

FFUnytt

FORENING FOR FJERNSTYRT UNDERVANNSTEKNOLOGI
NR. 3. AUGUST 2000

New technology gives electric ROVs a competitiv edge



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Promaster

Side 4

**Stjerneklart
i dypet**

Side 6

Statoil Gullfaks

Side 7

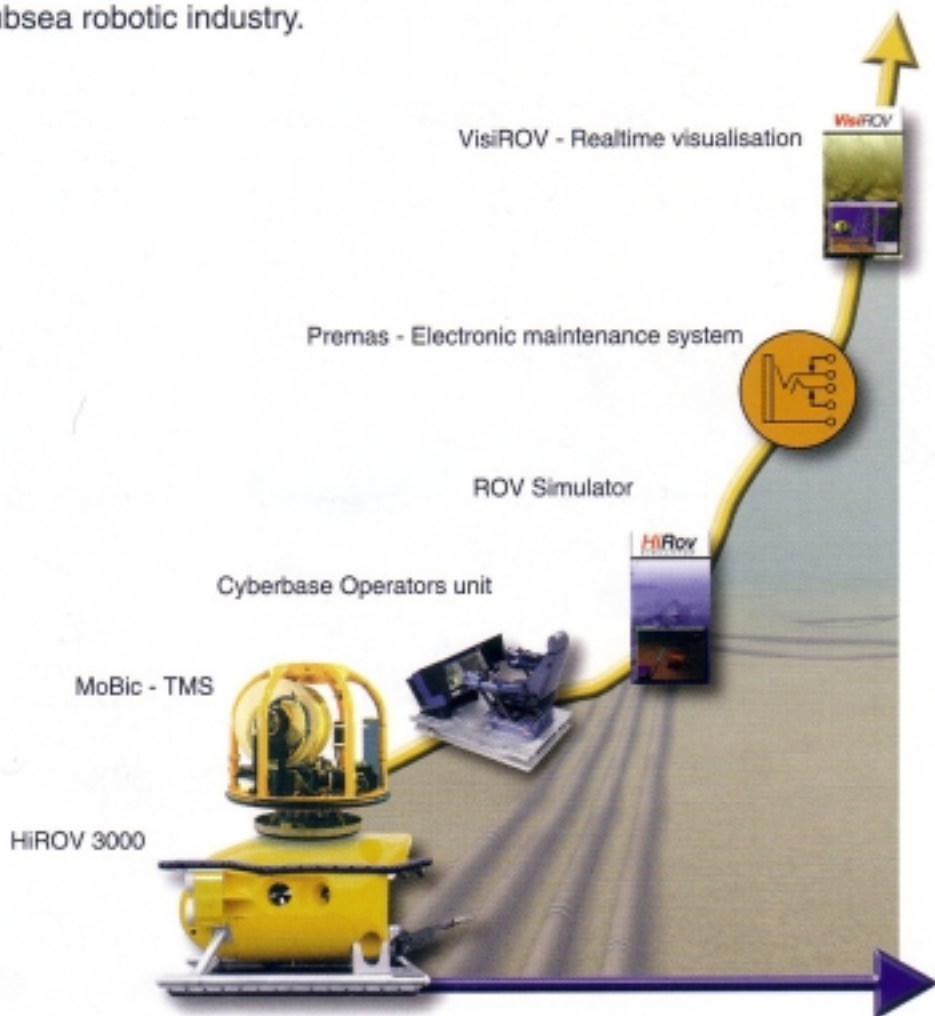
**Ny elektrisk
trencher**

Side 14



Technology at work

Hitec Subsea invests in technology and man machine interfaces. These investments is put to work in Remotely Operated Vehicles (ROV's) and other areas within the subsea robotic industry.



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FFU på Internett:
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Dear Colleges



Iwould like to thank the members and the sponsors for the opportunity to publish this number of FFU-Nytt in connection with ONS 2000.

FFU – Forening for Fjernstyrt Undervannsteknologi (Association for Remote Controlled Technology) main objectives are to communicate knowledge and contact between authority, educational establishment, research, operators, and sub contractor companies.

FFU publishes FFU-Nytt (Newspaper) 4 times a year. This year an improved Internet site has also been established, www.ffu-nytt.no, where you are welcome to visit us.

The last year has been a challenge for many companies, where few if any new contracts have been awarded. The oil companies' economy is better than ever. Statoil's profit was NOK 7.9 billion before and NOK 2.3 billion after tax in the first quarter of 2000. Despite this fact the industry is still waiting for new sub sea construction work, and the concern now is employee reductions.

The most positive in the business must be the Maintenance and Repair contracts. M&R work has become an important part of the ROV companies' income. And in the future these contracts will be of great importance for the industry. I believe that in the near future a number of new companies will find the way to this growing market. Also new Engineering companies have been established in the last few years, as a result of merges between some of the big actors in the sub sea market.

I hope you find FFU as an interesting organisation, and we wish all of you welcome to enjoy us as members.

Pål Espen Antonsen

PROMASTER: A NEW APPROACH TO HANDLING OF MODULES AND HEAVY OBJECTS IN DEEP WATER

The Promaster has been designed to provide a tool for the launch and recovery of modules and heavy objects of up to 1000 ton in deep waters down to 3000 metres with high precision in position accuracy and with the avoidance of any additional guidelines or other guiding systems. The system comprises a thruster module, a Launch And Recovery System, and a surface control system all installed on a monohull offshore ship.

Authors Francois Bernard, b&a industries. Svein Moldskred, Haugesund Offshore Services

The last 5 years have seen an explosive growth in the use of oil and gas technology installed directly on the seabed in increasingly deeper waters in order to reduce the costs of producing a barrel of oil.

As the production frontiers are getting deeper and deeper, a new generation of remotely operated vehicles seems to be required in order for sub-sea installations to remain economically viable.

1998 saw the barrel price fall below \$10 resulting in cutbacks in all areas of production and developments offshore.

Although the price of oil has climbed back in 1999, the target level to justify field developments is still below \$15 per barrel.

The challenge therefore is to develop a technology that will assist in maintaining oil production at sustained profitable levels at below \$15 per barrel and in some cases even below \$10.

THE PROMASTER DEVELOPMENT

Against this background, b&a Industries has developed the Promaster which intends to provide a radically new approach to the deployment and safe installation of virtually any loads to a depth of 3000 meters while cutting down both installation time and costs. The Promaster is a powerful tool, which uses a newly developed, self-contained and fully automated positioning and controlling system by which an absolute positioning accuracy of 1.5 meters through a 1000 meter water column is believed to be reachable. Structurally, the system comprises a main module and a counter module joined together by a frame, itself harbouring a hydraulic clamping device capable to mate with a load. Furthermore, a set of four powerful Curvtech thrusters (4 x 1.5 Te) mounted on turn tables and on either part of the modules two by two, ensure translation and torque control means, enabling the tool to direct the behaviour of the load while being deployed through the entire water column.

In order to enhance torque control (Max. 260 kNm) the structure is designed such that the counter module can travel along its horizon-

tal axis, while maintaining its Centre of Gravity (COG).

Keeping in mind the coherence of the Promaster design with other on-going projects, it was decided to provide the tool with the possibility to also mate loads up to 40 tons directly under the main module by a single docking pin arrangement.

Last but not least a special tooling and power plant platform able to swivel 270 deg. form an integral part of the Promaster system.



The Promaster Thruster module

The STAR System

STAR denotes "Storage, Transport, Application & Removal" and was specifically designed in order to bundle two or more cables made from different materials, moving unsynchronously and at different speeds with respect to each other – in this case, a synthetic fibre main lifting rope and an umbilical. The aim of such a development is to prevent "cables" from getting entangled or getting damaged while paid-in or out to great depth. The entire machine is automated and will be able to cope with displacement speeds of up to 2.4 m/s dictated by the Promaster heave compensated and constant tension winches arrangement.

The Promaster Launch & Recovery System (LARS)

The LARS consist of a 60 tones SWL A-Frame, a 60 tones SWL main lifting winch actively heave compensated and a set of 20 tones SWL umbilical winches constant tension controlled.

The winches are asymmetrically positioned in relation to the frame assembly allowing



STAR, Umbilical cable and lift rope clamping system

equipment to be positioned between the legs of the A-Frame without interfering with the various cables.

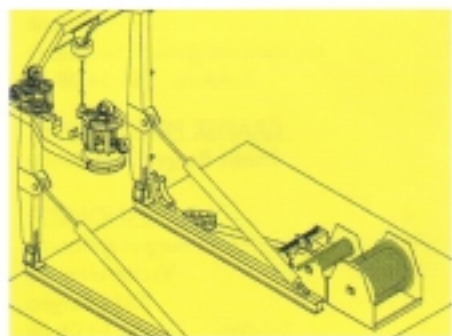
The assembly harbours a latching system comprising a rotary table allowing orientation of the lift if required and several damping mechanisms. For optimisation, a secondary heave compensation unit has been installed in the latching assembly of the Promaster, which can be actuated for final docking of the load at depth.

Present status and Marketing

The system is presently under construction in The Netherlands, France, Denmark, Norway and in the UK and aim to have its final deepwater tests during first part of 2001. New developments of the system are constructed under patent rights or are under patent pending.

The Promaster system will be marketed and made available for service operation on dedicated ships to users around the globe.

b&a industries have appointed Haugesund Offshore Services to represent the Norwegian market.



MacArtney controlling ocean systems - optically

Nexus fibre optic telemetry system - the new multibeam sonar multiplexer developed by MacArtney



Focal Technologies fibre optic telemetry system - video/data multiplexer model 903



Jupiter - a tool control system from Zetechtics



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Stjerneklart i dypet

West Tech AS i Haugesund introduserer en ny generasjon undervannskamera. Den digitale teknikken overfører stjerneklare foto fra dypet til oppdragsgiver på land i løpet av få minutter.

Av Thor H. Nordahl. Foto: West Tech AS

— Vi har store forventninger til dette kameraet og er nå klare til å markedsføre produktet på verdensbasis, seier dagleg leder Geir Egil Østebøvik i West Tech i Smedasundet Maritime Senter. Selskapet har brukt tid siden oppstarten i fjor sommer til å utvikle det nye heldigitale undervannskameraet. Den store lanseringen ble gjort på UI-2000 i Brighton tidlig i mars i år, hvor interessen var upåklagelig. Eiterspørselen har ført til at West Tech nå tar fram en versjon med 300 meters dybde-kapasitet (for bruk av dykker) og en versjon for 6000 meters dybde, hvor flere internasjonale forsknings-institusjoner er interessert.

Høg bildekvalitet

Østebøvik hevder at kameraet er det beste av sitt slag i verden. Det er tenkt brukt på ROV for å dokumentere arbeid og inspeksjon på en ny og bedre måte enn det som hittil har vært tilgjengelig i markedet. Kameraet (i standardversjon) er trykktestet for bruk ned til 3.000 meter. Ein av dei første brukarane er undervannsentreprenøren Stolt Offshore AS i Stavanger som til nå har fått levert to kamera

og har flere på leie.

West Tech har nyttet kjent teknologi i utviklingen av SDS-kameraet. Utgangspunktet er et Olympus C-2000Z stillbilde kamera som er plassert inn i et spesialbygd kamerahus. Ved å utvikle og bygge inn et skreddersydd kontroll- og overføringssystem kan kameraet settes opp for bruk av intern, ekstern eller ingen "blitz", settes opp med auto eller manuell fokus, justere lukkerhastighet og annet før bildet tas. Kameraet har en pseudo-video med 30 hertz oppdatering som føres opp til overflaten, slik at operatøren kan se nøyaktig hva han tar bilde av. Ved hjelp av medfølgende software, kan operatøren umiddelbart se kvaliteten på det bildet som er tatt og enten stryke det ut og ta nytt eller hente det opp til systemets PC på direkten. Deretter kan bildet sendes videre til land ved hjelp av e-post.

— Det nye med SDS-kameraet er den høye og svært gode bildekvaliteten (2.1 Megapixels/1600x1200 billedpunkter) som



muliggjør utstrakt bildebehandling, og at oppdragsgiva-

ren på land raskt kan få resultater av inspeksjonen på det aktuelle objektet. Dessuten kan vi tilby ein pris som er langt under konkurrerende produkt med lavere oppløsning, sier Geir Egil Østebøvik.

I slutten av april måned i år ble det utført en test sammen med Bloms Oppmåling med kameraet, hvor Bloms ville se om dette var brukbart som grunnlag for fotogrammetri eller 3-D målinger ved at det ble tatt bilder fra flere vinkler av et objekt. Det viste seg da at kameraet er i stand til å gi en oppløsning på 0,8 mm og hvor Bloms var meget fornøyd med resultatene. Målingene ble gjort ved å telle billedpunkter (pixels). Fra offshore om bord i MRV "Seaway Kingfisher" ble kameraet brukt tidlig i år, hvor brukerne var svært fornøyd med resultatene. Fra prosjektlederen fikk vi følgende uttalelse: "Jeg har nettopp sett gjennom de digitale bildene som ble tatt offshore fra Seaway Kingfisher og de er bare helt fenomenale! Superb kvalitet! Noe med det mest imponerende jeg har sett på lenge. Gratulerer! Dette lover meget bra!" Det er alt 20 ansatte i West Tech AS, men bemanningen vil bli noe høyere. Det er budsjettert med rundt 20 millioner kroner i omsetning i 2000 og kanskje det doble i løpet av noen år.



Høy kvalitet: En sjøanemone i Smedasundet fotografert med det nye digitale undervannskameraet.

Ung jubilant

West Tech AS feiret ett år den første juli i sommer, og er fornøyde med tingenes tilstand i sitt første leveår. - Så langt har det meste gått som planlagt. Vi ligger i tråd med forventningene og budsjettene og så langt ser alt bra ut, forteller Thor Nordahl i West Tech.

Som basis har det Haugesund baserte selskapet en serviceavtale med Stolt Offshore med en tidsramme på 3 år fra starten, hvor West Tech skal ha service og vedlikehold av Stolt Offshore's utstyr som er plassert i Norge. Denne avtalen har gitt etableringen ett godt grunnlag for videre utvikling.

- I løpet av siste år har vi lagt store summer ned i utvikling av egne produkter, som for eksempel mekanisk "Mini-latch" og "Maxi-latch", Digital Stills Camera med høy oppløsning for undervannsbruk, forbedret 3-finger klov for Schilling manipulatorer, spesiallys for fiskeoppdrett, "kraft-blokk" for tetherkabel til små farkoster (opp til 30 mm diameter).

HPR-transducer oppheng for redningselskapet, slepe-fisk med kamera for søk ned til 100 meters vanddyb med lys, spesialklov for håndtering av nedihulls verktøy/wireline verktøy på boredekk, hydrauliske kompensatorer og en rekke spesialverktøy for ROV for å nevne noen, sier Nordahl.

På service-siden overtales blant annet Schilling manipulatorer, pusteluftutstyr for dykkere og alle typer hydrauliske verktøy.

- Vi tar også service på sleperinger fra Focal, hvor vi har spesialkompetanse på utskifting og testing av de elektriske komponentene. West Tech er dessuten i stand til å levere komplette ROV-systemer fra de minste observasjons-ROV'er til store, avanserte, arbeids-ROV-systemer samt å drive service og vedlikehold på samme. Vi kan også stå for daglig drift av ROV-systemer for kunder, avslutter Thor Nordahl markedsjef ved West Tech.

Statoil Gullfaks Phase II bundels

By Trond Inge Ramsnes



Halliburton Subsea have recently launched and installed their biggest bundles to date for the Gullfaks Phase II development for Statoil. The 14km bundle constructed and installed in two 7km sections weighed in at an overall 18000Te - 9000Te each section. The size of the outer carrier pipe was also the largest to date at 1.257m (49.5") in diameter.

Gullfaks Phase 2 is a subsea gas recovery development of 8 wells (plus future option of 4 wells) tied back to the Gullfaks C platform in 200metres waterdepth. There are several similarities with the 10km long Gullfaks Phase I development, which tied back to Gullfaks A platform and was installed by Halliburton Subsea in 1998.

These similarities are

- a) the use of 13% Cr material for the Production Flowlines.
- b) the inclusion of Controls within the pipeline bundle.
- c) the inclusion of hot water heating in the bundle to prevent hydrates forming.
- d) the use of fibre optics for real-time flowline temperature monitoring.

The bundle comprises 2x14" Production and 1x8" Test line, 2x4.5" Heating lines, 2x2.5" Methanol lines and Controls Tubing/Cables. The fibre optic for temperature monitoring is installed, into a tubing conduit pre-installed in the bundle, from the platform once the system is completed. The towhead structures at each end of the bundles contain docking porches for the

connection of all tie-in spools and umbilicals using diverless connection tools. Three of the bundle towheads weighed 100Te each and the platform riser towhead weighed in at 150Te.

The bundles were constructed and launched from the Halliburton Subsea Wester Site in Wick, Scotland and were both installed diverless in a single campaign of 24 days. The steel production risers, which were also in Halliburton Subsea's scope were fabricated at Hinnavagen in Stavanger and towed to the field by the Controlled Depth Tow Method (CDTM). Buoyancy tanks were attached to the steel risers which were clamped in a flat pack arrangement. Once they were towed out and lined up with the platform J tubes, the clamps and buoyancy tanks were removed and the risers pulled into the J tubes. The 12" production risers were each pulled into spare 16" J-tubes at Gullfaks C platform with pull-in loads of 50Te despite the tight tolerances.

The production tie-in spools between the bundle sections and the bundle to risers, were heated by 'piggy backed' hot water lines encapsulated within the insulation system. This feature prevented hydrates being formed in the low points typically found in tie-in spools.

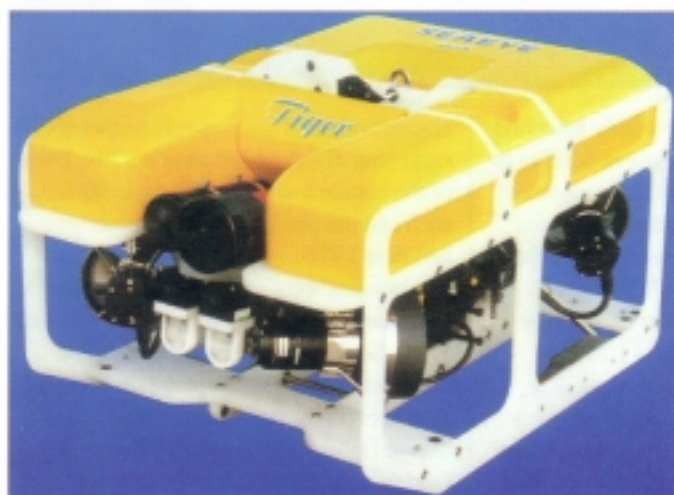
The completion of the Gullfaks Phase II bundles marked 43 bundles installed to date from the Wick site. Halliburton Subsea have one further bundle to be launched during the 2000 season, and a further two bundles committed for launch in the 2001 season.

West Tech AS har i dag representasjon i Norge for ROV-systemer, som dekker hele spekteret fra de minste observasjons-ROV'er til de større arbeids-ROV-systemene. Ved valg av representasjon for liten elektrisk ROV bestemte vi oss for Seaeeye Marine's farkoster, p.g.a. kvaliteten og valgmulighetene. Produktspekteret spenner fra den minste Seaeeye DT-600 til den største Seaeeye Panther (mellomstor arbeids-ROV) fra denne produsenten. For store arbeids-ROV systemer har West Tech representasjon for Hydrovision Ltd. som produserer store hydraulisk drevne ROV-systemer.

Elektrisk ROV bygget på åpen ramme

ROV-systemene fra Seaeeye Marine er korrosjonsfrie og lite vedlikeholdskrevende. Produktene fra det britiske selskapet blir av mange regnet som det ypperste innen elektrisk ROV'er. I Norge er det fortsatt bare Rockwater som bruker systemene, mens langt flere bruker selskapets ROV'er i Sør-Europa, Asia og Australia.

Av Thor H. Nordahl, West Tech AS



Seaeeye Panther utstyrt med SM 5 thrustere

Seaeeye Marine's farkoster er alle bygget opp på samme lest. Rammen som bærer alle komponentene er bygget opp av polypropylen platemateriale med alle festedetaljer og løftepunkt laget i rustfritt stål. Seaeeye Marine var den første produsenten som tok denne teknologien i bruk. Dette gjør ROV-systemene fra Seaeeye Marine korrosjonsfrie og lite vedlikeholdskrevende. Alle deler for rammene er data-skåret ut fra platemateriale, slik at nye rammedeler og/eller reservedeler alltid vil passe 100%. Seaeeye Marine's ROV'er er bygget opp hydrodynamisk med minst mulig "drag", for å kunne utnytte framdriftskraften fra thrusterne mest mulig effektivt.

Seaeeye Marine produserer også sine egne børsteløse likestrøms (DC) thrustermotorer som blir brukt gjennomgående på alle ROV-typene de produserer. Disse blir bygget opp individuelt, trimmet til perfektjon og grundig testet i vann og trykk tank før de legges ut for salg/bruk.. De fleste ROV-

modellene i Seaeeye's produktregister har thrusterne montert i en vektor-konfigurasjon for optimal utnyttelse og manøvrerbarhet. Thrustermotorene har gjennom årene oppnådd å få meget gode skussmål fra brukere verden over.

Seaeeye Marine's ROV systemer består av overflate power-supply, overflate kontroll-enhet, videomonitor og håndkontroller som et absolutt minimum. I tillegg kommer navlestrengskabel og selve farkosten. Alle farkostmodellene kan utstyres med manipulator og ekstra instrumentering etter behov. Systemene kan også utstyres med en undervanns garasje med kabelwinch som bruker "baille-arm"-prinsippet og derved sparer en ekstra slepering. Garasjen er også bygget av polypropylen og rustfritt materiale på samme måte som ROV'ene.

ROV-systemene fra Seaeeye Marine blir av mange regnet som målestokk for små elektriske ROV-systemer og de er brukt verden over i olje-industrien med oppgaver som bore-støtte, dykker-observasjon, lette til mellom-store arbeidsoppgaver, survey og generell observasjon.

Den siste tilveksten i ROV-spekteret fra Seaeeye Marine er Seaeeye B.O.S.S. Dette er en batteri-operert farkost som styres via en enkel optisk fiber. Denne har en operasjonstid på inntil 9 timer i vann med standard batteripakke og kan opereres inntil 2000 meter fra utgangspunktet. Operasjonstiden kan forlenges ved bruk av spesielle batterier. Farkosten vil være ideell for inspeksjon i kraftverks- og rørlednings-tuneller som er vannfylt. Systemet er meget lett og kan derfor også brukes i mange andre sammenhenger i forbindelse med søk og observasjon.

Batteri-flasken på farkosten kan skiftes på få minutter slik at en kan oppnå tilnærmet kontinuerlig operasjon med dette systemet. Seaeeye BOSS bruker samme thruster-teknologi som de andre modellene i Seaeeye's produktregister.



Seaeeye Tiger utstyrt med SM 4M thrustere

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Electric LARS Lightens the QUEST's On-Deck Handling System

By Wes Gerriets, ALSTOM Schilling Robotics



The new QUEST electric launch and recovery system (ELARS) from ALSTOM Schilling Robotics is so small and light that you would never guess it is used to handle a work-class ROV. The small ELARS size is made possible by the QUEST's reduced umbilical cross section size (only 27 mm for a 3000-meter system), which greatly reduces total umbilical weight. The estimated system shipping weight, including the QUEST WROV, TMS, winch/ELARS, and 3000 meters of umbilical, is 21,775 kg (48,000 lb).

ALSTOM Schilling Robotics is currently building a prototype of its all-electric LARS, which features proven ALSTOM AC vector drives. As designed, the system is much smaller and lighter than typical A-frame LARS equipment. The programmable all-electric drive system

offers cable recovery speeds over 1.3m/sec and active heave compensation for safe docking of the WROV and TMS. From the control van console, the operator can precisely monitor and control winch performance. Standard features include a Lebus-style grooved drum, a failsafe brake system, and automatic level winding.

The innovative deck configuration facilitates installation and mobilization, and allows the WROV and TMS to be transported while connected to each other on the skid base. The LARS/WROV/TMS equipment is lifted as one unit, simplifying placement and reducing crane dependence.

Rather than swinging the WROV/TMS package through an A-frame for launch and recovery, the QUEST ELARS simply lifts the WROV/TMS off the deck

and then moves the entire winch and gantry assembly on a track system to the deck edge. This track system has important advantages:

- Since the WROV/TMS package is not constrained by the width of an A-frame, larger tooling packages can be safely deployed.
- The TMS and WROV are less likely to be damaged by contacting the LARS equipment during recovery.
- LARS on-deck weight and complexity are significantly reduced.

The track concept is not new in the offshore industry. A similar track system is often used in saturation diving to move the bells from the cursor to the DDC. Also, entire drilling and workover systems are now moved between moon pools on tracks.

QUEST WROV FAQs

The electric QUEST WROV system from ALSTOM Schilling Robotics is based on a set of simplified, integrated subsystems for propulsion, control, and communication, and is the first WROV in 30 years to be engineered from the ground up. All aspects of the system, from training, operations, and maintenance through packaging and transport, have been studied, tested, and prototyped to identify the best practical solutions.

By Wes Gerriets, ALSTOM Schilling Robotics

The first article ever written about the QUEST appeared in the May 1999 issue of FFU nytt. In the months since then, we have received many inquiries about the vehicle's capabilities and how it functions in offshore construction applications. This article provides answers to some of the most frequently asked questions about the following topics:

- Tools and sensors
- QUEST WROV size and capability
- Electric thrusters
- Electrical power transmission and conversion
- Tether management system (TMS)
- Materials
- Control station

Tools and Sensors

Installing tooling and sensors is an important (and often difficult) part of any WROV mission. The QUEST is designed to make this task simple and efficient.

Q. Can I install and run hydraulic tools?

A. Standard equipment on the QUEST WROV includes a 7.5-kW electro-hydraulic power unit (HPU) that outputs 19 liters per minute at 207 bar. The HPU is powered by a QUEST electric ring motor that drives a fixed displacement CIG pump. One unique feature of the QUEST HPU is that up to three pumps can be "stacked," allowing one motor to selectively drive any one of the pumps. This feature lets the operator create flexible systems for tool operation or fluid delivery. Since the pumps are hydraulically independent, "dirty" hydraulic fluid, water/glycol, or preservation fluid can be delivered without contaminating the system. Since the drive motor is the standard QUEST brushless DC ring motor, fluid pressure (which is controlled by motor torque) and flow (which is controlled by motor speed) can be precisely regulated from the operator console.

Q. How many SeaNet connection ports are available for additional equipment?

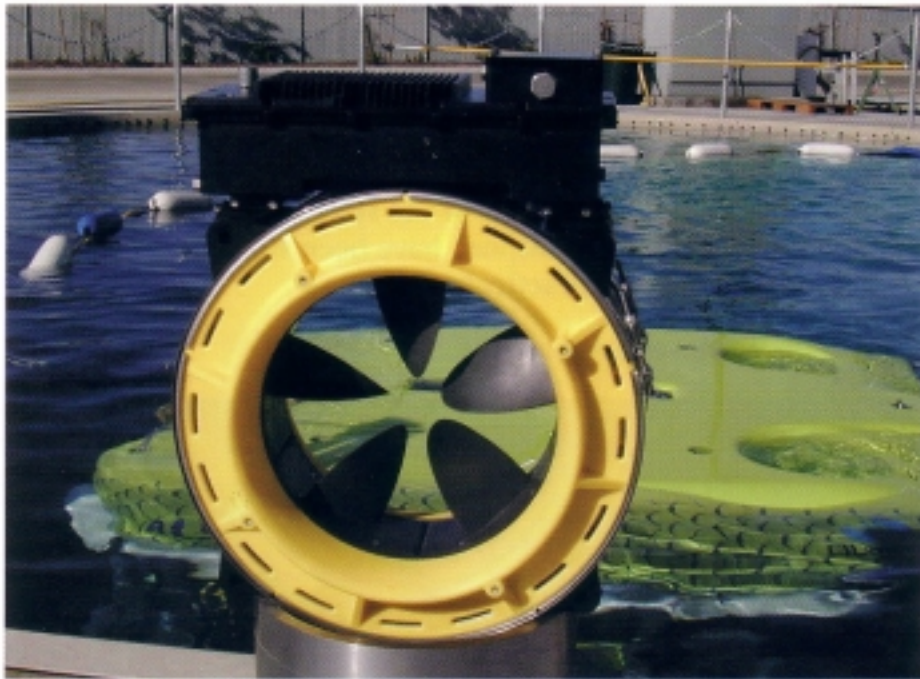
A. With a full load of standard equipment, the QUEST SeaNet communication hub



has 12 unused digital RS-232 connection ports and 4 unused analog/digital connection ports (for cameras, sonar, etc.). Standard equipment includes one ORION 7P and one RigMaster manipulator, HPU, eight-function hydraulic manifold, color camera, SIT camera, pan & tilt unit, five high-intensity discharge lights, sonar head, aft viewing camera, Doppler velocity log, Novatech strobe, and RF beacon.

Q. What electrical power is available for optional tooling?

A. The QUEST WROV offers several options for auxiliary electrical power. For sensors and small tools (including the SeaNet actuators), up to 250 W is available at each 26-VDC SeaNet connection port. For equipment with higher power requirements, two 15-kW connection points provide 600 VDC each. These 600-VDC feeds can power additional QUEST ring motors (for suction-piling skids, dredges, pull-in skids, etc.), or can operate standard electric motors. Power management and control is



always available at the GUI, allowing the operator to direct electrical current to the active tool. For dedicated tooling systems (such as trenchers), additional conductors can be added to the umbilical. A 150-kW umbilical for 3000-msw operation has a diameter of only 31mm.

Q. How can I interface rental (hired) equipment to the QUEST?

A. For items that cannot be easily converted to the SeaNet connection system, we supply a small interface bottle that features standard, threaded penetrations on one end bell and SeaNet connectors at the other end bell. Inside are terminal strips for interconnection and space for any required power supplies. The interface bottle allows the operator to easily and quickly install and remove temporary equipment.

QUEST WROV Size and Capability

Because the QUEST is noticeably smaller than most hydraulic work-class ROVs, some people have asked whether the QUEST can be used for construction support, survey, IRM, and other work-class applications. The answer is a definite "yes."

Q. The QUEST looks smaller than typical hydraulic WROVs. How does its performance compare?

A. The QUEST WROV is smaller; the standard 3000-msw vehicle is 1.7m wide x 2.3m long x 1.6m high. Approximate air weight (including a full suite of standard equipment) is 2275 kg, in contrast to standard hydraulic WROVs that typically weigh more than 4000 kg. Because the QUEST vehicle is not loa-

ded with equipment needed to produce hydraulic thrust (such as large, heavy, main HPUs, valve manifolds, and piping), the QUEST's frame and buoyancy unit can be smaller and lighter. And because the electric thrusters provide more output than most 150-hp WROVs, the QUEST is much faster (with speeds greater than 4 knots) and more controllable. The ability to direct maximum power to a specific set of thrusters (a feature not possible with standard open-loop hydraulic systems) also increases vehicle control.

Q. What is the QUEST's standard through-frame lift capacity?

A. The QUEST frame has a 2-tonne through-frame lift, allowing it to accommodate heavy tool skids. The design is DnV-certified and is tested prior to delivery. Mechanical "quick connect" points allow skids to be safely and easily interchanged while the vehicle is on deck.

Q. How much reserve buoyancy (lead) does the QUEST have for the installation of optional equipment?

A. In its standard configuration, the 3000-msw QUEST includes 160 kg of lead to accommodate optional equipment.

Electric Thrusters

An innovative electric ring motor provides the power for the QUEST's thruster, TMS drive, and HPU drive.

Q. How can the thruster have only one moving part?

A. On the QUEST 600-volt, brushless DC electric ring motor, windings and laminations are on the outer perimeter (stator) and the permanent magnets are in

the inner rotor. (This arrangement is the reverse of most general-use motors.)

The thruster blades are fixed to the rotor, which is the only moving part in the entire propulsion system. This design features an open center that allows debris to pass through. Also, because the motor is not in the flow path, thrust is equal in both directions.

Q. I've heard that the thruster does not use rolling bearings or dynamic fluid seals. How can this be so?

A. Ball and roller bearings typically require a sealed housing with lubrication, which in turn generally requires high-speed shaft seals. This design has frequently proven to be unreliable in operation and difficult to service in the field. The QUEST electric ring motor uses innovative hydrodynamic bearings that require only seawater for lubrication. (This design is similar to the journal bearings in an automotive engine crankshaft, except the QUEST's materials are plastic.) The natural pumping effect of the bearing system directs water through filters that screen out sand and debris.

Q. How powerful are the thrusters?

A. The QUEST's electric thrusters have a sustained thrust of 205 kg when measured in the worst case (static condition with no flow around the shroud). While hydraulic thrusters with the same throat diameter can demonstrate similar thrust in laboratory settings, this performance is never achieved in ROV applications. Typically, the hydraulic pressure and flow delivered to the thruster motor is 50% or less of the rated power due to pressure losses across valves and viscous losses through small-diameter tubes, hoses, and fittings. Efficiency is also lost through depth-related increases in viscosity and decreases in lubricity.

Q. How can the thruster be used to power a TMS or HPU?

A. For applications requiring a direct mechanical drive (the HPU pump and the TMS drum and tensioning sheave), the thruster blades are simply replaced with an adapter plate. The electric ring motors for these devices are identical and interchangeable, and technicians can easily swap motors in the field.

Electric Power Transmission and Conversion

By using new technologies and applying power conversion techniques not previously used on ROVs, we have made the QUEST's power system small and efficient.

Q. I have heard that you are using a transmission frequency higher than 50/60 Hz. Does this improve system performance?

A. The QUEST uses 3-phase, 3k-VAC power transmitted down the umbilical and tether at 600 Hz, allowing a significant reduction in power transformer size and weight. (A 60-Hz transformer with the same output rating weighs approximately 365 kg, five times more than the 73-kg QUEST transformer.) The electrical system allows the QUEST WROV to perform better simply because there is less ROV weight and size for the thrusters to push through the water. The reduced complexity of the electrical system also makes troubleshooting and maintenance much easier.

Q. Can the QUEST operate from the ship's mains?

A. The QUEST electrical system does not require any special filtering or conditioning for incoming power. The system operates on voltage levels from 380-575 VAC and at frequencies as low as 45 Hz. Assuming that the ship can supply at least 100 kVA for the system, there is no need for a dedicated generator or MG set. If a generator is needed because ship's power is unavailable, the QUEST WROV can use a generator that is significantly smaller (125 kW), lighter, and less costly.

Q. Why are the QUEST umbilical and tether so much smaller?

A. Using innovative electrical and optical transmission techniques has allowed us to significantly reduce cable size and complexity. The umbilical contains only three conductors (plus one spare) for main ROV/TMS power, in contrast to hydraulic systems that require up to 21 individual conductors just for power. Since the QUEST does not use AC induction motors, only one power circuit is required for the entire subsea system. For telemetry, just one single-mode fiber is required for all data and video transmission. A second terminated fiber is installed as a backup. Reducing the cable content and complexity shortens the time required for cable termination. Rather than using dozens of copper conductors and multiple fibers, the QUEST system needs only three power conductors and one fiber. This reduction in complexity also reduces the potential for connection errors. Since the QUEST umbilical is significantly smaller and lighter, the deck handling equipment can also be smaller and lighter. The in-water weight of the

umbilical (for a 3000-m system) is only 5.5 tonnes, while comparable hydraulic WROV umbilicals weigh more than 12 tonnes. With a diameter of 27 mm, the smaller umbilical allows a much smaller deck footprint for the winch and LARS. The smaller umbilical size also makes the deployed vehicle less likely to be affected by currents or dragged off the work site.

Tether Management System

By using equipment from the QUEST vehicle for TMS power, telemetry, and drive systems, we have created an electric TMS with superior operation and reliability.

Q. What improvements are featured in the QUEST TMS?

A. The TMS has a shuttling drum and a straight tether path that avoids the stresses and twisting common in typical designs. By eliminating tether twisting, cable life (especially for the optical fibers) is greatly extended.

Because the cable drum and cable tension wheel are driven by standard QUEST electric ring motors, speed and line tension are variable from the control station. An innovative clutch mechanism and constant tension operation reduce snap-load on the tether during ROV docking.

The TMS uses a standard SeaNet hub for telemetry and a QUEST voltage converter for power. These parts are interchangeable with those on the QUEST WROV.

Since the TMS is essentially a QUEST vehicle without the buoyancy system, configuration is simple and fast. Adding sensors, cameras, or tools is a "plug and play" operation. Even thrusters can be added by simply bolting on standard QUEST units and connecting the power and telemetry. The QUEST TMS can also be easily converted to a garage-style unit.

Materials

Q. Your communications often mention the use of plastic materials in QUEST WROV subsystems. How far have you taken the use of plastics?

A. Currently, engineering thermoplastics are incorporated into the electric ring motor, hydraulic compensator, SeaNet connector, SeaNet hub connection ports, and much of the mounting hardware. For example, the ring motor features an injection-molded frame, and the stator and rotor are completely encapsulated in thermoplastic. The

thruster uses plastic bearings and blades. We have invested heavily in injection-mold tooling to produce parts that are much lighter and essentially will not corrode.

Control Station

Q. At the Underwater Intervention 2000 conference, you exhibited a modern-looking control console and video/VGA display system. Will this system be included with every QUEST WROV?

A. At the beginning of the QUEST development program, we engaged human factors specialists to recommend ways to improve general operation and reduce operator fatigue and errors. As a result, the standard QUEST control system includes:

- Two-station operator console with individual touch-screen GUI displays
- Four universal hand controllers (to replace outmoded joysticks)
- TheaterView information display system (to replace 19-inch, rack-mounted monitors)
- Operator-selectable control modes, including Doppler-based ROV-DP (a first for a production WROV)

Pictures and Captions

Photo of operator console: The TheaterView system in the control station improves operator awareness and reduces fatigue.

Photo of thruster parts: In the QUEST thruster, the rotor is the only moving part.

Photo of the thruster: The QUEST thrusters are efficient and reliable.

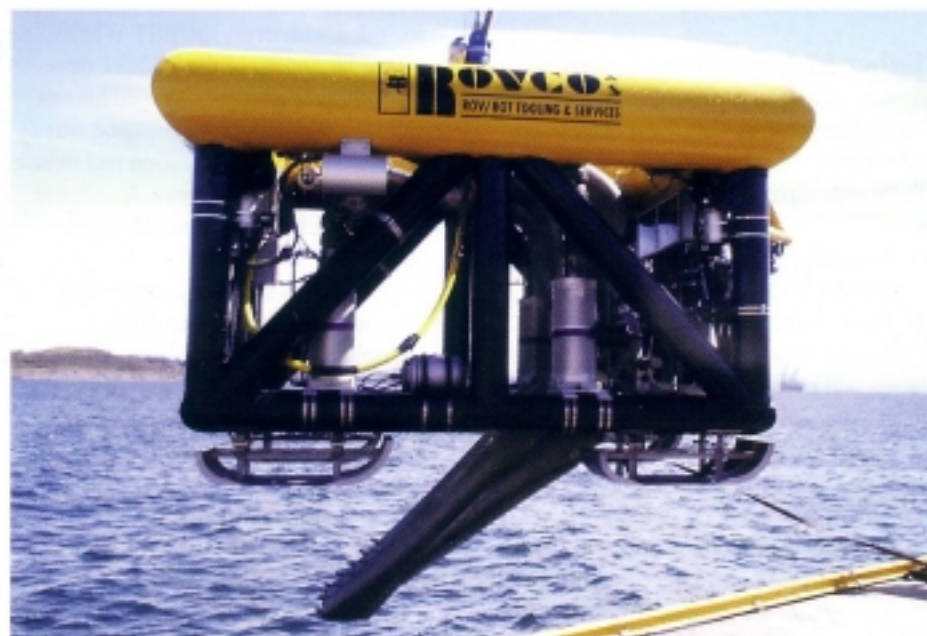
Photo of QUEST and TMS: Parts commonality between the QUEST vehicle and TMS simplifies maintenance and spares provisioning.



Ny elektrisk trencher

Stavanger selskapet Rovco AS har utviklet en ny type elektrisk trencher som kun veier ti tonn. Selskapet kjenner ikke til at det eksisterer andre elektriske trenchere på markedet i dag, og viser til de mange fordeler ved RTS 2000 "MERLIN".

Av Ole Klemsdal



Rovco ble etablert i januar 1999 av Sveinung, Atle og Helge Haugvaldstad. Selskapet drev den første tiden med operasjonell trenching for Dyk&Sjötjånst, med Telia sine trenchere. Raskt så de muligheten for å utvikle sin egen trencher, som kunne unngå problemene rundt breakdown som de hydrauliske systemene sliter med. Løsningen ble en elektrisk trencher, og arbeidet med å bygge "MERLIN" begynte i januar i år.

Utgangspunktet vårt var å analysere markedet, for å kunne utvikle komponenter

som manglet i de eksisterende systemene. Gradvis i utviklingen av nye komponenter så vi en elektrisk trencher vokse frem, kombinasjonen med nyutviklede komponenter som kunne samkjøres med eksisterende elektriske løsninger på markedet, forteller Sveinung Haugvaldstad.

Letteste på markedet

Pr. i dag kjenner vi ikke til noe annet selskap i verden som har utviklet en elektrisk trencher. I tillegg har vår trencher bedre kapasitet enn samtlige andre hydrauliske løsninger, mener Haugvaldstad.

All hydraulikken er fjernet fra selve trencheren, og resten av komponentene er flyttet opp i en container på båten. Dette gjør at effektiviteten blir mye bedre, og breake down blir mye lavere. I tillegg reduseres trencherens vekt, som gjør den enkel å sjøsette og løftes ombord. Rammestrukturen som er bygd opp av GRP rør i et fagverk, har også sin positive innvirkning på vekten til "Merlin". Rørkonstruksjonen er fylt med oppdriftsmiddelet (buoyancy), som gjør at den er den letteste farkosten på markedet i dag med tilsvarende effektivitet. Den har derfor ikke de store oppdriftsblokkene som kjennetegner de hydrauliske løsningene, og derfor er den mye sikrere i forbindelse med sjøsetting og løfting ombord. Vi bruker egne ledere helt fra kontrollkonteiner igjennom umbilical og ned til de forskjellige enhetene for å få et sikrere system. Om en av komponentene stopper, vil fortsatt alle de andre fungerer og vi trenger derfor ikke å stoppe operasjonen for å reparere den ene enheten, den tar vi når vi skal til overflaten for å gjøre planlagt vedlikehold.

Flere oppdrag på gang

I dag mobiliserer vi for operasjon i forbindelse med Troll, i sammen med det nederlandske selskapet Noordhoek. "MERLIN" er også under evaluering for et prosjekt der man skal legge ned en fiberoptisk kabel i Nordsjøen, og dette arbeidet skal foregå nå i vinter.

Vehicle Specifications:

Depth rating	2000 MSW
Length	5600 mm
Width	3500 mm
Height	3400 mm
Weight	10 ton (approx.)
Trenching Depth	3 m Maximum
Trenching Width	1 m Maximum
Thrusters	10 of Electrical 12" Dual Counter Rotating Propellers
Configuration	6 Horizontal (4 vectored) 4 vertical
Pulling force	1640KgF Forward/Aft. 960KgF Lateral 1360KgF Vertical

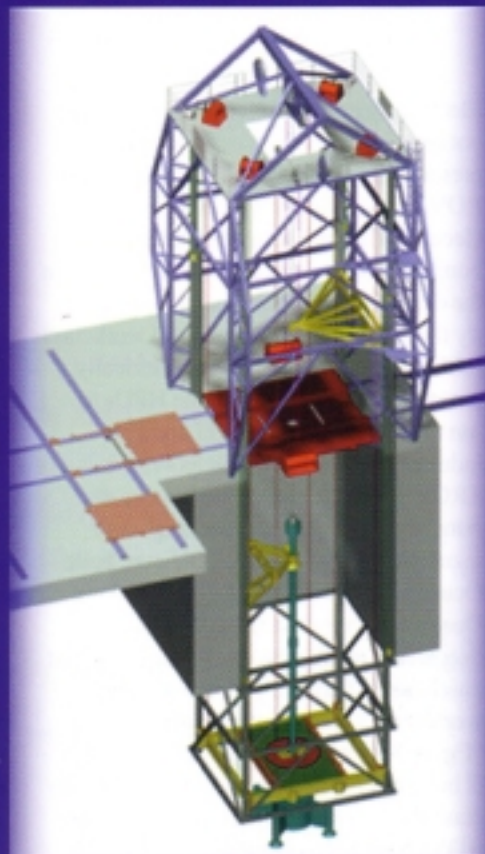
El. motors	4 of 300 kW Electrical Motors (Pump) All individual driven and adjustable speed in a frequency converter system
Jetting System	4 of Water Pumps 2000m ³ / h @ 14 Bar or 1000m ³ / h @ 22 Bar
Cameras	1 of SIT Camera 1 of Colour & Zoom Camera 6 of Colour Camera
Lights	6 of Spotlights, dimmed in pair 6 of Xenon lights 6 of Rovco lights

Sensors:	
Depth	DigiQuarts & Altimeter
Heading	Fiber-Optical Gyro
Pitch & Roll	Fiber-Optical Gyro
Sonar	Sonavision 4000
Auto Functions	Auto Heading / Auto Depth
Water Pressure	Differential Pressure Sensor
Power Requirements:	
RTS 2000	1400 kW, 440V/50-60Hz
Winch	100 kW, 440V/50-60Hz
Control container	100 kW, 440V/50-60Hz

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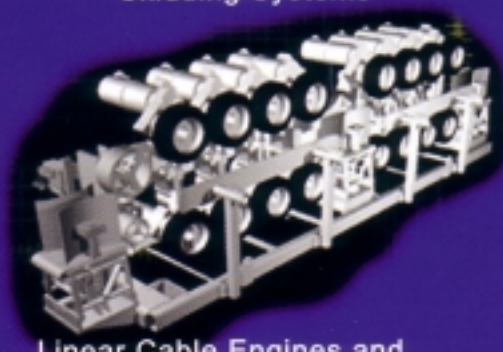


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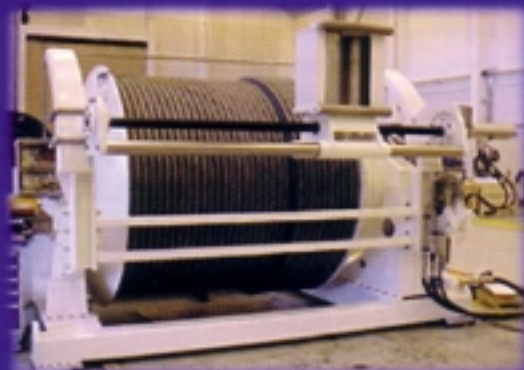
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Umbilical Winches / WOCS
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A new era of electric rovs

By Erik Hestnes Sæstad

Electrically powered workclass ROVs are not new, in spite of the hype and image presently being projected. In fact the first ROV, the U.S. Navy's CURV, was all-electric. This unit recovered the hydrogen bomb off the coast of Spain in the 1966. In the deepwater telecommunications industry the first cable recovery/burial workclass ROVs, Scarab 1 and 2, were electrically powered with electrohydraulic HPU's to run tools in 1978. In the Oil and Gas industry the first workclass ROV, the TROVE, was all electric and to this day remains one of the best handling, most maneuverable workclass ROV ever built. Oceaneering developed the U.S. Navy's Deep Drone series in the late 70's - a deepwater, all electric workclass ROV that continues to perform yeoman service worldwide today, i.e. the recovery of the "Egypt Air" wreckage, fall last year. This is but a brief summary of all electric workclass ROVs. In reality, electric workclass ROVs have been operational for over 40 years, versus a little over 20 years for their hydraulic cousins. Therefore the eMagnum is more an evolution, rather than a revolution.

Major milestones in this ongoing effort are:

- * Development and operation of the first commercial 6000 fsw rated electric ROV in 1978 - Scarab I and II.
- * Development of the first commercial 8250 fsw rated ROV in 1982 - Hydra™ 2500.
- * Development of the first all electric 10,000 fsw rated workclass ROV in 1984 - Deep Drone.
- * Development of the first 25,000 fsw rated electric ROV in 1986 - CURV III.
- * Development of the first family of high performance deepwater workclass ROV in 1993 - the Magnum Series.
- * Development of the high performance family of deepwater workclass ROVs in 1997 - the 150 hp Millennium Series.
- * Development of the first, Magnum, Millennium, or E-Magnum compatible deepwater inspection ROV, the Hydra™ Minimum.

The development of the 100hp e-Magnum is the most recent capability produced in Oceaneering's ongoing commitment to -

Continuous Improvement- in deepwater operations.

This to remain the industry leader in

deep-water remote work and intervention capabilities, performance, and cost effectiveness.

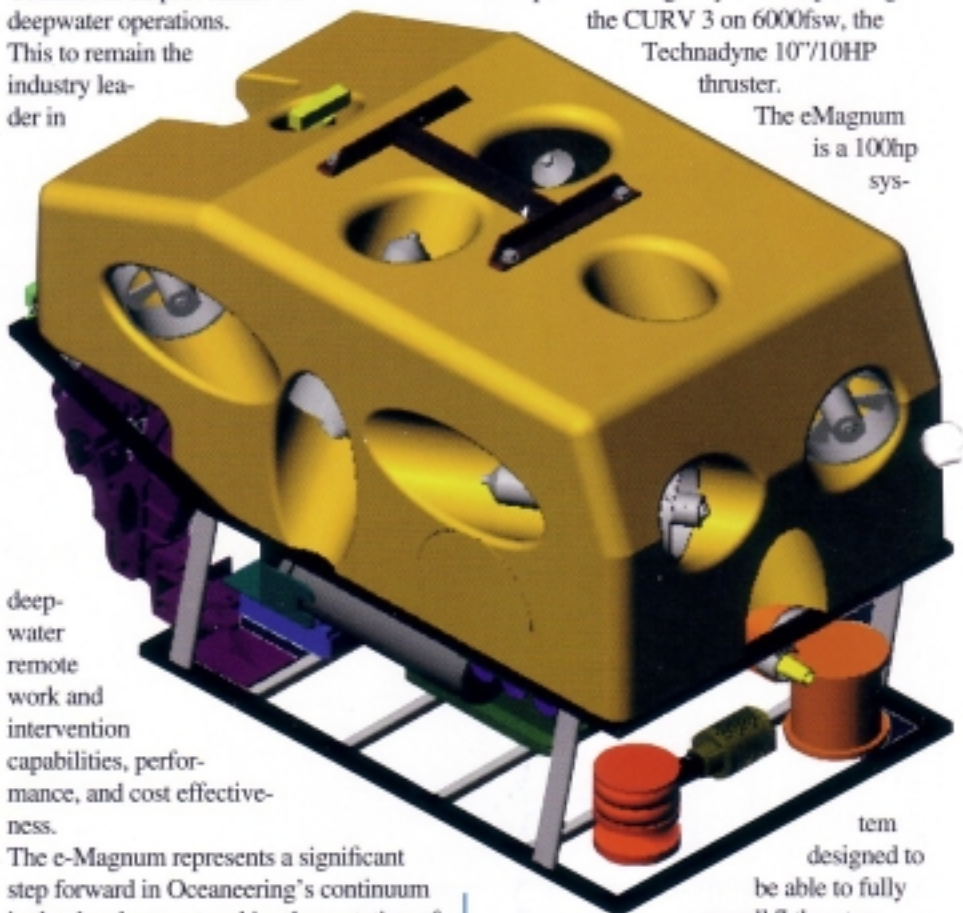
The e-Magnum represents a significant step forward in Oceaneering's continuum in the development and implementation of new technology and infrastructure specifically aimed at both reducing the costs associated with deepwater operations, and improving the performance/capabilities of such operations.

The 3000 m rated e-Magnum is designed to operate in a mode almost identical to the standard Magnum ROV except that it provides a higher thrust to drag ratio, and thereby is capable of operating more efficiently in a higher current regime, and will operate with an even higher degree of reliability than the industry standards.

The e-Magnum achieves this enhanced performance, by utilizing all electric thrusters thereby eliminating the efficiency losses inherent in a hydraulic system as well as the electric to hydraulic conversions. In addition, the ability of electric thrusters to operate more efficiently throughout their speed range, as opposed to hydraulic thrusters which operate efficiently only at the upper end of the hydraulic motor's operating envelope. Besides, the electric thrusters used on the eMagnum is the same type

well proven during 14 years of operating the CURV 3 on 6000fsw, the Technadyne 10"/10HP thruster.

The eMagnum is a 100hp sys-



tem designed to be able to fully run all 7 thrusters, without any decrease in power, in other words it can maintain the horsepowers evenly in the complete working envelope!

The e-Magnum's all electric propulsion, means that each thruster is independent of the others. As a result, failures do not cascade throughout the system. A hydraulically powered system can experience failures, or degradation, in the primary HPU's, valves, filters, and piping, all of which will impact performance. However, it is worth noting that Oceaneering's all hydraulic Hydra Magnum are the dominant deepwater ROV, carrying out well in excess of 60 percent of the worldwide ROV work deeper than 5000 fsw in the Oil and Gas Industry today! That's more than twice as much as the next two ROV operators combined.

The Magnum has an outstanding record for reliability and performance, last year averaging less than 0.5% downtime, relative to divetime, on a fleet of worldwide deepwater operations. Before start-up of our active

pilot/tech training, we saw a system downtime in average of 3,5%. Then, by the help of, among other elements, the training was decreased to 0,5% downtime after three years!

The e-Magnum has been specifically designed to be fully interchangeable with the Magnum. Essentially from the Control Van to the ROV-end of the tether, the systems are identical. Either ROV can plug into the end of the tether and operate through the same overall system – tether, cage, umbilical, winch, control systems, consoles, etc.

We have focused on the interchangeability instead of minimizing size, this to be able to adapt the eMagnum to the standard Magnum system. Some might say that we go against the trend of smaller and lighter vehicles and tms systems, that might be true, but for a very good reason! The umbilical is a Rochester standard that weighs 3010kg/km in water, and we still use the 1045kg side-entry cage. This because we need the ability to deploy the system in rough sea states, which requires rapid transit through the splash-zone. And in deepwater operations the weight of the cage prevents from drift-off due to strong current. In addition the cage is situated with a Vector Orientation System, thrusting cage to better handle the demands of deepwater operations.

The E-Magnum can be changed to a Magnum, or vice versa, in less than 12 hours. The benefits of this approach are enormous, and more than offset by the tradeoff from not optimizing on smaller size. To replace one ROV with the other requires only a tether re-termination and the entering of the new control program, which would be on a separate control window. By adopting this concept Oceaneering has minimized the need for an entire new series of parts spread throughout the system. Essentially 85 percent of the Magnum and e-Magnum are identical. This further simplifies inventory control, logistics, and more importantly, the need to train/retrain technicians on an entirely new ROV system. For all practical purposes, the only new training required will be associated with the electric motors powering the thrusters and their speed control modules. As these are significantly less complex than the hydraulic system, the training and execution will be straightforward.

We believe that this reduction in complexity will result in improved operational efficiencies. Oceaneering's approach means that during the period when there are a limited number of the E-Magnums availa-

ble, the first few years for example, there will be no scenario that can cause an operation significant lost time. If an E-Magnum is damaged, lost, suffers a serious failure, etc. it can be replaced by a standard Magnum in transportation time plus 12 hours.

Backup, replaceability, interchangeability and



preventive maintenance is absolutely critical in deepwater operations because of their inherently high costs. This situation becomes even more critical if the operations take place in remote areas.

The e-Magnum should not be viewed as a "better" ROV than the Standard Magnum. The systems are different in that each provides certain unique capabilities. The Magnums and Millenniums are able to use their hydraulic flows to not only power the ROV but to operate the widest range of subsea tooling possible. There is virtually no subsea tooling or workskid that cannot be supported by these two systems. Conversely, the e-Magnum utilizes a smaller HPU to operate an isolated 10GPM hydraulic supply for manipulators as well as the full range of tools found in deepwater drilling and completion operations, such as torque tools and cutters, etc.

The e-Magnum is not short of work capability in any way, except with respect to total hydraulic flow. It is important to examine the worksopes involved before making a final choice between the systems. As noted above, probably the most unique and valuable aspect of the e-Magnum and

Magnum is their interchangeability. Never before has there been the ability to customize the ROV work system to a degree that it can execute the scope of work in the most optimal manner possible. The ability to interchange the systems, once or multiple times, throughout an extended program that has a varying series of worksopes insures that the future deepwater programs do not have to be planned around a specific ROV's strengths and weaknesses.

'With the Magnum/e-Magnum concept we now tailor the workclass ROV to match the worksopes and allow subsea equipment designs, etc. to take advantage of this flexibility.

17 = Interaction between thruster and water in the nosse)

The e-Magnum represents the next major step forward in deepwater ROV capability and performance.

Its enhanced performance, combined with anticipated reduction in downtime, offers another way, potentially a better way, to support deepwater drilling and completion operations. Combine the e-Magnum, with the electric Minimum, and you have created a deepwater capability of unparalleled reliability and capability not previously achievable. The combination will save several days of rig time per

year, over the conventional ROV concepts offered by the balance of the industry.

The first years of this century offers exciting new opportunities, as the industry continues to address the capabilities and competencies of both its personnel and the hardware they operate. This approach is best typified by Oceaneering's philosophy of excellence: $e = mc^2$

- e = excellence: first in, last out, always
- m = motivation: individually and organizationally; sustained over time.
- c = competence: individual and organizational knowledge, training, expertise, and experience throughout the organization.
- c = capabilities: hardware; technologies; infrastructure; backup

All these areas need to be developed if we are to take advantages of the promise offered by any one of them.

NUI has delivered handling system for Hugin-3000

A service friendly and compact handling system for launch and recovery of autonomous vehicles

By Jon B. Seim



Last Autumn NUI a/s commenced engineering work on a container-based system for handling towed vehicles from the stern of support vessels. The design is based on NUI's experience with offshore handling of the Hugin-600 AUV "NUI Explorer". This offshore experience was an important criterion when Kongsberg Simrad a/s awarded NUI the contract for construction of a compact handling system for their Hugin vehicle. This is part of their delivery of a complete 3000 meter version, the Hugin-3000 system, to the US company C&C Technologies based in Lafayette, Louisiana.

The HUGIN 3000 system represents the third generation HUGIN technology and is a result of an extensive development effort from Kongsberg Simrad and FFI (Norwegian Defence Research Establishment) over the last three years. Construction started last Autumn and in June this year NUI handed over the system in Horten. A few weeks later the system was shipped to the US.

The system comprises 2 standard 20-foot containers: - a Launch&Recovery container for a hydraulically operated Ramp/Stinger mechanism, and a Service container for battery service and maintenance.

Even though the mechanical system is packed into the 20-foot L&R container the Ramp / Stinger mechanism protrudes well into the water from stern heights up to 5.5 meters. This is made possible by the use of a telescopic mechanism that is tilted and extended when required for handling the Hugin vehicle in and out of the sea, and is contracted into the confines of the container during sailing and servicing. The double doors facing the sea are fitted with a hydraulic

open/close mechanism for safety reasons. Similar to NUI's Hugin-600 system the Hugin-3000 vehicle is powered by a state-of-the-art aluminum/oxygen semi fuel cell battery developed and produced by FFI. The Service container therefore includes a section equipped with tanks, pumps, valves and control system for storing, filling, draining and flushing the vehicle battery fluids. Workshop and spares facilities are located in the other section, separated from the fluids section by a wall. The Hugin-3000 system is constructed for use in tropical waters with both containers well insulated and equipped with powerful air-conditioning.

The Hugin-3000 vehicle is equipped with an extensive sensor suite for seabed mapping - multibeam echosounder, side-scan sonar and sub-bottom profiler. Accurate positioning is ensured by an integrated navigation system. In order to protect the transducers of all these sensitive instruments the Stinger is equipped with cushions along all its length and the design includes a shock-absorbing hydraulic tilt mechanism. NUI's mechanical and hydraulic design has been based on detailed analysis taking into account the shock waves and acceleration forces encountered in adverse weather conditions. Even though the system is rated for such heavy loads the environmental forces exerted on the system are decoupled substantially through spring-loaded joints and a flexible mechanical / hydraulic design.

The delivery of this handling system proves NUI's capabilities within integrated electro / hydraulic / mechanical constructions from the design stage through the engineering and construction phases to final delivery and documentation.

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We also represent b&a industries for the Promaster system described in an article in this magazine.



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**ROV SIMULATOR**

Oceaneering har i flere år jobbet med å få utviklet en ROV-simulator for trening og opplæring av personell. Simulatoren er utviklet av et amerikansk selskap som er spesialister på utvikling av simulatorer, i tett samarbeid med Oceaneering Int. Den er designet for å mest mulig stå i samsvar med virkelige operasjoner. Den tilsvarende en Magnum WROV, og innehar alle funksjoner som i

**Instruktør**

virkeligheten. Det er et relativt stort system bestående av 7 PC'er som styrer hver sin funksjon. En master, en for sonar, en til hvert camera osv. Den er lagt opp med en instruktør-master. Det er her man legger inn alle operasjonelle forhold. Vi kan legge inn diverse forskjellige typer operasjoner (struktur og oppgave), hvor vi kan endre vanskelighets grad og virtuelle hydroatmosferiske forhold, som styrke og retning på strøm, sikt og renhet i vannet. Kontroll konsollet er laget identisk til det vi benytter i virkeligheten, noe som vil gi en følelse av real-time operasjon. Instruktøren kan følge pilotens ferd på sin monitor og kan gi instruksjoner og rettelser underveis. For å bedre kunne simulere konsekvenser av feilaktig operasjon,

legges det inn alarmer som indikerer direkte følger av måten en flyr på. Eksempelvis kan vi legge inn jordfeil, tap av kamerabilde osv som følge av at tethet får en stygg knekk. Eller vannalarmer, lekkasjer, telemetri brudd osv.

**Pilot trening**

Simulatoren er programmert med full "feedback", slik at hvis en kjører i sjøbunn vil man miste sikt og hvis en parkerer på et ventiltak, vil man kunne se at ROV'en beveger seg hvis man kjører manipulatoren ned i taket.

Simulatoren kan benyttes i flere sammenhenger foruten å trene opp offshore personell. Den kan benyttes til å laste inn en bestemt struktur for å verifisere tilkomst, å trene personell til en bestemt jobb, eller til research i design fasen av subsea tooling.

Poeng ved å trene offshore personell på simulatoren før de reiser offshore:

- Kjenne farkosten og kunne manøvrere den. (Sikkert og kontrollert.)
- Lære å navigere etter sonar.
- Lære konsekvensene av måten en flyr på.
- Lære teknikker for hurtig tilkomst, navigering og multioperasjon.

For ytterligere informasjon, vennligst kontakt

OCEANEERING

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- Trenching services
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Website: www.deepocean.no

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West Tech AS is the Norwegian sales and service representative for Seeye Marine Ltd, Zevulun Marine Systems Ltd. with Birns Aquama and Sea Steel Ltd.

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FFU - Forening for Fjernstyrt Undervannsteknologi

www.nui.no/ffu.html

FFU vil arbeide for å:

- Formidle kunnskaper og erfaring innen fjernstyrte undervannsoperasjoner
- Skape kontakt mellom utdanningsinstitusjoner, forskning, brukere, operatører, produsenter og offentlige instanser.
- Holde kontakt med andre aktuelle foreninger
- Skape god kontakt innen det undervannsteknologiske miljøet

FFU i dag

FFU har siden opprettelsen i 1988 opparbeidet en solid økonomi som har muliggjort egen sekretærfuksjon hos Norsk Petroleumsforening. FFU har ca. 90 medlemmer og har gjennomført flere utredninger knyttet til aktuelle undervannsteknologiske problemstillinger. Resultatet av disse tilflyter medlemmene gjennom blant annet temakveldene.

Hvem kan bli medlem?

Medlemmene kommer fra oljeselskaper, engineeringsselskaper, kontraktører, offentlig forvaltning, forskning og utdanningsinstitusjoner. Se under for priser og kategorier.

Temakvelder

Gjennom temakveldene tilbys medlemmene faglige foredrag innen aktuelle temaer eller visning av nytt utstyr.

Foreningen har blant annet som mål med temakveldene å formidle informasjon mellom ulike interessegrupper innen bransjen.

Utstillinger, konferanser, fellesreiser

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. FFU arrangerer fellesturer for medlemmene til konferanser og utstillinger som ligger innenfor foreningens virksomhetsområde. I 1992 arrangerte foreningen turer til San Diego og Monaco.

Utredninger

Som et ledd i foreningens virksomhet har FFU initiert og gjennomført følgende utredninger finansiert av flere oljeselskaper:

- * Behovskartlegging av forskning og utvikling innen fagfeltet fjernstyrte undervannsoperasjoner
- * Behovskartlegging for utdanning innen fagfeltet fjernstyrte undervannsoperasjoner.

Norsk Oljemuseum

FFU vil gjennom sin virksomhet gi støtte til Norsk Oljemuseum og bidra til at utrangert, men faglig interessant utstyr blir tatt vare på.

TYPE MEDLEMSKAP:	RETTIGHETER:	KONTINGENT:
Bedriftsmedlem	Deltakelse på FFUs arrangementer og aktiviteter åpen til alle ansatte - 25% rabatt	kr. 4.000,-
Assosiert medlem	Tillegg til bedriftsmedlemskap. Du får all informasjon, FFU-Nytt, invitasjon til temakvelder, etc. tilsendt direkte. Særlig aktuelt for store og/eller geografisk spredte virksomheter.	kr. 150,-
Personlig medlem	Som bedriftsmedlemskap, men ingen rabatt. Rettigheter begrenset til kun innehaver.	kr. 950,-
Offentlig instans - Ny kategori!	Samme rettigheter som bedriftsmedlem, men kun for den offentlige forvaltning.	kr. 500,-
Studentmedlem	Som personlig medlem, men redusert kontingent (hvis student)	kr. 100,-

Be FFU om innbetalingsblankett for kontingent eller nærmere informasjon om FFU:

FFU sekretariat v/ Ingun Meiler:

Telefax: 55 12 54 70
E-mail: ingun.meiler@npf.no
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Some of the seminar will be in the classroom at the Holmen Fjordhotell, Asker. Demonstrations will be on board the Colin Archer *RS Sandefjord* and *RS Idun*, as well as in the harbour tower at Leangbukta.

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