



Prototype
from Seabed Rig AS:

THE WORLD'S FIRST AUTONOMOUS DRILLING RIG AT ONS

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Tid for ONS

Fra 24. - 27. august vil flere av FFUs medlemmer få med seg mange spennende utstillinger og konferanser i Norges oljehovedstad Stavanger. Oljemessen ONS er en av de viktigste bransjefaglige møteplassene for energisektoren. Arrangementet gir en utmerket anledning til å skaffe seg en oversikt over hva som rører seg både innenfor subseafeltet og generelt innen olje/gass og energisektoren.

Tradisjon tro har FFU laget et ekstra bilag av medlemsbladet DYP i forbindelse med oljemessen. I dette nummeret av DYP kan du oppdatere deg på virksomheten til mange av utstillerne på årets messe.

Blant annet kan du lese nærmere om Seabed Rigs banebrytende prosjekt som involverer robotteknologi på en måte vi ikke har sett tidligere innenfor subseafeltet. Kenneth Mikalsen ble møtt med stor interesse da han presenterte prosjektet på FFU-seminaret i januar i år. Seabed Rig planlegger en rigg for demonstrasjon under ONS. Du kan i tillegg lese om Oceaneering som de siste årene har vært med i utviklingen og testingen av en miljøvennlig hydraulikkvæske til bruk på ROV-flåten.

Miljø er også et viktig tema i artikkelen om AAK sin nyutviklede elektriske ROV, Electric Elsub WROV. Fra Cosalt Offshore har vi dessuten en spennende artikkel om produksjon av ståltau til havdyp på over 3000 meter. Alt dette og mye mer kan du lese om inne i bladet.

Interessen for å bidra til ONS-utgaven av DYP har vært rekordstor. Vi takker alle bidragsytere og håper vi ses på ONS-messen.

Vi gleder oss! God lesning!



Med vennlig hilsen
Jan Henry Hansen
Leder FFU



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The prototype of the world's first autonomous drilling rig is assembled at Forus outside Stavanger. Seabed Rig AS has introduced robot technology as we know it from the auto and health industry and combined this with control system methodology from the space industry. The rig prototype shows that it is possible to implement this technology on the drill floor in order to potentially create a much more cost effective and unmanned drilling process.

Text and photo: Seabed Rig



Autonomous drilling rig from Seabed Rig AS

Seabed Rig AS is developing an innovative seabed drilling rig to carry out cost-effective exploration drilling from a location at the seabed, at deep waters and in arctic areas. The Seabed Rig consists of a patented encapsulated and pressure compensated design that ensures an environmentally friendly solution with zero discharge to sea and same safety barriers as for conventional drilling. The Seabed Rig is unmanned with automated and robotized working operations that are remotely supervised and controlled from an interactive 3D interface.

The seabed drilling rig is assisted by a surface vessel and connected via an umbilical that transports drilling fluids and contain control cables and power supply. Advantages of carrying out drilling operations from the seabed include less dependence on weather, no heave-compensation systems, reduced mud back pressure, no rigid riser system and no people onboard the rig. The development is supported by Statoil, the Norwegian Research Council (Petromaks and DEMO2000) and Innovasjon Norge. In the process of technology development, the company has brought forward a new generation autonomous drilling technology

and equipment that can potentially be used also in dry drill floor applications.

Overview of drilling equipment

The drilling equipment consist of roughneck, robot arm(s), rack and pinion lift and pipe handler robot(s) together with a top drive. The various pieces of equipment are controlled by dedicated axes controllers and operations are displayed realtime in a visualizator.



The current status of the project is that a full-scale prototype of the autonomous drill floor is function tested Q2 2010 on land in Stavanger. This prototype will also be displayed in connection with the ONS exhibition in Stavanger late August 2010.

Control system

In order to design drilling machinery with autonomous capabilities, it has been essential to develop machines that can perform in such a constellation. All machines are designed to be self contained and independent, meaning that all machines hold all neces-

sary components and systems in order to operate. The interface on each machine is communication and power. Breakdown of one machine, component or system will not have any influence on the function of the other machines in the system.

Each machine holds its own axis controller, and a full 3D model of the entire rig. In this way, all the machines, at any time, will have full control with the whereabouts of all parts in the entire rig. By doing this, the machines are capable of synchronizing their movements with each other to optimize the overall process, and to avoid collisions.

All the machines continuously broadcast their status on the local network. A software application in the control center holds a complete 3D model of the entire rig. This application changes the 3D model in real time as the machines are physically changed. This gives the operator a 3D interface to the rig, which is updated in real time. The operator can navigate around inside the 3D model to get a closer look on the various machines and processes. This interface is easily available for remote connection through a normal internet connection.

MACHINES

Robot arm:

The rig contains a powerful robot on the drill floor, to assist in handling and operations. The robot is an all electrical manipulator with seven axes and 3000 kg handling capacity. The robot holds an axes-controller that synchronizes and optimizes the movements of the different joints correlated to position and time. The robot can be remotely manipulated by an operator, but the control system is designed to take inputs in form of task commands, such as; "go there", "fetch that", "operate this" and so on. The robot will by itself calculate the optimal paths of movement in order to execute the received commands. The axis control will change the planned movement paths taking into account a changing environment, meaning that if there is another machine operating in the same space as the robot, the robot itself will avoid interfering with the other machine. The robot can operate various tools for different operations, such as grippers, torque tools, inspection tools and dedicated operation tools. In addition, a multipurpose hand, called the HandyHand, has been developed with human-like characteristics. This hand has fingers that can be orientated and manipulated to grab a wide variety of geometries. The hand has its own control system and when connected to

the robot, the robot will act as a slave for the hand. All the tools can be docked and undocked to the robot by the use of a specially designed tool interface that can hold wireless power and communication, in addition to a rotating shaft applying 5 kW torque to the tool. No assistance is needed for the robot to dock or undock.

Pipe handler and lift:

The pipe handling will be performed by one to two robots located between the lift and the pipe magazines. These robots are in principle clones of the drill floor robot with regards to the control system, but with a different mechanical layout. They are equipped with patented grippers that can handle both drill string and casing. The hoisting machinery consists of an all electrical rack and pinion system, holding an electrical top drive. The hoisting machinery and the top drive have the same lifting and torque capabilities as conventional drilling equipment.

Roughneck:

The roughneck is concentric with spinning and torque in the same function. It has a balanced internal lift between the two torque wrenches that allows the system to limit the axial force between the two tool joints. It

can also handle non-centric tool joint alignments. The internal control system keeps track of all parameters at all time, and produces a state report of all operations. All process parameters are verified with two independent systems with dissimilar measurement principles, in order to give the control system full contingency.

A paradigm shift

For the last 20-25 years, forward-looking players of the conservative drilling industry have been crying for introduction of technology that has been successfully introduced in other industries, in order to optimize the processes on the drill floor. With its autonomous drilling rig prototype, Seabed Rig AS has introduced robot technology as we know it from the auto and health industry, and combined this with control system methodology from the space industry. The rig prototype shows that it is possible to implement this technology on the drill floor in order to potentially create a much more cost effective and unmanned drilling process on the rigs. The building bricks that Seabed Rig AS has made available, will likely create a paradigm shift, where also the conservative drill floor operations in the future will be structured as production cells with no human intervention.



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SCALE TREATMENT FROM EDDA FAUNA

Text: Inge Grutle, Project Engineer DeepOcean Photo: DeepOcean

Scale is a mineral deposit which forms inside pipes, valves and in the reservoir and poses a flow restriction leading to production decline. Managing the scale build up is a key factor for maintaining and enhancing production, particularly for older oil fields and fields with water injection. Many subsea fields cannot easily be treated from the nearest topside installation, so scale management has to be performed locally on the actual subsea template.

Chemical scale treatment has the advantage that no physical equipment has to enter the well and the well control is not taken over by the vessel, but remains at the applicable installation for the duration of the operation. The chemical treatment as such is not treated as well intervention and can therefore be performed from a more cost efficient vessel, like a MPSV (Multi Purpose Support Vessel).

DeepOcean has through our IMR contract with Statoil, performed local chemical scale treatment operations on subsea production systems from MPSV's. Using MPSV's for this purpose is a cost and time effective solution giving both a low cost alternative and flexibility to combine scale treatment with other IMR or light construction tasks.

Scale management is both about removing already accumulated scale and preventing new scale deposits to form. Though there are mechanical solutions, i.e milling and water jetting, for scale removal chemical dissolving has proved to be an efficient way for removing scale. Chemical scale removal can be performed both in the near bore reservoir, production tubing and in critical components of the well system.

In many cases performing preventive chemical treatment, or scale inhibitor squeeze, will be even more cost effective than relying on corrective measures and suffering from a temporary production decline. A diverse range of scale inhibitor squeeze operations can be performed from MPSV's, as long as

the required tank capacities, certification and pumping systems are in place. The DeepOcean flagship for scale treatment, the IMR vessel Edda Fauna, is fitted with a vessel integrated scale treatment system. This integrated system contains all key features (i.e pumps, tanks, control system) to make the vessel ready for operation with minimum mobilization. Up to 800m³ of well stimulation chemicals can be loaded in the vessels tanks and by only including an injection hose onboard, the vessel is ready to "squeeze" wells at rates up to 1200 l/m and pressures up to 690 bars.

There are tank facilities onboard to carry a wide range of wells stimulation chemicals, both acidic and alkaline. The vessel tanks and pumping system complies with the IBC (International Bulk Chemical) code and the IMO guidelines for handling and transport for liquid hazardous and noxious substances in bulk on offshore support vessels. Edda Fauna also meet all requirements in order to get the DnV notation for "Well stimulation". A dedicated chemical dosing system ena-

bles dosing of multiple chemicals simultaneously from 0-15% of full flow and there are also systems for batch mixing of chemicals offshore. This renders the vessel fully flexible for many tasks and can be mobilized for large scale treatment campaigns without having to return to shore for refilling of chemicals.

The integrated scale treatment system also has features to handle complex pumping operations including gelled, foamed and heated treatments in order to tailor-make the pumping program to each individual well. The scale treatment on Edda Fauna is a very good example of the opportunities which lay in utilization of MPSV's for well stimulation activities.

With many subsea oil producers are maturing and going into late production phases we anticipate that scale management will continue to be a major factor in improving and sustaining production in the coming years and that scale treatment from MPSV's will be a excellent solution also in the future.



Hva skjuler seg under overflaten?

Vi avdekker kritiske tilstander over og under vann ved hjelp av spesialkunnskap og avanserte instrumenter. Gjennomarbeidede metoder og betydelig erfaring har gjort oss til en aktør i verdensklasse bl.a. innen fagområder som;

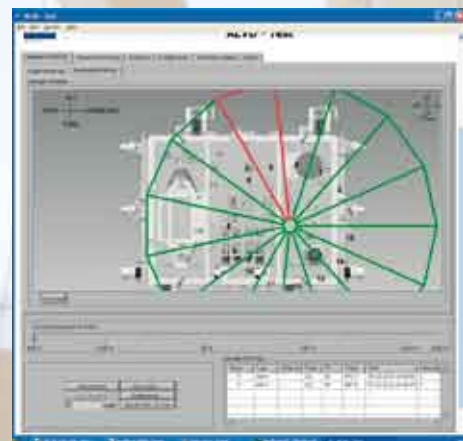
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Wire Rope Management

Throughout the Norwegian oil adventure Cosalt Offshore Norway has been a major supplier of steel wire rope to the oil & gas sector. Due to the Operator's move towards oil & gas development in increasingly deeper water depths, the need for longer, thicker and more powerful steel wire rope has emerged.

Text: Rune Bjørkevoll, Technical Manager Cosalt Offshore, Funis Veritas
 Photo: Cosalt

Back in the 90's a steel wire rope of 1500 meters and 70mm diameter was defined as a really big rope. Today it is not uncommon to hear about lengths over 3000 meters and diameters reaching 120-140mm. In early 2010, Cosalt Offshore delivered a Bridon steel wire rope of 3200 meters and dia. 128mm to Aker Solution in Galveston, Texas.

These ropes come with a variety of new challenges. Logistics alone with regards to the shipping, cranes needed and spooling gear are a handful. But what often worries the owner and user the most is the purchasing process, maintenance, continuity and predictability of the steel wire rope. The purchase price of such a rope might be as much as nok. 3-5 mill, but the operation needed in order to get the rope delivered on to the crane/winch onboard a vessel can easily be just as costly!

The cost issues raised by an unplanned operational stop because of, or related to, the rope can also run very high. Still it is not uncommon that factors such as wrong specification, lack of- or wrong procedures, lack of- or bad maintenance and incomplete documentation limits the expected lifespan of the rope, or causes unnecessary and expensive delays during service.

To help address these issues, Cosalt Offshore, together with Bridon Rope and Sparrows Offshore, have formed FUNIS VERITAS (FV). As a consultant, world renowned expert & author of leading publications on wire rope technology, Prof. Richard Chaplin, University of Reading, is also a part of FV. The idea behind Funis Veritas is as simple as it is genius. We will tie in all relevant factors in order to offer our clients a more



Extreme consequence of heavy steel wire rope after faulty use.

accessible, reliable and predictable, prolonged lifespan of these steel wire ropes.

We would like to assist and advise our Client, even before specification of rope is set. By analyzing information about intended use and type of winch/crane etc FV will help Client determine type of rope and also offer the logistic processes and spooling. We will manufacture the various necessary procedures, and offer advisory support during use, inspection and maintenance. When the rope is taken out of service FV will offer to, in cooperation with Client, make an in-depth analysis of the rope seen in light of the lifespan and usage it has been exposed to.

In order to make things as easy as possible for our Clients, Cosalt Offshore has developed an online web base, user friendly and accessible, for daily logging of ALL activity of the rope. One feature of the data base

will be to hold absolutely all relevant certificates and other documents relating to the specific steel wire rope, including procedures, test documents, and available information on the winch/crane which holds the rope.

When looking at Funis Veritas and the online system in context, one will have a complete, operational and user friendly Wire Rope Management System, giving the Client full traceability with all documentation on everything done to the rope since before purchase, and also all relevant procedures and certificates. All online and all available 24-7. The online system allows for FV to have an excellent starting point when supporting Client during use of wire rope, this being general advice, lift plans, technical questions, procedures or assistance with closing possible non conformances from Client's client.

This is still a new service provided by Cosalt Offshore, but we have already been introduced to several existing, as well as potential, new Clients and the reception has been very positive. With Operators such as Statoil it is getting to be more or less mandatory for the service companies to in fact have a functional Wire Rope Management system in place in order to avoid, or at least minimize, risk for unplanned operational stops triggered by faults and/or damage to winch/crane rope. This is of course one of the reasons for the very good reception Funis Veritas and the Cosalt Wire Rope System has experienced.

For any more information or, if You have any questions, please contact Cosalt Offshore Norway; phone +47 51 55 45 00, e-mail : sales@cosaltoffshore.com

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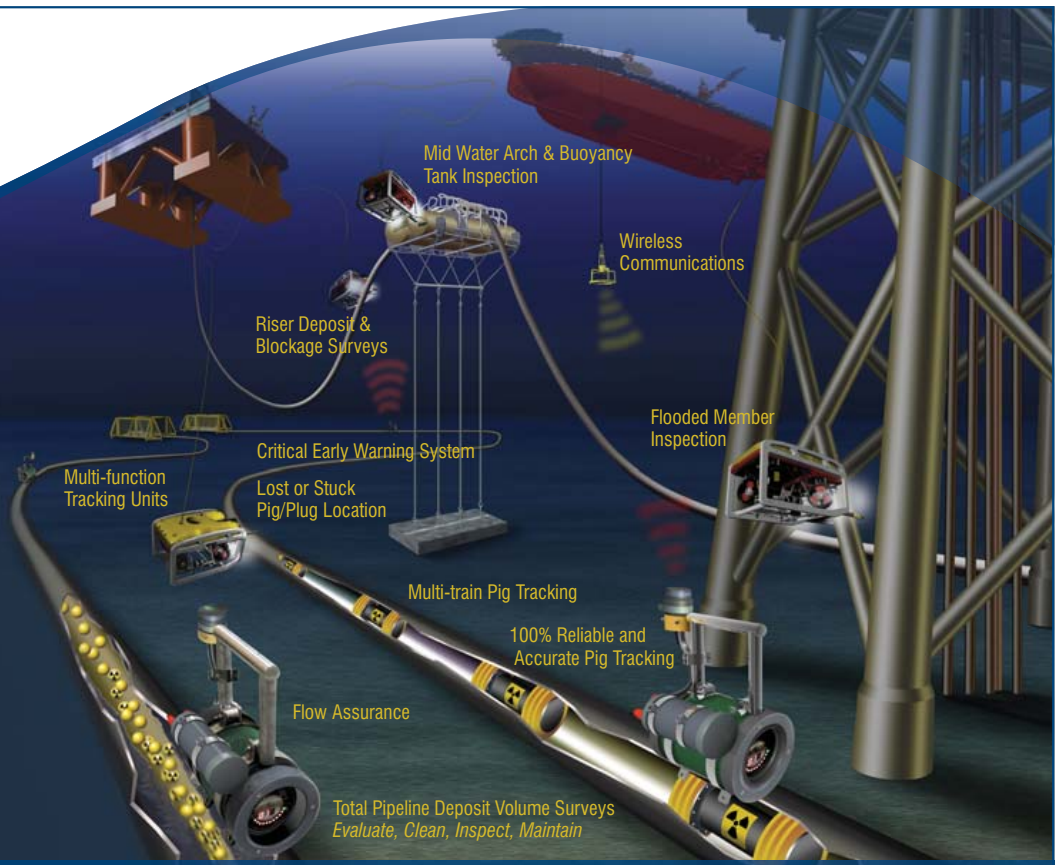
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Elsub Electric WROV

- Meeting the Challenges

AAK Subsea AS, a wholly owned subsidiary of AAK Group AS, commenced commercial operations in January this year with an innovative electric, heavy duty work-class ROV, the "Elsub". Designed, developed and produced in Stavanger, the Elsub is believed to be the first electric ROV of this class and design to have entered into service.

Text: Svein Sund,
Director Marketing & Business development



We asked the Managing Director of AAK Subsea, Anthony Scott, what the primary design goals were and to relate these to the operational experience to date.

High reliability

– We initially set out to build a robust electric HD WROV with industry leading reliability coupled with ease of operation and maintenance offshore to deliver low downtime and low operating cost to the customer, says Scott.

The Elsub has now been operating under a long term rental contract on a drill ship located off Venezuela for the last 6 months. Up to the time of writing, the Elsub has accomplished

89 dives of varying work scope and has accumulated over 500 hours subsea with negligible downtime attributable to equipment failure. Due to the challenging operating conditions there has been a fair amount of damage experienced but the system's user-friendly design has enabled such damage to be quickly repaired by the crew onboard and has resulted in excellent continuity of operational service.

Environmentally friendly

– An equally important goal was to develop an ROV that had the smallest possible environmental footprint and in particular minimal oil content.

In Norway, Statoil in particular, has taken a lead in encouraging the subsea industry to

develop environmentally friendly equipment. Being powered by electric thrusters, the Elsub is a practical response to that lead and offers the potential for further reduction of its environmental impact.

Versatile, multi-task capability

– Efficient power, maneuverability and stability were also principal design goals.

The Elsub concept was designed to provide the pilots with instant response to control inputs with controllable power. The pilots have universally reported that the Elsub is a highly manoeuvrable and responsive ROV. Total topside power requirements are significantly reduced due to the elimination of inefficient electro-hydraulic thruster drives.

The way forward

– We have ambitions, says Scott. According to him is it entirely practical to further minimize the environmental footprint of the ROV and its associated equipment. Development of a full complement of electric tooling and accessories is the next challenge, and electrically powered options for the other main components making up the spread are already in existence or feasible.

The AAK Group of companies has up to 30 years of experience in providing integrated maintenance and inspection services and products to mobile rigs and offshore installations. The development of an innovative electrical work ROV strengthens the AAK

Groups capabilities in subsea operations for the offshore industry. The development of the second generation Elsub design is now complete and AAK Subsea is preparing to expand its fleet of new ROV's in 2010 and 2011.

Footnote: AAK Subsea AS and AAK AS, under the auspices of the Subsea Technology and Operations banner, is jointly developing a subsea wire scanning capability utilising the Elsub as the work platform for the proprietary scanner unit. This is an example of the innovative approach of the AAK companies.

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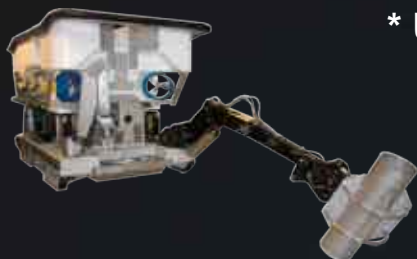
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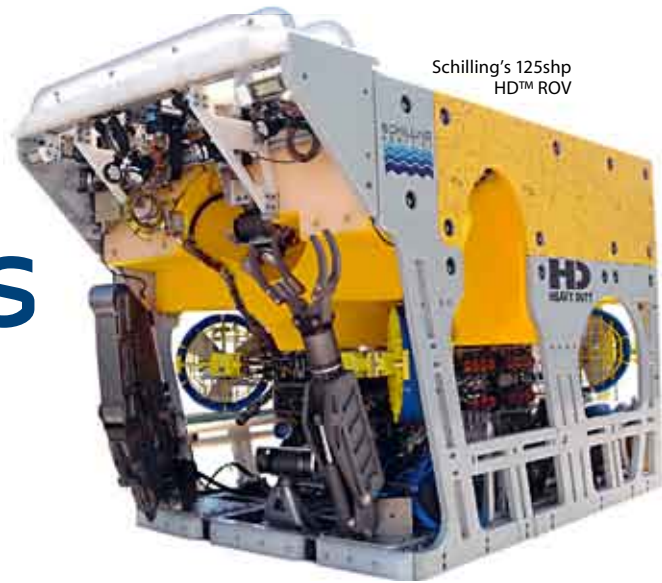


Schilling's HD™

- Delivering More, for Less

Schilling Robotics' 25th anniversary this year coincides with the company delivering its latest advancement in ROV performance and technology - the 125shp HD™ ROV. During the development of the HD™, Schilling paid particular attention to new industry requirements being set by E&P companies, including Statoil.

Text and photo: Schilling



Schilling's 125shp HD™ ROV

It became apparent that the industry needed a workclass ROV system that was not only compact and cost-effective, but also flexible in terms of system configuration for performing a wide variety of tasks including drill support, inspection, maintenance and Repair (IMR) and medium-duty construction.

During the last decade, the ROV industry primarily focused on building fleets of ultra-heavy duty ROV systems to support deep-water field construction. Now, the industry is seeing many new deepwater drill rigs and ROV support vessels entering the global market to support new exploration, and life-of-field maintenance for the rapidly growing subsea infrastructure. These rigs and vessels all require mid-size ROV systems, with topside equipment that has an optimized deck footprint to increase the amount of vessel capacity for other equipment and tasks.

Although there are several ROV systems available in the mid-size class, Schilling noted that many customers identified common limitations. Key issues included; i) Limited market versatility, ii) Lack of physical space onboard the ROVs, iii) Inability to easily integrate tooling packages, and iv) Difficulty performing system maintenance due to compact configuration.

Schilling recognized the importance of solving these limitations in the development of the HD™ system, and concluded that the industry trend of repackaging larger vehi-

cles into a smaller configuration would not achieve the desired outcome. Tyler Schilling, CEO stated " It's important to understand how ROVs will be used offshore and the limitations of the operational environment. It's also important to understand when to adapt existing technologies to solve a problem and when you have to deliver a better solution".

The foundation of the HD™ is a framework that has been designed to fit the high-end specifications and configuration flexibility required within the market. The HD™ can be outfitted for Drill Support on one operation, then quickly and easily reconfigured with a comprehensive range of tooling for IMR or construction operations on another project. The HD™ provides the most onboard capacity for adding tooling compared to any vehicle in its class and can accommodate 3,000Kg under-slung tooling skids. In addition, the frame is designed with simple mechanical interfaces to enable rapid exchange of fore and aft mounted tooling packages.

Schilling's focus on providing a core foundation for the HD™ that was built with the operator and the task in mind required a refined solution for the vehicle's control and hydraulic power systems. Schilling leveraged its Digital Telemetry System™ (DTS™) that is standard on all of their ROV and related tooling products. This Ethernet based control system has been utilized for almost a decade on Schilling systems and provides a plug-and-play interface for tooling/survey

equipment integration, while consuming minimal space on the vehicle compared to traditional solutions that require bulky one-atmosphere canisters.

Existing solutions for ROV hydraulic power systems were considered, but traditional HPU's require a large number of subsystems that all have to be interconnected with piping, manifolds, filters, compensators and power distribution components. This valuable space can be used for integrating onboard tooling, and presented the most significant area for improvement. Schilling solved this problem and increased available space on the ROV by more than 40% by supplying an integrated hydraulic power system. As with the DTS™, Schilling's HPU is modular in design, enabling simple diagnostics and rapid maintenance if required.

Schilling's philosophy of delivering increased performance, and not compromised performance, is also evidenced in the HD™ with the inclusion of automatic piloting features based on their StationKeep technology. This enhances any ROV pilot's ability to work in the most challenging subsea environments where visibility and currents present a challenge. Combined with an ergonomic operator control environment that provides an intuitive interface, and a launch and recovery system that is optimized for road transportation and rapid mobilization, the HD™ system presents a solution for customers who need performance and flexibility in today's markets.

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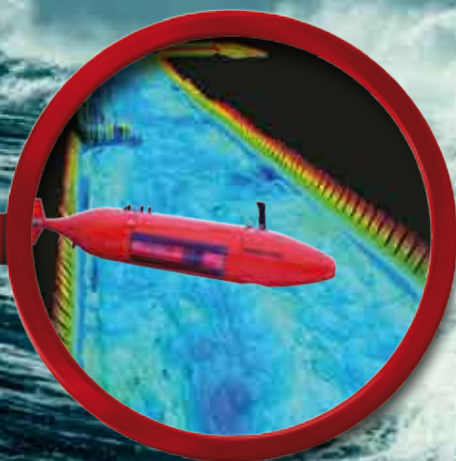
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IKM Subsea - Norwegian Rov Operator/ Fabricator

- A Success Story

IKM Subsea AS located at Bryne just outside Stavanger has had a busy and challenging spring season. The launch vehicle (ROV), MERLIN WR 200 was completed and immediately brought into operation on the Normand Prosper (Solstad) anchor handling vessel. A development program lasting for more than 2 years had come to an end.

Text and photo: IKM Subsea

A Factory Acceptance Test (FAT) was executed to verify the functionality of the system and the system was subsequently mobilized/ installed in the vessel. IKM was given a three week installation window on the vessel to permanently install the ROV spread in the ships hangar, and in the true IKM spirit a multi-skilled project team managed and performed the total installation at Mekjarvik on time.

Following this integration, the vessel immediately mobilized for the first ROV work ever on this vessel.

Testing of a ROV system was challenging for IKM, but doing actual work with the system is altogether a different story. This was a major challenge for IKM and for the MERLIN subsea technology as a whole.

The ROV concept is different from existing ROVs. The MERLIN WR200 is a fully electrical work class ROV based on a composite frame with state of the art control system and

advanced technical solutions. The company has claimed "Superior Handling, Increased Power and Increased Reliability". Did the system meet these expectations?

Mr Kurt Kleppe, operations manager at Fugro says:

"IKM Subsea with the Merlin WR200 did an impressive job for Fugro Survey AS performing survey activities in the Goliat field during May- June this year. Both the stability and available power from the Merlin WR200 was truly impressive. Vital to the success of the survey job was the interface between the ROV and Fugro's survey spread. ROV operations in connection with interfacing to Sub Bottom profiler, Multibeam Sonar, Side-scan Sonar, Doppler, Bathy Suite and Fiber Optic Gyro is generally a challenge. IKM performed this integration well within the timeframe given in close cooperation with the Fugro survey team. The survey work was performed reliably, thus collecting and producing survey data efficiently for Fugro and its end customer".

The MERLIN WR 200 system has been in operation since April. From the very beginning the system performance has been highly stable, achieving above industry standard average uptime. The "electrical advantage" is pronounced and the expectation of an absolute minimum downtime is achieved. The composite buoyancy system proved to give enhanced in-flight and work platform stability. The dual contra rotating thrusters produced an unsurpassed high power level, enabling the vehicle to perform the most challenging ROV work available. The man machine interface had been one of the most prioritized design areas of the vehicle. The feedback from the pilots were all good, an expression to sited "this vehicle system really performs well".

MERLIN production unit no 2 is completed in July this year with further 4 vehicles under way this year.

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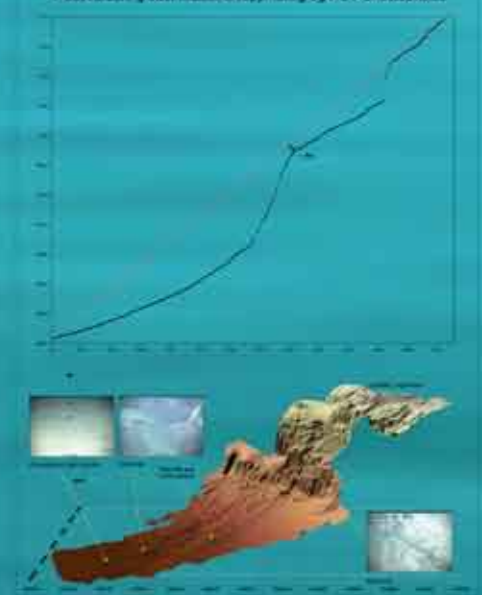
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Arnstein Wee, Technical Director and CTO, together with Hans Olav Hide, Managing Director and CEO.



Combined multiphase and wet gas meter

FMC Technologies' subsidiary Multi Phase Meters AS (MPM) was established when its founders recognized a need for a new method of measuring the constituents and flow rates of a production line (including oil and gas rates, water cut and salinity). MPM identified a technique called process tomography, commonly used in other industries, as a potential application for oil and gas operators.

In 2004, with funding support from six major oil companies, MPM began developing prototypes for their first multiphase meter. The central technology of the MPM meter is marketed as 3D Broadband™. The basic concept is to send and receive electromagnetic waves in multiple planes and over a wide frequency spectrum through the fluids inside the flowline. The technology development benefitted greatly from the consistent and active involvement of experts from the oil companies, and initial tests were very successful. The result: meters that are almost as accurate as single-phase meters which can be deployed quickly and considerably less expensively than conventional systems for both topside and subsea applications.

Unique self calibrating

One of the unique aspects of the MPM meter is its self-calibrating feature, which allows inline measurement of the water salinity and the gas properties. This provides an immediate correction for fluid property changes occurring in the field, making the meter very robust to these common chan-

ges, and significantly improving the accuracy of the measurements.

Another uniqueness is the DualMode® functionality, meaning that the MPM meter is a combined multiphase and wet gas meter. In the early years of production, many fields start out producing predominately oil. However, as the oil is depleted and the pressure is reduced, the fields normally develop into producing mostly gas. Production from multiple zones in a reservoir may also cause significant changes in the gas and water fractions (GVF and WLR) as well as drastic changes of fluid properties over time. In other cases, such as gas lifted wells or long horizontal wells at low pressure, the GVF may continuously change from multiphase to wet gas conditions, referred to as slug flow. For these kinds of field applications a multiphase meter might be required in the early years of production, while a wet-gas meter is needed later in the field's life. However, the MPM meter with DualMode® will automatically switch between multiphase and wetgas measurements, and one meter can be used for the full field life.

Wet gas challenge

For wet gas applications, the challenge is often the accurate measurement of small saline water rates in a gas dominated production stream. For a wet gas meter to provide such measurements, once the liquid volumes have been successfully measured, the small liquid fraction must then be split into water and oil. Additionally, operators would often like to know the conductivity and salinity of the produced water in order to determine its source. Hence, a metering system that is capable of extremely high resolution is required for this task.

Tested and field proven

The MPM meter has been subjected to separate and equally rigorous blind testing at a number of industry test facilities and oil company field applications to ensure that the meter works as designed in real-life environments. Its testing has demonstrated the meters superior measurement accuracies over a large operational range. The subsea meter has gone through extensive operator driven programs, using the most stringent industry standards as a basis. The meter completed the DNV RP-203 qualification process, and is fully qualified to meet API 6A and API 7D for up to 15,000 psi, 480 degrees Fahrenheit (250 degrees Celsius) and 11,500 feet (3,500 meters) of water depth.



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“Teamwork is not just doing something together,
it is the unity of mind for a single cause.”



Testing av HCS-systemet ved Aker Solutions fabrikk på Tranby.

Staying connected

A new generation of diverless subsea connectors has been developed by Aker Solutions, making the installation of subsea systems in deep water easier, faster and more reliable.

Text: Alex Markland
Photos: Aker Solutions

For today's deepwater offshore developments, far beyond the depth limits for divers to work underwater, sophisticated remotely operated tools are needed to interconnect subsea hardware on the seabed. A range of pipelines and pipework - flowlines, jumpers and umbilicals - some of them rigid, some of them flexible, must be securely tied-in to subsea wells, manifolds and other equipment.

"Making such connections safely and reliably, often thousands of feet below the sea surface, requires purpose-designed systems which can be operated by remotely operated vehicles," explains Bård Kristiansen, Aker Solutions' product and concept manager for subsea tie-ins and structures. "As subsea developments have moved into ever deeper

waters to access fields which frequently have higher operating pressures and temperatures, the tie-in connection systems have grown in size and complexity, and installation costs have increased accordingly. This is why we set out to develop a range of new subsea connectors which are lighter, easier to install and more cost effective, to meet the current and future needs of our clients.'

Many existing connection systems depend on large 'running tools' - mechanical/hydraulic devices which bring together the two sides of a connection before joining them. These are heavy, require large service vessels to transport the equipment, and more service hands to carry out the operations - altogether a slower and more costly process.

Aimed at overcoming such drawbacks, Aker Solutions has worked with both oil companies and leading installation contractors, to develop a new generation of subsea connectors, which are already being used offshore.

"The new connectors are more compact and can be mobilised faster on smaller vessels by fewer service hands; the installation tools are lightweight and can be moved around subsea by standard work-class remotely operated vehicles (ROVs); no heavy running tools or additional external guiding are involved; and the overall connection operations are much faster. We believe these are the most efficient connectors available," says Kristiansen.



Illustrasjon av hvordan VCS systemet installeres subsea.

Two versions of the connection system have been developed by Aker Solutions, one for vertical connections (VCS) and one for horizontal connections (HCS). The connector design has been standardised for use in 12,000 feet (3650 metres) of water. Internal operating pressure can be up to 10,000psi, although a 15,000psi design could be qualified if required; normal operating temperature design is up to 250°F (121°C), but connector seals for 356°F (180°C) are also available.

Among the many attractive features of the new VCS is the tolerance for a starting offset of ± 8 degrees between the two hubs

for rigid spool installation (± 15 degrees for flexibles), which will subsequently become perfectly aligned when the clamp is closed. The connector is already being installed offshore Ghana for the Jubilee field development, where 135 connectors of 6 inch and 12 inch diameter (168-324mm outside diameter) will be installed during 2010.

The intention is to build a portfolio of VCS sizes, up to 28 inch diameter (711mm outside diameter).

The HCS is an evolution of Aker Solutions' tried and tested guide and hinge-over system for horizontal connections. Aker

Solutions currently has a 12 inch HCS is currently undergoing full scale testing at the company's Tranby facility in Norway. The plan is to have a range of HCS connectors up to 28 inch, although a 42 inch (1059mm) connector is also in the early development stage.

Adding to the advantages of both VCS and HCS is the fact that the connection process is readily reversed – the connectors can be opened to allow seal replacement or hub cleaning, without employing a surface crane for assistance and without subsea hardware being brought back to the surface.

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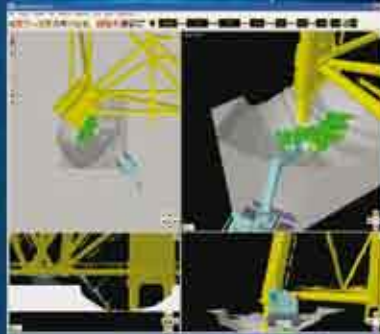
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Underwater Works without limits...



ROV Crew på Magnum142 går over til ny type hydraulikkvæske.



På lag med MILJØ

Oceaneering tar i bruk nytviklet miljøvennlig hydraulikkvæske på ROV-flåten.

Tekst: Egil Egeland, ROV Manager Norway
Bilde: Oceaneering

Oceaneering har over de siste år brukt mye tid og ressurser på å finne frem til en miljøvennlig hydraulikkvæske for bruk på ROV-flåten offshore. I løpet av de siste 3,5 år er det på et utvalg av systemene logget 22.500 dyketimer på slik væske med gode erfaringer.

I utgangspunktet har en ROV et lukket hydraulikk-system. Under normale omstendigheter skal det derfor ikke forekomme utslipp av hydraulikkvæske til sjø. Hvis man med bakgrunn i en utilsiktet hendelse får en lekkasje til sjø, vil det være et svært begrenset volum med væske som kan lekke ut. Med bakgrunn i det lukkede system, og lave volum væske, er det pr i dag ikke spesifikke miljøkrav til type hydraulikkvæske som brukes på ROV. Ethvert utilsiktet utslipp skal logges med volum og type væske for å holde kontroll på miljøregnskapet, hvor som kjent målet er 0 utslipp.

I forbindelse med Tooling operasjoner og for eksempel tilhørende Hotstab løsninger er det økt risiko for at mindre volum hydraulikkvæske kan slippe til sjø. Oceaneering er av den oppfatning at man ved innføring av raskt biologisk nedbrytbar hydraulikkvæske på ROV / Tooling systemer vil kunne innføre en ekstra barriere for skåning av miljøet.

Den syntetiske væsken som Oceaneering har testet ut offshore de siste 3,5 år går under kategorien miljøvennlig (raskt biologisk nedbrytbar) og er anerkjent som et miljøvennlig alternativ på land i Europeisk målestokk. Den har imidlertid ikke vært klassifisert på Norsk sektor i henhold til "Harmonised Offshore Chemical Notification Format" (HOCNF) som er den anerkjente standarden på miljøgradering av kjemikalier som brukes SubSea. Målet har vært å finne frem til et produkt som tilfredstiller minimum Gul klassifisering

på HOCNF skala (Akseptable miljømessige egenskaper). Ifølge eksperter er det ennå ikke mulig å fremskaffe et produkt med akseptable egenskaper som kvalifiserer til PLONOR listen og således klassifiseres som Grønn iht HOCNF.

PANOLIN AG i Sveits tok utfordringen med å videreutvikle eksisterende hydraulikkvæske med det formål å tilfredstille nevnte krav. Væsken som er blitt utviklet har fått betegnelsen PANOLIN ATLANTIS 22. Etter en lengre periode med testing og HOCNF godkjenning har Oceaneering hatt det nye produktet til utprøving med blandt annet fullskalatesting i sjø med ROV. Alle testresultater viser at dette er et fullverdig produkt og implementering av den nye væsken er allerede iverksatt offshore på noen av Oceaneerings ROV-systemer. Neste skritt vil være å få generell aksept på bred basis for bruk av denne type væske på integrerte operasjoner.

ROV Crew på Magnum142 går over til ny type hydraulikkvæske

Dagens Manipulator og Toolingpakker er fortsatt dominert av hydrauliske løsninger. Det er ting som kan tyde på at vi vil se mer og mer elektriske løsninger på toolingsiden fremover med bakgrunn i videre teknologisk utvikling på dette området. Parallellt med denne utvikling er det viktig å fokusere på de tiltak som er mulig å gjennomføre med eksisterende teknologi og anerkjenne de utfordringene som finnes med denne teknologien slik at man kan få rett fokus på korrigerende tiltak.

Vi håper at våre erfaringer kan nyttes av andre innen samme bransje som miljøfremmende tiltak for vår felles virksomhet offshore!

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FFU har siden opprettelsen i 1988 opparbeidet en solid økonomi. FFU har ca. 330 medlemmer og har gjennomført flere utredninger knyttet til aktuelle undervannsteknologiske problemstillinger.

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Utstillinger, konferanser

FFU er faglig representert ved undervannsteknologiske arrangementer i Norge. På denne måten søker foreningen å bidra til at tidsaktuelle temaer blir tatt opp. FFU arbeider også for at undervannsrelaterte konferanser, kongresser og møter blir lagt til Norge.

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