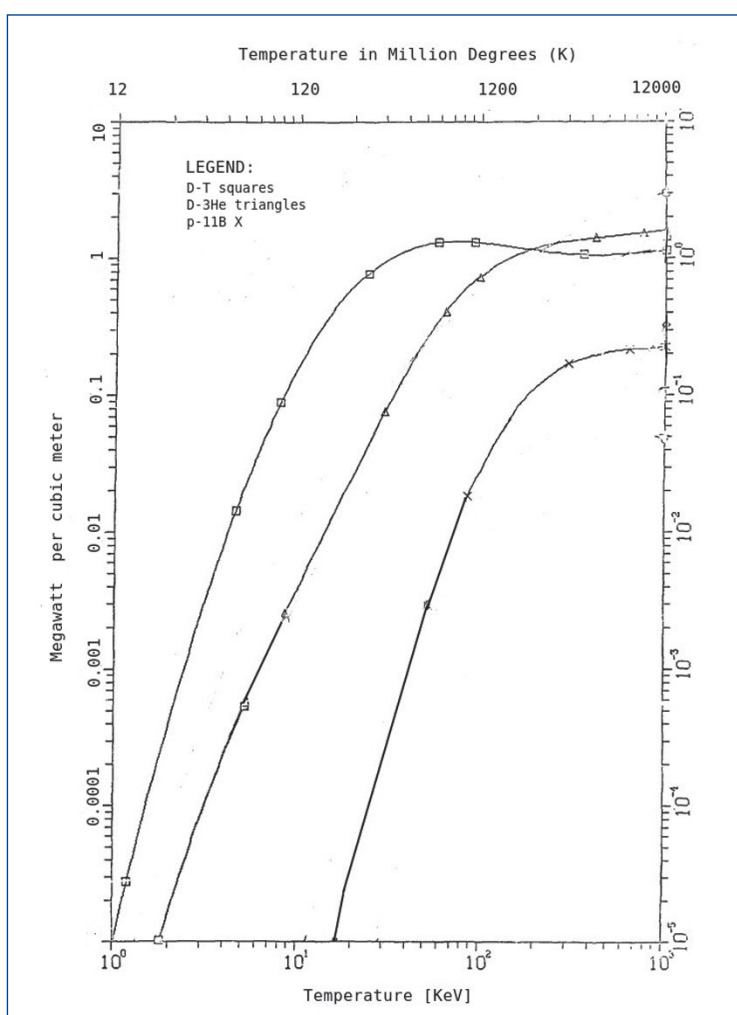
As fusion science acquires new insights, the development of handy, less expensive fusion reactors for marine propulsion is possible. Fusion could deliver thermal energy to be converted into electricity, or provide electricity directly to ship motors.

Fusion Conditions

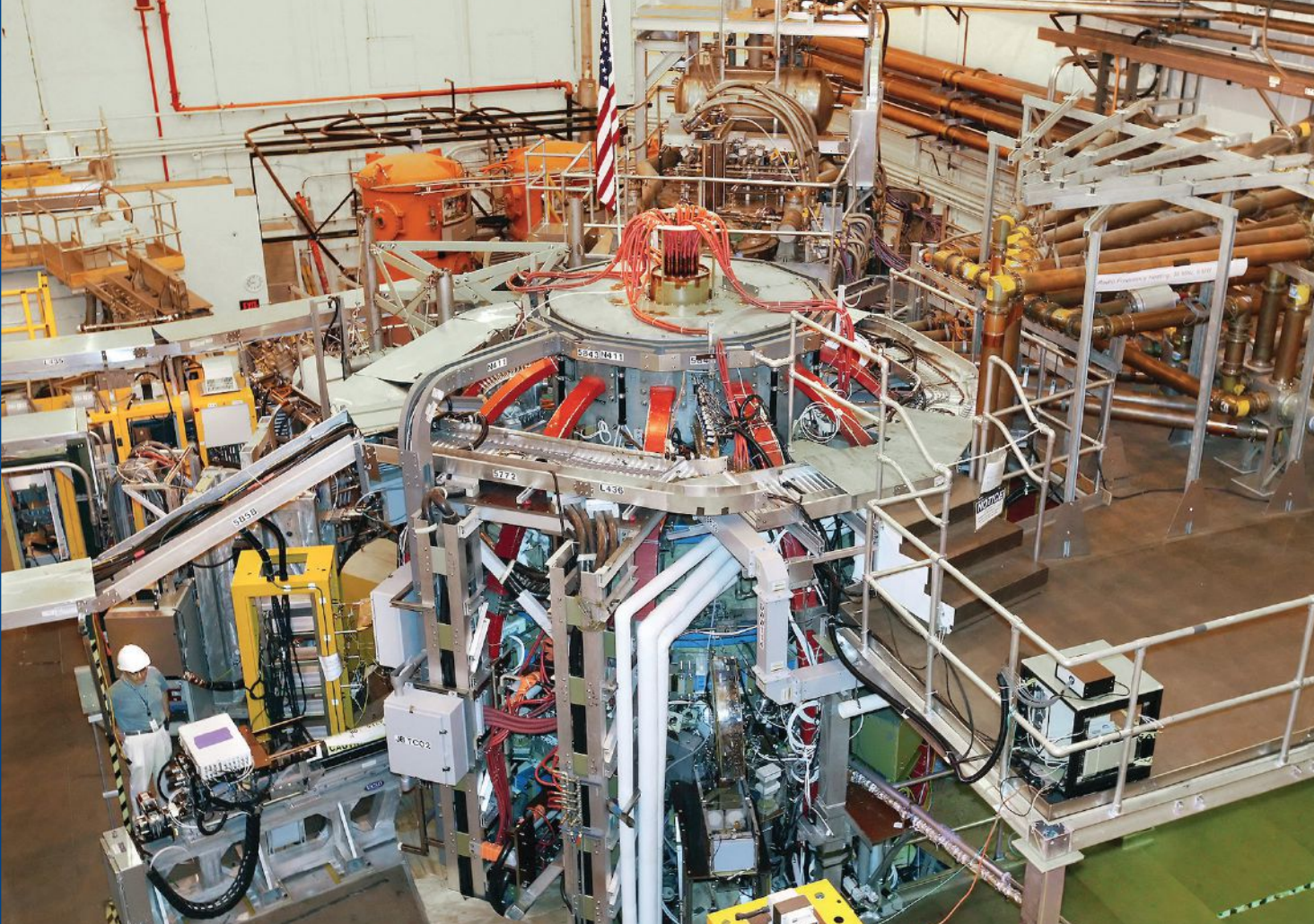
A nuclear reaction releases energy if the starting nuclei are relatively light, with a high binding energy, and the two nuclei overcome the electrostatic repulsion that separates them to form one or more new nuclei and subatomic particles. The mass loss between the sum of the initial particles and the reaction product converts to energy.

For example, the Sun produces energy by a succession of nuclear reactions known as the proton-proton chain. The heat and the gravity pressure at the Sun's core, at 15 million° C, allows for fusion to occur. Since the late 1950s, thermonuclear fusion was possible in the laboratory with no net energy gain.

In 1955, the engineer John Lawson found the three key conditions of a self-sustaining controlled reaction with net gain on Earth: temperature, or kinetic energy of the particles; density, or the number of particles per cubic centimeter; and inclusion (confinement) time, or the time these particles remain close together. The product of these three factors remains the measure for estimating the progress toward achieving controlled fusion.



Comparison of power density versus temperature for D-T, D-3He and p11B fusion. (Credit: Adapted from J. R. McNally, Jr., Oak Ridge National Laboratories, 1981)



A view of NSTX, a device that tests the spherical tokamak design for future fusion facilities. (Credit: Elle Starkman, Princeton Plasma Physics Laboratory)

On Earth, seawater contains plenty of deuterium, and tritium is produced via the neutron bombardment of lithium, so the more accessible reaction is fusing deuterium (the two-nuclei hydro-gen isotope) and tritium (the three-nuclei isotope) to make helium. For a density of about 1×10^{20} ions per cubic meter, the temperature inside a reactor on Earth must rise above 100 million° C, and the confinement time of the particles must exceed 1 sec. to achieve fusion in this case. Albeit at much higher temperatures, the fusion of alternative nuclei may lead to reactions that gain enough energy to sustain themselves while providing some surplus.

Considering the fuel candidates available for fusion, the current focus is on three types of reactions: deuterium-tritium (D-T), deuterium-helium and hydrogen-boron.

The fuels must be in plasma state, or as a gas containing a large fraction of unbound electrons and nuclei, negative and positive charges, respectively, which strong magnetic fields can influence.

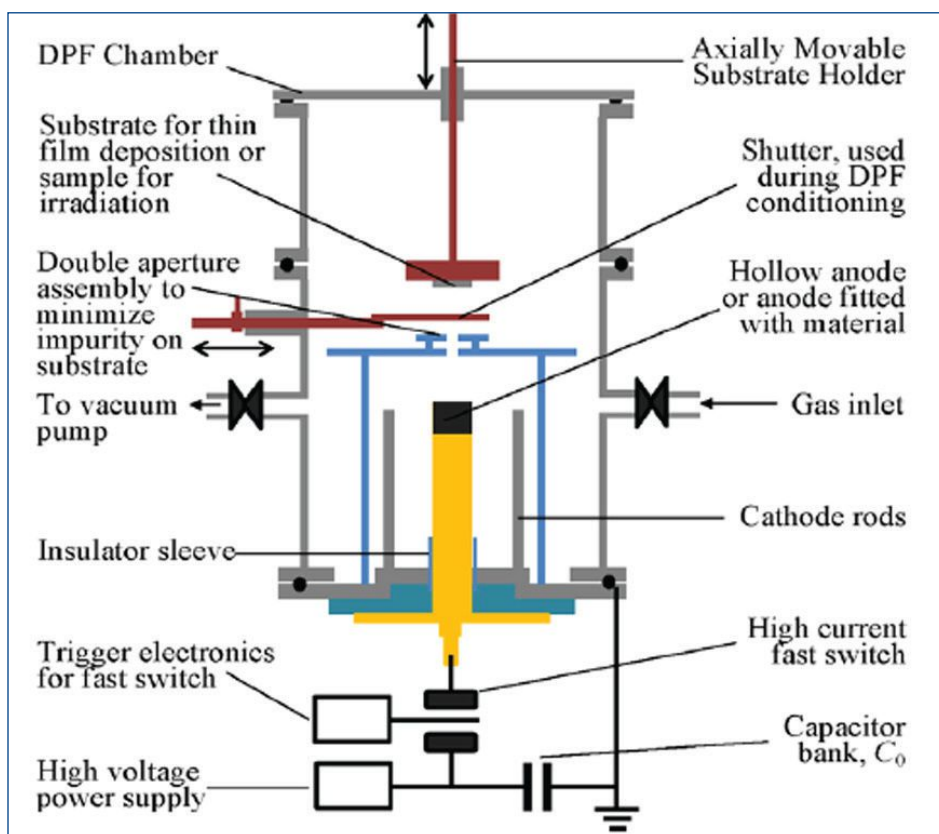
Magnetic Confinement

Almost half of private fusion enterprises adopt the magnetic confinement approach based on D-T, the reaction requiring the lowest temperature and with fuel

sources accessible on Earth. The energy content of the D-T reaction is about 340,000 GJ per kilogram of fuel.

During and after the first energy crisis of the 1970s, fusion efforts concentrated on tokamaks, a reactor type developed in the Soviet Union in the 1950s in which the fuels are confined within a torus-shaped vacuum chamber at low pressure density. A two-component toroidal magnetic field traps the plasma particles within a closed loop to prevent them from flying away when accelerated to the extreme temperatures necessary for fusion. Superconducting magnet coils surrounding the vessel ring generate the primary toroidal field component. Located at the center of the machine, magnet coils of the poloidal field components influence the plasma cross-sections. The scope of the field is to keep the heated particles off the vessel walls, where the plasma could contaminate itself while losing heat.

One challenge is generating fields strong enough to contain the plasma while the energy spent on building up the fields remains low. The ratio between the power produced by a reactor and the injected outside power, Q , is the figure of merit of a fusion reactor. "Breakeven" means that the output energy of a reactor equals the energy spent to bring the plasma to fusion, or $Q = 1$. "Ignition" occurs beyond $Q = 1$, when there is surplus energy.



Dense Plasma Focus assembly. (Credit: R S Rawat, 2015)

The Joint European Torus (JET) in the U.K. has achieved $Q = 0.7$ thus far.

A more practical figure of merit is QE, the ratio between the useful electricity produced by the system and the electricity fed for running it. Eighty percent of the energy released by burning D-T is neutron kinetic energy absorbed and converted to heat by a blanket inside of which a coolant flows. The coolant exchanges the heat, carrying it outward to move a turbine connected to a generator. All losses in this process contribute to the calculation of QE. The remaining 20 percent of fusion power is carried by energetic alpha particles confined within the plasma to sustain reaction continuity.

Roughly, a gainful fusion pulse requires a confinement time above 1 sec. Tokamak temperatures have risen steadily, but progress on confinement time has been limited. Confinement time was experimentally deduced to scale with the plasma radius and the field of the machine, and inversely with its external power loss. Hence, reactors with ever larger major radii appeared a sensible choice. Weighing 23,000 tons, the International Thermonuclear Experimental Reactor (ITER), a demonstration machine under construction in southern France with a major radius of 6.35 m, is expected to reach 3.7 sec. of confinement time. No tokamak has achieved breakeven yet.

Inertial Confinement

In inertial confinement, high-energy lasers, or a physical projectile traveling at 6,000 m/s, target a capsule

with deuterium and tritium. The capsule implodes at high temperatures, causing particle fusion. Using high-energy lasers, the inertial confinement reactor at the National Ignition Facility of the Lawrence Livermore National Laboratory in California achieved breakeven for the first time in 2022 and ignition in 2023. Because of precise target requirements, inertial confinement does not appear to suit ship propulsion.

Compact Tokamaks

At the U.S. Department of Energy's Princeton Plasma Laboratory in the U.S. and at the U.K. Atomic Energy Authority (UKAEA), researchers have experimented on a compact spherical reactor type. In 2016, UKAEA concluded that "it is not possible to compensate for low confinement by increasing device size. At first this might seem a negative result. However, it implies that small devices

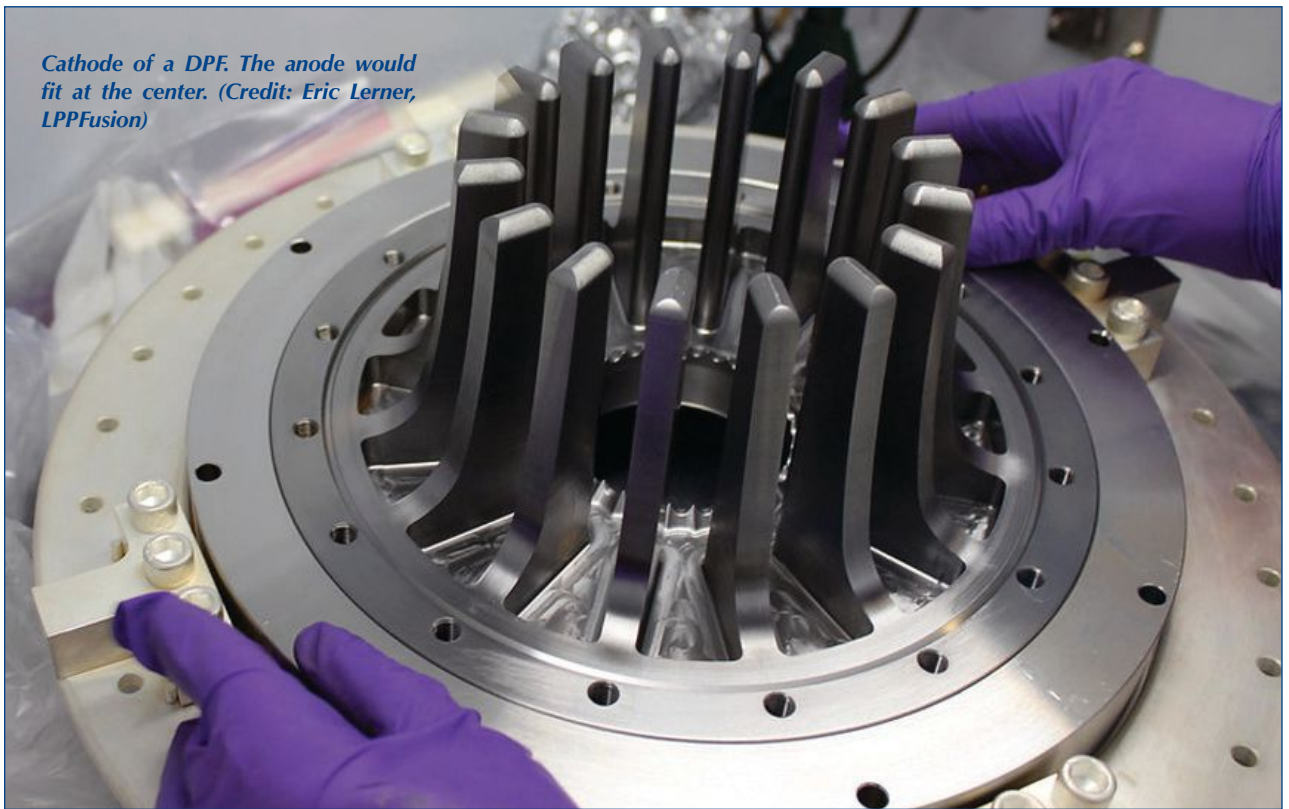
can, in principle, perform as well as large devices, and so it is potentially positive."

Tokamak Energy in Oxfordshire, U.K., has built a spherical tokamak having a radius of 0.4 to 0.5 m, with a high toroidal field, that recently achieved an ion energy of 9.6 keV (over 100 million° C).

The Spherical Tokamak for Energy Production (STEP) project of the UKAEA aims at the construction of a spherical reactor planned for supplying electricity to a medium city by 2040. Such compact tokamaks could be installed in port facilities to promote energy autonomy in swapping the batteries of electric propulsion vessels, such as the *Yara Birkeland*, which is the world's first fully electric, autonomous, zero-emission containership.

Miniaturizing to ship dimensions a D-T reactor of any type involves solving the problems deriving from high neutron radiation. Neutrons cannot be controlled magnetically because they have no charge. When fuel or confinement stops, on purpose or by accident, most radiation in the reactor subsides. There is no risk of meltdown. While in operation, however, D-T fusion reactors will become a radiation source. Their 14.1-MeV fast neutrons will be approximately seven times more energetic and 10 to 20 times more in number than those in nuclear fission plants. Endangered by neutron fluence, structural materials of the reactor and the magnets will need to be manufactured using expensive components made of tungsten carbide or high-entropy alloys requiring frequent refitting. Such constraints may discourage shipowners to install D-T reactors for vessel propulsion.

Cathode of a DPF. The anode would fit at the center. (Credit: Eric Lerner, LPPFusion)



Aneutronic Fusion

The shipping industry needs a low-radiation technology that can size down to vessel dimensions. Fusing deuterium with helium-3 ($D-3He$), the light, three-proton isotope of helium, yields helium-4 and a proton. Protons are charged particles: The plasma energy can be converted into electricity. Ships could sail via “fusion direct” electric propulsion without turbines.

Plasma temperature for $D-3He$ must rise up to 700 million° C. To reach such temperatures, Massimo Zucchetti at MIT has proposed using D-T fusion as a primer to ignite $D-3He$ reactors. The helium-3 isotope is scarce on Earth but abundant on the Moon, from where NASA, the European Space Agency and China propose to collect it. Greg De Temmerman, former coordinating scientist at ITER, thinks that the $D-3He$ technology will mature after a substantial deployment of D-T reactors by the end of this century.

Recently, scientists reconsidered the proton-boron aneutronic reaction ($p^{11}B$). The charged alpha particles released in the fusion can be converted to electricity and feed ship motors directly. The estimated boron abundance on Earth amounts to 1.2 billion tons. The downsides lie in the lower energy yield and in a higher reaction temperature requirement of over 100 keV, or 1,200 million° C. In a mix where boron features a higher atomic charge than tritium, heating the fuel is more difficult because of the Bremsstrahlung X-rays that radiate off the acquired kinetic energy of the electrons while these decelerate when colliding with the ions. In short: The more one heats the plasma, the more energy is lost on Bremsstrahlung, which is why this reaction type was abandoned in the 1970s.

Inspired by the physics of neutron stars, Eric Lerner, now at LPPFusion, reasoned in 2003 that inside strong magnetic fields, “very little energy can be transferred to the electrons in such collisions.” This implies a significant reduction of the heat loss due to strong X-ray emissions as the temperature rises to reaction in an intense field. In very strong magnetic fields, even greater losses derive from the synchrotron radiation of relativistic electrons. The challenge is to find an opportunity window.

Five private enterprises in the world are pursuing boron fusion. For example, HB11 in Australia works on laser-pulse-driven boron fusion, and LPPFusion in New Jersey works on the Dense Plasma Focus (DPF).

The Dense Plasma Focus Returns

The Dense Plasma Focus is a machine built in the 1960s in which electromagnetic forces create, accelerate and pinch plasma. The device comprises two coaxial cylindrical electrodes insulated at one end and open at the other. The electrodes are enclosed in a vacuum chamber, where fuels made of light elements are injected. The cathode is grounded, and the anode is connected to a fast switch which, if closed, discharges the current accumulated by a capacitor bank. The switch closure releases several kilovolts between the electrodes, producing an electric field enhanced by the insulator. In the strong field, the gas ionizes, and a current sheath moves down radially along the electrodes, forming filaments. The collapse of the sheath at the end of the anode, the inner electrode, causes the plasma filaments to concentrate, or pinch, together, thus leading to the formation of dense, magnetically confined hot spots lasting 10 billionths of seconds, called plasmoids. The plasmoids, radiating

X-rays, emit intense beams of accelerated ions and electrons and form a favorable fusion environment, as their intense neutron emissions reveal.

In the early 1970s, researchers of Euratom and of Italy's National Research Council proved that the fusion processes within the plasmoids belong to a class that, according to the knowledge of the time, was unsuitable to yield net fusion. However, in a February 2023 paper, the International Center for Dense Magnetised Plasmas in Warsaw reversed these conclusions, thus making the DPF a competitor in net fusion again.

Boron Reactors

In 2021, DNV published the concept of a 19,338-TEU, fusion-powered container vessel (FPCV). The concept was developed by ABB, DNV, General Fusion, JMU and NYK. In the proposed FPCV, a D-T fusion reactor supplies thermal energy to a system of steam turbines that generate electricity to feed six motors driving the ship's twin propellers.

The economic analysis of this study concluded that, over 15 years, the estimated savings on a conventional 20,000-TEU ship would be \$1 billion. DNV's research quantifies the extraordinary advantages to shipowners of fusion propulsion for merchant vessels, while revealing that D-T reactors fit only in vessels of the largest tonnage—albeit at the cost of more than 662 boxes of cargo. It further identified “the highest commercial risk related to the large volume of cooling water discharge in port.”

In comparison, prospective proton-boron (p11B) reactors would have certain advantages. They would be scalable down to small vessel dimensions; would not need a steam turbine and electricity generators block, which represents two-thirds of machine costs; would not have radiation emissions that make a ship less attractive to ports and crews; and would reduce machine noise drastically for less disturbance of marine fauna.

Constructed with an investment of just \$500,000 each, the experimental devices FF-1 and FF-2B of LP-PFusion achieved record confined energies up to 200 keV. Eric Lerner, the president and chief scientist of LP-PFusion, who also targets marine propulsion, estimates that for a 5-MW DPF reactor “the cost of operation will be about 0.3 cent per Kwh. So, per unit, this will be \$15 per hour of operation, \$10,800 per month of continuous use.” On the whole, p11B fusion research would benefit the shipping community as it aims for low fuel costs and net-zero carbon.

Much work remains to be done before nuclear fusion can be viable for ship propulsion and other energy needs on board, but advances are being made in the physics to make this possible. **ST**

Vittorio Lippay is a member of the Institute of Chartered Shipbrokers and the Institute of Physics. He has a first-class B.S., with honors, in astronomy and has worked for a major manufacturer of research-grade sensors for solar physics in California.

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FernBin Project Enables New Functionality for Inland Waterways

By Herbert Berger • Lars Reckers • Thomas Kaulbach

A vessel that can be remotely controlled does not sound very spectacular—until it becomes clear that we are talking about an inland waterway vessel loaded with 1,500 tonnes of cargo. Rhenus PartnerShip launched just such an ambitious research project, called FernBin, with renowned project partners, including Argonics, RWTH Aachen University, DST (the Development Centre for Ship Technology and Transport Systems) and the University of Duisburg-Essen. The goal is to enable remote control of an inland waterway vessel from a land-based control center.

Operating the devices must work just as reliably from the remote control center as on board. Functions and safety are only guaranteed if the vessel can also be managed from a distance without delay. For the project team to create the technical conditions for such a system, Rhenus PartnerShip made available the inland waterway vessel *Ernst Kramer*, which went into service in 1974, as the pilot ship. It is 104.97 m long, 9.50 m wide and has a maximum draft of 3.15 m. The *Ernst Kramer* was designed to carry a payload weighing 2,273,645 tonnes. A Mitsubishi Heavy Industries S16R-MPTA engine producing 1,170 kW and operating at 1,600 rpm is used as the main drive system.

This vessel was chosen to demonstrate that Rhenus's existing fleet can be equipped with the new remote control technology without incurring enormous costs. The vessel is ideally suitable as a generic prototype with its dimensions.

Safeguarding Controls with Fast Data Transmission

Some of the existing analog technology was first removed, converted and replaced by digital signals in order to make the *Ernst Kramer* fit for service. The key was how to best connect the network on board the vessel with the server on dry land so that all the signals could be transmitted in real time, as far as possible. Errors in the system occurred quite often at the beginning, for exam-

ple, through connection problems between the two networks or because of individual components, which had a negative effect on the network. Rhenus then removed individual components, which could not be bridged, and replaced them with new processes so that the main engine, rudder, bow thruster, radio and radar equipment could also be accessed by mobile communications from a distance.

The biggest challenge involved data transmission in real time. Transmission from dry land to the vessel and back again normally takes less than half a second. However, each individual delay in transmitting a signal from the vessel to the control center on land adds up: If the transmission is good, the time required to reach the vessel and back takes almost 300 milliseconds. If the delay involves 2 sec., the programmed system changes the display in the land-based control center to red, indicating to the skipper that the transmission is becoming poorer and a higher level of attention is necessary. Depending on the situation, the skipper at the control center on land must then decide whether the delay is acceptable. An example of an acceptable delay would be when navigating under a bridge if it is certain that the signal will become stable again very soon. In uncertain situations, such as if there is very little clearance next to a riverbank, it is necessary to return the controls to the vessel and to the second skipper on board. Thus, a skipper must always be present in the vessel's wheelhouse to be able to take over the controls of the vessel.

Mobile Signal Reception Is Key

Before the pilot vessel could be deployed, the project group initially tested all the functions necessary for movement: the revolutions per minute of the main engine, the gearbox including the coupling, the rudder position, and transmitting and adjusting the radar image and the radar pilot.

The team performed the first test journeys from July



Rhenus demonstrated the remote control system at the German National Maritime Conference. Visitors were able to follow the ship's passage live from the FernBin stand in the conference center. The seven cameras on board the Ernst Kramer transmit the latest information to the land base.



2023 onward, and they were staggered in five blocks. During the journeys, which lasted between two and four days, a skipper and two project experts were in the wheelhouse on board and one skipper was present on land with other members of the team. The job of the skipper on board was to take over the controls again if any difficulties occurred. Depending on the scenario, those involved examined which transmitted functions they needed to refine or extend and in which regions remote controls were realistically feasible during the journey.

As expected, some problems occurred during the test journeys; for example, the drop in transmission quality of the mobile communications when the *Ernst Kramer* ran into a heavy rain storm. The reception was disrupted or broke down completely. However, those involved in the project were quickly able to solve the problem by using improved antennas and increasing the transmission performance. As a result, the team then also had to consider which mobile communications company offers the best data transmission in any given region.



Rhenus PartnerShip made available the inland waterway vessel Ernst Kramer as the pilot ship for the FernBin project.

Software, Forecast Tools Boost Reliability

The project partners used the test journeys to determine which means are the simplest to handle the remote controls—both at the control center on land and for the integration process on board. The team asked questions such as: Which additional functions should we install? What did we notice during the practical test—what's missing and what would be sensible? How can we best communicate various emergency situations?

The team is also testing which camera types and positions guarantee both all-around visibility and a detailed view for those operating the remote controls. The team is constantly developing new ideas in order to make the remote controls even more reliable. There are some supporting software programs, such as one that evaluates the LiDAR sensors. The close-range radar is displayed on board, and the team is working on transmission. Other forecast tools are also being introduced, and they inform the skipper in which direction the other vessels in the vicinity are moving.

Initial Deployment

Rhenus gave a live presentation of the remote control system for the first time at the 13th German National Maritime Conference in 2023. The visitors were able to follow the ship's passage live through the port of Duisburg and the river Ruhr estuary from the FernBin stand in the conference center. The presentation aroused a great deal of interest in those who attended. The visuals were so impressive that some of the visitors initially thought this was a demonstration on a simulator.

In addition to the radar image and the ECDIS map data as the main sources of information, camera imagery is visible at the remote control center. The seven cameras on board the *Ernst Kramer* transmit the latest information to the land base for screen display. This gives those responsible the complete overview of the situation on board. The skipper in the control center on land can al-

ready look hundreds of meters ahead. This makes it easier to assess the journey compared with traditional navigation.

Using the remote controls could also create longer operating times. While the crew is taking its rest periods, the vessel could continue to be operated from the remote control center. An appraisal according to route sections might also be feasible: Sections, which operate with a track guidance system, could be operated from the remote control center, while other routes that require greater attention because of low or high water levels or the potential risk of a collision would continue to be controlled from the vessel.

Training Courses for Skippers

The add-on module to remotely control the inland waterway vessel can be installed on board as easily as the TrackPilot track control system that is already used on many ships. What is crucial when integrating the remote control function in the vessel's management system is complying with the rules for its use. For example, it must be clear whether the skipper on board is off duty as soon as the control center on land takes over and the remote controls have been activated, or whether he or she is on standby.

Transmission details are just as important: How is a skipper on board informed that there are connection problems and that a person needs to take over? The hand-over possibilities must be kept simple, and the functions explained quickly so that the technical details of remote control operations do not complicate general questions about handling.

Trust in the system is the first step to success. There's a certain degree of skepticism among the skippers who think that they're suddenly going to just be a passenger rather than the helmsman. Part of the training course is a general introduction on how skippers hand over control properly or take it over again on board.

Some of the existing analog technology was removed, converted and replaced by digital signals in order to make the Ernst Kramer fit for remote control service.



Skippers Can Telecommute

The project offers many benefits for the entire profession in the future. Inland waterway shipping is being seriously affected by the shortage of specialist workers. Using the concept of remote controlled inland waterway vessels, it would be possible to offer the option for some skippers to work from their home office. In this way, the profession could be organized in a much more family-friendly manner.

The project offers other advantages. Remote control enables Rhenus to make the operating times of the vessels much more flexible and expansive; create better competitive conditions; and tap into new transport systems and markets. At the same time, the international

logistics specialist is improving shipping traffic in terms of reliability and simplicity with this project.

To nurture these possibilities, standard guidelines for transport operations on remote controlled inland waterway vessels should be created. Regulation to simplify this process in the future would be ideal.

Conclusion

The modern control center on dry land already matches the state-of-the-art bridge on a newly built vessel. The control center on land has all the important monitors and touch screens for the central ship's displays, and it is designed to be variable and adaptable. This concept can be scaled, and the remote control facility could therefore act as a traffic management center in the future to monitor several vessels.

The FernBin project seeks to ensure that navigating inland waterway vessels using remote controls can become a reality. It will run until March 2024. **ST**

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ROVs for Port Security

Underwater Drones Help Fight Against Parasite Smuggling

By Robert Jechart • Mira Nagle

It would be short-sighted to discuss the future of port security measures without mentioning the technological advancements associated with professional underwater drones, such as ROVs. Globally, professionals are opting to reinforce their security teams with these indispensable tools to enhance their capacity to counter illicit operations within their territories.

Oceanbotics Inc., a professional underwater ROV manufacturer based in southern California, recently took center stage on a groundbreaking episode of “60 Minutes Australia” entitled, “What is parasite smuggling, and why is it so dangerous?”

The term “parasite smuggling” describes the illicit transportation of drugs using small hatches on the sides of cargo ships. Traditionally, combating this type of drug smuggling involves trained port security professionals diving down to inspect these compartments, a process that is both tedious and extremely costly.

The SRV-8 underwater ROV is fully equipped to assist port security professionals in the detection and monitoring of parasite smuggling and other illicit activities.

In the episode, Michael Outram, commissioner of the Australian Border Force, discusses the ongoing issue of drug smuggling in the country, and why they purchased Oceanbotics’ SRV-8 as a tool to help monitor their jurisdiction, including the Port of Sydney.

The episode highlights the pivotal role of Oceanbot-





(Top to bottom) The ruggedized Xbox controller makes for user-friendly operations. This SRV-8 was deployed in less than 3 min. Operators have likened the SubNav OS to Apple's iOS in ease of use.



ics' cutting-edge SRV-8 in dismantling an \$80 million cocaine smuggling operation. The Australian Border Force officers deployed their ROV to identify a suspicious attachment on a ship. They discovered and confiscated approximately 200 kilograms of cocaine, equivalent to 1 million street deals.

SRV-8 Design

The SRV-8 distinguishes itself as the most user-friendly and maneuverable small working-class ROV on the market. Operators of various ages and skill levels can easily learn to use the drone in 10 min. or less, and they can maneuver the drone as deep as 305 m (1,000 ft.). This type of control is enabled by the SRV-8's ruggedized Xbox controller, a familiar tool for many operators, and the seamless integration of Oceanbotics' SubNav OS software. The combination provides users with an "Apple-like experience" for underwater ROVs, where the vehicle outperforms its competitors in performance, and the software is the cornerstone of the entire operation.

SubNav OS works as more than just an operating system. Clients have said that they are impressed by its user-friendly interface and integration with applications such as imaging sonar and navigation systems. The software leaves little room for error, ensuring a smooth deployment, even for users with limited experience.

The SRV-8 excels in harsh water conditions and poor visibility, thanks to its rugged frame and powerful light capacity. Accessories and add-ons enable users to customize their underwater drone to fit spe-



Accessories and add-ons allow users to customize their underwater drone to fit specific needs.



cific conditions, ensuring mission-critical tasks are completed effectively.

Conclusion

The "60 Minutes Australia" episode not only showcases the capabilities of Oceanbotics' SRV-8 ROV but also raises awareness about the threats posed by maritime drug smuggling. It underscores the importance of investing in advanced technologies that empower law enforcement agencies to stay one step ahead of criminal organizations who are exploiting the vastness of our oceans for illicit activities.

So, what does the future hold for professional underwater ROVs in the port security industry? In the realm of underwater exploration, remotely operated vehicles are poised to become smarter and more autonomous. This means these underwater vehicles will have the capability to independently carry out various tasks, such as navigating along the hull of a ship during inspections and actively searching for potential threats.

The crucial elements enabling this autonomy lie in advanced software and AI technology, complemented by an intuitive user interface. Essentially, these technological advancements will handle the majority of tasks during inspections, marking a thrilling phase in the evolution of ROVs. Oceanbotics is eager to contribute to, and be part of, this exciting journey. Learn more at: www.oceanbotics.com. **ST**

Robert Jechart, founder and CEO of RJE International Inc., has shaped the global underwater technology market for over 30 years. As CEO of Oceanbotics Inc., a division of RJE, he pioneers user-friendly underwater drones. Dedicated to the community, he actively engages with organizations such as California State University, Fullerton's Foundation Board. Jechart, a proud father of two, resides in Irvine, California.

Mira Nagle is the marketing administrator at Oceanbotics Inc. She oversees the company's marketing operations, including advertisements, content creation, trade show collateral and digital/print publications. Her love for the outdoors, particularly the ocean, is evident in her pursuits, aligning seamlessly with her academic background in marketing and marine science.

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USVs for Defense

TECHNET Indo-Pacific Conference Highlights Uncrewed Vessels

By George Galdorisi

For those who follow defense issues, it is impossible to miss the impact of emerging technologies on changing the character of warfare and on the security and prosperity of the United States. There are numerous technologies that have the potential of enormous influence on defense, both at home and abroad, in the third decade of the 21st century. Some of the most prominent include next-generation fighter aircraft, quantum computing, stealthy bombers, artificial intelligence and unmanned technologies in all domains.

For the U.S. Navy, unmanned systems—especially uncrewed maritime systems—offer the promise of providing the U.S. military with an asymmetric advantage over potential adversaries. Ukraine's use of weaponized uncrewed surface systems to attack Russian naval vessels on multiple occasions has demonstrated just one use of these platforms. Many more missions are evolving, including those that can contribute to homeland defense, such as offshore energy infrastructure protection, port

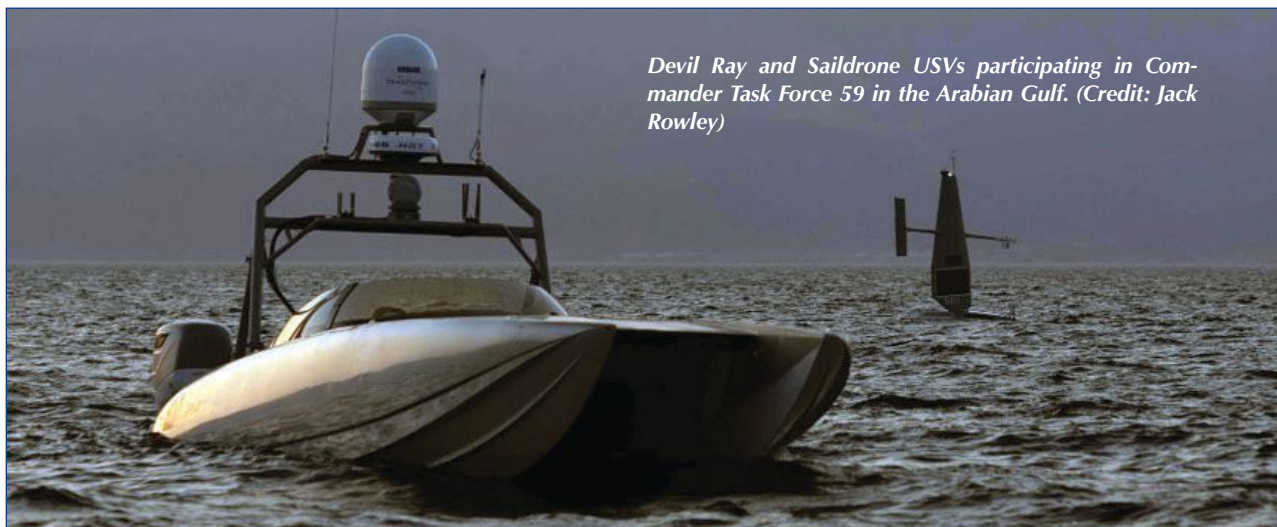
and harbor security, ship protection and many others.

The U.S. Navy has taken several actions to define and accelerate its journey toward uncrewed platforms. These include publishing an Unmanned Campaign Framework; standing up an Unmanned Task Force; establishing Surface Development Squadron One in San Diego and Unmanned Surface Vessel Division One in Port Hueneme, California; and conducting many exercises, experiments, and demonstrations both in United States waters and overseas to evaluate uncrewed platforms.

Indeed, the Navy's Force Design 2045 document envisions a fleet of 500 ships: 350 crewed vessels and 150 uncrewed maritime vehicles. This represents a once-in-a-generation shift in fleet composition and one that places big bets on emerging technologies that can make uncrewed maritime vehicles more autonomous.

Uncrewed Systems in Indo-Pacific

This U.S. Navy emphasis on uncrewed maritime ve-



Devil Ray and Saildrone USVs participating in Commander Task Force 59 in the Arabian Gulf. (Credit: Jack Rowley)



hicles was on full display at a major international military-industry event held in Honolulu, Hawaii, late last year. TECHNET Indo-Pacific drew more than 4,000 delegates from throughout the Indo-Pacific region. As in previous years, the conference featured keynote speakers as well as breakout panels on uncrewed maritime vehicles, among other topics.

Reserve Deputy Commander, U.S. Pacific Fleet, RAdm. Eric Ruttenberg delivered the event's opening keynote address. His presentation, "Indo-Pacific: The Stakes Could Not Be Higher: Implementation of Modern Technologies Must be Accelerated to Meet Military Needs," covered a wide range of challenges and opportunities facing the U.S. Navy in the Indo-Pacific region. He emphasized that the most pressing need for Pacific Fleet is innovation, and the velocity of innovation must accelerate, and the Navy must engage nontraditional manufacturers to accomplish this goal. Pacific Fleet is looking for ways to get unmanned surface vehicles forward to desired areas of operations, and the fact that the Navy is committed to buying a number of large unmanned surface vehicles is a step in the right direction, he said.

Pacific Fleet's strong emphasis on unmanned will enable warfighters to conduct missions in a contested environment that manned systems cannot do due to adversary anti-access/area-denial capabilities, Ruttenberg explained. Unmanned systems must continue to be evaluated in exercises, experiments and demonstrations, and the Pacific Fleet will lead in this area, he said. The Integrated Battle Problem series represents the pinnacle of experimentation and will continue in 2024 and beyond.

It is easy to see that the U.S. Pacific Fleet, which is responsible for dealing with the United States' principal adversary in the region, is leaning forward to leverage uncrewed maritime vehicles to perform a plethora of missions for a number of reasons, among them: their ability to reduce the risk to human life in high-threat areas; to deliver persistent surveillance over areas of interest; and to provide options to warfighters that derive from the inherent advantages of unmanned technologies.

Regional Exercises

In another session that was heavily focused on uncrewed maritime systems, "The Impact of Unmanned Maritime Systems on Asia-Pacific Navies," a panel of

subject matter experts in the field highlighted many of the strides the U.S. Navy has made in getting these technologies into the hands of sailors and Marines to evaluate them in the operational environment.

The panel discussed international maritime exercises held under the auspices of Commander Task Force 59 in the Arabian Gulf, which set the standard for uncrewed maritime vehicle experimentation and included operations with several regional partners. Navies of these nations explored the capabilities of USVs, such as the Saildrone, the MARTAC MANTAS and Devil Ray (Sea Technology, October 2023), and many other USVs from participating nations.

RIMPAC/Trident Warrior was a major coming out for USVs operating with the fleet. As a result, the Integrated Battle Problems are increasingly evaluating USVs in broader and more intense sets of missions.

Australia has become a leader in USV experimentation. Autonomous Warrior 2022 expanded the evaluation of USVs from Australia, New Zealand, the United Kingdom and the United States, and featured 30 autonomous systems, including Saildrone, MANTAS and Devil Ray.

The panel emphasized that the goal of Pacific Fleet is not to field fully autonomous systems at some future time but, rather, to field semiautonomous systems *now*.

Conclusion

It is clear that the Department of the Navy is committed to an accelerated development path for uncrewed surface systems so that they can complement the Navy fleet and perform missions that keep sailors and Marines out of harm's way. This bodes well for both the Navy's role in national security, as well as for all aspects of homeland defense. The fact that the Navy and Marine Corps have operated commercial-off-the-shelf (COTS) uncrewed surface vessels, such as MANTAS and Devil Ray, for thousands of hours in exercises, experiments and demonstrations has helped evolve these platforms to the point where their technical readiness levels make them ready for use now for the homeland security missions mentioned above.

If the U.S. military and homeland defense communities want to buy-down inherent technical risk and challenge the paradigm of long-cycle Federal Acquisition Regulations (FAR) in the deadly serious business of ensuring this nation's security and prosperity, it is long past time to leverage a near-term solution using COTS technologies for a plethora of mission sets. While complex programs of record are developing next-generation technologies, it is vital to provide a parallel-path solution that leverages mature subsystems ready to provide "speed to capability" today. **ST**

George Galdorisi (U.S. Navy, retired) is a national security professional. His 30-year career as a naval aviator culminated in 14 years of consecutive service as executive officer, commanding officer, commodore and chief of staff. He is a 40-year Coronado, California, resident and enjoys writing, especially speculative fiction about the future of warfare. Galdorisi is the author of 18 books, including four consecutive New York Times bestsellers.

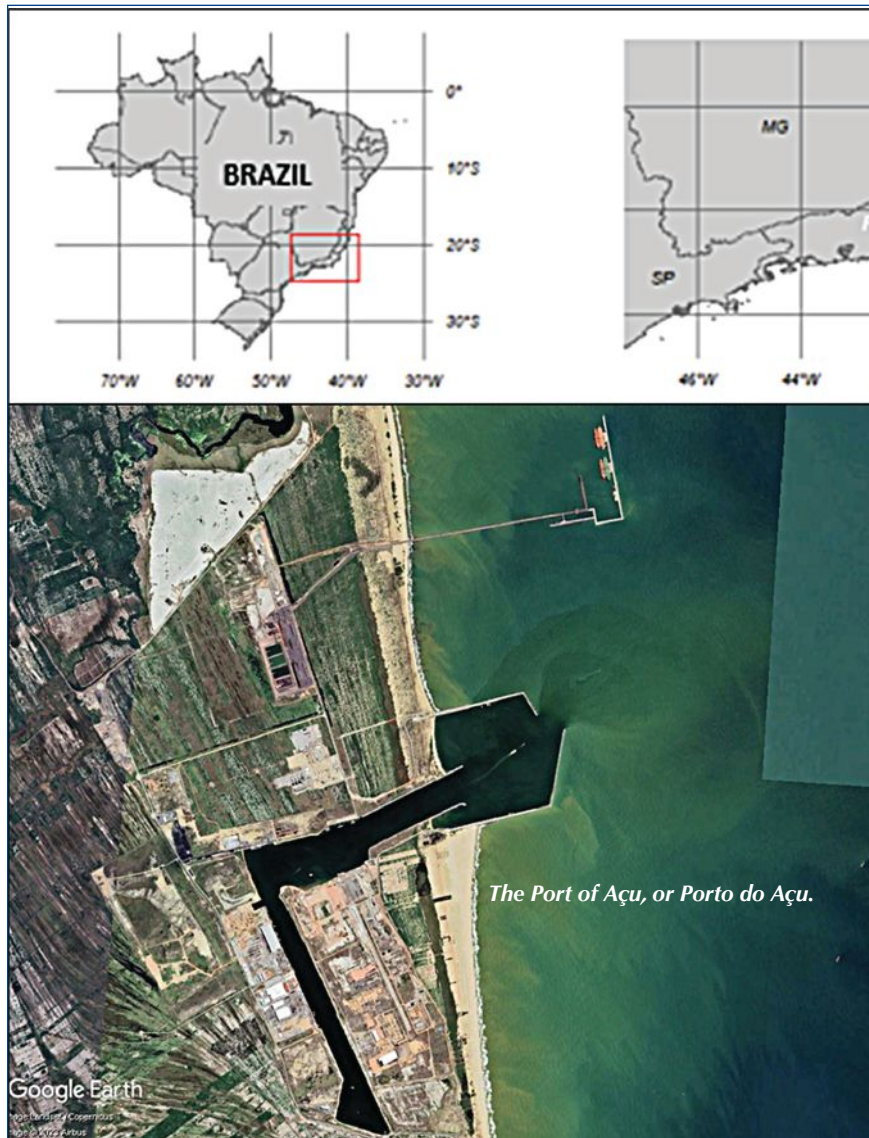
Metoceanography for Deepwater Port

Data-Driven Seascap Enhances Safety, Sustainability at Port of Aç

By Luana Machado • Dr. Andrea Gallo • Vinícius Neves

The Port of Aç, or Porto do Aç, stands as the largest deepwater and private industrial port complex in Latin America. Nestled in the northern region of Rio de Janeiro state, Aç is a burgeoning port committed to sustainable growth. Operational since 2014, it boasts 22 established companies and 10 private terminals across two main infrastructures. The first, offshore (T1), extends 25 m deep and encompasses the Iron Ore Export Terminal and the Oil Double Banking Terminal. The second, on-shore (T2), at 14.5 m deep, houses a dredged channel accommodating all other terminals. This industrial port enterprise is founded on the pillars of efficiency; environmental, social and corporate governance (ESG); and innovation. As Brazil's third-largest iron ore private terminal, and responsible for 30 percent of the country's oil exports, it is in the process of constructing the largest thermoelectric power park in Latin America and hosts the world's most extensive offshore support base.

The port is working with the companies VAST, Ferroport and the company Porto do Aç (PDA) on vessel operational safety, and one of their initiatives is the metoceanographic real-time monitoring of environmental conditions, managed by OceanPact. As a Brazilian company excelling in environmental, sub-sea, and logistics and engineering solutions, OceanPact plays a pivotal role in studying, protecting, monitoring, and sustainably using the sea, coast, and marine resources in general. Catering to the diverse sectors of oil and gas, energy, mining, telecommunications, port operations, navigation, tourism, fishing, and aquaculture, OceanPact's mission at the Port



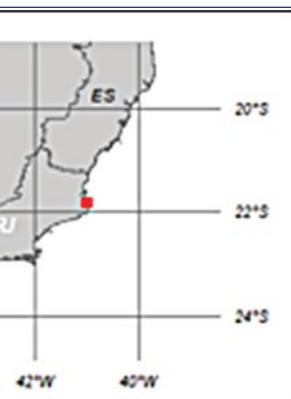
of Açú is to uphold and provide high-quality, real-time data for various gages. This includes electronic and equipment maintenance, data transmission, filtering, and delivering the final information via web apps to computers and smartphones, all orchestrated through the SIGMA platform (Sistema Integrado de Gestão e Monitoramento Ambiental).

Stations

A total of nine stations (three in T2 and six in T1), some equipped with more than one piece of equipment, are strategically positioned to collect comprehensive data, encompassing wave parameters, current profiles, wind details, precipitation, visibility and tide levels.

The five wave and current stations feature an ADCP positioned at the bottom, facing upward. These are connected to a main buoy that houses an integrated system with solar panels, batteries and modems, facilitating the real-time transmission of data to a cloud-based system.

Similarly, onshore stations rely on solar power and are connected to data loggers for data transmission to the gateway. Additionally, for T1, for all the data required, there is a station dedicated to reducing the vulnerability of port operations in the absence of the primary station.



Database

Processed data are housed in the database, where a quality flag is assigned to each set of data. Only data classified as good quality are showcased in the app. Quality control scripts adhere to QARTOD recommendations (Quality Assurance/Quality Control of Real-Time Oceanographic Data) from IOOS (Integrated Ocean Observing System), NOAA. These manuals prescribe quality control processes as “required,” “strongly recommended” or “suggested” for each sensor type. Thresholds for test acceptance are based on a statistical analysis of historical data provided by the Port of Açú.

The main tests for Group One (required) are: timing/gap; syntax; location; gross range; and climatology. The main tests for Group Two (strongly recommended) are: spike; rate of change; and flat line. The main tests for Group Three (suggested) are: multi-variate; attenuated signal; and neighbor or forecast.

Data Analysis

The stored data are accessible



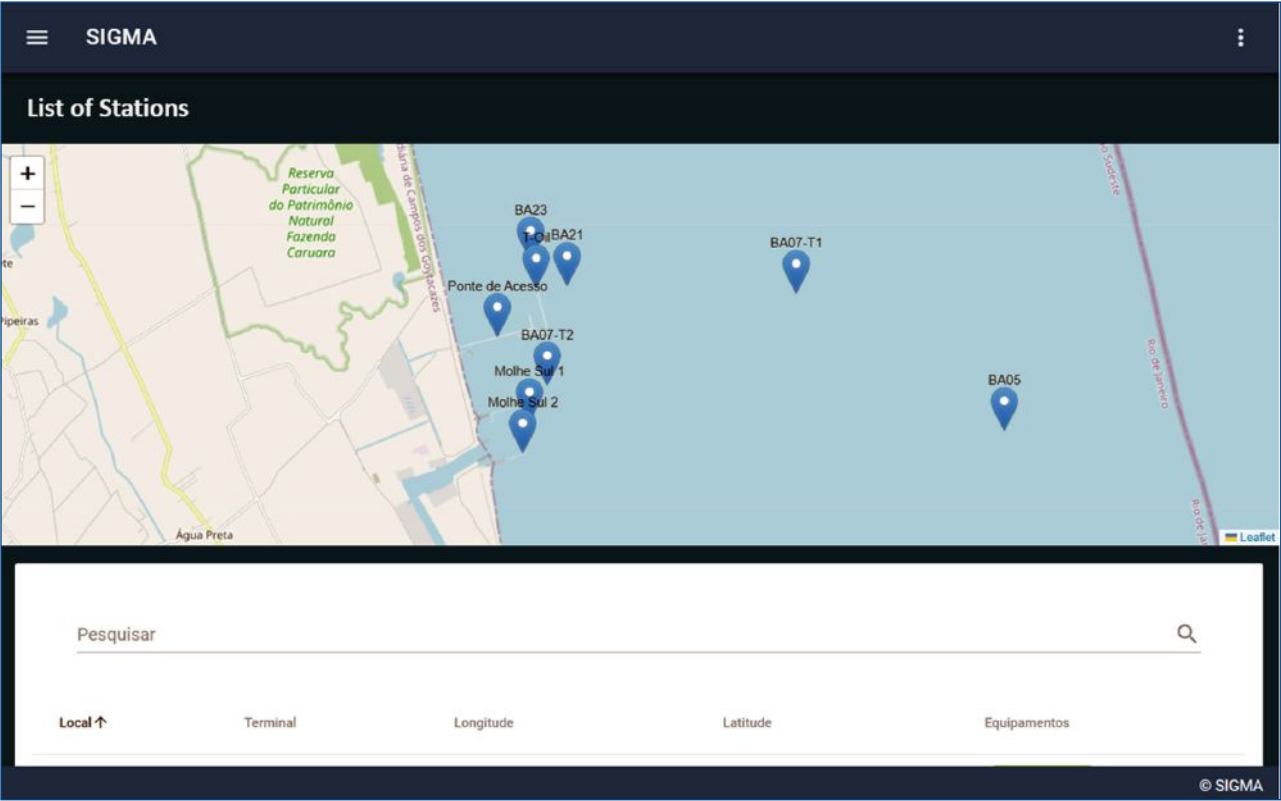
Example of last data received at a given station, shown on smartphone app.

for download at any time, enabling in-depth analysis of environmental conditions. Additionally, integration with various applications and dashboards is facilitated through APIs. Monthly reports meticulously compare the time series of both primary and secondary stations, aiming to unveil patterns and correlations, and offering detailed insights into any interventions undertaken.

This data set plays a pivotal role in calibrating forecast models, serving as a robust foundation for statistical analyses, and enhancing our understanding of the environment. It enables the identification of changes in seasonal patterns, thereby contributing to a more comprehensive knowledge of the dynamic environmental landscape.

Station Maintenance

Operating around the clock, maintenance assumes a crucial role. OceanPact’s dedicated work base within the port complex stores spare parts and equipment, facilitating swift diagnosis and repair by technicians when necessary. Maintenance tests encompass communication system checks, cable and parts integrity, battery assessment, solar panel and connector cleaning, structural fix-



STATION	TERMINAL	PARAMETERS
BA05	T1	 Waves and Currents
BA07-T1	T1	 Waves and Currents
BA23	T1	 Waves and Currents
BA21	T1	 Waves and Currents
T-Oil	T1	 Visibility and Winds
T-Ore	T1	 Precipitation, Winds, tides
BA07-T2	T2	 Waves and Currents
Molhe sul 1	T2	 Winds and Visibility
Molhe sul 2	T2	 Precipitation and Tides

Main Challenges

Engaging in monitoring projects of this nature presents an array of challenges, primarily revolving around the constant evaluation of data and equipment integrity. The marine environment, known for its hostility, poses several recurring issues. Common problems include the risk of data cable ruptures caused by friction with the structure and encrusted organisms, sedimentation affecting ADCPs, damage to modem antennas by marine birds, reduced solar panel efficiency due to obstruction by bird feces, poor signal quality, battery malfunctions, interference with

fishing activities leading to equipment displacement, and occasional collisions with boats, not to mention the occasional theft.

A critical situation arises when station problems occur during unsafe conditions for operations, resulting in prolonged unavailability of crucial data. To address these challenges, OceanPact has established a dedicated local crew. Each incident triggers a thorough investigation, with subsequent improvements implemented to sustain station operations. This proactive approach includes redundancy measures for data transmission, modified frames for ADCPs to prevent sedimentation, maintenance

(Top) Location of the stations. (Bottom) Parameters measured at each station.

ture examination, signal strength tests, and equipment replacement if needed.
For offshore stations (ADCPs), professional diving services are essential. Accessing onshore stations depends on platforms designed for elevated work, introducing considerations of environmental safety and third-party service availability as potential operational limitations.

Maintenance at an ADCP station.



of readily available spare parts for swift deployments, and a proficient programming team ensuring optimal performance of computers and applications. The significance of real-time data for operational safety cannot be overstated.

Innovations and Future Developments

OceanPact's commitment to innovation extends beyond the realm of metoceanographic monitoring. Ongoing research and development initiatives aim to enhance the tools and the SIGMA platform beyond the project. Plans are underway to integrate artificial intelligence (AI) algorithms into the data analysis process and forecast modeling tools, providing predictive insights for more proactive decision making, as well as customized dashboards and personified alerts.

Moreover, there is a focus on expanding the scope of monitored parameters to include emerging environmental factors. Anticipated developments include the incorporation of advanced sensors, such as those detecting oil spills. This forward-looking approach ensures that OceanPact intends not only to meet the current demands of safety and efficiency but also to remain at the forefront of technological advancements in maritime and environmental management. **ST**

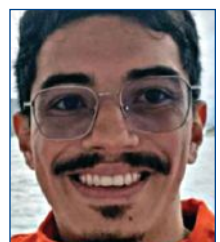
Luana Machado is the manager of numerical modeling and oceanography at OceanPact. She has more than 13 years of expertise in offshore and coastal dynamics. Specializing in numerical modeling and data analysis, she navigates metoceanographic parameters, such as waves, currents, tides and sediment transport. Proficient in oil spill studies and real-time observation, Machado excels in project development, delivery and team leadership.



Dr. Andrea Gallo is a technical manager at OceanPact. She holds a Ph.D. in coastal and oceanographic engineering and has more than 25 years of expertise. Specializing in environmental management and physical oceanography, she leads numerical modeling teams, focusing on geophysical, geotechnical, metocean and environmental data processing. Her extensive experience includes hydrodynamic modeling and metocean data analysis.



Vinicius Neves is a data support assistant at OceanPact who is currently majoring in mathematical and Earth sciences at UFRJ. Proficient at mathematical modeling, data processing and systems development, he is enthusiastic about robotics and automation. Additionally, he conducts research in photonics for the application of sensors using plastic optical fibers.



international

Teledyne Center in Poland

Teledyne Marine has opened a service center for AUVs in Poland, established in partnership with Enamor Ltd., a research and production company based in Gdynia, Poland. Enamor focuses on cutting-edge technology projects in navigation, communication, hydrography and automation.

Enamor's collaboration with Teledyne Gavia spans over a decade, beginning with the initial delivery of Gavia AUVs for the Polish Navy Explosive Ordnance Disposal divers in 2012. Subsequent Gavia deliveries include those for the *Kormoran*-class mine countermeasures vessels.

Recently, the Polish Ministry of Defence procured the Teledyne RESON SeaBat T20-S Module for a fleet of four Gavia AUVs.

VIKING Acquires Evac Systems

VIKING Life-Saving Equipment has acquired the rights to manufacture and supply Undertun marine evacuation systems (MES) from the Norway-based company Sverre Undertun.

The solution applies to the small ferry market due to its easy installation and use. Suitable for up to 150 persons, Undertun MES are ideal when installation heights and crew numbers are low.

Maritime Venture Capital

A new venture capital fund, acting as a melting pot for innovation, will help transform cutting-edge ideas into viable businesses across the maritime, logistics, energy and leisure sectors. The fund is named Galactic Beacon Ventures.

Powered by Columbia Group, the fund plans to identify and nurture innovative ideas into successful businesses that leave a lasting legacy and are true to the fund's sustainable credentials.

Ferries for Scotland

Caledonian Maritime Assets Ltd. (CMAL) has launched MV *Isle of Islay* at the Cemre Marin Endustri shipyard in Yalova, Turkey.

The vessel is the first of four ferries being built at the yard, and it marks a major milestone in CMAL's commitment to delivering new ferries to serve the Scottish islands.

With the hull now structurally complete, all blocks for the vessel have been erected and surveyed. The ferry, which will serve Islay and Jura, is set to be delivered in October 2024.

Remote Satellite Connectivity

VTT Technical Research Centre of Finland has launched a satellite communications research project to develop new solutions for critical communications.

The project aims to facilitate communication between authorities in challenging conditions, such as during ma-

jor forest fires, but satellite connections are also beneficial in maritime operations and remote mining areas.

The idea behind the project is that if satellite connectivity can be established directly via mobile phones, there would be no need for users to purchase separate devices, and connections would work even in remote areas.

The project, entitled "6G-enabled Satellite-based Machine Type Connectivity for Demanding Applications in Remote Regions" (6G-SatMTC), was launched in April 2023 and has progressed to the next phase.

Trelleborg Expands in Vietnam

Trelleborg Marine & Infrastructure, specializing in polymer solutions for the marine, infrastructure and energy industries, has begun construction for its new manufacturing facility in the Phu My 3 Specialized Industrial Park in Vietnam's Ba Ria Vung Tau province.

The state-of-the-art facility, strategically located in one of Vietnam's rapidly developing economic zones, was commissioned in response to the growing regional and global demand for Trelleborg's marine construction, infrastructure, and fender solutions.

Caldwell Stocks Up on ROV Hooks

The Caldwell Group Inc., based in Illinois, has added ROV hooks from RUD to its in-stock program. The hooks, available in 10- and 25-t capacity, are supplied through Caldwell's dealer network, primarily for use in underwater applications in the Gulf Coast region.

Caldwell and the RUD Group have united their sales and marketing activities in North America and now stock more ROV hooks in the region than ever before.

Access to ROV hooks is important to major subsea and oil and gas contractors for utilization in multimillion-dollar projects to handle valuable loads in hazardous environments, often many miles offshore and down to water depths of 10,000 ft.

More Transits Allowed in Panama Canal

The Panama Canal has increased the number of daily transits to 24, starting in January, for the benefit of its customers.

Previously, 22 vessels transited daily, divided into six Neopanamax and 16 Panamax.

The canal authority has put in place restrictions in response to the challenges posed by the current state of Gatun Lake, which is experiencing unusually low water levels for this time of the year due to the drought induced by the El Niño phenomenon.

Navico Centers of Excellence

Navico Group, a division of Brunswick Corp. and a supplier of integrated systems and products for the marine and RV industries, has made a multimillion-dollar investment in its Lowell, Michigan, facility to create two centers of excellence in metal fabrication and electrification. The investment will increase quality, capacity and efficiency, as well as improve product manufacturing capabilities.

ChartWorld Rejoins CIRM

ChartWorld Group, a provider of maritime navigation solutions, has rejoined the Comité International Radio-Maritime (CIRM).

ChartWorld and Teledyne Marine have united forces under the Raymarine CIRM membership umbrella, joining as full associate members.

This move enhances ChartWorld's profile and increases the company's exposure to the wider marine electronics community.

Third Wave of Tacoma Blue Startups

Washington Maritime Blue's Tacoma Maritime Innovation Incubator (TMII), a program dedicated to contributing innovation and economic growth within the South Sound, has welcomed four companies and one community member into the Third Wave Cohort.

The cohort will have access to mentorship, networking and programming opportunities to help business operations scale. The startups will be able to tap into the Maritime Blue ecosystem, which includes advisers and mentors worldwide.

The Third Wave Cohort comprises: Black Muse LLC, focused on leveraging the metaverse for businesses and schools; Future Gen, a Gen Z career exploration platform; Novellus Energy, utilizing hydrostatic and hydraulic pressure to generate hydrogen; Othentk, helping businesses increase productivity and reduce risks and costs through cybersecurity; and Glocal Solutions (Third Wave community member), providing organizations with the critical data and solutions necessary to change and thrive.

Energy Transition to Accelerate

Over the next two years, the United States will experience a remarkable acceleration in the energy transition in the electricity sector, according to new figures by the U.S. Energy Information Administration (EIA).

Utility-scale solar generation is set to grow by 75 percent in just two years, pushed by the anticipated addition of 79,000 MW of new capacity. The EIA described the increase as the "major driver" behind its electric sector power forecast, which expects generation from renewables—utility-scale solar, wind and hydro—to be almost twice the amount generated by coal in 2025.

Wind and solar are expected to account for 18.5 percent of all the electricity generated in the U.S., and hydro is anticipated to add another 6.5 percent. Wind and utility-scale solar by themselves will generate more power than coal in 2024.

Barge for Tidal Energy Tech

HydroWing has designed the Quad Hull Barge to lower cost of installation and maintenance for its tidal stream array technology. The scalable HydroWing is the largest tidal stream project in Wales to be successful in the U.K. government's latest Contracts for Difference round. The project was awarded 10 MW at the Morlais tidal energy site in Anglesey. The technology is a wing system enabling removal of sets of tidal energy turbines without needing to remove or work on the foundations. **ST**

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Maritime Assessment System



MAS is a web platform that enables evaluation of seafarers' professional knowledge in a large number of maritime topics using multiple-choice tests. The manager in charge of assessing seafarers will send invitations to take a test by email to applicants, who then can use a link in the email to log on to MAS and take the test assigned to them. Company Branch offices can be set up, and seafarers' test results will be grouped per branch office. SHIP IP Ltd.

GNSS Antenna

TW5394/TW5794 Smart GNSS Precise Heading Antenna is targeted to the burgeoning market for precise heading in unmanned vehicles and robots. It supports moving-base RTK precise heading and PPP-RTK high-precision location capability via L-Band. The integrated L-Band receiver allows operators to deploy an augmented position solution when operating outside of terrestrial communications range by receiving PPP-RTK augmentation directly from the satellite. Communication interface options include USB or RS-232 to the host system. Tallysman Wireless Inc.

Emissions Management

ClassNK ZETA (Zero Emission Transition Accelerator) is a tool for visualizing greenhouse gas (GHG) emissions and CII ratings of ships. It is based on data submitted to the ClassNK MRV Portal, a system for fuel consumption reporting in compliance with regulations such as IMO-DCS and EU-MRV. EU-ETS management and BIMCO CII

Clause vessel monitoring are two new features. ClassNK.

Liquid Bulk Management

UAB-Online offers a software solution that enables stakeholders in sea and inland shipping to digitize their handling operations, while Systems Navigator's Dropboard offers a planning and scheduling system for ports and liquid bulk terminals. This tech collaboration improves the entire liquid bulk process by providing integrated data that enables each stakeholder to make decisions based on real-time information. UAB-Online and Systems Navigator.

Ultrawide Display



NSX ULTRAWIDE is the world's first fully featured ultrawide marine display. Delivering all the benefits of dual screens in one place, NSX ULTRAWIDE is up to 63% wider than the NSX and provides a more streamlined and immersive experience. The latest C-MAP DISCOVER X charts are optimized specifically for NSX, and the NSX ULTRAWIDE display's high pixel density enables unprecedented levels of detail. The X-Gen charts also offer the new C-MAP Safety Alerts to automatically alert users to hazards up ahead. Simrad Yachting.

Deck Officer Training Assessment

ECDIS Training Assessment (ETA) platform helps optimize bridge team management and uphold best practices in vessel operations as an online continuous professional development tool for deck officers. The assessment, based on multiple-choice testing, enables crew members to identify any weaknesses or gaps in their ECDIS skills, enabling

self-evaluation and further learning on their personal or company devices. Anonymized at the crew user level, the digital tool also generates a consolidated fleet-wide report to help shipowners evaluate their deck officers' ECDIS proficiency and identify areas for training development and focus. NorthStandard.

Power Control Platform



IPS Professional is an advanced technology and propulsion platform for superyachts and commercial marine vessels that builds on the Inboard Performance System (IPS) and Electronic Vessel Control (EVC) technology, with unique enhancements for larger vessels. It enables a vessel to have up to eight power sources and includes perfectly matched software, services, and support, all integrated via proprietary EVC technology. AB Volvo Penta.

Hybrid Connector

A compact addition to the TrustLink Metal Shell (MS) series, the Hybrid seamlessly delivers power, data and communication all in one. Two optical passes enable the combination of single-mode and multi-mode fiber optics, along with four electrical contacts. Expanded optical beam technology ensures robust and secure connections. MacArtney A/S.

Gas, Flame Detection

iTrans 2 offers smart sensor capabilities that support an intelligent electronics platform. The fixed gas detector provides one or two points of detection from a single head for maximum flexibility, with both readings shown. Gas sensors are mountable directly to the transmitter or remotely. Teledyne Gas and Flame Detection.

Watertight Testing

Portascanner WATERTIGHT PLUS is a hand-held ultrasound watertight integrity tester for inspecting the watertightness and weather-tightness of hatch covers, watertight doors, and multi-cable transit seals in marine environments. It is a portable solution that can be used by a single operator to test a large number of different hatches and seals in one quick and easy inspection. Coltraco Ultrasonics.

Navigation Software Update

Actisense has had its NMEA gateway, NGX-1, sea-tested by Nobeltec to confirm full compatibility with TIMEZERO navigation software. The NGX-1 now supports both regular (115,200 bps) and high-speed (230,400 bps) data transfer rates for smoother integration. Nobeltec and Actisense (Active Research Ltd.).

Voyage Planning System

Planning Station Model PS-100 charts the fastest, safest routes with ease via tools such as route

creation, user charts and instant ship speed calculations. Users can maintain total situational awareness with overlay of real-time radar, AIS, weather data and more on a single screen. Furuno Electric Co. Ltd.

Heavy-Duty Grease

Rykon is a new overbased calcium sulfonate complex grease for heavy-duty and extreme-pressure marine applications. It delivers outstanding oxidation and thermal stability to protect equipment from failures. Rykon provides an alternative to lithium-based thickeners. Chevron Corp.

Naval Satellite Communications

ARC-M4-Block 1 is a 1.3-m multi-band terminal that provides access to X-band, MIL Ka-band and 2.5-GHz commercial Ka-band networks. Customers can utilize simultaneous X-band and Ka-band transmit and receive when operating on a WGS satellite, with resilient connectivity and throughput. Intellian Technologies Inc. **ST**

environmental monitoring

ASL Buys Metocean Buoys

ASL has acquired three Mesemar PBM-15 polyethylene buoys for a major metocean study the company is undertaking for a client project. These buoys are designed to the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) recommendations and are made from rotomolded virgin polyethylene, filled with closed-cell expanded polyurethane foam. They are suitable for deepwater sites, where extreme weather requires a more robust buoy for metocean data collection. They allow for adding an internal ballast weight for greater stability and high shock resistance.

Given successful recovery of the buoys this spring, ASL will add them to its lease pool. Applications include measuring directional waves offshore to support the development of wind farms and other marine re-

newable energy projects that require stable, reliable data collection.

The PBM-15 provides a robust platform suited to harsh conditions offshore, or a stable platform in more protected waterways. This platform can easily be configured to meet client monitoring needs and client-customized instrument packages. Examples of data collection include, but are not limited to: directional waves, wind, barometric pressure and custom solutions.

Study of Magma Beneath Hunga Tonga

Researchers, in a study published in *Science Advances*, have mapped the magma system that was the source of the massive Hunga underwater volcano eruption in Tonga two years ago, which triggered record-setting lightning and a mega tsunami. The research showed the merging of two magma chambers,

located at depths of 6,600 and 33,000 ft. (2 and 10 km), respectively, beneath the volcano.

The eruption released about 30 percent of the magma, resulting in a 2,800-ft.-deep (850-m) caldera.

The researchers theorized that magma from a gas-rich source welled up from deeper in the Earth's crust, adding to the intensity of the explosion.

Eruptible magma of up to 6.2 cubic mi. (26 cubic km) could remain in the two chambers beneath Hunga.

Coastal Blue Carbon Loss

Researchers from William & Mary's Virginia Institute of Marine Science have, for the first time, quantified the seaside erosion of backbarrier lagoon and peat deposits along Virginia's Atlantic Coast.

The study, published in *Nature Communications*, counters the traditional understanding about vegetated ecosystems dominating the coastal storage of carbon.

In addition, the study determines

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that the erosion and landward migration of the barrier islands along the Virginia Eastern Shore not only leads to an extremely rapid rate of carbon erosion—releasing 26.1 gigagrams of organic carbon annually—but also entails potential trouble for the continued ability of the entire system to function as a net sink for carbon.

The existing body of research focuses primarily on carbon storage in salt marshes, with an emphasis on the role of marsh plants.

This study finds that the sand, silt, and clay found at the bottom of unvegetated lagoons are less carbon-dense than marshes, but these elements play an outsize role in carbon storage—as indicated by their contribution of more than 80 percent of the carbon eroded along the beach and shore face of migrating barrier islands—because of their thickness and ubiquity across the landscape.

These new findings counter many common assumptions about carbon burial in coastal habitats, with implications for the assessment of blue carbon for research and carbon market purposes.

The study's findings are specific to open-ocean coastlines where transgression—the rapid retreat of the shoreline due to sea level rise and storms—is occurring.

The study highlights a critical issue: the impermanence of carbon stored in coastal environments.

While these ecosystems overall are efficient at sequestering carbon, their vulnerability to erosion and sea level rise means that their role as long-term carbon sinks may be overestimated.

This finding challenges the current understanding of coastal carbon budgets, which often focus on vegetated ecosystems and overlook nonvegetated lagoon sediments, such as those that are now being eroded along Virginia's barrier beaches.

The team's findings underscore the need for integrated coastal management strategies that consider the dynamic nature of these environments in response to climate change.

Seaweed as Climate Strategy

The Running Tide company is testing ways to send tons of seaweed to the bottom of the ocean to determine if submerging seaweed could be part of an effective strategy for mitigating climate change, *Eos* reported. When these algae photosynthesize, they turn carbon dioxide from the upper ocean into biomass. In some parts of the ocean, submerging that biomass below thousands of meters of water could

lock its carbon away for hundreds or even thousands of years, reducing carbon in the atmosphere.

Running Tide plans to release billions of baseball- to basketball-size seaweed-bearing buoys off the coast of Iceland. The buoys will wander the ocean for weeks or months as the seaweed grows, then naturally become waterlogged and sink. Eventually, the company hopes to sink megatons or even gigatons of biomass every year. **ST**



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Environmental Review of Sunrise Wind

The U.S. Bureau of Ocean Energy Management (BOEM) has completed its environmental review of the proposed Sunrise Wind energy project, which is located approximately 16.4 nautical mi. (nm) south of Martha's Vineyard, Massachusetts, approximately 26.5 nm east of Montauk, New York, and 14.5 nm from Block Island, Rhode Island. BOEM estimates the proposed 924-MW project will power more than 320,000 homes with clean, renewable energy.

The project plan submitted by Sunrise Wind LLC includes up to 94 wind turbine generators (WTGs) and their associated export cables. The onshore export cables, substation and grid connection is located in Holbrook, New York. The lease area covers approximately 86,823 acres.

In response to comments from government partners, key stakeholders and the public, and after considering project feasibility, BOEM developed a preferred alternative that includes fewer turbines (84 WTGs) to accommodate geotechnical feasibility of the project; reduce impacts to benthic habitat and Atlantic cod; and meet the energy needs of New York, Massachusetts and Rhode Island.

BOEM considers all alternatives in the development of its final decision and any conditions of approval.

BSEE Decision on Pacific OCS Offshore Energy Infrastructure Decom

To further protect the environment and the people who live near and enjoy the waters off the Southern California coast, the U.S. Bureau of Safety and Environmental Enforcement (BSEE) has published a record of decision (ROD) for the decommissioning of offshore energy infrastructure on the Pacific Outer Continental Shelf (OCS).

The decision provides a systemic pathway for the removal of obsolete offshore oil and gas infrastructure, following site-specific environmental assessments and approved decommissioning plans. It also ensures no oil and gas infrastructure will remain on the Pacific OCS seafloor that could interfere with navigation, commercial fisheries, and other current or future ocean users.

The ROD is the culmination of the programmatic environmental impact statement (PEIS) process for oil and gas decommissioning activities on the Pacific OCS. The final PEIS, published in October 2023, recommended the selection of the alternative of complete removal of all oil and gas equipment and facilities on the Pacific OCS. Twenty-three California oil and gas platforms, all installed between the late 1960s and 1990, are subject to eventual decommissioning.

The decision also documents that prior to decommissioning, a facility must undergo a site-specific National Environmental Policy Act review that will assess a variety of potential environmental impacts from infrastructure removal, including noise, water quality, air quality, cultural resources, marine life and more.

Senate Bills to Modernize US Weather Comms As Natural Disasters Increase

The U.S. Senate has unanimously passed NOAA's Weather Radio Modernization Act and the National Weather Service Communications Improvement Act, bipartisan bills aimed at modernizing the nation's weather communication and radio service as the country faces increasing weather disasters. The bills were introduced by Committee Chair Sen. Maria Cantwell (D-Wash.) and Ranking Member Sen. Ted Cruz (R-Texas) in May 2023. The bills now head to the U.S. House of Representatives.

The NOAA Weather Radio Modernization Act would: require upgrades to outdated weather radio technology to provide reliable and continuous weather and emergency alerts; expand radio coverage to rural areas that do not currently have access to the National Weather Radio alert system; increase National Weather Radio coverage to reach 98 to 99 percent of the United States population; and update National Weather Radio infrastructure and reduce reliance on copper wire transmissions, which are increasingly unreliable because copper is impacted by extreme temperature changes and severe weather.

The National Weather Service Communications Improvement Act would improve the National Weather Service's internal instant messaging system and implement a modern cloud system to accommodate more users and faster service.

NOAA's National Weather Service operates a nationwide network of public radio stations that broadcast weather warnings, forecasts and emergency information 24/7.

New DHS Arctic Center of Excellence

The U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T) has selected the University of Alaska to lead a consortium of U.S. academic institutions and other partners for the new AD-AC-ARCTIC Center of Excellence (COE) for Homeland Security in the Arctic. S&T will provide ADAC-ARCTIC with \$46 million over a 10-year cooperative agreement period.

The ADAC-ARCTIC COE will focus on critical research to prepare for and implement effective responses to challenges facing the Arctic domain.

The COE will lead a consortium of academic, industry, government, laboratory, and local and indigenous community partners to help provide access to rigorous research and education resources for DHS and broader homeland security stakeholders.

Working closely with DHS operational components, the ADAC-ARCTIC research portfolio will conduct research and develop multidisciplinary solutions focused on natural and man-made disasters, ice melt, and communications infrastructure. Vital insights gained from academic-led innovative research will help the department adapt operational missions to the complex, evolving Arctic domain.

In addition to conducting research, the ADAC-ARCTIC COE will lead training and education efforts for students, faculty, and the DHS workforce. **ST**

US Navy Assault Ship Christening

Hill's Ingalls Shipbuilding division has christened the U.S. Navy's third *America*-class amphibious assault ship, *Bougainville* (LHA-8). It is the second ship named in honor of Bougainville Island in the Solomons.

The name commemorates a successful World War II campaign enabled by close coordination among the U.S. Navy, the U.S. Marine Corps and U.S. allies. During the campaign, which lasted from 1943 to 1944, Allied forces secured a strategic airfield from Japanese forces in the northern Solomon Islands, helping the Allies break the Japanese stronghold in the South Pacific.

Ingalls has delivered 15 large-deck amphibious ships to the U.S. Navy. In addition to *Bougainville*, *Fallujah* (LHA-9) is also under construction.

Autonomous Maritime Response Vehicle Demo

Greensea IQ is the first to successfully complete a demonstration of a prototype Autonomous EOD Maritime Response Vehicle (AEMRV) for the Defense Innovation Unit (DIU) and U.S. Navy, according to the company. Utilizing the advanced capabilities of OPEN-SEA Edge, the system provides the computing resources needed to power edge perception systems and advanced autonomous behaviors of EOD Workspace, enabling human-in-the-loop autonomy and untethered command and control over the ROV platform.

The demonstration took place over several days in the open ocean off the coast of San Diego, featuring a fully integrated OPENSEA Edge-driven untethered ROV, a VideoRay MSS Defender modified by Greensea IQ to include batteries, and an acoustic modem. Real-world tasks were demonstrated by autonomously searching the environment for threats using acoustic communications.

The demonstration highlighted the autonomy system for EOD Workspace, Greensea IQ's robot-agnostic software platform for mine countermeasure and explosive ordnance disposal operations. It also showcased Safe C2, Greensea IQ's communication platform for long-range standoff command and control of autonomous ocean robots. Both are integrated within the OPENSEA Edge modular, hardware-agnostic system.

Construction Begins on German Navy Frigates

The F126 project has reached a milestone: the cutting of the first steel for the new multi-purpose frigates for the German Navy.

In June 2020, the equipment management organization of the Bundeswehr, BAAINBw, awarded the construction contract for the four F126 frigates to Damen Naval as head contractor, together with subcontractors Blohm+Voss and Thales. It is the largest shipbuilding project in the history of the German Navy, and the contract includes an option for two more frigates.

The ships will be built entirely in Germany at shipyards in Wolgast, Kiel and Hamburg. The steelwork and pre-assembly for the stern will take place at the Peene

shipyard in Wolgast, part of the NVL Group. The fore-ship will be built in Kiel, where it will be assembled with the stern then towed by sea to Blohm+Voss in Hamburg. Final outfitting, commissioning, testing and delivery, as well as outfitting of the onboard systems, will take place at Blohm+Voss in Hamburg. Delivery of the first ship is scheduled for 2028.

With a length of 166 m and displacement of up to 10,000 tonnes, the F126 frigates will be the largest in the German naval fleet. The multi-mission platforms can operate globally in all conditions, from the tropics to the polar regions.

New Facility for NOAA's Atlantic Ops

The U.S. Navy, on behalf of NOAA, has awarded \$146,778,932 to Skanska USA, from New York, to design and build a new NOAA facility on Naval Station Newport in Rhode Island. It will be the new home of NOAA's Marine Operations Center – Atlantic.

The facility will include a pier to accommodate four large vessels, a floating dock for smaller vessels, space for vessel repairs and parking, and a building for shoreside support and warehousing. Construction is anticipated to be completed by 2027.

NOAA's fleet of 15 research and survey ships are operated, managed, and maintained by NOAA Marine and Aviation Operations. NOAA's Atlantic fleet collects essential data to protect and manage marine resources, understand climate change, and produce nautical charts. **ST**

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Equinor Sells in Nigeria, Invests in Norway, US Gulf

Equinor and Chappal Energies have entered into an agreement for the sale of Equinor Nigeria Energy Co. (ENEC), which holds a 53.85 percent ownership in oil and gas lease OML 128, including the unitized 20.21 percent stake in the Agbami oil field, operated by Chevron. Agbami is Nigeria's largest deepwater field.

In Europe, Equinor has entered into an agreement to acquire Shell's equity in, and operatorship of, the Linnorm discovery in the Norwegian Sea. Equinor will acquire a 30 percent interest in the PL 255 covering the Linnorm discovery, conditional upon taking over the operatorship from A/S Norske Shell. The deal is expected to close during the first quarter of 2024. The Linnorm discovery is the largest undeveloped gas discovery on the Norwegian Continental Shelf.

Norway has awarded Equinor 39 new production licenses in 2024: 18 in the North Sea, 13 in the Norwegian Sea and eight in the Barents Sea. Equinor is the operator of 14 of the awarded licenses and a partner in 25.

In the U.S., Equinor and Shell Offshore Inc., a subsidiary of Shell plc, have reached the final investment decision for the Sparta deepwater development, located in the U.S. Gulf of Mexico (GOM). Equinor holds a 49 percent interest in the field. With a designed capacity of 100,000 barrels of oil equivalent per day at peak, Sparta is expected to begin production in 2028. Expected ultimate recoverable resources are currently estimated at above 250 million barrels. The development plan includes eight production wells tied back to a semisubmersible floating production unit.

FPSO Mooring Pre-Install

Jumbo Offshore Installation Contractors B.V. has been awarded a contract by MODEC Guyana Inc. for the pre-installation of the moor-

ing spread of the FPSO Errea Wittu, to be located offshore Guyana. The FPSO's name means "abundance," and it will have the capacity to store 2 million barrels of oil. It will produce approximately 250,000 barrels of oil per day and will have gas treatment capacity of 540 million cubic ft. per day and water injection capacity of 350,000 barrels per day.

The FPSO mooring system will be supplied by SOFEC Inc., a MODEC Group company, and comprises a total of 19 mooring legs.

Jumbo Offshore will use its heavy-lift construction vessel *Fairplayer* for the transport and installation of the 19 suction anchors, 8,800 m of chain sections, and 43,168 m of polyester rope, with the minimal amount of installation voyages, simplifying logistics.

Subsea Processing of CO₂-Rich Dense Gases

TechnipFMC has been awarded an integrated engineering, procurement, construction and Installation contract by Petrobras to deliver the Mero 3 HISEP project, which uses subsea processing to capture carbon dioxide-rich dense gases and inject them into the reservoir.

TechnipFMC, in partnership with Petrobras, has advanced the qualification of some of the core technologies needed to deliver the HISEP (High-Pressure Separation) process entirely subsea, several of which are proprietary and will be used in other subsea applications. These include gas separation systems and dense gas pumps that enable the injection of CO₂-rich dense gas.

The Mero 3 project in Brazil's pre-salt field will be the first to utilize Petrobras's patented HISEP process subsea. HISEP technologies enable the capture of CO₂-rich dense gases directly from the well stream, moving part of the separation process from the topside platform to the seafloor. In addition to reducing greenhouse gas emission intensity, HISEP technologies increase production capacity by debottlenecking the topside gas processing plant.

These technologies are supported by Petrobras and its partners in the Libra Consortium.

The contract covers the design, engineering, manufacture, and installation of subsea equipment, including manifolds, flexible and rigid pipes, umbilicals, power distribution, and life-of-field services.

Novel Subsea Power System Design for Offshore Wind

Aker Solutions has signed a front-end engineering and design (FEED) contract with the Marine Energy Test Centre (METCentre) in Norway to pilot new subsea power system technology that has the potential to significantly reduce the costs and complexity of offshore wind farms.

The project will see Aker Solutions provide new power transmission technology, Subsea Collector, for the METCentre's offshore wind test area, which today comprises two floating offshore wind turbines located 10 km off the southwestern coast of Karmøy, Norway.

The test area will expand to seven floating offshore wind turbines from 2026.

Subsea Collector provides an alternative solution to connect multiple wind turbines electrically in a star configuration instead of the traditional daisy chain pattern, allowing for more flexibility in offshore wind farm architecture and construction.

The design also allows for reduced cable length per turbine and park, as well as less vessel time and installation costs.

Initial findings support total cost savings on a 1-GW floating wind farm of up to 10 percent.

The main component parts of the Subsea Collector comprise a 66-kV wet mate connection system provided by Benestad and subsea switchgear with supervisory control and data acquisition by subsea power and automation alliance partner ABB.

Installation will be carried out by Windstaller Alliance, an alliance between Aker Solutions, DeepOcean and Solstad Offshore. Aker Solutions will also provide the static export cable to shore. **ST**

UKCS Energy Basin Digital Twin to Advance to Net Zero

FutureOn will provide access to its FieldTwin platform to support researchers aiming to deliver the world's first Smart Energy Basin as part of Net Zero Technology Centre's (NZTC) Data 4 Net Zero (D4NZ) project.

The company will donate licenses for its platform so those involved in the project can start to develop and combine data science, visualization and modeling tools to create a digital copy of the entire U.K. Continental Shelf (UKCS) energy basin. The completed model, which will become a resource for the energy sector, aims to enable enhanced decision making, increased visibility and streamlined operations as the industry progresses toward net zero.

Collaborating with partners, including the National Subsea Centre (NSC) and Robert Gordon University (RGU), FutureOn will support two key work packages as part of the D4NZ project: the Future Energy Tool and the Marine Environment Industrial Planning Application.

As part of the Marine Environment Industrial Planning Application project, the use of FieldTwin will provide a visualization of energy transition activities, such as offshore wind turbine placement, and a dynamic front-end graphical user interface for the algorithms and solutions developed by the research teams. The software will streamline the importation and visualization of multiple data sources, enabling comprehensive impact assessments of the seabed related to multi-user activity.

Complementing NSC's work across future climate modeling and fishing movement patterns, FieldTwin provides a visually intuitive means of evaluating the environmental impact of seabed activity and the co-location of maritime industry with future energy infrastructure. This has never been more critical as the Scottish Fishermen's Federation reports that more than half of Scottish fishing grounds

could be lost by 2050 due to the development of offshore renewables.

FieldTwin enables rapid scenario analysis to reflect uncertainty in co-location and consent requirements and provides valuable 3D context for stakeholder engagement to mitigate risks to both the maritime industry and project development.

To support the Future Energy Tool project, FieldTwin's intuitive features will enable users to design and model the entire subsea infrastructure and cabling associated with offshore energy production assets, facilitating the transition to eco-friendly energy solutions.

Eco River Ferries in Argentina

The Delta del Paraná in Argentina is the only river delta on Earth that empties into another river, creating 8,400 sq. mi. of wetlands. For the families who call the delta's 1,000 tiny islands home, the "lanchas colectivas," or vintage mahogany wood passenger ferries powered by old diesel engines, are the primary mode of transport, albeit at the cost of the delicate ecosystem.

The EcoLancha initiative, spearheaded by Delta Argentina Uruguay, the region's second-largest ferry operator, is set to revolutionize river transport. The *Delta Eco One*, a sleek prototype, is conducting test runs in the Paraná River and the Rio de la Plata. The 22-passenger aluminum vessel is powered by twin Torqeedo Cruise 12.0 motors and Power 48-5000 batteries, achieving a top speed of 9 kt. An 1,100-W roof solar panel powers the onboard equipment and air conditioning.

Consortium for Digital Ship Design Approval

SSI, offering software, services and expertise for shipbuilding, has joined the OCX Consortium to facilitate the digital exchange of vessel design data for class approval.

The OCX Consortium seeks to develop a common standard for data exchange that can be used by vessel designers and shipyards to provide classification societies with

3D design data independent of the software on which it was created. Using a standardized OCX format enables stakeholders to exchange all data and documentation concerning the asset design required for its verification and approval prior to the start of construction.

By creating conformity around data standards, the OCX approach simplifies the exchange of data between class and designers alike and promotes the use of 3D data that can be used across the life cycle of the vessel.

SSI ShipConstructor already supports creation of 3D vessel design models that will be available for export in a common file format. Class personnel can use the OCX model to complete their assessment of a design's viability and its compliance with class rules.

Digital Shipyard

HD Hyundai Heavy Industries, the world's largest shipyard, has announced a joint development project (JDP) with NAPA and CAD-MATIC, two providers of smart 3D maritime design, engineering and information management software, to accelerate the digital transformation of the shipbuilding industry.

The joint project will develop a next-generation ship design and information management solution, which will also embed a product life cycle management system.

The partnership will harness advanced 3D models and the latest developments in information management technology to create intelligent solutions to support the entire shipbuilding process.

This will help HD Hyundai Heavy Industries implement its vision of a "digital shipyard," where smart data and digital twins support optimal design and provide valuable data throughout a ship's life cycle.

The new partnership aims to increase shipbuilding efficiency, which will include shorter time schedules, lower costs, and higher quality in large and more complex shipbuilding projects via digitalization and a seamlessly integrated solution. **ST**

contracts

TechnipFMC, Newcastle, U.K., has been awarded an integrated engineering, procurement, construction, and installation contract to deliver the Mero 3 HISEP project, which uses subsea processing to capture carbon dioxide-rich dense gases and then inject them into the reservoir. Petrobras.

Tracerco, Billingham, U.K., will deploy its pipeline inspection technology, Discovery, as part of an agreement between three of America's largest oil and gas companies, all of which operate different riser pipes on multiple platforms in the Gulf of Mexico. The project is part of the first life extension permit granted for these assets. Undisclosed.

Ulstein Verft, Ulsteinvik, Norway, has been contracted for two new construction service operation vessels (CSOVs), with two additional options. The CSOVs will be equipped with a hybrid battery propulsion system and prepared for green methanol fuel to enable carbon-neutral operations. Undisclosed.

Strategic Marine, Singapore, has signed a shipbuilding contract for a fourth-generation fast crew boat to enter the Bruneian market for long-term operations. The vessel will be future-proofed for a gyro stabilizer, optional installation of a motion-compensated gangway and a hybrid system. Bruneian Amarco Sdn Bhd (AMARCO).

Stena RoRo, Gothenburg, Sweden, has placed an order for another RoPax-class E-Flexer vessel from a Chinese shipyard. The vessel will be delivered in the first quarter of 2026 to Corsica Linea and will operate between Marseille and Corsica. CMI Jinling (Weihai).

Wood, Houston, Texas, has secured a contract for detailed engineering of the topsides facilities on Woodside Energy's Trion floating production unit in Mexican waters of the

Gulf of Mexico. HD Hyundai Heavy Industries.

KVH Industries Inc., Middletown, Rhode Island, has made a distribution partnership agreement with a low Earth orbit (LEO) connectivity provider to offer LEO connectivity services supporting terminals for commercial and leisure vessels. Eutelsat OneWeb.

Force Technology, Brøndby, Denmark, will deliver its innovative SimFlex4 AR solution as part of an extensive upgrade for a Queensland-based maritime simulation and training facility. Smartship Australia.

BAR Technologies, Shanghai, China, has entered into a partnership agreement to wholly manage and oversee the production of BAR Technologies' WindWings, enabling auxiliary wind propulsion, in China. CM Energy Tech. **ST**

meetings

APRIL

April 8-10—Interspill, London, U.K. www.interspill.org.

April 9-11—Undersea Defence Technology, London, U.K. www.udt-global.com.

April 14-18—OCEANS 2024 Singapore, Singapore. <https://singapore24.oceansconference.org>.

April 16-18—Subsea Technology Eastern Mediterranean, Limassol, Cyprus. www.subseatechnologyconference.com.

April 17-19—NOIA Annual Meeting, Washington, D.C. www.noia.org.

MAY

May 6-9—Offshore Technology Conference, Houston, Texas. 2024. otcnet.org.

May 20-23—MTS Buoy Workshop, Sequim, Washington. www.mtsociety.org/buoy-workshop.

May 21-24—International Harbour Masters Congress, Tanger Med, Morocco. <https://harbourmaster.org/events/international-harbour-masters-association-14th-biennial-international-congress>.

May 27-30—Canadian Hydrographic Conference, St. John's, Canada. www.chc2024.org.

JUNE

June 4-6—Capitol Hill Ocean Week, Washington, D.C. <https://marinesanctuary.org/chow-2024>.

June 6—Offshore Carbon Capture & Storage Symposium, Houston, Texas. www.noia.org.

June 10—Speed@Seawork, Cowes, U.K. <https://seawork.com/about-speed>.

June 11-13—Seawork, Southampton, U.K. www.seawork.com.

SEPTEMBER

September 11-12—Oil Spill India, New Delhi, India. <https://oilspillindia.org>.

September 17-19—South America Offshore Wind, Rio de Janeiro, Brazil.

September 23-26—OCEANS 2024 Halifax, Halifax, Canada. <https://halifax24.oceansconference.org>.

NOVEMBER

November 4-7—EURONAVAL, Paris-Nord Villepinte, France. www.euronaval.fr.

November 7-10—Europort, Rotterdam, Netherlands. www.europort.nl.

November 19-21—Marine Renewables Canada Conference, Halifax, Canada. <https://marinerenewablesconference.ca>.

November 19-21—MAST Australia, Adelaide, Australia. mastconfex.org.

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

Supply Chain Companies Must Adapt to Climate-Related Risks—Jon Davis

Jon Davis leads the Everstream Analytics applied meteorology and climate team as chief meteorologist. He heads forecasting operations for energy, agriculture and supply chain logistics. Davis has a track record in leadership at companies such as Citigroup and Chesapeake Energy. With over 35 years of experience, he is a foremost expert on the impact of weather/climate on global commodities and business.



Extreme weather is becoming distressingly commonplace. From 1980 to 1999, for example, there were 3,656 extreme weather events worldwide, according to the United Nations. From 2000 to 2019, there were 6,681; nearly one per day, on average. The total costs from extreme events over those two 20-year periods went from \$1.63 trillion to \$2.97 trillion; a rise of 83 percent.

In the 1980s, weather events in the U.S. resulting in more than \$1 billion in inflation-adjusted damages happened about once every four months; today, the rate is every three weeks. Hurricanes, droughts, floods, severe winter storms and wildfires, among other events, contribute to the total.

Rising global temperatures are at the root of these events, with air and ocean temperatures undergoing unprecedented spikes. 2023 was officially declared the hottest year on record, and a strong El Niño in early 2024 was expected to cause further disruptions in weather patterns.

Companies in the supply chain, which are experiencing a growing number of delivery delays and cancellations as a result of the weather, need to rethink their approach to managing weather-related risk.

Different weather events affect the supply chain in various ways. The Panama Canal, for example, is experiencing its worst drought since 1950. The lack of water has forced

canal operators to restrict the height of drafts in the canal's locks and limit the number of vessels that can pass through each day. The longer wait times could force very large tanker carriers (VLTCs) to avoid the canal starting this year and opt for other routes via the Cape of Good Hope or the Suez Canal.

Winter storms also cause significant delays and cancellations in the supply chain. For example, a widespread deep freeze in Texas from February 11 to 20, 2021 caused an average delivery delay of almost two days. And the Christmas freeze in Buffalo, New York, from December 21 to 26, 2022 caused a 40 percent decrease in shipments.

The Canada wildfires in June 2023 not only degraded air quality and visibility in New York, Chicago and other cities, but also delayed deliveries in those cities by up to two days. In certain areas, the reduced visibility due to wildfire smoke caused a 50 to 75 percent decrease in the number of shipments.

In addition, flooding and heavy rains last spring caused transportation disruptions in California, Nevada and Utah, resulting in a 20 to 30 percent decrease in shipments in the affected areas.

Hurricanes cause some of the biggest supply chain disruptions. Hurricane Ian's initial landfall in Florida in late September 2022 caused a 75 percent drop in shipments compared with the previous weeks. Completed deliveries were delayed an average of 2.5 days.

The pace of weather disruptions is expected to continue in 2024, with record-high global ocean temperatures increasing the strength of storms and rising air temperatures expanding their reach. And extreme shifts in precipitation patterns are expected to increase the incidence of both droughts and flooding.

It's clear that companies can no longer rely on historical weather patterns in planning their shipment

lanes and calculating how long deliveries will take. Nor can they wait for a weather event to arrive before responding because a delayed response increases the costs.

Leading companies are changing strategy accordingly. Everstream analyzed nearly 5 million U.S. shipments during the same three-month period in 2019 and 2023 and found that 3 percent of shipments had shifted to shipment lanes with lower variability in delivery times (a combination of geographic route, transport mode and carrier). Three percent might not sound like a lot, but that's more than 70,000 shipments that moved to more reliable routes.

The choice of a more expensive route can depend on the risks of a missed delivery. One Everstream Analytics' client, for example, supplies mission-critical materials to a manufacturer that could have to shut down its plant if supplies aren't delivered on time. Using a less reliable lane could risk damaging or even ending that business relationship. The supplier decided to move away from lower-cost, higher-variance ground trucking and opt for more expensive but lower-variance air freight.

Not all shipments, of course, will warrant a higher-cost option—although they still are subject to delays and cancellations from severe weather. Companies can manage that risk by opting for predictions that are informed by data on climate change, such as applied meteorology, which uses weather and climate information to address problems facing commercial operations. Advanced approaches can provide context, detect trends and offer actionable insights to help companies identify lower-variance and lower-risk options.

With severe weather events becoming more frequent, supply chain companies need to be more proactive in planning how to deal with disruptions. **ST**

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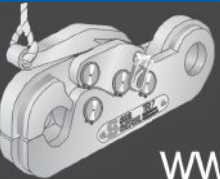
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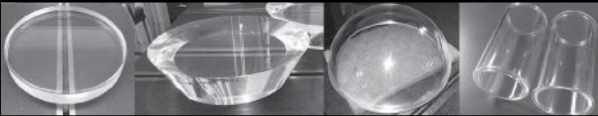
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