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MTS marine technology society

PILING
IRM ROBOTS

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Technology

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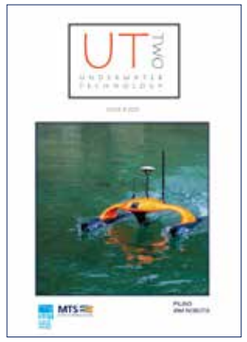
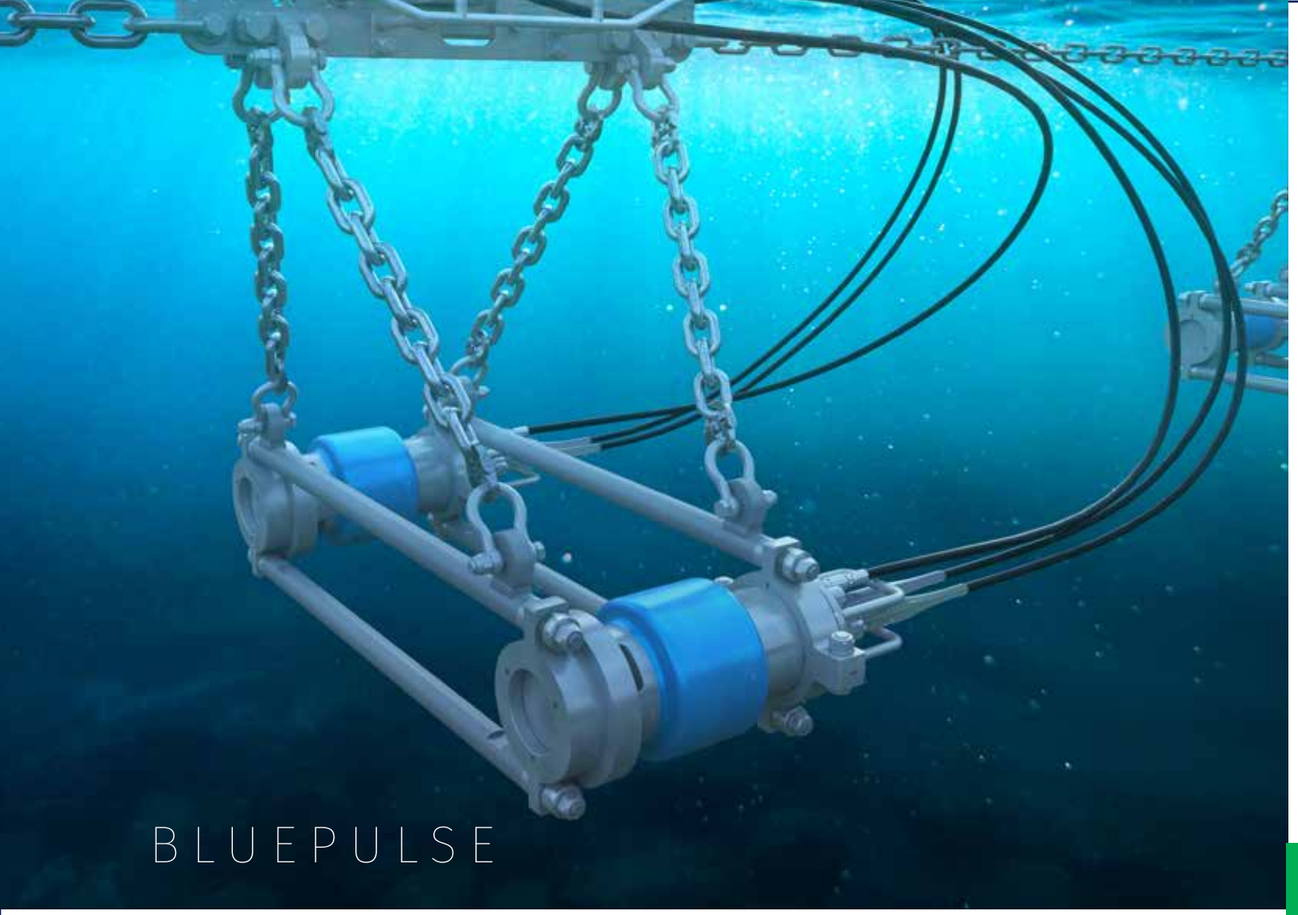


Cover: EvoLogics' Sonobot 5



BLUEPULSE

Sercel has launched Bluepulse, a purpose-built acoustic source designed to help protect marine wildlife from high-frequency emissions, while maintaining highly accurate and reliable results for seismic acquisition.

Bluepulse is compatible with all existing peripherals making it an easy choice for surveys requiring limited highfrequency source emissions.

Through intelligent engineering and design, existing G-Source and G-Source II units can be easily upgraded with Bluepulse technology, saving customers up to 40% on the cost of fleet conversions.

The new units offer available range options in three different casings, twenty-two different volumes and with two frequency limits (100Hz and 200Hz) to comply with regulatory environmental standards and restrictions. The source array can thus be configured and customised to meet exacting survey requirements.

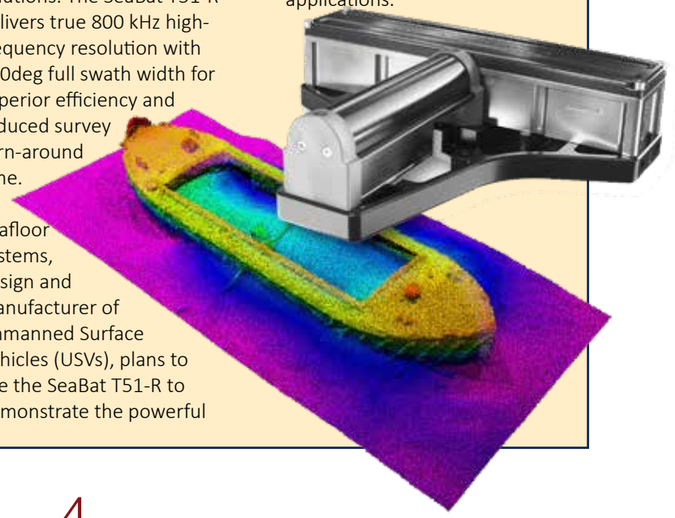
SEAFLOOR ORDERS SEABAT T51-R

Seafloor Systems has purchased Teledyne RESON's newest sonar, the SeaBat T51-R Multibeam Echosounder.

The SeaBat T51-R is the latest addition to Teledyne RESON's class-leading portfolio of SeaBat marine survey solutions. The SeaBat T51-R delivers true 800 kHz high-frequency resolution with 150deg full swath width for superior efficiency and reduced survey turn-around time.

Seafloor Systems, design and manufacturer of Unmanned Surface Vehicles (USVs), plans to use the SeaBat T51-R to demonstrate the powerful shallow water survey capability of their two largest USVs, the EchoBoat-240 and HydroCat-180.

Seafloor Systems is a long-time agent, customer and integrator of Teledyne sonars for a wide array of remote survey applications.



VESTERHAY

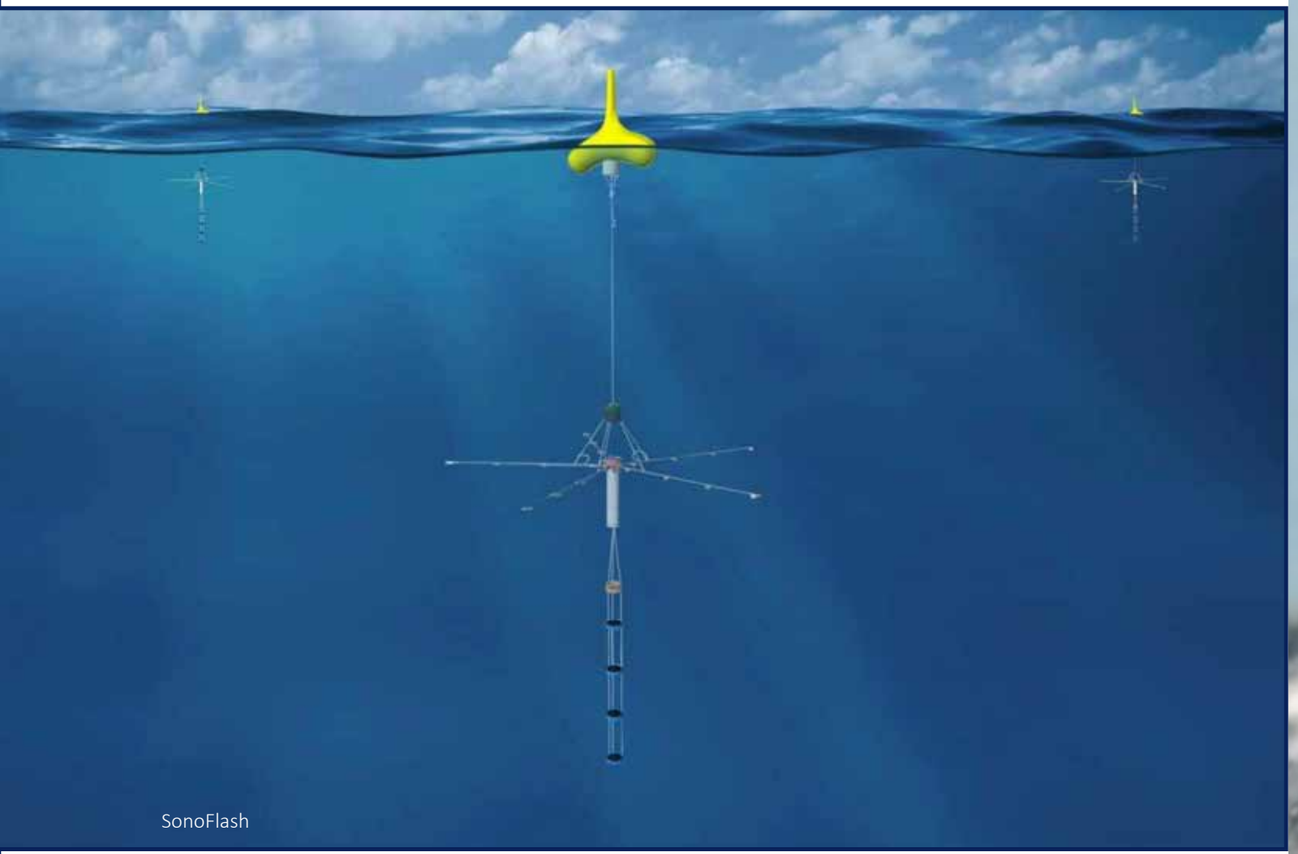
Jan De Nul will transport and install a total of 41, 8.4 MW wind turbines for use on the Vesterhav Nord & Syd the offshore wind farm in Denmark.Jan De Both offshore wind farms are located in the Eastern part of the Danish North Sea.

Nul's jack-up installation vessel Vole au vent will be mobilised for this installation project.

The contract between Jan De Nul and Vattenfall includes the design, engineering, manufacturing, procurement and delivery of the Sea-Fastening. Jan De Nul will also be responsible for the engineering of the RAMS for the marine operations related to the wind turbine installation, as well as the transport and installation of the 41 Siemens Gamesa wind turbines with the jack-up installation vessel *Vole au vent*.

41 wind turbines

SOLOFLASH



SonoFlash

Originally unveiled in 2018, Thales' new-generation anti-submarine sonobuoy SonoFlash has now been adopted by the French navy.

Today's sonobuoys are either passive or active. By contrast, the SonoFlash buoy offers the best of both modes, combining a powerful, optimised low-frequency transmitter with a high-directivity passive receiver.

With the combination of these two capabilities, and the added advantage of long endurance, the SonoFlash buoy is suitable for a wide array of deployment scenarios.

The SonoFlash buoy offers high tactical flexibility and opens up promising new opportunities for multistatic operation. Coupled with the FLASH dipping sonar, for example, the SonoFlash buoy enables an aircraft to expand its coverage area and respond with greater agility to evasive manoeuvres by a submarine.

Thanks to its digitised signal and optimal communication range, the SonoFlash buoy data can be readily exploited by any piloted or remotely piloted aircraft, naval vessel or shore centre equipped with a sonobuoy processing system.

It will be delivered to the Navy from 2025 and could be available to all types of unmanned platforms.

NEWS

SEAGULL MANIFOLD INSTALLATION

Neptune Energy has completed the installation of the manifold and umbilical for its UK Central North Sea Seagull project.

TechnipFMC, working under the Neptune Energy Alliance Agreement, undertook the construction activities on the development from the *CSV Deep Star* vessel. The activities included the installation of the 350t Seagull manifold, the pull-in and installation of the 17 kms control umbilical between the bp-operated ETAP platform and manifold, and the installation of a Wye Structure and associated operations.

Seagull is a high pressure, high temperature (HPHT) development, on UK licence P1622, Block 22/29C, from a new four-slot manifold, 17km south of the ETAP Central Processing Facility (CPF). Proved plus probable gross reserves are estimated at 50 million boe.

The development will be tied back to the ETAP CPF, partially using existing subsea infrastructure. New infrastructure requirements have been minimised by reuse of the Egret manifold tie-in point on the Heron cluster pipeline system and wash water line.

● TechnipFMC has completed the acquisition of Magma Global (Magma), the leading provider of composite pipe technology to support the Energy Transition.

TechnipFMC originally acquired an interest in Magma in 2018, combining its strong history in flexible pipe technology with Magma's advanced composite capabilities to develop a disruptive composite pipe solution for the traditional and new energy industries. Magma technology enables the manufacture of Thermoplastic Composite Pipe (TCP) using Polyether Ether Ketone (PEEK) polymer, which is highly resistant to corrosive compounds, such as CO_2. When combined with TechnipFMC's flexible pipe technology, this forms a Hybrid Flexible Pipe (HFP) that will be deployed in the Brazilian pre-salt fields.

Manufactured by a fully automated robotic system, PEEK TCP will also be a critical enabler for both the carbon capture, utilization and storage (CCUS) and hydrogen transportation markets, and particularly in offshore applications.

Justin Rounce, Executive Vice President and Chief Technology Officer at TechnipFMC, said: "This technology will also be a key enabler for offshore Energy Transition developments, such as transportation of green hydrogen, as pioneered by TechnipFMC's Deep Purple offshore energy system, and transportation of CO2 utilizing an integrated carbon transportation and storage solution."

COLUMBUS ONLINE

Serica Energy has achieved first production has been achieved from Columbus. The well was opened into the Arran subsea system and hydrocarbons from the C1z development well started flowing on [24] November.

The comingled Arran and Columbus production streams are now being exported to the Shearwater platform for processing and onward export to the gas and liquid sales points.

Columbus is expected to be producing at its potential by Early December.

TRITECH UPDATED USBL TRACKING SYSTEM

Tritech has released the new MicronNav 200 UltraShort Base Line (USBL) system. The MicronNav 200 is the latest generation of USBL tracking systems from Tritech and is designed for small underwater vehicles and diver supporting applications.

The updated system benefits from a number of new features including data transfer interleaved with USBL positioning, software integration into Google MapsTM, improved magnetic compass accuracy by 1deg and compatibility with the new Micron Battery Modem.

The system comprises a subsea Micron Modem or Micron Battery Modem, a surface USBL transducer with integral magnetic compass and pitch/roll sensors, a surface MicronNav 200 interface hub and bespoke operating software that can be controlled by a topside PC computer or laptop.

The MicronNav 200 uses spread spectrum acoustic technology which provides a robust method for communication between the dunking transducers and the vehicle Modem.

The USBL transducer can provide 180-degree hemispherical coverage below the transducer, allowing vehicle tracking in very shallow water. Omni-directional coverage is provided by the Micron Modem and Micron Battery Modem.

Both the USBL transducer and the Micron Modem/Battery Modem can be commanded to switch from positioning mode to data transfer mode, allowing the same hardware to be used to establish an underwater acoustic communications link.

The MicronNav 200 also offers a new look and more robust casing for the MicronNav 200 hub as well as a smaller, more accurate USBL head that is easy to calibrate and deploy.

MicronNav 200 USBL system

BRAZIL

C-Kore Systems recently signed a contract with TechnipFMC in Brazil for delivery of their sub-sea testing tools for the Mero 1 project, in which Petrobras (40%) acts as Operator of the Libra Consortium, formed by the companies Shel, Total, CNODC and CNOOC (10%), with Pré-sal Petróleo as the manager of the Production Sharing Contract.

The C-Kore tools will be used to perform the subsea electrical verification of the umbilicals after installation.

C-Kore's subsea testing tools are used by operators and installation contractors around the world on both installation campaigns and fault-finding operations. The Cable Monitor unit confirms the insulation resistance and continuity of the electrical lines while the Subsea TDR unit localises anomalies within 20cm. With C-Kore's automated units and on-line training, no extra offshore support is needed to run the equipment.

C-Kore's monitoring units

iXblue has launched the UmiX Series of inertial measurement units (IMU) based on Fibre-Optic Gyroscope (FOG) technology. It brings the high performance and reliability to a miniaturised, ITAR-free device. It is the most compact high performance inertial measurement unit in the world.

"Intensive developments, and decades-long experience with FOG technology has led to the breakthrough that is UmiX," said a representative. "By integrating the performance of a fully fledged FOG based system onto a compact, ready to use OEM IMU, the UmiX Series reaches unprecedented level of performance for its size.

UmiX Series' performance allows it to be used for a wide range of demanding applications, including navigation, high-end stabilisation and pointing within airborne and land sensor payloads or weapons,

iXblue's UmIx

for georeferencing and targeting purposes. In addition, thanks to its compact size, iXblue's latest IMU can easily be mounted on all types of platforms.

UmiX Series has an in-run bias of 0.03°/h and a bias residual of 0.2°/h (1σ), making it fit in both tactical and short-term navigation classes of IMUs. UmiX also comes equipped with iXblue's iXal-S vibrating quartz accelerometers, which have a dynamic range of ~100g max, with navigation grade bias and scale factor, mostly unrivalled in such class of IMU.

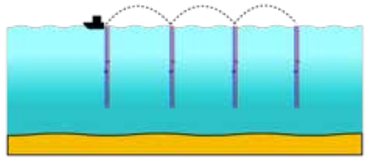
This high degree of performance fits in a Ø88.9 × H75 mm hermetically sealed enclosure with a low nominal power consumption of 4W, 7W at peak. The solid-state nature of FOG sensors makes UmiX Series a robust and reliable IMU with a Mean Time Between Failure (MTBF) of 120,000 hours.

The first model in the UmiX Series: UmiX U5 is a dual use system was launched recently while UmiX U9, a military-grade version of the IMU, qualified to MIL environments will be available in 2022.

UNDERWAY WINCH

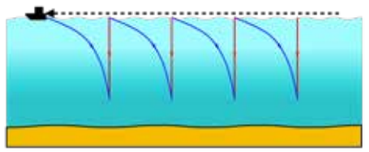
Sound velocity profiling is a used to measures the speed of sound throughout the column of water.

Surveys are often carried out from a floating vessel. The vessel will stop at a each survey station, allowing it to lower a sound velocity probe, suspended on a wire, to the required target depth. It is then winched back on board after which, the vessel sails to the next survey point.



Conventional SVP Survey

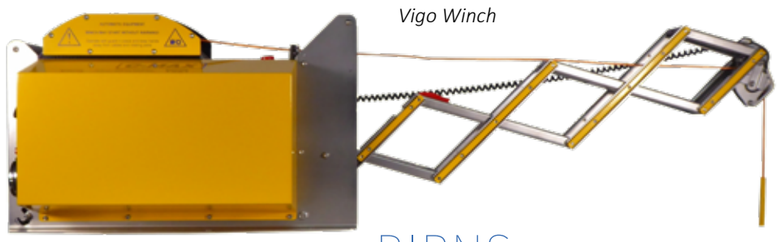
A more efficient method of surveying is perhaps Underway Sound velocity profiling. In this the survey is carried out while the vessel maintains a continuous speed and course.



Underway Survey

C-Max has launched a new Vigo profiling winch which simplifies the task of repeatedly deploying a sound velocity profiler or other instrument, eliminating the need for an operator to manually collect profiles from the rear deck. It can also be configured for use from unmanned surface vessels (USVs).

"We designed the system to operate primarily with a Valeport SWiFT SVP, with an option to use a RapidSV profiler for deeper water work," said a spokesman. "Both these profilers feature Bluetooth data transmission, allowing automatic retrieval of the recorded profile."



Vigo Winch

WINCH

The winch is a self-contained system, requiring only single phase 230v power, and a wired ethernet connection to operate. A boom carrying the line sheave that can be extended over the stern for deployment of the profiler, or retracted for access to the sheave an profiler on completion of the series of casts and therefore, no swivelling platform is needed.

The winch incorporates several features designed to make its installation easier and its operation simpler and more reliable. These features include:-
a) Integrated control and operation software that runs on the winch and is accessed through a web browser.
b) Built-in GPS receiver.
d) A line-limit tube and switch mechanism to alert the operating software that the profiler is very close to the line sheave.
e) Audible and visual warnings prior to any automatic movement.

BIRNS

BIRNS has introduced the new, Millennium Interconnect Catalogue. BIRNS says that its 6km-rated Millennium series provides quantifiable superior performance characteristics.

The catalogue details major enhancements, such as a significant expansion of pin configurations, direct links to downloadable configuration drawings, and comprehensive, strategic additions to product selection and part numbering guides, as well as highly detailed specification tools to walk the user through the selection process.

Birns connectors

For example, it features a new, highly detailed RF section, which highlights BIRNS' recent breakthroughs with low losses and better VSWR, for example: -.32dB loss and 1.17 VSWR at 1.5GHz. It also outlines the company's revolutionary new 1V series of 75Ω coax contacts with the same footprint as a 50Ω.

It also looks at details the company's ultra-high speed data rates—cable assemblies with data transfer rates of 9.4+/- 0.1 Gigabits per second, and incredible optical performance data, including the industry's lowest insertion and return losses. It also includes a range of rigorous qualification and testing capabilities, such as 48 hour+ continuous testing of electro-optical cable assemblies at 6km in a controlled 2°C (±1°C) environment.

BAS DRIX

The British Antarctic Survey (BAS), has added an iXblue DriX Uncrewed Surface Vessel (USV) to its advanced robotic survey means.

Deployed from polar research stations and from the British polar research ship RRS Sir David Attenborough, the DriX USV will help BAS conduct multi-disciplinary sciences such as surveying the impact of ocean currents on melting ice flow or mapping the seabed in the polar regions.

A versatile platform able to deploy various sensors with multiple missions' capabilities, the DriX USV will be equipped with CDT, ACDP, MBES and MetOcean sensors and will help BAS capture data from the extreme polar environments.

iAHC

Seaqualize has successfully completed offshore trials for its *Delta600* inline Active Heave Compensator (iAHC). Together with testing partners Van Oord and nautical research institute MARIN, the offshore lifting tool was tested for fixed-to-floating, floating-to-fixed and floating-to-floating transfers of 300mT loads.

One perennial problem with offshore lifting is working in harsh conditions where the entire crane vessel moves rhythmically up and down with the waves. These undulations are transferred to the load through vertical steel line in the form of a sudden slack/pull action. This becomes particularly challenging if the load has a large horizontal surface area. It provides greater resistance to upward drag can impose unacceptable strain on the line.

Cancelling the natural pitch of waves and keeping the load motionless requires heave compensation technology. It essentially works by filtering out the wave movements. Doing so immediately enlarges the scope of operations by expanding the weather window.

There are two types.
Passive Heave Compensation (PHC) systems involves anchoring a line directly or indirectly to the seabed. This is commonly found on semisubmersibles. The anchored line provides a fixed datum irrespective of the crane rising and falling.

The alternative is Active Heave Compensation (AHC). This is enabled by using the data from vessel's motion reference unit (MRU) to detect vessel displacement (heave, pitch and roll). A programmable logic control (PLC)unit on the winch system then applies advanced algorithms to calculate how much line needs to be taken in or paid out to compensate for this calculated movement.

EXTERNAL HEAVE COMPENSATION
This heave compensation is often carried out onboard, sometimes actually on the winch itself. An alternative to that is an external system.

Such a device would be located not in the vessel, but within the subsea wire assembly itself. In the past, external heave compensation systems have been based on one or more cylinders charged with nitrogen to a specified gas pretension before launch. The soft, dampening spring essentially acts as a shock absorber, reducing the motion and line tensions.

The cylinder is normally tuned to the object's load and mass, water depth, sea conditions, lowering-line properties (eg, mass and stiffness), the properties of the object being lowered, the vessel's characteristics and the desired acceleration at depth

These are usually used for sub-sea and splash zone operations to reduce the dynamic shocks on the crane. Those tools are not able to hold a load still, or actively steer the position of a load in-air. When set-incorrectly, they could even cause resonance when used for lifts above the water line.

Recently, some PHC's have been made adjustable (Adjustable PHC), which allows the user to switch between two states: a weak and a stiff spring.

Seaqualize lifting system

This helps with lifting, but does allow for full position control.

DELTA600

Around 2 years ago, Seaqualize announced that it had developed the world's first iAHC, the Delta600 – a tool specifically designed for heavy lift, in-air load control. The tool can balance and transfer loads of up to 600mT in mid-air, while the barge or crane vessel is heaving up and down in heavy seas of up to Hs2.5m.

Seaqualize has now successfully completed offshore trials.

The testing has been carried out in association with partners Van Oord and nautical research institute MARIN.

The offshore lifting tool was tested for fixed-to-floating, floating-to-fixed and floating-to-floating transfers of 300mT loads.

This functionality is of great benefit during offshore wind turbine installations or when lifting delicate loads to and from floating supply vessels or barges. By engaging the Delta, the operational time for installation contractors greatly increases, especially in the hard-to-work winter, autumn or spring seasons.

It offers contractors greater planning flexibility, and lifting crew a higher level of control, safety and efficiency. With the worldwide increase in demand in the offshore wind sector, increased capacity and efficiency is greatly needed. In the wider offshore community, perfectly controlled lifts are equally essential to safe, timely and efficient operations.

KEY TEST RESULTS

During the tests, several very gentle set downs and quick liftoffs have been performed. MARIN observed that the tool is able to control the load within an envelope of 5cm, with minimal accelerations and dynamic crane forces.

Liftoffs where performed with a solid 90% of the load already in the hook of the crane before liftoff, while still fully compensating all waves. This significantly reduces impact loads on the load, crane and rigging and results in a controlled and stable liftoff.

Finally, the tool showed off its "follow-mode", where the test weight could actively match all heave motions of the target vessel, to further minimize set-down impact for floating to floating set downs.

Next steps:
Seaqualize plan to follow this up with the Delta1000 600mT. The company says that offshore wind turbine sizes are growing explosively, thus requiring ever bigger lifting tools for still very delicate components.

Currently Seaqualize is designing the next version, the Delta1000, equipped for all next generation wind turbine components.

Further conceptual improvements include the addition of single lifting points for quick-connect systems, and smart controlled tugger winches for supreme control in the horizontal plane.

At the same time, the company will further develop its offshore operational support capabilities, by deploying the Delta600 in the field.

SUBSEA
MICROPILES

Houlder has been working with foundations specialists Subsea Micropiles in adapting land-based micropiling technology to provide offshore wind foundation and anchor solutions. Houlder is providing marine operations and engineering support to accelerate market development.

A micropile is a small-diameter (<300mm) friction pile that is bored or drilled, possibly at an angle to accommodate axial and lateral loads. They are connected via couplings to achieve the desired pile length. This can vary from 6 to 20m depending on soil/ rock type and strength. Once installed, central reinforcement bar and cement grout allows for load transfer into the bearing soil or rock.

The group effect of micropiles remain a central aspect of geotechnical engineering research. The ultimate holding capacity of a pile group is much greater compared with the load of a single pile multiplied by the number installed. The interaction between the anchor template or 'pile cap', and synergistic effects increases lateral resistance.

INSTALLATION
For subsea applications, a robotic seabed drill is used to install and

grout micropile anchor foundations. Mimicking the root piles of trees, the group response of multiple piles represents a highly efficient distributed anchor solution, capable of withstanding significant axial and horizontal loads with a stable and consistent connection point.

"Since the 1950s Micropiling has grown to become a widely used foundation and anchoring solution for onshore infrastructure, as a proven low-noise and low-impact approach to soil interventions," said Subsea Micropiles CEO , Derek Roberson. "The more recent development of robotic seabed drilling equipment for geotechnical survey is a key enabling technology which provides an ideal means of installing drilled micropiles for a wide range of applications.

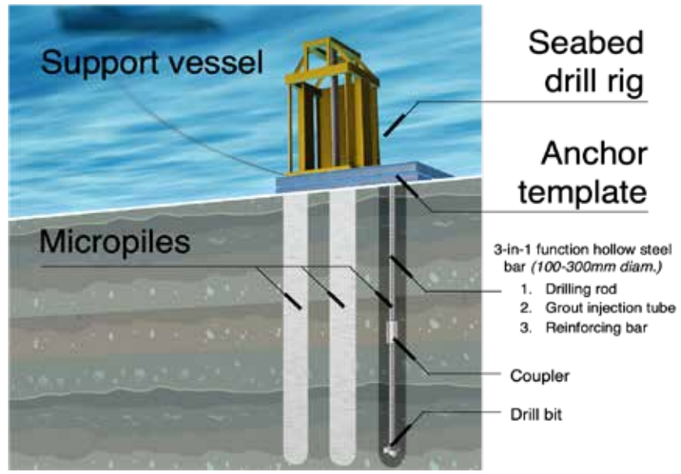
"In addition to representing a more materially efficient solution (ie, less steel = less cost), one of the most significant factors in the cost of offshore construction is the hire of the installation vessel and ancillary equipment."

The company says that using smaller, local and more available support vessels can avoid the high daily rates and mobilisation costs that are typical for many projects.

"Another potential savings arises from the fact that a micropile installations can be adapted to soil conditions as found," said Robertson. "Pile refusals and project delays are avoided as micropiles can be driven through rock obstructions which in turn, may contribute to the ultimate anchor holding capacity.

Micropiles have an extensive track record (onshore) of good performance in the full range of soil and rock conditions, including soft to stiff clays, sands and gravels. For subsea anchors, design parameters (e.g. size, number and length of piles) can be adjusted for conditions as found.

Seabed micropiling systems



TORPEDO PILES

Torpedo pile for umbilicals

Deep water moorings are particularly expensive. Around 20 years ago, Petrobras carried out research into a new anchor technology designed to reduce such costs. Called Torpedo piles, these anchors are simple to fabricate and easy to install, using a single vessel.

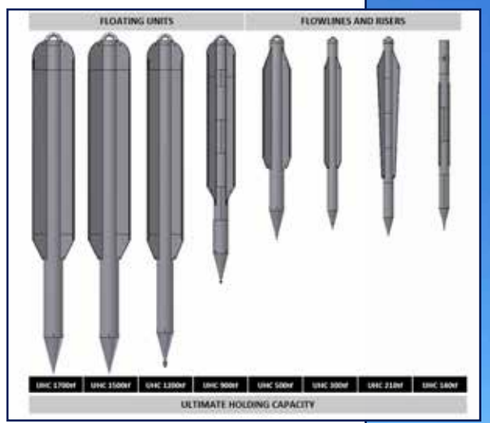
Since then, over 2000 torpedo piles have been successfully installed in Brazilian offshore projects.

Torpedo anchor manufacturer Anchortech Solutions, a subsidiary of DELP, has been responsible for delivering 700 piles. In addition, the company has 250 piles currently under production for Brazilian projects such as Mero 2, Búzios 5, Marlim 1, Marlim 2, Itapu, Parque das Baleias.

Torpedo piles are gravity-type anchors installed as projectiles that can penetrate the sea floor. The dart-shaped anchor is a tubular steel column with four vertical fins (flukes) on its upper section. It is filled with scrap chain and concrete.

At the top is a cast steel padeye for connection with the mooring shackle. This allows a mooring load in any direction. At launch, a mooring line is attached at the top of the anchor, with enough slack as not to impede penetration.

The torpedo anchors are lowered to depth of between



30 and 165m above the seabed depending on the lithology, and then released, allowing it to free-fall. The resulting kinetic energy is sufficient to drive the pile 20m–30m down into normally consolidated clay, providing the required vertical-load resistance.

The size of the torpedo pile depends on a variety of factors such as soil characteristic and the design loads.

For umbilicals and flowlines, Anchortech produce smaller piles with a smaller holding capacity. A holding capacity of, say, 200-250 kips may increase to 500 kips after 10 days.

Since the first designs, the piles themselves have not really changed although there have been minor adjustments in order to allow handling and overboarding.

There have, however, been Improvements to the electronic monitoring device – an instrumented system to read and validate the installation parameters.

Overboarding a torpedo pile

Torpedo pile design

SAFE WAVE

in June 2021: RTsys deployed its COMET-300 AUV around WAVEGEM.

At the start of the year, a €1.5 million project was launched to address environmental concerns of emerging wave energy technologies. Called SafeWAVE , it was funded by European Maritime and Fisheries Fund (EMFF) programme of the European Union.

The project SafeWAVE – Streamlining the assessment of environmental effects of wave energy is led by AZTI, includes a multidisciplinary team of partners bringing togTN, AZTI, RTSYS, UCC and Ecole Centrale) and data managers (Hidromod), aiming to involve the wider community of ocean energy key stakeholders from across Portugal, Spain, France, and Ireland.

Several tests are being carried out on different MRE demonstrators deployed in European countries. These tests aim to improve our understanding of the effects of these structures in their environment and to develop solutions to remedy any negative effects.

Since 2019, the SEM-REV has been hosting GEPS Techno's prototype, WAVEGEM, a hybrid platform for wave energy recovery. The environmental monitoring operations of the SafeWAVE project are conducted around this platform. In order to collect data, SEM-REV has joined forces with RTsys, a company specialised in underwater acoustics and robotics and partner in the SafeWAVE project.

During this operation, in June 2021: RTsys deployed its COMET-300 AUV around WAVEGEM. This two men portable and very enduring autonomous underwater vehicle (more than 20 hours) was equipped with a dual frequency Side Scan Sonar (Klein UUV3500) to collect the widest covering area of data on the underwater landscape all around WAVEGEM.

A second vehicle have also been deployedduring the measurement compaign : the NEMOSENS µAUV which is much more compact and light (0,9m / less than 9kg) but nevertheless with a high ratio power/ autonomy (10 hours endurance, speed from 3 to 8 knots). NEMOSENS micro AUV equipped with an experimental acoustic sensor had enabled to collect acoustic data for noise monitoring purpose.

WIND SEMI

Equinor has revealed its preferred floating wind foundation design for full-scale gigawatt (GW) commercial floating offshore wind. The Wind Semi, a semisubmersible wind turbine foundation, has been designed with flexibility, specifically to allow for fabrication and assembly based on local supply chain capabilities.

"We are ready to develop the next generation, large-scale commercial floating offshore wind. By leveraging our twenty years of floating offshore wind experience and innovations, we plan to develop GW-size floating projects in one single phase," Sonja C. Indrebø, Equinor's vice president of Floating Offshore Wind.

"At 1GW, this project would be over 30 times bigger than Hywind Scotland, the UK's and Equinor's first floating project and have the potential to not only position Scotland as a leader in deep water technology, but also create opportunities for both existing suppliers and new entrants to the offshore wind sector".

Since it began production in 2017, Hywind Scotland has consistently achieved a higher capacity factor than other UK wind farms, demonstrating the true potential of floating offshore wind.

The Wind Semi has several features making it particularly suited for harsh waters, and solutions that can maximise the opportunities for the Scottish supply chain:

Increased dependability: By introducing a passive ballast system, the Wind Semi has a simple substructure design, reducing the risk of system failure and the amount of maintenance needed.

Simpler, more robust design: A flat plate design that is free from bracings, heave plates and complicated nodes that are prone to fatigue cracking. With a harbour draught of less than 10 m, the Wind Semi's turbine integration can be assembled at most industrialised ports.

Wind Semi

TECHNIP FMC ACCELERATES ORBITAL

TechnipFMC has signed a Memorandum of Understanding with Orbital Marine Power, to jointly collaborate in tidal energy to accelerate the global commercialisation of Orbital's technology and deliver the first commercial scale floating tidal field.

Orbital's unique floating turbine, the most powerful in the world to date, can harness underwater currents generated by tides, which can then be converted into electricity and exported to shore.

Because of its predictability, tidal energy offers a reliable and consistent form of renewable energy. Tidal energy has the ability to make a cost-effective contribution to net zero transitions around the world at a utility scale.

When combined with TechnipFMC's integrated approach, industrialization capabilities and project management expertise, Orbital's technology can be scaled-up to meet the increasing demand for renewable energy and significantly lower the cost of delivering tidal energy.

There is currently one gigawatt of consented tidal sites in the United Kingdom.

Orbital Tidao Power

OSCILLA POWER

Oscilla Power recently loaded its new wave energy system, the Triton-C vessel onto a barge for Kaneohe, Hawaii. When deployed, it will generate clean, renewable power from the Pacific waves.

This is the first commercial-scale demonstration of the Triton technology, which has been under development for more than a decade, supported by the State of Washington, the U.S. Department of Energy and private funders.

Oscilla Power Triton-C

WAVES POWER

Ocean waves represent a huge untapped large-scale renewable energy resources.

Over 70% of the earth's surface is covered with water. The energy contained within waves has the potential to produce up to 80 000TWh of electricity per year - sufficient to meet global energy demand five times over.

Ocean waves are generated by wind passing over the surface of the sea and because waves originate a long way from shore, computer models of wave propagation allow accurate forecasting of incoming waves up to five days in advance.

In comparison with wind or solar energy, therefore, it is easier to predict how much and when, energy can be generated. Because the peaks and troughs of wave energy are not in sync with those from wind or solar, combining the power from these sources acts to even out their combined output, leading a more predictable and steady renewable energy mix.

TRITON AND TRITON C

Oscilla Power has designed two wave energy systems based on the same multi-mode architecture and geometry –the Triton and the Triton-C.

The Triton-C is a 100 kW rated power system designed for remote or isolated coastal communities, or small facilities It is intended to be competitive in locations that are off-grid and diesel powered.

Conversely, the Triton is a much larger scale 1 MW rated power system that is designed to be installed in large arrays to provide utility-scale power. This version will be about three times bigger in size than the Triton-C. The first utility-scale demonstration of the Triton is planned to be near a port in Southern India.

HOW IT WORKS

At its core, the Triton technology employs a highly efficient arrangement known as a *multi-mode point absorber*. It consists of a geometrically optimised surface float connected to a ring-shaped, vertically asymmetric heave plate by three taut, flexible tendons. Using this arrangement, the Triton has four key advantages over other wave energy converters.

Unlike most conventional wave energy devices, Triton's surface float can extract energy from ocean waves in all six degrees of freedom (heave, pitch, surge, roll and yaw) allowing for increased energy capture across a wider range of ocean conditions.

Triton's projected performance is based on extensive numerical modelling validated by experimental tank testing at a range of scales from 1:10 to 1:50 scale. This performance has been independently validated through 1:20 physical model testing conducted by the US Department of Energy.

This method provides high efficiency energy conversion. Triton uses three independent hydrostatic, hydraulic drivetrains to provide a highly reliable, flexible and efficient conversion of mechanical energy to electricity.

The hydraulic drivetrain has been engineered to effectively manage the highly variable power flows and dissipate peak energy as needed. This enables the power variability to be significantly reduced, allowing a more constant power output.

The electrical output of the three independent drivetrains is then aggregated and supercapacitor storage is used to further reduce the power variability and increase the power quality. This substantially mitigates one of the greatest challenges with wave energy devices.

Triton C units

Every wave energy converter has an optimal force/displacement profile for maximum mechanical energy capture in each wave condition. Triton's drivetrain is fully controllable and will permit arbitrary control profiles to be applied. Importantly, the drivetrain has been developed around conventional commercial components with proven track record.

To achieve this and provide optimum efficiency, each drivetrain involves a number of duplicated stages that can be independently selected and combined so at to precisely match the wave environment. This provides improved redundancy and allows the components to work at their optimum power bands for any conditions and provide maximum part-load efficiency. Oscilla has said it has demonstrated an overall mean conversion efficiency from wave to wire of greater than 75% and expect to increase this in future.

A third advantage is the low cost of installation. Triton uses flexible tendons to connect the float to the reaction ring. This allows the use of very simple and lower-cost installation strategies than other Wave energy devices. The Triton will be towed to deployment sites with the heave plate hard mated to the bottom of the surface float.

After mooring the surface float, the system is lowered to the deployment depth using temporary on-board winches, as shown in the figure below. The winches are employed in reverse for heave plate recovery.

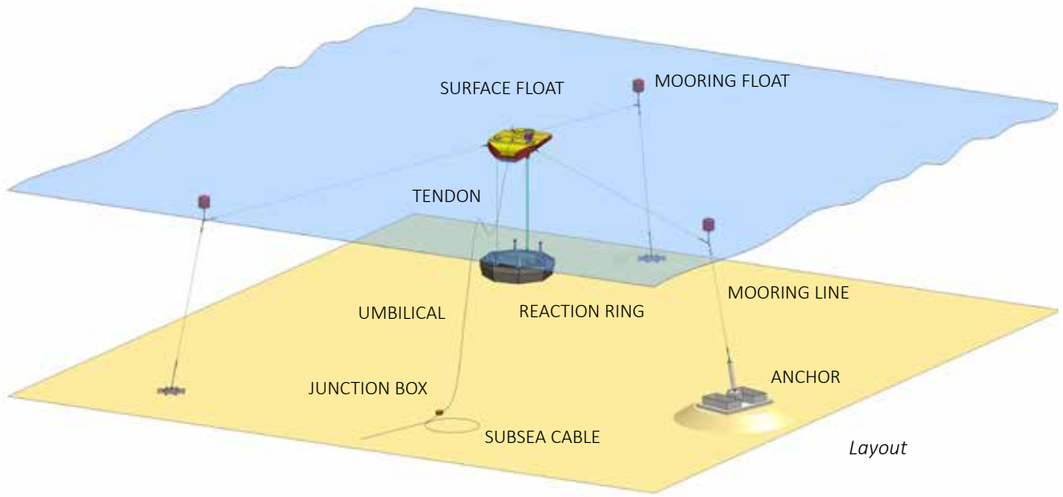
These self-deployment and self-recovery functions remove the need for specialized vessels or heavy lift equipment during installation and recovery operations. Only a regular tug is required to tow the system and supply hydraulic power for winch operations.

The use of a transport configuration allows towing and installation in higher sea states, increasing the duration of acceptable weather windows and thus reducing vessel standby costs. Importantly, this simplicity allows for systems to be recovered for major overhauls quickly and at lower cos

The last advantage is the survivability.

Triton has been engineered from the start to be survivable in extreme ocean conditions. Locations with the highest energy also tend to experience the most severe extremes and so a viable survival strategy is critical.

In the Triton this is accomplished through a number of approaches. As weather conditions increase, the float is detuned by adding water ballast, altering the natural periods of the system and lowering the reserve buoyancy.



Layout

A CLEAN BREAK

ARGONÓT

SymbyTech is presently carrying out trials of its Argonót underwater drone that it has developed to provide inspection, intervention, and asset integrity management services.

When vessels cross waterways, it is common for biofouling to adhere to the hulls. The accumulated mass adds weight to the ship, increasing the frictional resistance. This leads to the propulsion systems becoming less efficient and the result is a rise in fuel consumption and emissions.

Drydocking to remove the fouling and to inspect is expensive. The industry traditionally prefers an Underwater Inspection in Lieu of Dry-Docking (UWILD) solution under the guidance of class and flag. UWILD facilitates the inspection of the submerged part of the hull while the vessel is operational to reduce downtime, additional travel time and cost.

For many years, the scope was performed by divers while ROVs have conducted the work with reduced risk to personnel. Both methods, however, are inefficient, unstable platforms that produce poor deliverables. UWILD conducted by dive teams takes about nine times longer than ROV.

Closely analysing the problem, South African company, SymbyTech, developed a system that can crawl along the hull using a magnetic traction arrangement to adhere to the hull.

Grant du Toit says, “SymbyTech developed Argonót to have a very high weather tolerance, higher than any ROV. As our traction is magnetic, Argonót is always close to the hull surface with near 100% stability.”

"Some hull cleaners remove the biofouling and allow it to gravitate into the harbour. The problem is that in doing so, it deposits fauna and flora species that establish in zones with no natural predators, jeopardising local environments.

“As Argonót moves along the hull, however, it cleans and inspects. The removed biofouling is fed into a filtration system via a hose where it is strained, filtered, treated, and returned.”

“The multi-tool platform can also carry specialist cameras, sensors, and intervention tooling. We use Artificial Intelligence technologies such as Machine Learning (ML), Machine Vision (MV), VSLAM, and photogrammetry.”

CRAB

SeaRobotics has been awarded a US Navy Small Business Innovation Research (SBIR) Phase I contract to develop a CRawling Amphibious Breacher (CRAB), an amphibious robotic crawler capable of proofing shoreline assault lanes and neutralising explosive/ on-explosive obstacles to ensure clear landing zones for Armed Forces personnel.

Phase I includes developing a cost-effective means of demonstrating how SeaRobotics’ proposed CRAB concept could operate in SWARM formation to specifically disarm various mine types—buried and submerged—in surf and beach zones.

As such, CRABS are required to be rapidly deployable from a surface or subsurface marine asset in coastal waters (up to 400m from shore) in depths up 12m (or approximately 40ft.)

One of the other defined Key Performance Parameters is the capacity to drop GPS markers to accurately identify optimal assault lanes, made visible via a shared operating system that plots landing paths on a driver display aboard a command Amphibious Combat Vehicle (ACV).

PHASE II of the Navy SBIR process is to manufacture a scaled prototype to demonstrate system performance and test the required range of operational parameters.

Results will inform the necessary refinements for a Phase III development plan and ultimately transition the proposed technology to Marine Corps use.

ROBOTIC SYSTEMS

Accelerating the development of robotics and autonomous systems (RAS) will be a significant enabler to reaching Net Zero, according to new research from the Offshore Renewable Energy (ORE) Catapult.

ORE Catapult highlights that by 2050, the global robotics market in the energy sector will be worth £8.4bn. With its high-growth forecasts, wind energy (onshore and offshore) is expected to open up a new robotics frontier that will be valued at £1.3bn by 2030, increasing to £3.5bn by 2050. Meanwhile, declining production will see the oil and gas market’s robotics market peak at £5bn in 2030, before reducing to £3.3bn by 2050.

The UK is targeting a seven-fold increase in offshore wind capacity by 2050, and with this growth comes the need for more operations and maintenance (O&M) activity. With windfarms set to be located in deeper, more remote, often challenging waters, securing safe access for humans will be a significant industry challenge.

Accelerating and investing in the development of advanced RAS will mitigate this risk and means robots will handle not only routine maintenance tasks, but also improve pre-emptive maintenance, which will extend the life of components and turbines at sea, supporting the industry’s waste reduction drive.

ORE Catapult’s report highlights that the global wind O&M market (both onshore and offshore) will grow from £51bn in 2030 to £120bn in 2050. While robotics will take a share of this prize, these technologies will also combine with data and digital solutions and other forms of O&M to increase that market share.

ORE Catapult supports many robotic technologies that have already shown promise for the offshore wind sector, including robots that can crawl turbine blades to conduct repair and maintenance, robots that can perform subsea cleaning and inspection tasks, and uncrewed vessels that provide a power and communication hub for remotely operated and autonomous underwater vehicles.

Wind turbine inspection robot, Amphibian

MAG ROVER

SONOMATIC RECENTLY USED ITS MODIFIED MAG ROVER TOOL TO ASSESS CORROSION RISKS FOR A LARGE SUBSEA OIL STORAGE TANK LOCATED ON THE SEABED

Seabed storage tanks are a characteristic feature of some oil developments. One such structure, standing in water depths in excess of 130m, essentially consists of a 45m^2 steel box with each of its 6 faces representing a potential corrosion threat. Recently, operator wanted information on the tank's integrity to feed into its studies for the field of life extension and continuation use.

Over the years, inspection company Sonomatic has built up a range of subsea inspection crawlers, deployed from a workclass- ROV, designed to carry out automated ultrasonic subsea inspection. Using magnetic wheels, these move along steel structures taking thickness measurements.

In order for the ultrasonic tools to work, they require very close contact with the metal surface. The preliminary visual inspection showed a build-up of marine growth and seabed silt on all external surfaces. This growth would have to be removed before the ROV inspection programme started to scan the walls and identify areas of interest.

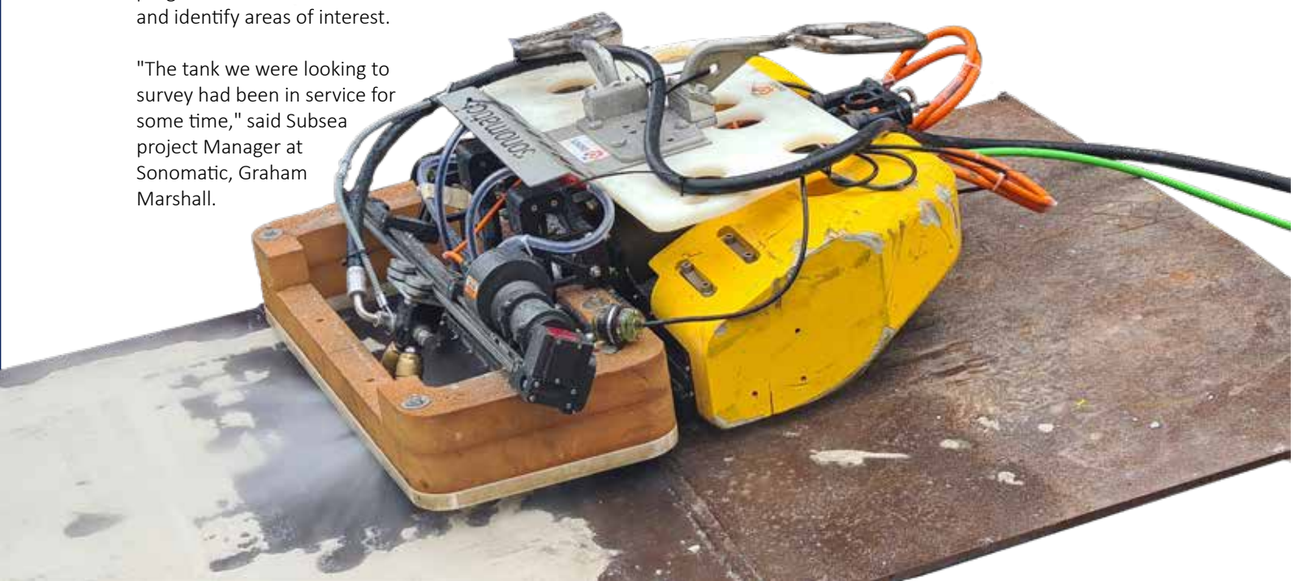
"The tank we were looking to survey had been in service for some time," said Subsea project Manager at Sonomatic, Graham Marshall.

"There wasn't a vast amount of marine growth and certainly not enough to the add the expense of a gritting spread, but parts did require removing.

"The operator enquired whether we could supply a cleaning mechanism that could be attached to the front of the MagRover ultrasonic tool, that would allow simultaneous cleaning operations in and phased array inspection in one pass, to reduces costs and inspection time.

"This was actually something that we were independently looking at because in the past, cleaning equipment operated by another subcontractor had failed and this left us with the inability to collect data."

Closely coupling a jet washer cleaner to the Mag Rover would allow only critical areas to be measured while leaving everything else undisturbed. What made this particular operation challenging, however, was that the bottom of the tank was supported 1m above the seabed on a support frame.



While the MagRover could normally be deployed via a power umbilical from the ROV, the crawler would mean it having to be fed under the tank using an extended umbilical.

"All our tools are developed at our head office in Warrington and the design team," said Marshall. "They set about developing a jetting system powerful enough to remove debris but small enough to de mounted on the front of the MAG-Rover. It had to be completed with limited time due to vessel operational timeframes.

"This was challenging from an engineering viewpoint as it was important to ensure the debris from the marine growth removal could not block the scanner workings, by getting stuck under the ultrasonic probe travelling behind the cleaning nozzles.

The jets produced a pressure of 0- 520 bar. In operation, the maximum pressure in this project was not used but the designers wanted a reserve for hard elements and future applications.
"The 120 element ultrasonic scanning system measures a path 256mm, but

Mag Rover

we had to clean a wider band for the magnetic wheels. In total, the system needed to clean a 600mm track.

"In the measurement programme, it was not necessary to scan the entire tank surface but just selected runs, although some specified a track length extending up to 109.5m Obstructions on the top of tank caused navigational restrictions on longer runs."

The MAG-Rover successfully carried out the cleaning and inspection campaign on all four sides, and the top and bottom faces of the tank. Cameras and sensors from MAG-Rover provided 360deg visual and navigational feedback so that the vehicle could avoid anodes and other obstructions when operating 20+ meters away from the ROV.

Sonomatic carried out the work as a series of long, full length (45m) scan runs on top and sides of the tank. The extended vehicle had to avoid hard protruded sections, especially at the top of the tank. It carried out five runs of although some were difficult to complete due to obstructions.

"We knew the tank base would present challenges and this proved so," said Marshall. "With the one metre gap between the sea bed and the base of the tank, we were limited on were we could place the ROV. The combined scanner had to be travel into the centre of the tank on its own , linked by a long umbilical up to 25m away.

"Because of the high risks, we carried out runs in a safe and tightly controlled way. In total, we collected over 700m of data on all faces of the tank. The accurate phased array corrosion mapping data sets satisfied the CRA requirements and showed that the tank will be fit for purpose for several years to come."

Mag Rover

BladeBUG

BladeBUG is a novel inspection crawler for examining wind turbine blades. Many crawlers on the market use a wheel or track for locomotion. This design, however, employs a biomimetic action similar to that of an insect which allows the 'platform' to move across curved surfaces.

"Turbine blades are very robust but the conditions can be severe," said Chris Cieslak, CEO and Founder of BladeBUG. "In normal operation, the leading edge comes under a considerable amount of stress with parts spinning at around 200mph. Over time, the impact of raindrops, ice or snow particles on the surface can become a focus for microcracking or even leading edge erosion.

Being the tallest structures in the sea, turbine blades are often subject to lighting strikes. As a consequence, a low resistance pathway runs through the blades to earth. Sometimes, these systems fail or work loose with potentially catastrophic consequences.

"Blade health and integrity is understandably paramount hence wind turbine structures are routinely inspected. Aerial drones are particularly adept at this. They fly around the turbine blade taking photos that can be stitched together to look for damage or defects. These can pinpoint problems and pinpoint areas requiring a closer and more detailed visual analysis, however sometimes, the extent of the damage is not always visible."

At present, visual inspections are carried out by trained rope access technicians who abseil down the vertical blade surface, however this presents a number of challenges and risks which have led to it being banned in some countries. Needless to say, improved safety and further autonomy are two key drivers that have accelerated technology across the industry opening up new opportunities for technology developers like BladeBUG to develop innovative solutions.

BladeBug on a turbine blade

Semi-automated cleaning and inspection devices are commonly used in the offshore industry but often, these either have to be attached to a frame or can wander across flat surfaces (eg ship's hulls) by means of a vortex suction system or a magnetic attractor to keep the crawler firmly against the surface.

The problem facing wind turbine inspection is that the blades are made from composites and not metal which rules out the use of magnets. One of the many challenges is the varying curved aerodynamic surfaces of wind turbine blades which immediately obviates traditional suction crawlers that require a flat plane or fixed radius to maintain the seal.

The novel solution provided by BladeBUG is a crawler that emulates the walking action of an insect. It essentially consists of six articulated legs with a vacuum nozzle positioned at the end of each leg enabling it to adhere to the curved surface of the blade at any point along the length.

"When walking over the curved planar surface, the crawler lifts the leg up and moves it to the new position before re-engaging the suction," said Cieslak. "Each leg has its own vacuum generation pump providing greater redundancy and improved reliability.

"The BladeBUG platform is very manoeuvrable and can use its body as an end effector given it has 6 degrees of freedom. During the locomotion, any three legs can move in the air while the other three remaining remain in contact with the stable base."

So how long would it take to scan a turbine blade?

"We wouldn't scan an entire blade," continued," Cieslak. "A visual inspection can be executed by aerial drones in about an hour, and we couldn't or wouldn't want to compete with that.

"The BladeBUG platform is designed to be deployed after the visual inspection is completed, to perform a much closer visual analysis of the targets generated from the aerial drone inspection. "Importantly, the platform has a modular payload bay that can house an impressive 8kg of equipment. It may be used to accommodate a range of other inspection tools such as ultrasonic non destructive testing equipment to identify potential damage below the surface that cannot be detected from a photograph.

"This can reveal, for example, if the internal layers have become de-bonded or the surface layer has become detached from the shear webs that keep the two blade surfaces apart. The blades are thoroughly scanned before leaving the factory, however defects may occur between then and the end of the installation process.

DEFECTS

Any defects should be assessed and treated early as they can be detrimental to the condition and overall integrity of the blade. Taking no action could result in poor performance, costly repairs or even catastrophic failure if left untreated.

The modular payload bay has the ability to integrate a range of bespoke or standardised industry tools to perform early stage repairs such as sanding and potentially filling operations to prevent cracks in the outer surface from escalating.

"Initially we plan to use off the shelf tools- exactly the same that rope access technicians currently use to perform their inspections/repairs, but we have begun to develop our own bespoke, possibly automated designs in the future. One example, could be surface scanners that look for levels of erosion and possibly reapply surface coatings "

"At present," said Cieslak " inspection is typically performed by rope access technicians that access the blades by using ropes to abseil down the structure. We see the BladeBUG platform being used as a collaborative robot under the direction and control of up skilled technicans trained to operate our technology. Transferring these repetitive, tedious and mundane activities to be performed by our platforms will enable technicians to work with greater safety and efficiency in extreme environments.

ROV

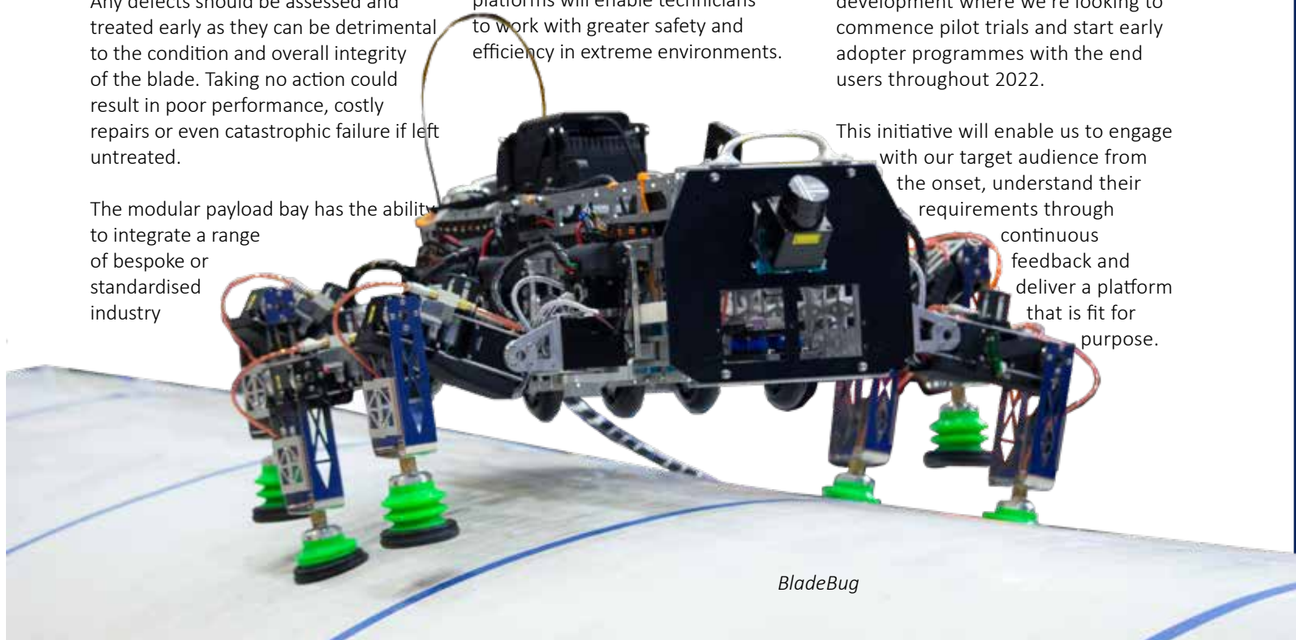
It is important to recognise that the bugs are not autonomous, but connected by a tether using a design adapted from those that have been used on aerial drones for years. These modified high strength cables are very small very lightweight and highly durable.

The advantage of permanent power is that the BladeBUG platform has an indefinite runtime and can supply sufficient resource to run mechanical devices. The tether also transfers valuable and in the event of power failure acts as a vital safety line to support recovery.

"The current prototype we are presently trialling has a length and span of about 600mm,"said Cieslak. "It is not tiny but not massive, easily fitting inside a rugged peli case making it convenient to transport. The body size however, could be easily changed to accommodate different equipment.

"We're now at a stage in our development where we're looking to commence pilot trials and start early adopter programmes with the end users throughout 2022.

This initiative will enable us to engage with our target audience from the onset, understand their requirements through continuous feedback and deliver a platform that is fit for purpose.



BladeBug

BladeBUG

IRM

NORTEK BRINGS NAVIGATION ACCURACY TO TANK INSPECTIONS

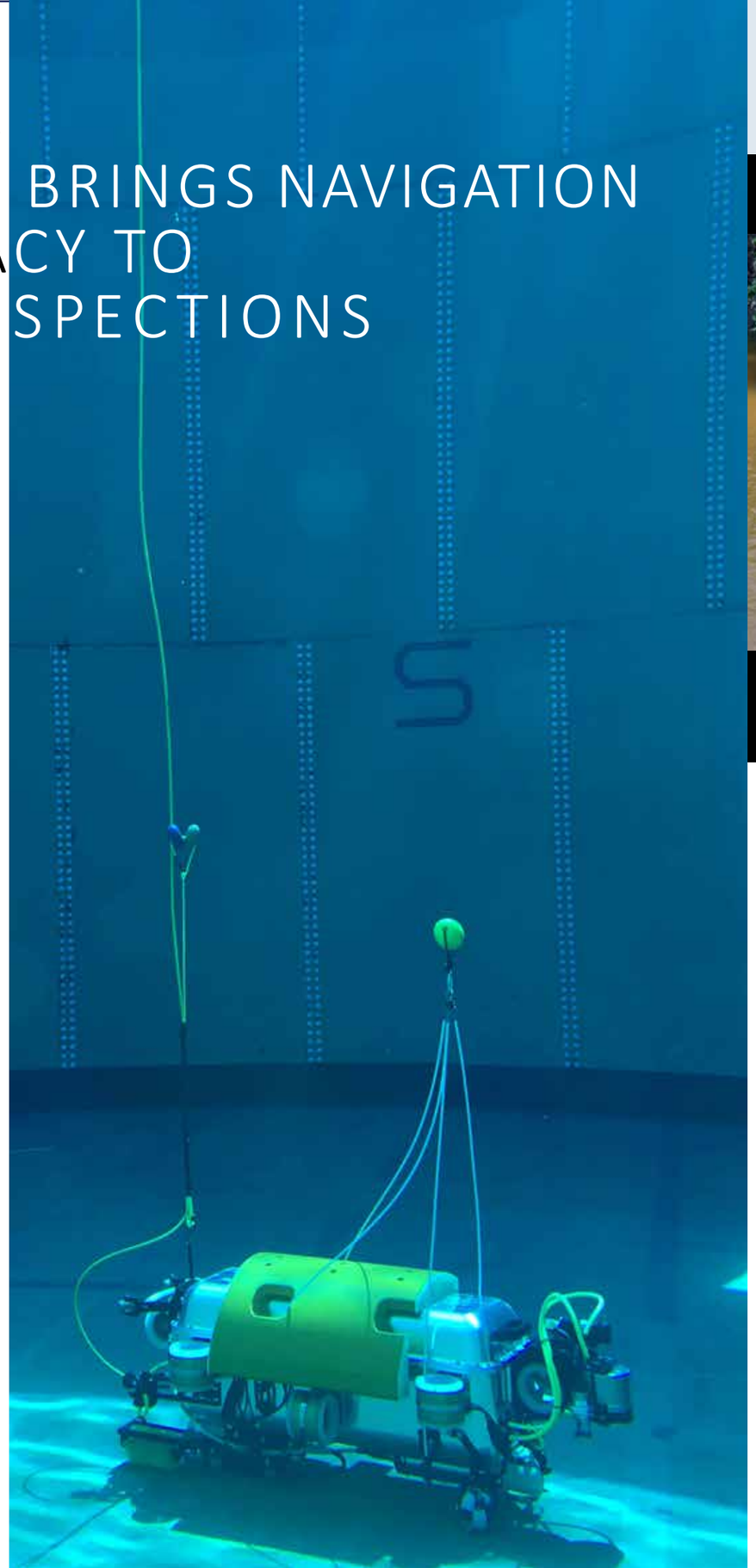
A pioneering autonomous robot with a high-performing DVL is revolutionizing fuel tank inspection – while eliminating potential operational hazards.

Nortek's Doppler Velocity Logs (DVLs) are already established as industry-leading instruments for velocity calculations in subsea applications. But pioneering Boston-based Square Robot has now successfully deployed them in a very different and challenging environment.

Tank integrity and storage a major issue across all industries, especially in a time of cautious commodity pricing. Square Robot is helping to change the face of the oil and gas industry through its development of an innovative robot that can provide detailed assessments of the conditions in above-ground petroleum storage tanks.

Using the robot eliminates the need to empty the tanks of liquid so that humans can enter to carry out detailed inspections – a costly, time-consuming and potentially hazardous procedure still used in most tank assessments.

The "Square Robot", from which the company takes its name, is essentially a highly robust, autonomous robot laden with sensors, able to fit through the 24-inch "manway", the standard-size portal fitted to the top of storage tanks.



Earlier this year, Square Robot and its wholly-owned subsidiary Veritank are delighted to announce a global agreement with ExxonMobil and its affiliates to deploy and develop in-service robotic inspection services in above ground storage tanks around the world.

The initial phase of the agreement will see Square Robot's industry-leading robots used to provide services to ExxonMobil throughout the U.S., UK, Europe and Far East. Square Robot's autonomous robotic solution delivers in-service inspection –which potentially helps with minimising vapour and chemical releases while maintaining tank operations.

Simultaneously, ExxonMobil is supporting Square Robot's development programme for next generation robots. ExxonMobil's support will accelerate this programme, with first deployments due for field trials later this year.

Square Robot's next generation of robotic technology will allow deployment to more of our tankage assets, further supporting our commitment to efficiency and operations excellence."

The Square Robot vehicle with the four-transducer Nortek DVL1000 mounted at the extreme left. The vehicle deploys ultrasonic testing, HD cameras and other non-destructive methods to assess tank wear and tear; the assessment depends on the DVL for pinpoint positioning.

BATHY 2

Valeport has launched Bathy2 – a new integrated sensor suite designed to meet bathymetric requirements for a reliable, accurate and robust instrument with more functionality to suit specific operations up to 6000m in depth.

An enhancement of the popular Midas BathyPack, the new Bathy2 uses state-of-the art sensors to generate Sound Velocity and Density profiles for precision depth and height data.

This evolution brings together the benefits of density corrected output directly from one instrument, alongside the flexibility of third party pressure sensor input and Valeport interchangeable pressure modules to allow users enhanced accuracy at different depths.

Improving the user experience has been a key driver in the development of this superior bathymetric instrument and the addition of a dedicated data output for INS allows bathymetric data to be efficiently communicated directly with users' own operational software.

Other helpful benefits include the flexible pressure options using Valeport's interchangeable pressure sensors, these field-swappable sensor heads make it easy for users to select the correct pressure for their working depth bringing benefits of exceptional reliability and a higher degree of accuracy.

Designed for surveyors requiring bathymetric data from ROVs, underwater vehicles or drop

Bathy 2

structures, Bathy2 also has an external pressure sensor input option for Digiquartz referencing.

This comprehensive bathymetric package offers other useful parameters such as Altitude and Bathy2 interfaces with the Valeport VA500 altimeter and other popular third party makes.

Data transfer is via Ethernet or RS232/RS485 interfaces and the Bathy2 Interpreter function via the Valeport Configure software allows data out on extra ports in industry standard formats, this facility also allows for an atmospheric pressure data input.

SMART MINIIPS2

The smart miniIPS2 underwater pressure sensor with accuracy to 0.01%, offers a cost-effective solution to vehicle pilots who require highly accurate depth information in real time.


Mini IPS2

This innovative pressure sensor, with a unique interchangeable pressure module, allows the user to quickly and easily change the pressure transducers whilst in the field, with no tools required, to maximise operational specific depth requirements.

UVSVX-

The compact uvSVX is designed for underwater vehicles where space is at a premium and it delivers calculated salinity and density data, along with SVP as standard. Like the miniIPS2 it also features field-swappable sensor heads, has a depth rating of 6000m and delivers 0.01% accuracy. The interchangeable pressure transducer, with integral calibration is easily changed in a couple of minutes without opening the instrument and is available in 10, 20, 30, 50, 100, 200, 300, 400 and 600bar variants.

SWIFT CTD AND SWIFT CTDPLUS

The latest addition to Valeport's popular SWiFT profiler


uvSVX

family, the SWiFT CTD profiler provides enhanced accuracy and versatility for those requiring CTD measurements. The SWiFT CTD profiler delivers survey-grade sensor technology coupled with the convenience of Bluetooth® wireless technology, rechargeable battery and an integral GPS module to geo-locate each profile.

Using Valeport's high accuracy sensor technology to combine sensors for multiple profiles in a single drop, the SWiFT CTD features a new fast response temperature probe and operates down to 500m as standard. With an operational battery life of up to five days and the convenience of charge via USB, the SWiFT CTD is intended for offshore, coastal, harbour and inland environmental and hydrographic survey use.

A CTDplus version is currently available with Turbidity at present and combines CTD measurements and Turbidity observations, in addition to providing computed Salinity, Density and Sound Velocity.


SwidtCTD

SONOBOT 5

About 10 years ago, EvoLogics launched its breakthrough Sonobot, one of the very first autonomous surface vehicles to appear on the market.

It was designed to carry out rapid surveys, particularly in flat waters of rivers and inland waterways. This especially included surveying shallow or hard to reach locations, possibly to inspect underwater constructions such as pipes, cables walls etc.

It began to be used for the hydrographic survey of ports, harbours and inland waters, plotting water depth and measuring sediment thickness. It was also utilized for searching for objects such as munitions, archaeological artefacts or even bodies.

One of the most important tenets of the original Sonobot was the ease of use. It was designed to be assembled quickly and handled by a single person but small enough to be fit into a normal car for transportation.

SONOBOT 5
Recently, EvoLogics launched the latest iteration of the design, the Sonobot 5. It has a number of advanced features but still firmly adheres to the design principles of its predecessor.

"In recent years, one of the main things our customers wanted was to work faster and to take measurements faster," said Dr. Rudolf Bannasch, MD of EvoLogics. "They especially wanted to carry out measurements in fast flowing rivers,

Sonobot 5 trials

but it would require the vehicle speed of up to 10 kts. We decided that this would essentially mean having to redesign the whole vehicle, making it larger and more powerful while still being compact enough to fit into the back of the car.

ORIGINAL SONOBOT
"The original Sonobot's idea was actually based on a monohull but we soon saw that we would achieve a better response for the applications we envisaged if we had twin hulls. To improve motion and stability in the waves, we widened and extended the floats, although not as wide as to prevent the vehicle from being transported in the car," said Bannasch.

"The original Sonobot basically consisted of a sensor body mounted on parallel support bars which were, in turn, firmly secured to a pair of metallic domed cylindrical floats by means of screwed connection that could be engaged quickly without requiring tooling.

"The rear end of the floats incorporated integral jet thrusters which provided the locomotion."

Sonobot 5

SONOBOT 5
Sonobot 5, the latest iteration, is subtly different to the original, and incorporates the latest in communications and sensor electronics.

"The floats are far more moulded and boat-shaped than their predecessors. Instead of propellers, they incorporate higher power water jets, providing increased speed and endurance. The float bodies also contain the swappable battery packs which can be recharged in less than 3 hours and enable 10 hours of operation.

"The waterjets give the vehicle fast access to points of interest," explained Bannasch. "They do not have rudders but can carry out precise manoeuvres by variably distributing power to each jet.

The main body is more elongated and streamlined than the earlier version and the body/hulls are connected with aerodynamically-shaped hinged arms.

In order to be stored, the main components of the original Sonobot had to be dismantled into constituent parts, but the new design consists of an ingenious hinged single unit that can be unfolded on site. The quick release clips then secure the structure in its working position. This arrangement makes final assembly and deployment even quicker than before.

The new design keeps the vehicle body arched well above the water surface, obliviating any resistance the previous version may have encountered from wave tops.

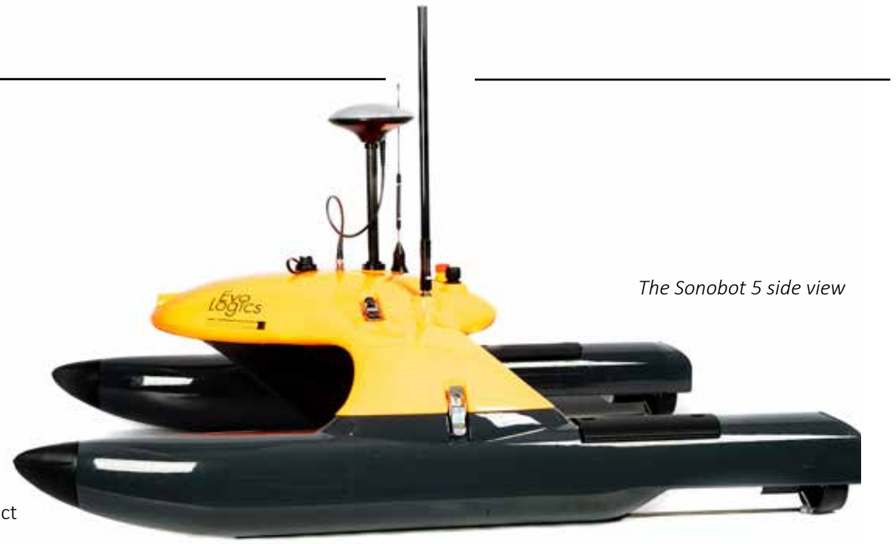
For depth measurements,

Above and top. A previous Sonobot version The sections are connected and disconnected by means of screw threads.

a broadband echosounder was slung underneath the main body of the original design, measuring the seabed with an accuracy of +1.5cm. The Sonobot had an optional side-scan sonar located in its floats.

In the new design the body lies relatively higher above the surface. The acoustic sensors of the Sonobot 5 are located in a dedicated central arm unit that extends down into the water.

The sensor systems are based on the latest single-beam/multibeam echosounder and side-scan sonar according to customer needs. At the very front of the body is an integral HD camera for navigation support, photo- and video recordings. This is particularly useful in operations conducted in remote locations and surveillance.



The Sonobot 5 side view

"There are great advantages in combining acoustic and camera systems, especially for object recognition", said Bannasch.
"In many operations, it is quite difficult to distinguish objects in the sea so we have developed an artificial intelligence-based system as an extra module that runs directly onboard the vehicle and analyses raw data from the sonar output and video feeds. It can even distinguish between different species of fish and different obstructions in the water.

For our customers in Holland, it is often necessary to search for missing persons or structures (e.g. cars and bicycles). The intelligence makes it easier to find them. A cloud-based ecosystem around the new OR system provides users with regular updates and new detectable object classes. It also allows uploading user datasets for the system to be trained for new object types upon request."

Object recognition is an AI-based module that runs directly onboard the vehicle and analyses raw side-scan sonar or video camera output. Objects of interest are detected and visually highlighted in the operator's control software onshore - all live during the mission. A cloud-based ecosystem around the new OR system provides users with regular updates and new detectable object classes.

COMMS
In the original version, the navcomms system was based on WLAN and differential GPS which enabled high accuracy cartography.

"In Sonobot 5, communication over a redundant mesh network enables work both with or without a WLAN station onshore, including integration of additional modules (laser tracking) without any configuration effort," said Bannasch. "We can use mobile phones connection and also implement satellite communication, if necessary."

The vehicle has both autonomous and radio-controlled operation modes. The mission planning includes settings for sonar parameters.

The Sonobot 5 is built from seawater-resistant robust materials (basalt laminate, stainless steel, plastic), and is suitable for operations in a variety of areas including industrial waste waters.

The Sonobot 5 is designed to be folded by hinges and secured quickly by latches instead of screw threads

FRIDAY PHOTOS

Look at UT2subsea every Friday on Linkedin

NINIAN CENTRAL

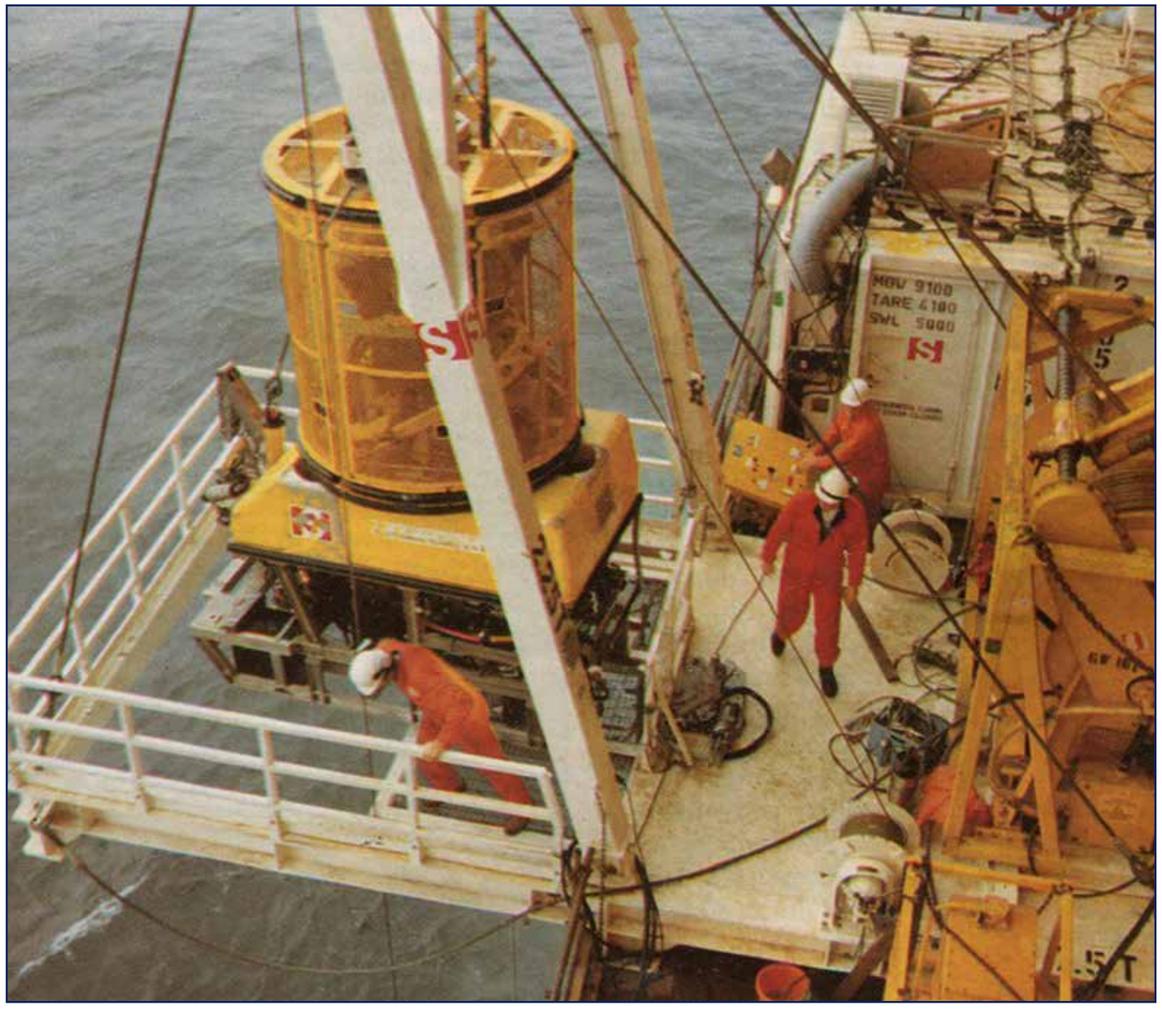
In November 1977, the 350,000t substructure was partially submerged to allow the 6500t steel deck frame to be floated over and mated

HELICOPTER

Can you remember that some time ago, we had a cool image of a helicopter coming away from a platform. Well here is another one flying from the Key Manhattan.

ULA 1991

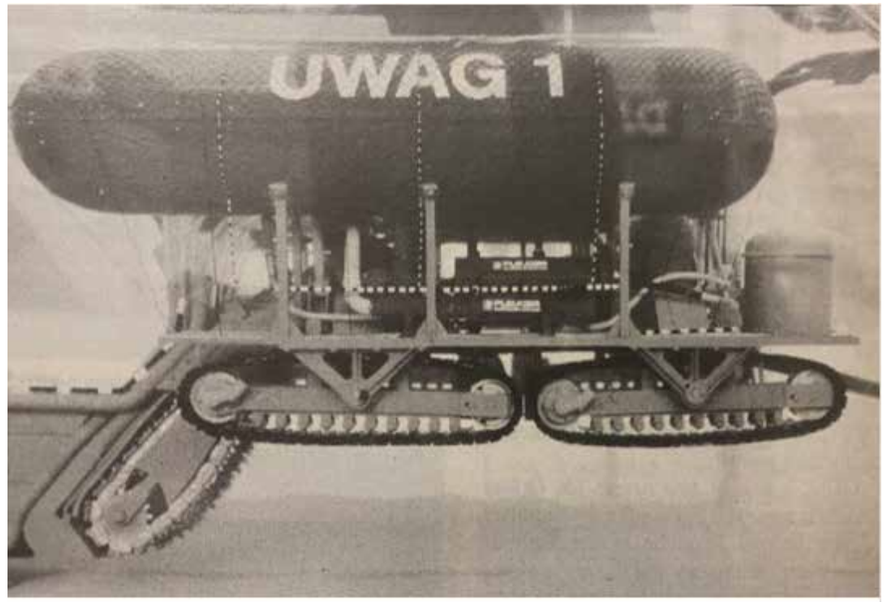
The Triton ROV being launched from a cantilever skid deployment frame. Engineers said that the hardest part was to reach the extremities of the three platform Ula complex from the launch point on the central platform.



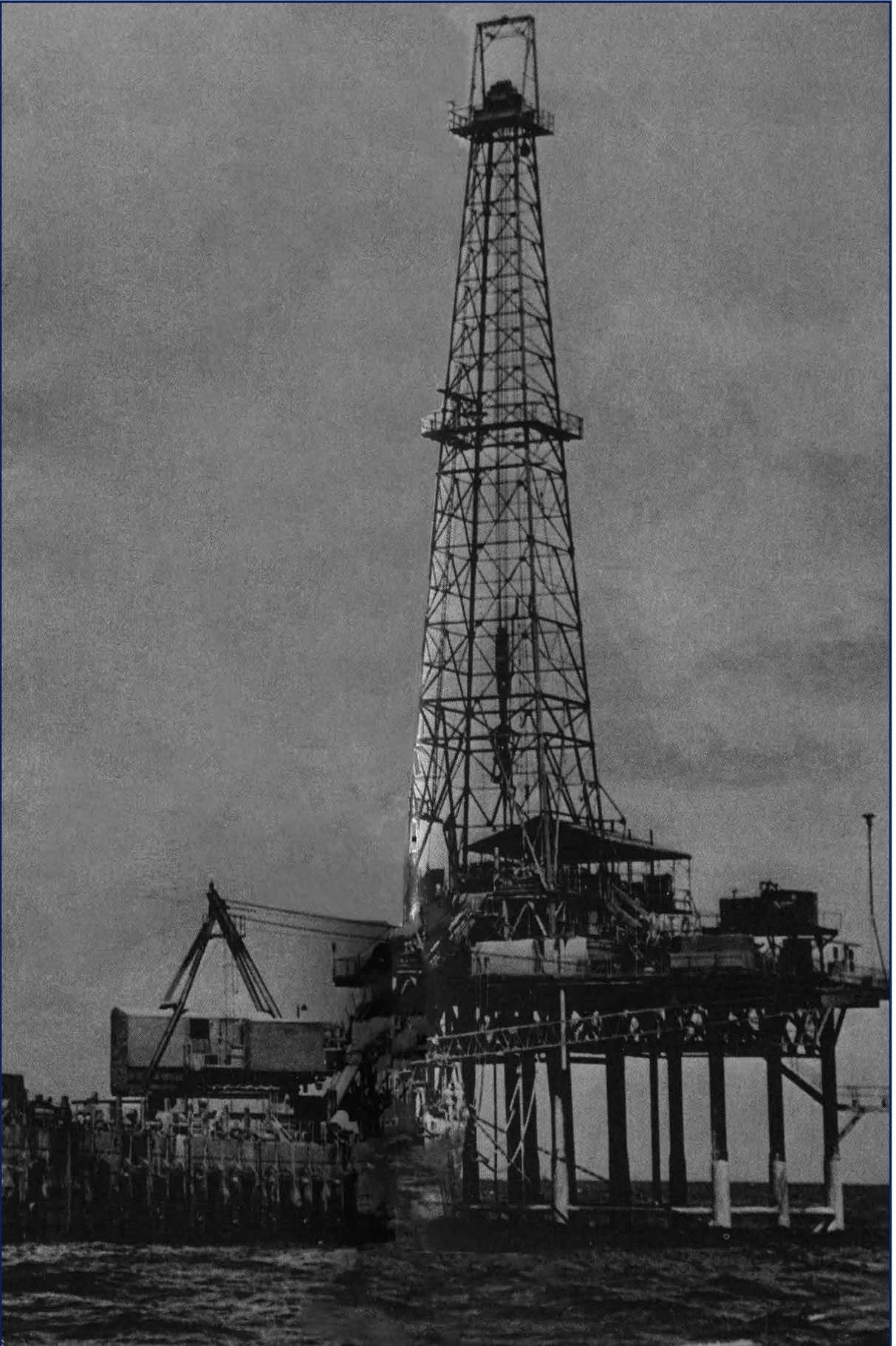
FULMAR 1982

The Fulmar platform was designed by McDermott. Oil was exported using the Medora Floating Storage Offloading (FSO) vessel (out of picture). In December 1988, this floating vessel broke free and drifted, narrowly missing BP's Clyde platform.

UWAG



The UWAG Trencher



Atlantis 2005

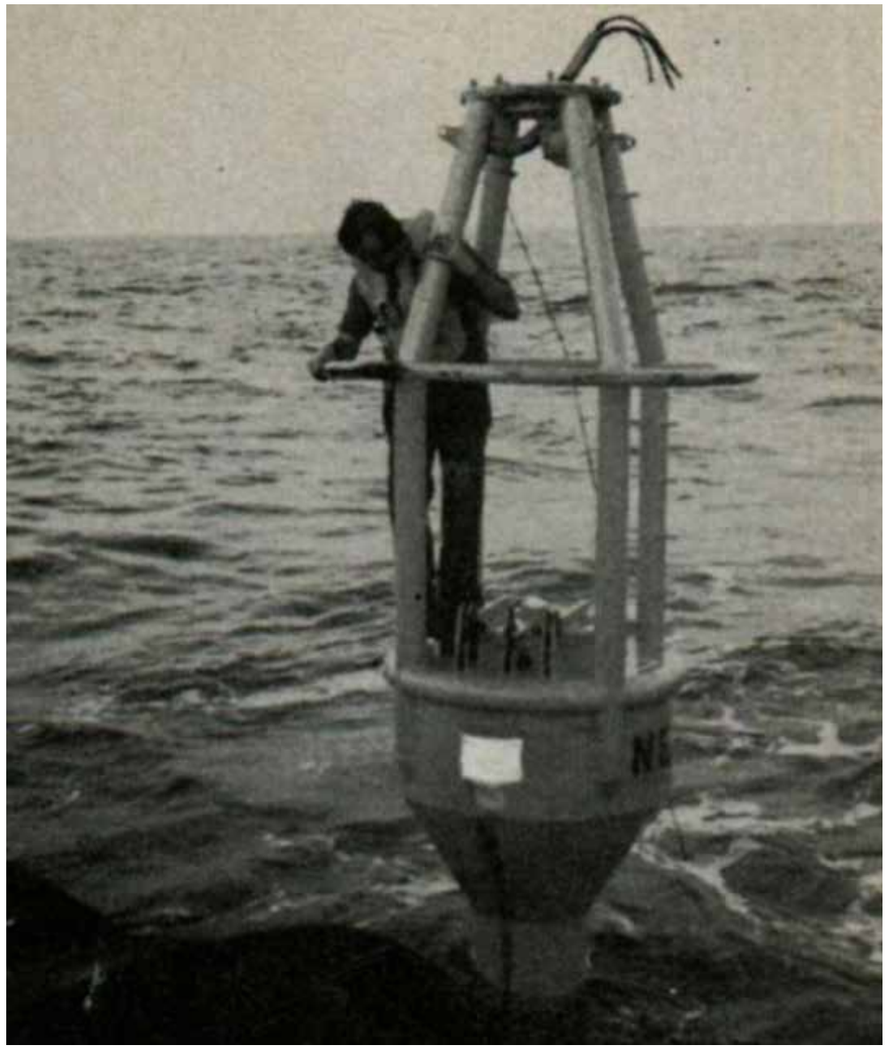
The semisubmersible was to be come the world's second largest floating production system after Thunder Horse. It was built at Korea's DSME yard

Left: Drilling and production platform in the Gulf of Mexico

SEISMIC DATA BUOY

In 1980, a 30m tension leg spar buoy was installed for collecting seismic data around 2 miles NW of Mobil's Beryl A platform.
It formed part of a Dept of Energy/Institute of Geological Sciences (Edinburgh) study on earth tremors.

The Seatel buoy was designed by Havron Engineering of Cardiff, and was built by Ocean Inchscape. It was deployed by the Oil Mariner.



Rowan Gorilla II 1985

One of a new generation of severe environment drilling jackups at SB's

Offshore base at Peterhead

HARDING 1996

The 23000t TPG500 platform being towed to the Harding field, to be sited on the concrete storage tank. It took a day and a half to tow the platform

BAYU UNDAN CONOCOPHILLIPS

Dockwise's MV Blue Marlin leaving the float-over slot after installation of the second topsides on the preinstalled jacket in the Timor Sea. The two topsides had a weight of 11 500 and 13 900t.

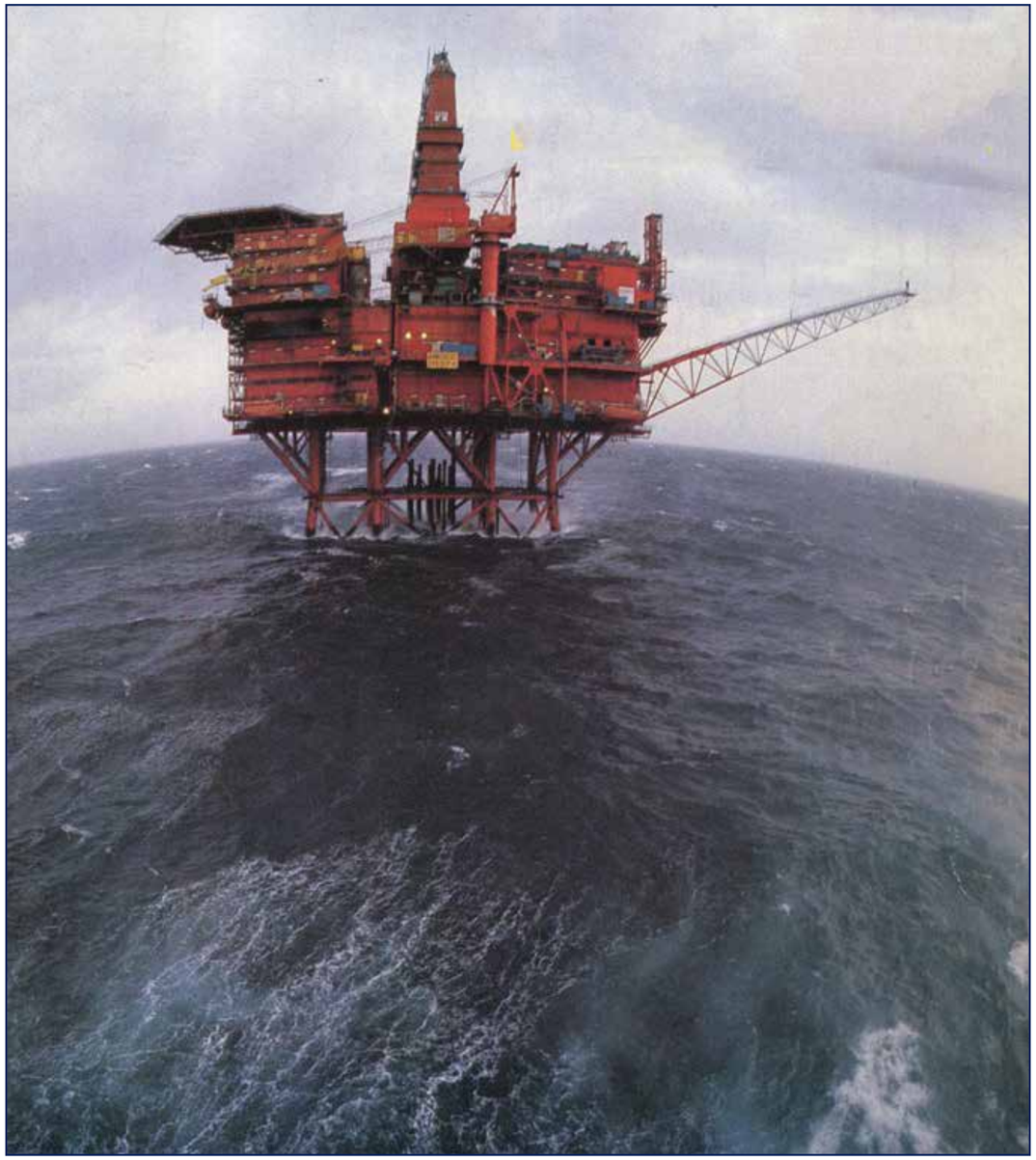
Morecambe Bay

Amoco's NW Hutton 1983

During the installation, an intense storm blew up. Four piles were driven onto the jacket but yet to be grouted. The seafloor bottom bracing sustained damage. This threatened to delay the project.

A Lloyds and Amoco survey concluded, however, that the bottom bracing was critical to the launch but provided little support once the structure was piled.

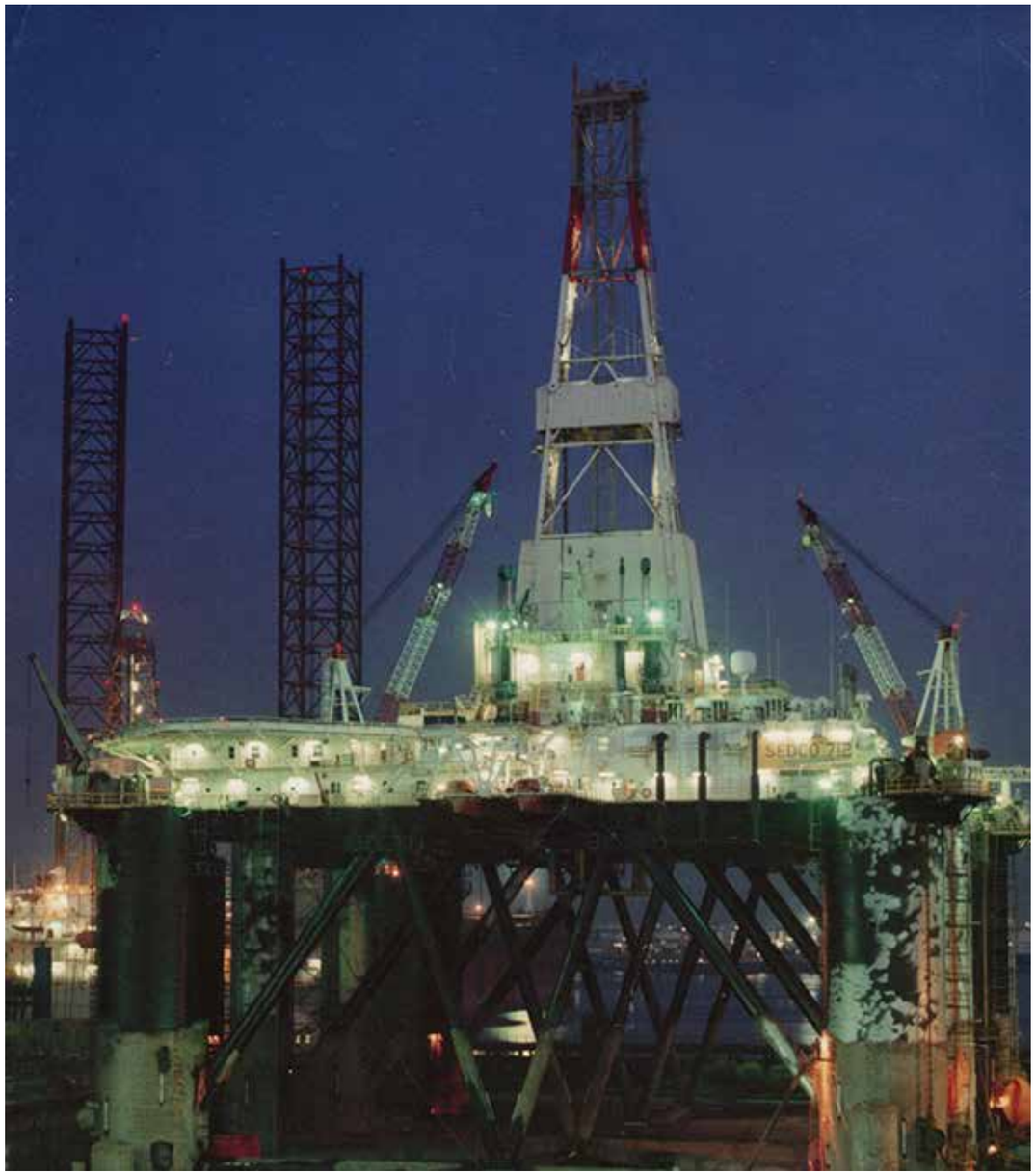
You can't see it, but there are two drilling derricks!



Norlift

Sedco 712

Later to become the Transocean 712, it entered service in 1983.
It could drill in 2000ft of water.



THE MONITOR

The monarch-class jack up in the North Sea. It was designed for deep high-pressure, high temperature drilling. It was delivered in 1992

Scott

Being installed in 1993

VESLEFRIKK

In 1989, it broke the lifting record when it recorded 9050t.

HELDER B 1986

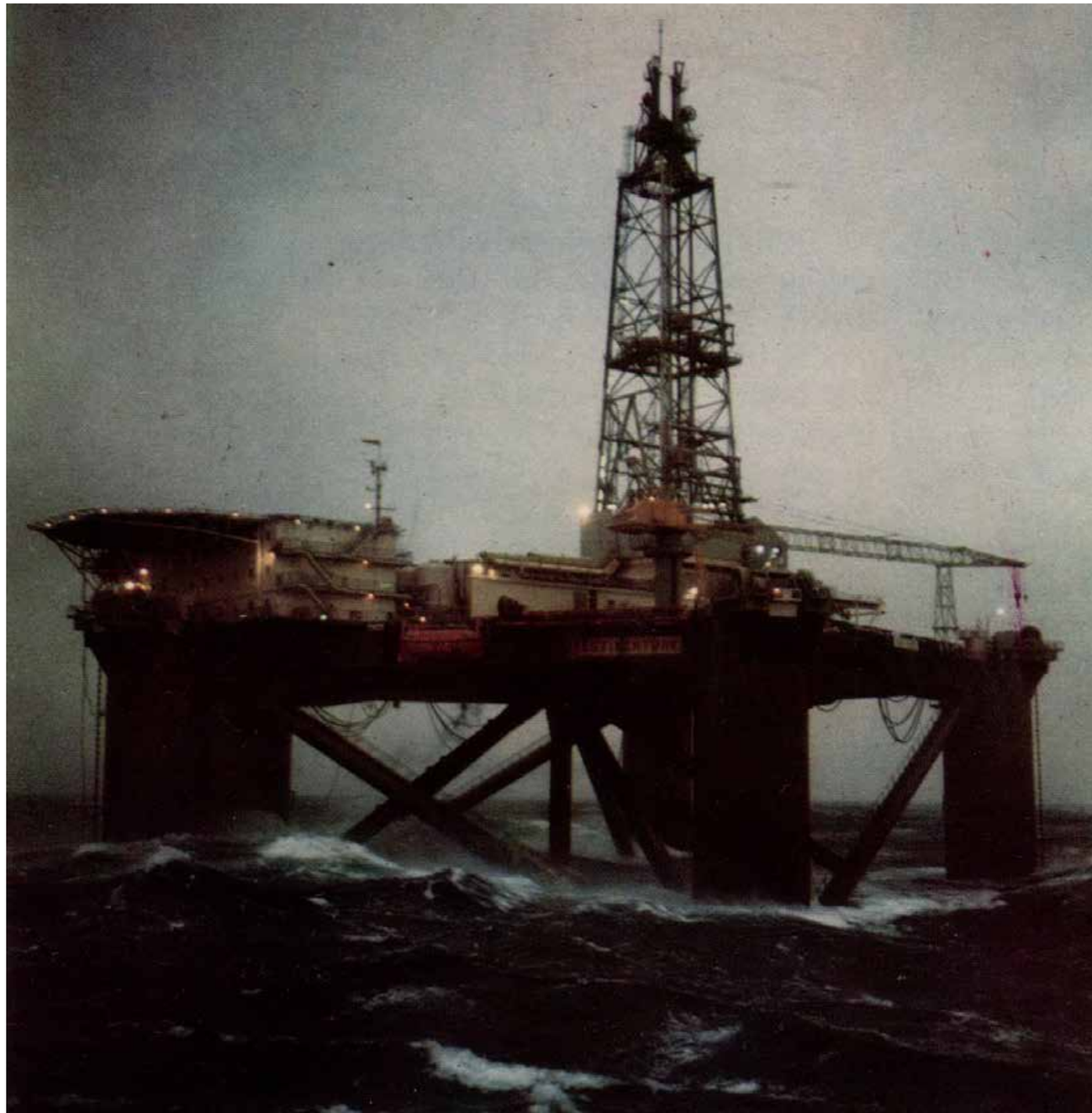
Unocal's Helder B tripod being installed by the Hermod.

Mobil Beryl B

The topside being lifted on the jacket by the Balder. The lower production deck built at UIE was installed in two 2400t sections. The upper production deck, built by Cleveland Offshore was then installed in one 2600t lift.

West Venture 1973

The 5-leg semi was developed by Marcon (a JV of Smit and RSV) and built by CFEM in France.



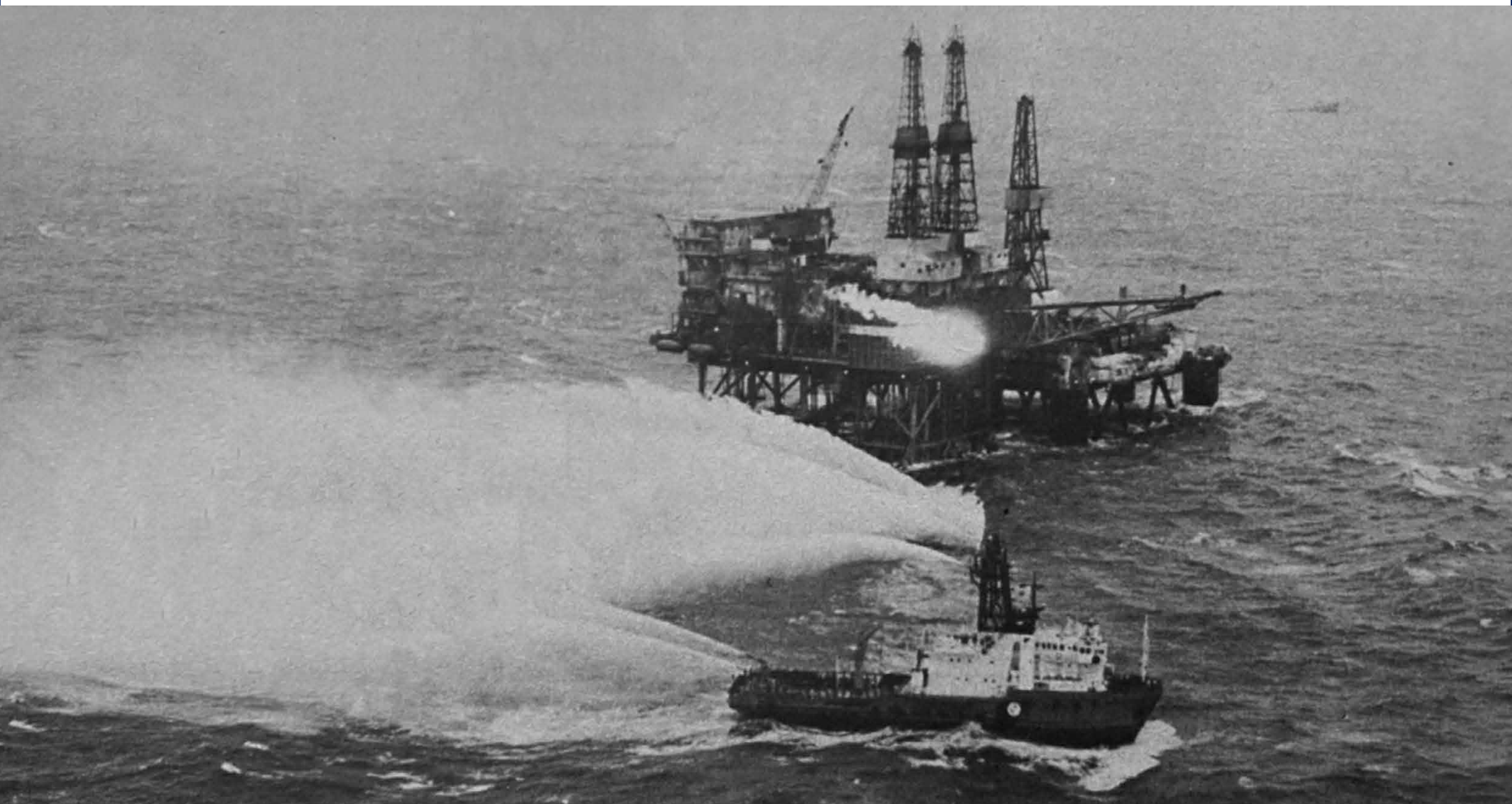
The Blue Whale 1978

Acting as support at Maui B.Carrying out piling.
It had a 2000t crane mounted amidships

Northern Protector 1978

The Northern Protector going through firefighting drills near the claymore platform. It could project water 177m at a rate of 20 000 gals(US)/min. Top speed? 13.5 kts seeing as you asked.

At the time, Shell had the Capalonga and BP, the Forties Kiwi doing roughly the same thing.



Marine 500

Working for Chevron in Western Australia

Marine 500

Working for Chevron in Western Australia

The BAR 331

Working for European Marine Contractors

SMIT PIONEER

Working on a 105 day charter with Coflexip Stena. It was bound for Le Trait for loading materials for the vertical lay system.
Then off to Newfoundland!

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