FFUnytt

FORENING FOR FJERNSTYRT UNDERVANNSTEKNOLOGI
NR. 4. DESEMBER 2000

Husk 2001 seminaret!

"IMR, Inspection Maintenance & repair" er temaet for FFUs årlige seminar, som avholdes onsdag 31. januar 2001 i Statoil Forus.

- Vi mener at dette er et tema som interesserer de fleste i bransjen, siden det har vært mye fokus på IMR den siste tiden, forteller en av møtelederene Trond Eriksen fra Oceaneering.

Side 23

Signifikant bølgehøyde
Side 4

SmartControls
Side 6

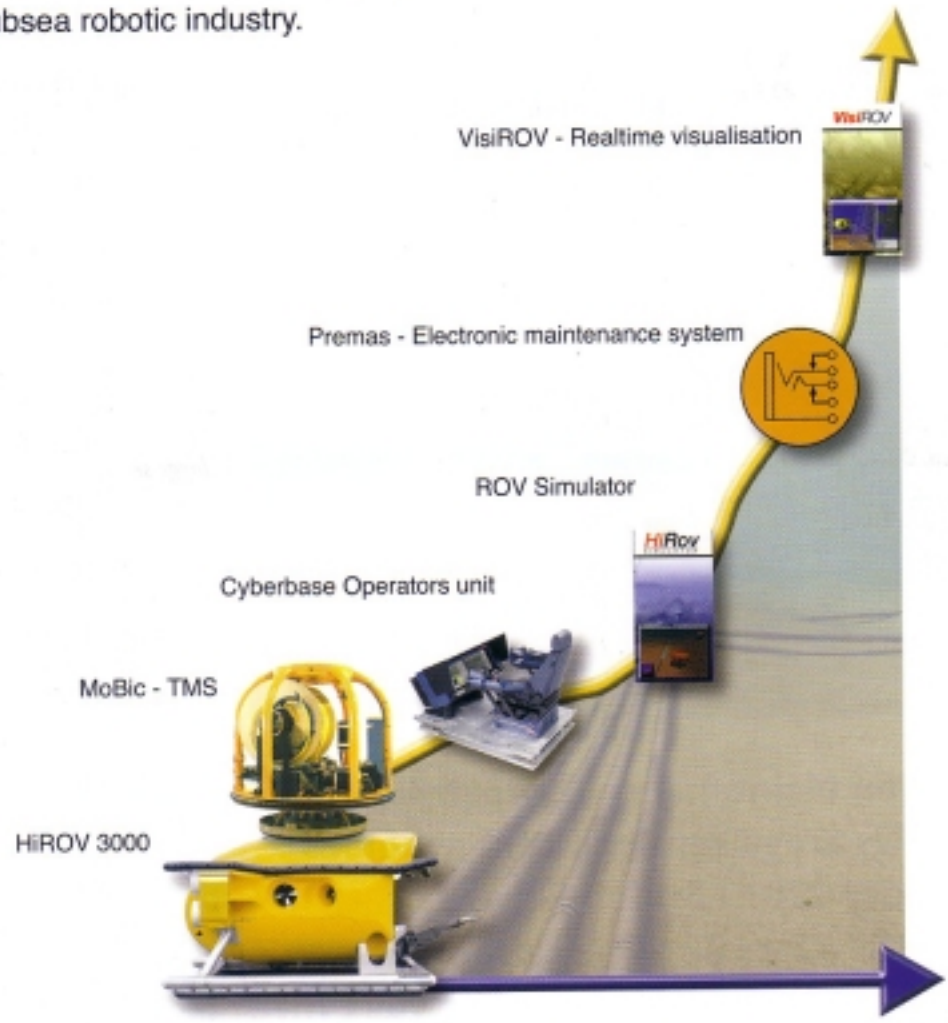
"Venom" fra Hydrovision
Side 14

Alpha Thames – subsea separasjon
Side 16

Elektrisk ROV fra Argus
Side 18

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.



HITEC SUBSEA

Hitec Subsea AS Fabrikkvn. 7 Postboks 8120 4068 Stavanger
Tel: (+47) 51 20 20 20 Fax: (+47) 51 20 20 71
contact Roar Laug at roar.laug@hitecvision.com
www.hitec-subsea.com

FFU

Forening for Fjernstyrt Undervannsteknologi

www.ffu-nytt.no

SEKRETARIAT:
Sekretær Ingun Meiler
E-mail: ingun.meiler@npf.no
Telefon: 55 12 58 41
Telefax: 55 12 54 70

ADRESSE:
Sekretariatet
v/Norsk Petroleumsforening
Sandslimarka 251
5254 Sandsli

STYRETS LEDER:
Pål Espen Antonsen, Halliburton
E-mail: paal.antonsen@halliburton.com
Telefon: 51 83 80 12
Telefax: 51 83 83 83

STYREMEDLEMMER:
Erich Luzi, Statoil
Stian Røksten, Norsk Hydro
Lars Aga, Kværner Oilfield Products
Tore Diesen, Bennex Transmark Norge
Trond Eriksen, Oceaneering
Magne Tolo, Stolt Offshore a/s
Thor H. Nordahl, West Tech a/s

REVISORER:
Helge Stang, Saga Petroleum ASA
Sven Petter Jacobsen, DSND Subsea a.s.

FFUnytt

REDAKTØR:
Jon Seim, NUI
Postboks 23, 5848 Bergen
E-mail: jbs@nui.no
Telefon: 55 94 28 53
Telefax: 55 94 28 04
Mobil: 90 18 67 47

REDAKSJONSSEKRETÆR
Ole Klemsdal
Vaskerelven 39
5014 Bergen
E-mail:
ole.klemsdal@mediabergen.no
Telefon: 55 54 08 05

GRAFISK PRODUKSJON:
Media Bergen Produksjon

ANNONSER:
Media Bergen annonser
Vaskerelven 39
5014 Bergen
Telefon: 55 54 08 00
Telefax: 55 54 08 40

INNHOLD

Signifikant bølgehøyde side 4

SmartControl side 6

"Venom" side 14

Odim's håndtering-system side 14

Subsea separasjon side 16

Elektrisk ROV side 18

ROVCON side 20

FFU Info side 22

FFU seminar side 23

FFU på Internett:
http://www.ffu-nytt.no

Dear Colleges

På vegne av styret i FFU, vil jeg benytte anledningen til å ønske alle en riktig God Jul og et Godt Nytt År.

Hva det nye året vil bringe gjenstår å se, men vi kan med stor sikkerhet si at det i allefall blir et nytt FFU seminar. Trond Eriksen og Tore Diesen har jobbet hardt med å sy sammen programmet til seminaret, som denne gang vil ha temaet Inspeksjon, Vedlikehold og Reparasjon (IMR). Her er det bare å gripe sjansen folkens og melde seg på i god tid.

Jeg vil også benytte anledningen til å rette en liten pekefinger mot noen av våre medlemmer og medlemsbedrifter. Vi har hatt endel problemer med å kreve inn medlemskontigenter og seminar avgifter. Håper alle skjønner at FFU er avhengig av disse inntektene for å holde foreningen i gang! OK, nå er det sagt.

Et av styrets største oppgaver siste periode har vært å starte vår nye hjemmeside. Denne er nå oppe og går, så det er bare å logge seg på www.ffu-nytt.no og se hva som skjuler seg der. Lars Aga har jobbet masse med å starte denne siden, og fortjener en honnør for dette arbeidet. Men helt problemfritt har det ikke vært, og masse arbeid gjennstår. Og da spesielt med å legge inn artikler og informasjon. Dette er et arbeid som styremedlemmene må gjøre fortløpende i tiden framover.

Vår nye informasjonskilde vil, som dere skjønner, gå gjennom hjemmesidene og via E-mail. Så for de av dere som ikke har registrert deres E-mail hos oss, få det gjort.

Nok en gang kjære kolegaer og medlemmer. GOD JUL og GODT NYTT ÅR til dere alle fra FFU-Styret.

Pål Espen Antonsen
Leder

Signifikant bølgehøyde

Av Jon Seim og Pål Atle Solheimsnes, NUI a/s

Signifikant bølgehøyde er en målt eller beregnet størrelse for å angi en viss bølgetilstand og sannsynligheten for forekomst av gitte bølgehøyder.
H_s er den generelle betegnelse for Signifikant Bølgehøyde.
$H_{1/3}$ er et tall på H_s basert på faktisk målte bølgeverdier og blir kalkulert som middelverdien til den 1/3-del av bølgene som har høyest amplitude, over en gitt tidsperiode.
H_{m0} er betegnelsen på et estimat av H_s basert på et bølgespekter. Dette beregnes ut fra en formel basert på et gitt bølgespekter, for eksempel Jonswap. Ved bruk av et slikt bølgespekter i denne formelen kan det plottes ut sannsynlighetskurver som vist under.

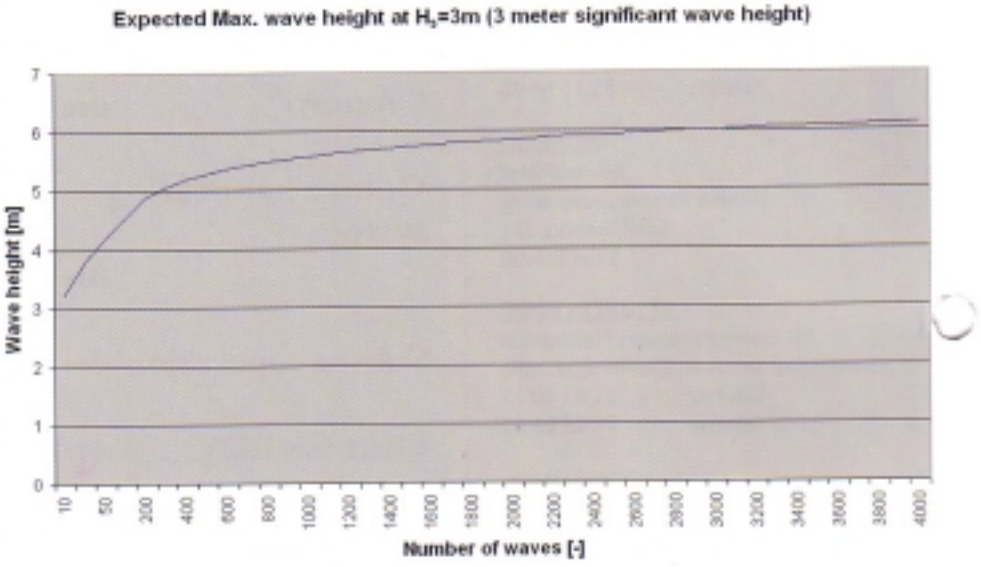
Et estimat for maksimal bølgehøyde:

$$Hmax = H_s \sqrt{\frac{Ln(N)}{2}} \quad \text{(for stor N)}$$

Der N er antall bølger.

Ved H_s = 3 meter viser denne kurven hvor mange bølgetopper som må forventes for å oppleve én bølgetopp ved en gitt høyde.
For eksempel vil en bølgetopp på 5 meter inntreffe i løpet av ca. 250 bølgetopper.

Referanser:
"Ocean Technology – Sea Load on ships and offshore structures". O.M.Faltinsen 1990
"Hydrodynamikk og Havmiljø – Grunnkurs". Dag Myrland, NTNU 1994



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

The MacArtney Underwater Technology Group supplies and services a broad range of products, systems and engineering for the offshore, survey, geophysical, ocean science, military, security, civil engineering and nuclear markets worldwide.

www.macartney.com

MacArtney

MacArtney Norge AS • Tel. +47 5168 1200 • Fax +47 5168 1210 • E-mail mac-no@macartney.com

SmartControls contributes to increased oil and gas recovery

FMC Kongsberg Subsea, Statoil and Shell have in cooperation developed technology to increase the oil and gas recovery from subsea completed wells. All three companies have a significant experience from subsea field development and operations.
The project has focused on technologies that allows increased production rate and total production by being "smarter", and the project has been named SmartFields®
The SmartControls is one of the results from the technology agreement project and was offically introduced to the market at ONS 2000.
SmartControls is the next generation subsea control system with capacities and Capabilities exceeding today´s systems.
The system can provide a full integration of all monitoring and control functions on the sea bottom and downhole by a modular and flexible communication network based on Internet technology. Intercaces can easily be made with all suppliers of subsea or downhole equipment and reduce or eliminate interface problems that often occurs with todays systems.
Part of the SmarControls is SmartServer, a database and software package allowing monitoring and processing data from the entire subsea field, giving information on among others status of equipment, fluid properties, flow conditions etc. This will give new and valuable information for optimization of the field production.

SmartControls™

for Smart Subsea Fields

By Sissel Halmøy, FMC Kongsberg Subsea

1. Introduction

Through the SmartFields® project, FMC Kongsberg Subsea together with Statoil and Shell have addressed the challenges to achieve increased Oil and Gas Recovery from Subsea Wells at lowest possible cost through out the lifetime of the field.

In the SmartFields project, we have analysed what the existing systems can provide and what the future subsea oil and gas production systems will demand in order to increase the production rate and the total production. Based on these analyses, a set of development activities were initiated, among them the development of a new generation production control system, SmartControls, to provide the future need for an infrastructure at the seabed. The real motivation for the electronics and software upgrade was to provide a vehicle to implement intelligence into the system. This paper describes the requirements that have guided the development and the results achieved so far.

Within the overall SmartFields project there are several complementary development activities targeting the SmartFields goals, e.g. Light Well Intervention and Subsea Processing, but these are not described any further in this paper.

The SmartFields project started in January 97, jointly funded by FMC Kongsberg Subsea and Statoil. A/S Norske Shell joined the project in January 99. The project comprises a multidiscipline working team. Close co-operation with experts in Statoil and Shell and with suppliers of SmartWell and processing equipment has been vital with regards to the results and the selected technical solutions.

2. Traditional subsea control systems – the starting point

The development of subsea technology was revolutionary when it started several decades ago. It overcame the obstacles of a hostile environment, remote handling and remote control. The monitoring and control functions have, however, been limited to pressure, temperature and position readings, opening and closing valves and choke positioning. The production and control systems have now become an established technology for subsea oil and gas production.

Some of the basic elements that have to function in this environment are:

- Local actuators with remote control
- Local instrumentation with links to topside
- Supply and control of power, both electric and hydraulic
- Computing power for local data handling and control
- Communication, both of commands to subsea and of measurements and process status from subsea.

Originally, the main challenge was to make all these elements work. At present and in the foreseeable future, we are faced with other challenges and new requirements. There is a drive to increase recovery from the subsea oil and gas fields, to cut capital expenditure and to reduce the operational cost of the fields.

3. The new challenges

The field of subsea production is developing rapidly. It is impossible to predict all future requirements, but some elements can be pinpointed:

3.1 Reservoir and topology

Longer distances

There is a demand for developing fields with increasingly longer tieback distances from platform, production vessel or shore. Connection direct to shore will be preferred when technology makes this possible.

Increased water depths

New records regarding water depths are constantly reached and will be further pushed as soon as new technology allows cost efficient developments. 3-4000 meters seems to be a real possibility within some years.

HPHT

Complex high pressure and high temperature reservoirs have been discovered and are under development. The development of such fields can further be optimised by new technology.

Marginal fields
Small, marginal fields are seen more frequently today. These fields often have more complex reservoir structures and heterogeneity's and require rethinking compared to larger fields.

3.2 Increased complexity subsea and downhole

Optimisation of subsea production
It is a well-established "truth" that production from subsea wells is less efficient than production from platform wells. Production rates are lower and total recovery from the reservoir is lower. Application of new technology and intelligent software will enable production to be optimised.

New instrumentation and control equipment subsea and downhole
More and more equipment becomes available for installation subsea and downhole. Local monitoring generates more information on the status and on the production. Remote actuators and control give the possibility to do the recommended adjustments.

Subsea and downhole processing
Subsea and even downhole separation and boosting of oil, gas and water will make the production from most subsea fields more profitable. This allows for longer distances to the facilities, and opens up for new subsea field developments as well as extended lifetime of existing fields.

Subsea power distribution
As a result of longer distances to the installations and new equipment with high power consumption, for example megawatt pumps subsea and downhole, the requirements for subsea power distribution increases.

3.3 Operational phase issues

Extensions and changes to existing subsea installations
New technology makes it feasible to upgrade the existing subsea fields in order to prolong the lifetime and achieve higher revenue from the reservoir. Backward compatibility in new control systems is therefor important. Similarly, to deal with extensions, the new control systems must be modular, flexible and easy to extend.

Remote waters and hostile environments
Complex subsea installations need to be connected to local experts from the suppliers or to expert teams within the industry or in the oil companies. Likewise, computer programs for optimisation and surveillance purposes must be remotely connected.

Sissel Halmøy og Svein Sandok demonstrerte SmartControl på ONS'2000.

Well intervention and overhaul of subsea installations
The growing focus on increased recovery from the reservoirs, from the point of view of getting more out of the wells and increases profit, requires cost effective well interventions and overhaul of equipment. This paves the way for technology that supports Light Well Interventions and ROV operations. Facilitating secure and reliable accessibility to the subsea wells during the lifetime of the field is important to be able to do the requested logging operations as well as optimising, maintenance, stimulation and equipment replacements.

More responsibility and improved support from suppliers
The complexity of the installations increases and may need specialists for equipment surveillance or maintenance. The demand for fast and efficient support is increasing.

4. What is required and what is provided by SmartControls to meet these challenges

SmartControls has been developed as a platform for control systems targeting the above challenges.

An overview of the SmartControls system is included below to give a brief understanding of the main topside and subsea elements described further in the text:

During the initial analyses it was concluded that the following elements needed focus:

- Communication
- Computing power with special focus on
  - flexible interfaces to subsea and downhole equipment
  - flexible, high level interfaces to process control systems topside
- Integrated, common infrastructure
- Remote support
- Intelligence through software applications.

4.1 Communication - more capacity, minimum delay and longer distances

4.1.1 Communication requirements

One of the challenges of efficient remote control to support optimised production is to make the control appear local so that the user gets a "hands-on" feeling with instant response. The user shall not be concerned either if the wells are hundreds of kilometres away or in deep waters. This applies even if the "user" is an automatic control loop. This requires fast response, instant feedback and reliable data which in turn means faster communication, more data and less delay.

One means of optimising the production is improved availability of reservoir data. This results in a requirement for more instrumentation, especially downhole. Permanently installed seismic and other "image-type" sensors will soon be available. All this new instrumentation and

application of the measurements requires more data and more frequent data transmission from subsea to topside. Another aspect is that it becomes feasible to correlate measurements from different wells. To support this, an accurate time stamping is needed.

Noisy equipment subsea or downhole such as megawatt pumps, long distances or large amount of data may require use of fibre optics for communication.

New communication solutions have to be backward compatible. A lot of subsea field developments are extensions to existing fields or infrastructure, and the new communication technology must operate together with the old.

New communication solutions also have to be prepared for future extensions of the fields. This sets requirements for ample capacity and a flexibility in the topology that can cater for extensions that go far beyond of that seen in today's subsea fields.

4.1.2 SmartControls, communication solutions

To meet the new requirements with regards to communication, two modem developments have been carried out within the SmartFields project; the LongSpeed powerline modem and the Fibre optic modem.

Fibre optic modem

- 1-8 Mbaud full-duplex
- At least 200 km and a potential for more than 300 km if needed, point-to-point topology with one subsea electronic module per fibre.

LongSpeed powerline modem

- 33600 baud subsea-to-topside and 9600 baud topside-to-subsea full-duplex
- Potential for up to 100 km with point-to-point topology
- 40 km with crowfoot topology and four subsea electronic modules per power-pair. Each of these subsea electronic modules has the full 33600/9600 baud communication capacity (i.e. it is not shared between them.)
- Can coexist on the same power-pair as today's powerline modem (PLMS160).

This is a large improvement compared to today's powerline modem (PLMS160):

- 2400 baud polled half-duplex, crowfoot topology with four subsea electronic modules per power pair (the four subsea electronic modules share the communication line).

The LongSpeed powerline modem may be installed in existing subsea fields without any changes in the umbilical and without interfering with the existing PLMS160 communication.

Fibre optic communication may be used on it's own or together with electrical communication. Each subsea electronic module has space for two modems. Any combination of PLMS160, LongSpeed and the Fibre Optic modem is possible.

All communication networks are normally redundant.

Together with routers and repeaters there are **no limitations** with regards to subsea field layouts from a communication point of view.

The communication protocol used in all the new communication systems is TCP/IP. This is probably the most widely used communication standard today on everything from process control systems to Local Area Networks (LAN) in office buildings.

4.2 Computing power - capacity for more local calculations, flexible interfaces

4.2.1 Computing power and interface requirements

More computing power is required to meet the new challenges related to increased instrumentation, new actuators and processing equipment – subsea and downhole. This new equipment calls for increased data rates, minimum delays, more local logic and more local control.

Improved control of subsea wells is not achieved with increased amounts and rates of data alone. All measurements must be validated. One of the obstacles against further optimisation is variation and uncertainties in the subsea instrumentation. Intelligent use of mathematical models and combinations of measurements may improve this and give validated measurements.

Flexibility for extensions and changes in subsea installations requires a control system that allows for remote reconfiguration and updating of software.

Simple, flexible interfaces to a wider range of subsea instrumentation and equipment are required to simplify integration of equipment from different suppliers to the subsea control system.

High level interfaces to topside process control systems will make the subsea installation appear more like a standard straightforward process and remove some of the current complexity.

4.2.2 SmartControls, computing power and interface solutions

SmartControls includes a new subsea electronic module inside the Smart subsea control module (SmartSCM), a new topside electronic module (SmartTEM) and new software. Flexible interfaces to subsea and downhole equipment and flexible, high level interfaces to the topside process control systems are part of the solutions.

Each of the Smart subsea electronic modules contains a processor card (CPU200) with three PowerPC family processors from Motorola/IBM. The processors may be upgraded within the same family, and if needed for special applications, more cards may be installed.

The Smart topside electronic module is the central communication node in the system. All information from all subsea installations is collected and further routed to the right users topside; the operator, the service personnel, the production planner, other specialists, databases or computer programs. The topside electronic module will handle all details regarding the subsea installations and provide a high level interface to the topside process control systems. It may also contain the outer control loops and intelligent applications for the subsea fields.

The Smart topside electronic module operates both with the new and with the existing subsea units. To take one step at the time, the new topside electronics module may be installed together with existing subsea units. This provides advantages topside compared with the current system in addition to being prepared for future extension with new electronics at the seabed later in the lifetime of the field.

New software is developed both for the Smart subsea electronic module and for the Smart topside electronic unit. The

software is developed according to object oriented methods. pSOS is chosen as the real-time operating system (RTOS). pSOS is used in military applications, in hospitals and in space industry, and is assumed to be secure. PowerPC family processors and pSOS are used in the production part of the system. This ensures a stable system with minimum down time. Pentium processors and Windows are chosen in the parts of the system where down time is not critical and because of the availability of standard software and Human Machine Interfaces.

The software will be re-used from project to project. This implies that the software will be well tested, which in turn results in high reliability.

The software in the Smart topside electronic module provides a simple, standardised interface to the process control systems. The detailed logic like checking the status of subsea valves, chokes etc. is done locally. This reduces the complexity and also the number of tags to be handled via the interface.

The Smart subsea control module has been specifically designed to accommodate the new generation of advanced sensors and intelligent wells. An additional separate electronic can for equipment requiring high power dissipation or volume beyond single eurocard format is also available. This can is typically used for power supply to downhole multizone/multilateral well control systems (SmartWells) and for the fibre optic downhole sensor interface. The following interfaces are standard:

- Hydraulic control lines
- 4-20mA sensor interfaces
- Serial lines
- CAN bus interfaces (ISO 11519-2 or ISO 11898) with CANopen protocol
- 24V & 12V power supplies for external equipment.

4.3 Integrated solutions – common infrastructure

4.3.1 Requirements for integrated solutions

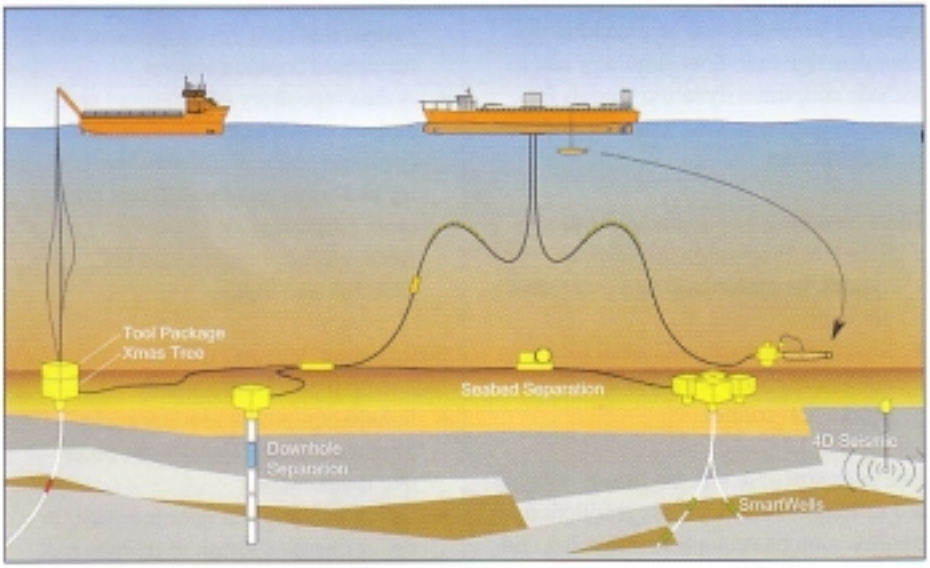
The infrastructure is a significant part of the capital cost in subsea fields. It is therefore important to make optimal use of the investment. One obstacle when applying some of the new, promising technology like the SmartWell equipment, has been the requirement for separate power supply, communication lines and control systems (non-integrated solutions). This has led to a high cost when implementing these in existing fields and even in new subsea installations.

Furthermore, all such equipment is part of the overall control of the field. To optimise the production, full integration should be provided (integrated solutions).

4.3.2 SmartControls integrated solutions

The focus within the SmartFields project has been to provide a common, integrated solution that fully utilises the infrastructure in an optimum manner, as illustrated below:

The SmartFields concept ensures that subsea and downhole instrumentation and equipment from any third party manufacturer can be interfaced with SmartControls, by utilising the subsea control system infrastructure for communication and power supply.



SmartControls Integrated Solution

State-of-the-art subsea and downhole monitoring and control products can be easily integrated, such as:

- Intelligent Well Completions / SmartWell equipment, whether electrically or hydraulically operated
- Downhole sensors, both electrical and fibre optic
- Subsea sensors for production control, processing control, equipment surveillance or any other seabed or reservoir monitoring.

4.4 Remote support

4.4.1 Requirements for remote support

Even though we strive to simplify the interfaces and the control of the subsea installations, the actual subsea systems in themselves become more complex. The users cannot be expected to be experts on all aspects of such systems, and occasionally expert assistance will be needed.

To send experts to the installations, especially at remote locations, is costly and time-consuming. Accessibility to the right people for such operations is another aspect. Significant cost benefits would be achieved if the expert could be brought "on-line" from an office location.

4.4.2 SmartControls, remote support solutions

In the new SmartControls, remote support is provided. Standard Internet technology is applied, but the access will be provided via a dedicated secure link. This facility means that the expert can be brought "on-line" wherever she/he is, provided there is access to a PC with Internet web browser and connection to a telephone line. In this way, the expert can diagnose, give advice, make changes if required, and provide software updates.

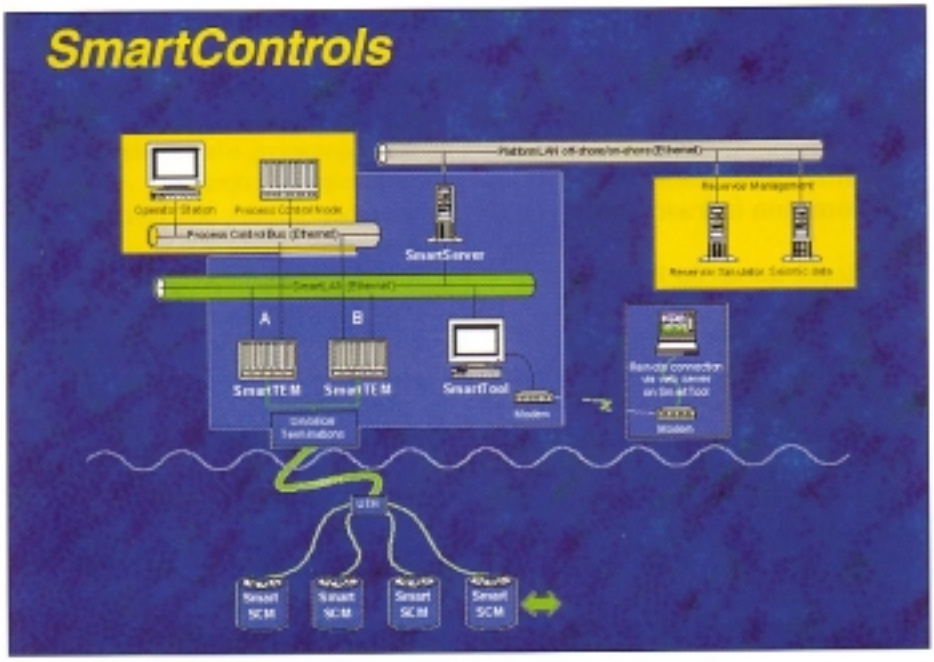
4.5 Intelligence – through software applications

4.5.1 Intelligence requirements

Increased oil and gas recovery from the subsea fields and lower costs may be supported by intelligent use of the data from the installations combined with knowledge of the underlying processes.

4.5.2 SmartControls, intelligence solutions

The real motivation for the SmartControls electronics and software upgrade was to provide the opportunity to implement intelligence into the system. There were



SmartServer overview

too many limitations in the existing control system for implementation of intelligence.

SmartControls basic development is soon finalised, and the system is now ready to implement intelligence. Only the imagination may limit this.

Implementation of control applications, including 'MaxPro' and 'Idun', and of the SmartServer gateway and SmartServer clients 'WellStatus' and 'EquipmentStatus' will be the focus henceforward. These applications are described below and the arrangement is illustrated in the following figure:

Control Applications, including MaxPro and Idun

The Maxpro and Idun software includes models of and controllers for the total oil and gas producing system. Capable and reliable sensors in combination with the control algorithms facilitate local control loops which pave the way for autonomous subsea systems. The SmartControls architecture allows for control at different levels. The control philosophy will depend on the available computing power and communication rates for the specific field. The topology in SmartControls allows for optimisation of one well, one subsea template, one flowline or the total subsea field.

MaxPro is a general multiphase flow network simulator. It is used for planning and development of complete production systems from reservoir to final processing. It includes wells, flowlines and also processing equipment. A coupling to Open Eclipse reservoir simulator is already established in MaxPro. This will be further developed to facilitate consistent production planning in both Eclipse and MaxPro. Time dependent constraints will be included in addition to the current production plan constraints.

The *Optimisation Module* in Maxpro will calculate the overall optimum operation point for the reservoir including the transport system and the process. It is foreseen that both steady-state optimisation and predictive "long"-term (appr. 1 month) optimisation will be supported.

MaxPro is primarily a steady-state simulator, but includes a hydrate simulator which is a thermal transient simulator for cool-down and heat-up times of flowlines. The transient simulator will be extended to a complete dynamic flow simulator and to include simplified dynamic models for process equipment like separator and compressors/pumps.

Idun comprises two main applications:

- Idun PA; Production Allocation system for multiphase rate estimation per well
- Idun PC; Production Control for automatic choke setting and production control

The Idun software will be closely connected to MaxPro for seamless production optimisation based on actual flowing and process conditions.

The *Idun PA* system will be generalised to be a Process State Estimator. This includes flow rate calculation as current Idun PA, and extensions to include tools for estimation and monitoring of non-measurable parameters in reservoir, transport system (wells and flow lines) and process. The state estimator is a combination of mathematical models for known physical behaviour, and estimation techniques for phenomena that are poorly understood.

Idun PC will perform both basic control and optimisation of the production system. For operation, the module will use both direct measurable quantities like pressure, and non-measurable quantities like flow rate that is estimated in Idun PA.

The module will be extended to include non-linear Model based Predictive Controller (MPC) for multivariable control of reservoir, transport system and process. The MPC will have manual input or input from an overall steady-state or short time optimisation module. The benefits of using a multivariable controller are several but will not be addressed any further in this paper.

SmartServer, gateway and clients

Increased volumes and higher quality of information from the reservoir and production equipment may lead to higher production rates and increased recovery from oil and gas fields. SmartServer provides improved capacity to handle this increase in information volume and data rates from the reservoir and subsea installations. SmartServer is a support system for handling the increased complexity.

SmartServer gateway functionality provides:

- Connection to the subsea control system that runs via a topside modem for subsea communication
- A data repository of measured and derived data that improves accessibility to, and value of, information both for end-users and for different computer programs
- Access to information via OPC, CORBA and SQL.

SmartServer "clients" will have the following typical functionality:

- Subsea equipment monitoring to avoid unplanned shutdowns; predictive maintenance
- Operations support giving advice on use of chemicals, risk of hydrate and scale build-up, estimation of time to

SmartServer overview

hydrate conditions following shut-downs, alarms, significant changes in process, and allowing operator on-the-job training
- "Intelligent software" that monitors key data from the subsea installation
- Functions for operator support related to procedures and process.

Current plans for the SmartServer comprise a Field Simulation Database and three FMC Kongsberg Subsea "clients": 1) Well Status, 2) Equipment Status and 3) Computer Based Training (CBT) in subsea well control. "Clients" from other vendors such as systems for well logging, process control, multi-phase flow and reservoir management can access the database either as subscriptions or via internet/intranet.

The *Field Simulation Database* defines a database format, an object model and an interface definition to provide and receive engineering and asset information, that can be used for storage of data through out the lifetime of the field.

Well Status loggs the relevant values related to a well and can further derive more data from the measured values. Based on the available information the values will be validated and when appropriate, marked suspicious. Events that leads to changes in values may be logged and a written information stored to ease the analysis. The validation can be done as simple measurement validation and up to simulation models for prediction of process behaviour.

Equipment status collects all data related to operation of the subsea equipment, all modifications, replacements and signatures from valve operations. The Equipment Status client will utilise the collected information together with simulations, FMC Kongsberg Subsea experience and other accessible information, to give a status on the subsea and downhole equipment. It will be possible to get pre-warnings on potential equipment failure or malfunction.

The extended use of simulators and logging databases enables development of products for improved understanding of process and well behaviour for all involved in subsea production and intervention by Computer Based Training.

5. Conclusions

The SmartControls development is a full upgrade of all Production Control System electronics and software, both subsea and topside. It has been in progress for three years, and comprehensive qualification testing will be completed late this year.

FMC Kongsberg Subsea is currently experiencing an increasing demand for SmartControls functionality, even faster than expected. Uncertainty in oil prices and marginal fields are two of the driving forces. The oil companies realise that intelligent well equipment and subsea / downhole processing equipment have a large potential and will be essential in the effort to achieve production information and optimisation and thus improved recovery.

The SmartControls system has a flexible architecture, redundancy and high reliability as well as maintainability, surveillance and optimisation possibilities, either locally or remote. The system can be installed independently of the water depth.

In addition to the deep-water aspect, there is a trend towards longer distances, both step outs from existing facilities as well as direct to shore. The SmartControls system is prepared for these challenges. SmartControls is the infrastructure solution to any subsea field.

There are no limitations with regards to subsea field layouts from a communication point of view. Additionally, SmartControls provides the opportunity to implement intelligence into the system, paving the way for autonomous subsea systems.

The project has demonstrated the merits of combining leading technologists from non-subsea background, such as IT and military equipment development staff, with experienced subsea personnel.

Hydrovisions "Venom" ROV for Canyon Offshore Inc.

Av Thor H. Nordahl, West Tech AS

Selv i et generelt dårlig år for ROV-industrien, hvor mange produsenter har forandret fokuseringen mot kabel ned-gravingsmaskiner eller slått seg sammen med andre selskaper, har Hydrovision klart å bøye av for trenden. Selskapet har klart å forbli uavhengig, og har klart å utvikle en ny arbeids-ROV. Vi kan derfor med glede kan annonsere signering av kontrakt med Canyon Offshore Inc for det første av disse systemene i **Venom 3K-150** konfigurasjon.

Denne **Venom** ROV'en vil bli operert fra Cal Dive's nybygg Q4000 semi-sub arbeidsrigg som skal leveres neste år. Dette er samtidig Hydrovision's første arbeids ROV salg til USA.

Venom 3K-150 er en 3000 meters ROV, har 150 hk hydraulikkpakke og inkluderer Hydrovisions nye PC 104 baserte "Curvetech" kontroll-teknologi som bruker åpen teknologifullt utvidbar software. Dette inkluderer data logging og "black box"-muligheter sammen med distribuert intelligens på overflaten. Kontrollsystemet kan kobles til et lokalt datanettverk og/eller Internett.

Farkosten til Canyon Offshore vil bli utstyrt med et dobbelt hydraulikksystem, hvor fremdriftssystemet vil bli adskilt fra verktøy-hydraulikken. Curvetech thrusterne vil få de siste bøyd-akse motorene fra Rexroth med aluminium hus på HT380 thrustere. Dette vil bety økt kraft fra thrusterne, og bedre effektivitet med en betraktelig reduksjon i vekt. Verktøyshydraulikken inkluderer en "skredder-sydd" ventilpakke, med trykk- og strømnings-måling, som kan avleses på operatørpanelet.

I tillegg til ROV'en, vil Hydrovision også levere sitt nye Top Hat TMS-system med det patenterte pendlende kabel-leder- og auto-stramming-system for tether-kabelen. TMS-systemet vil gjøre ROV'en i stand til å operere i inntil 1 kilometer radius med en 27 mm diameter tetherkabel.

Venom kan også gjøres tilgjengelig med en 100 hestekrefters hydraulikk-pakke og kan videre leveres for grunnere dybder med et enklere og billigere hydraulikksystem.

Flere detaljer gå inn på http://www.hyrovision.co.uk. eller kontakt undertegnede.

Odim's Håndteringssystem for ROV-Geobay

Odim's håndtering system for ROV kan vise til øket operasjonstid under dårlige værforhold og sikker og effektiv operasjon i 7-8 meter signifikant bølgehøyde.

Av Lars Ståle Skoge, Odim

På vårt første Aktive Heave Kompenserte system for ROV handtering levert om bord i skipet Geobay - Bergen, så opplevde vi noen problemer under operasjon i heave kompensert mode tidligere i år.
Dette er nå ordnet og det viste seg å være en feil ved oppsettet på skipets MRU (Motion Reference Unit) som forårsaket dette.
Systemet om bord fungerer nå utmerket, og Einar Sånum, en av ROV operatørene om bord sier at han lett vil kunne operere systemet i 7-8 meter signifikant bølgehøyde, *både med og uten TMS*, som også er den kapasitet vi har designet systemet for, basert på *behovene til de fleste oljeselskap.*

Odim's system som kan operere under slike værforhold, vil gi operatøren 60 operasjonsdøgn mer i Nordsjøen pr.år.
Også under gode værforhold, med kun 0.5 meter bevegelse av skipet i sjøen, så reduserer den aktive heave kompenseringen bevegelsen av TMS/ROV ned til kun 5 cm. Med bakgrunn i den kontrollerte handteringen som ligger i systemet, kan operatørene kjøre systemet manuelt uten heave kompensering i opptil
4,5-5 meter signifikant bølgehøyde.
Alt dette er med på underbygge uttalelsen om at dette er det beste systemet de har operert noen gang.

At systemet også kan opereres med kun en operatør for å kjøre vinsj, handtering system og ROV'en, er også en virkelig stor fordel i forhold til andre systemer, som må bruke 3 operatører på en slik operasjon. Dette er et resultat av det integrerte kontroll systemet og den aktive heave kompenseringen som ligger i systemet.

En annen fordel med systemet er at problemet med brudd på kabel og behov for reterminering er fjernet i forbindelse med at en passerer gjennom splash-sonen på grunn av at ROV kabelen ikke løfter ROV/TMS gjennon denne fasen av operasjonen.

For sluttbrukeren betyr alt dette spart tid og penger.

For brukere av ROV systemer, er det viktig å merke seg at systemet er tilgjengelig både for MoonPool system og med A-Ramme for bruk over siden på fartøy.
System for handtering av Trenchere med bruk av tilsvarende LARS system som for ROV med/A-Ramme og Cursor for harde værforhold, er også tilgjengelig..
Dette inkluderer løsning som tillater "slimline buoyancy" å passere systemet inn på vinsjen uten manuell handtering.

Low risk subsea processing ready to go

By David Appleford

Alpha Thames is now offering its unique AlphaPRIME modular system as a low risk solution for maximising hydrocarbon recovery by separating the produced gas and water phases at the well head and pumping only oil to the surface. This can increase well production by up to 75 per cent and is considered essential if oil companies operating in deep ocean are to avoid the wasteful practice of pumping water thousands of feet to the surface with the oil. It has the additional benefit of eliminating other problems associated with hydrates and multiphase flow and is calculated to reduce production costs by $2 to $3 a barrel.

Alpha Thames is now offering a low risk version known as the AlphaPRIME IST (Industry Standard Technology) system. By using conventional tried and tested manifolds, valves and components configured to fit the AlphaPRIME concept it is felt that oil companies can now start winning the benefits of subsea processing without the uncertainty that comes with a system containing unproven elements. In parallel with this, Alpha Thames will continue with the development programme for its innovative components, introducing them gradually into future AlphaPRIME systems to gain confidence in a fundamentally conservative industry.

Alpha Thames is a highly experienced British design engineering company based in Upminster, Essex, and is part of the Kockums Engineering Group of Sweden with Saab Technologies as its parent company. Alpha Thames was one of the first companies in the world to address the technical challenges presented by subsea processing and over the past 11 years and has gained an unrivalled knowledge of the economics and the technology of subsea field development. It has invested countless man hours in the engineering design needed to bring such a system to fruition with much of the work being applied to the development of new connectors, valves and actuators so that an AlphaPRIME module can be installed and operated on the seabed with optimum efficiency. These have been incorporated within a complete AlphaPRIME system that has now been built at the workshops of Kockums Engineering in MalmØ, Sweden.

The high costs of offshore field development make the logic of subsea separation irresistible and numerous oil companies have studied the AlphaPRIME system with great enthusiasm. The potential cost savings have the ability to de-marginalise fields and re-write the economics of offshore production and could have an important bearing upon the proposed sell-off of marginal fields by the large oil companies.

Although AlphaPRIME IST will lack the compactness and ease of installation and operation promised by the more advanced design, it will perform in the same way and permits a more cautious introduction to subsea separation. As experience is gained, the modular nature of the design makes it possible to recover the unit and install new components for trial while maintaining production with the twin module remaining on the seabed. In the unlikely event that a new component fails to perform as hoped, production can simply be switched to the spare module while modifications are carried-out on the trial component. This introduces a level of redundancy and future-proofing that eliminates any risk from the adoption of subsea processing.

The launch of AlphaPRIME IST has also been accompanied by an increased willingness by Alpha Thames to licence its extensively patented design to oil companies or contractors and to work in partnership with their own engineering departments. It is felt that the specialised subsea engineering expertise needed for the development of a comparable system would make it prohibitively expensive and time consuming for companies to start such a project from scratch in-house. Alpha Thames now believes that valuable new partnerships can be made with any oil company aiming to leapfrog ahead of its competition in this important area of offshore technology.

The AlphaPRIME system

The benefits of the AlphaPRIME system derive from the use of a single autonomous module that incorporates all of the well's manifold, pumping, flow control and processing units. The module is electrically powered and, weighing 25 to 80 tons depending on throughput requirements, is completely retrievable for maintenance or modification. If required, an AlphaPRIME system can begin life by operating as a straightforward manifold centre and be upgraded later. This might include the addition of further production capabilities such as the gas and/or water separation that may become necessary as the characteristics of the field change during its life cycle. The ease of recovery of the AlphaPRIME system also ensures a unique level of flexibility and future-proofing since, as well as being easily modified to suit changing field conditions, it can also accommodate new technologies as they become available.

An entire AlphaPRIME installation can be operated remotely without any ROV intervention or personnel being necessary to maintain or control it. It is an all electric system that simply requires a 5 MW power supply. The characteristics of its design also make it suitable for use in remote locations out of the water on wells in swamps or transition zones where power can, if appropriate, be supplied by a diesel generator within the module itself. Whenever maintenance or upgrading is necessary the entire module is quickly and easily removed and transported to a workshop environment. Here the work can be carried-out safely and free of the pressures encountered during in-field maintenance and the entire system can be fully tested before it is re-installed.

Because an AlphaPRIME system will usually operate with two modules in place, full production can be maintained by diverting the well flow to the spare module. This eliminates the need to shut-in any of the wells and ensures that full production continues throughout maintenance operations.

Although it is ideal for deep water applications, an AlphaPRIME IST system can be installed in water of any depth and begins with the positioning of a docking module either directly onto a single pile, or pile structure that contains no valves or moving parts. The docking module is connected to a power supply and uses a normal multiple bored well head connector that enables flow lines to be tied-in conventionally. This is typically followed by the rapid installation of two self-aligned production modules that, once connected to the docking manifold, enable production to commence. Because the modules can be retrieved with equal speed and because no maintenance work need be conducted in the field, support vessel charter costs are significantly reduced.

Although its concept is unique, the design of the AlphaPRIME IST system is fundamentally an imaginative application of trusted and field-proven technology. Lateral thinking by a team of skilled design professionals has created a system that now appears set to re-write the economic rules of oil production.

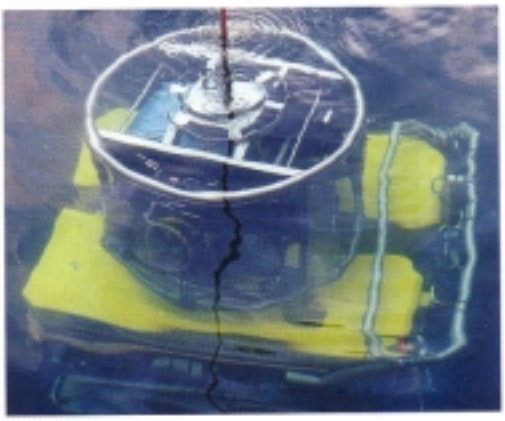
Elektrisk arbeidsROV

Av Frode Korneliussen, Argus Remote Systems AS

Argus Remote Systems har produsert og utviklet elektriske ROV-løsninger for offshore-industrien i snart 10 år. Argus RS har i dag tre standardmodeller som bygger på en felles teknologibase og konfigurasjon. Argus Rover er en observasjons-ROV, Argus Mariner er en lett "arbeids"-ROV og Argus Mariner XL har kapasitetene til en tradisjonell arbeids-ROV.
Mariner XL er bygget for å ha adgang til de fleste installasjoner, og med sine mål; høyde:1m., bredde 1.5m.og lengde 2m, er dette innenfor dagens krav.
Farkosten har thrustere på 4 kW og en konfigurasjon med 3 i vertikal- og 4 i horisontalplanet, med 45 graders vektor.

Skyvekraft med denne konfigurasjonen blir ca.240 kg i horisontalplanet og 240 kg i vertikal-planet.
Dette gir farkosten en meget bra oppførsel under operasjon og den flyr med en høy stabilitet, men det ligger "krefter" helt i bunn.
Kreftene blir overført fra en 50kW trafo fra overflaten med en overføringsspenning på 990Vac(3000Vac), som transformeres ned til de ønskede spenninger på sub´en.
Vi snakker hele tiden her om tilgjengelig kraft ut på hver motor og ikke "ønsket" kraft, med dette kraftpotensialet så begynner virkelig krefter, vekt, størrelse å bli interessante for brukerene.
Brukerpotensialet for et slikt konsept bør være stort fordi man her snakker om en ROV som har krefter og interface-´potensiale til å utføre det en tradisjonell arbeids-ROV kan yte.
Standard leveres ROVen med flytestoff med HCP 100 kvalitet, men resten av sub´en har standard dybde-rating på 2500m.
Rammen er produsert av 50x5mm aluminiumsrør, helsveiset og nærmest nøytral, dette gjør at rammen er solid og den tåler store ytre belastninger.
Kontrollsystemet er basert på Argus Stand-alone kontrollsystem, det vil si at man ikke er avhengig av pc for kjøre nødprosedyre.
Instrumenteringen og alarmer blir presentert på videoskjerm og pc, slik at en til enhver tid kan overvåke power, utstyringer til motorer, datastreng og jordfeil.
Hver motor er koblet til sin egen motorstyringflaske, og dermed kan feilsøking utføres uten å utføre dypt inngripende operasjoner på felles flasker i systemet, kun lokale inngrep.
Dette medfører at en kan lett lokalisere feil som er oppstått på motorsiden og eventuelt skifte den motorstyringen som har hatt feil.
Samtlige elektriske ROVer fra Argus RS bygger på samme "struktur" slik at de forskjellige modellene er lett å "vandre" i mellom. Dette vil da gi klare fordeler innenfor opplæring og reservedeler/service kostnader.

Slik som TMS til Argus Mariner XL er det valgt en All Ocean 350 TMS, dette er en enkel TMS med en forbedret latch-mekanisme fra den tidligere 250 TMS modellen.
Den faste junctionboksen har fått en meget god løsning slik at terminering og service er lett tilgjengelig og dette er et stort fremskritt fra de tidligere modeller, 350 modellen har en kapasitet på 230m med 22mm tether.
Med de forbedringene som er gjort med TMSen så blir ROV og TMS pakken en økonomisk og operasjonell utfordrer i markedet.



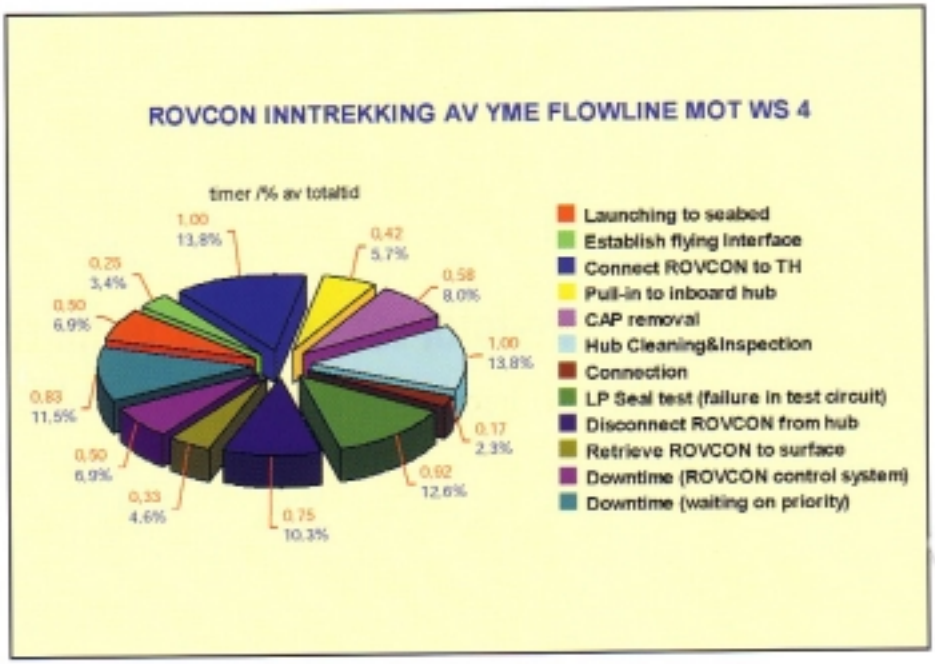
ROV operert inntrekking og oppkobling av rørledning på Yme

Inntrekkings- og oppkoblingsverktøyet ROVCON ble brukt for første gang i forbindelse med undervannsoperasjoner på Yme i november 1999. Yme er et lite oljefelt lokalisert sør-vest for Egersund. Feltet er bygd ut med en jack-up plattform og et undervannsproduksjonssystem som er installert 12 km fra plattformen. Undervannsproduksjonssystemet er installert på ca. 80 meters vanndyp, og er koblet til plattformen med to 8" rørledninger. Det består av en hovedstruktur med tre oljeprodusenter og en satelittbrønn som er koblet opp til hovedstrukturen. Satelittbrønnen ligger ca. 15 meter fra hovedstrukturen.

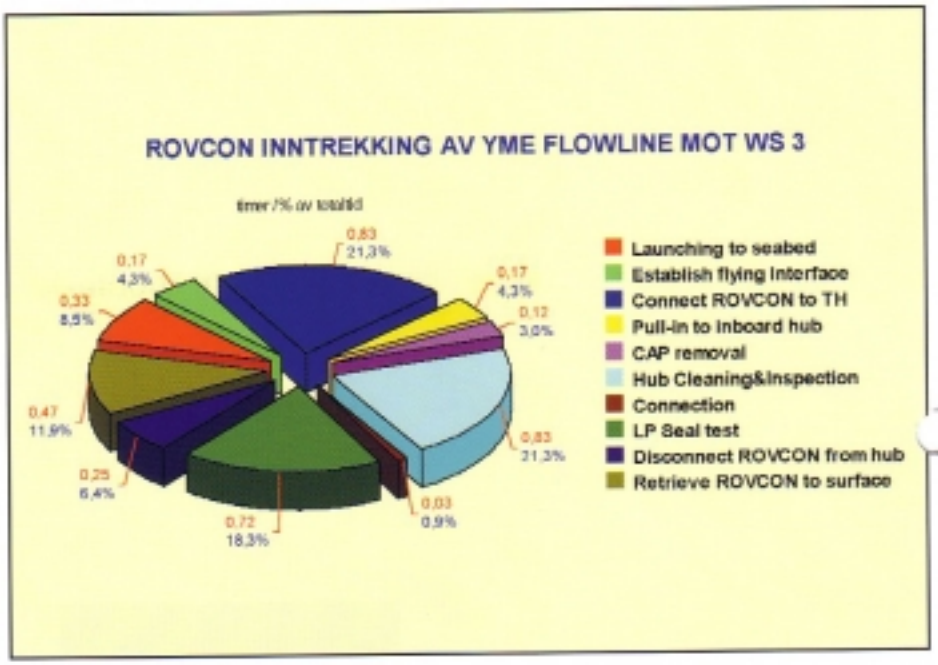
ROVCON er et ROV operert inntrekkings- og oppkoblingsverktøy utviklet av Kongsberg Offshore a.s. i samarbeid med Oceaneering. Verktøyet kobles til undersiden på en ROV, og fjernstyres via ROVens kontrollkabel. Hydraulikken tas fra ROV'ens integrerte hydraulikkpakke. ROVCON har oppdriftselementer påmontert rammeverket og er nøytral i vann. Et komplett ROVCON system veier ca. 2400 kg i luft. Verktøyets dimensjoner er LxBxH = 2,5 x 1,7 x 0,6 m. ROVCON er designet for et maks. operasjonsdyp på 2500 m, men pr. i dag begrenser oppdriftselementene operasjonsdypet til 500 meter.

På Yme ble den fleksible rørledningen mellom satelittbrønnen og hovedstrukturen koblet opp i november 1999 fra fartøyet CSO Wellservicer. Begge inntrekkings- og oppkoblingsoperasjonene ble gjennomført med ROVCON, og operasjonene gikk veldig bra. ROVCON ble koblet til en Millennium ROV fra Oceaneering. Begge inntrekkings- og oppkoblingsoperasjonene forløp tilnærmet problemfritt.

Ved den første inntrekkingen tok det omtrent 6 timer fra ROV med ROVCON forlot dekk til systemet var oppe igjen. Det var noe nedetid på ROVCON kontrollsystem, og lavtrykkstesten feilet. Disse to hendelsene utgjør omtrent 20% av totaltiden, og gir et tillegg i effektiv operasjonstid på omtrent 1,5 timer. Se figur 1 for detaljer om tidsforbruk på deloperasjonene.



Figur 1 Første ROVCON inntrekking



Figur 2 Andre ROVCON inntrekking

Den andre inntrekkingen gikk veldig bra, uten problemer med kontrollsystem eller lavtrykkstest. Det tok i underkant av 4 timer fra ROV med ROVCON forlot dekk til det var oppe igjen.

Personell fra både KOS og Oceaneering gjorde en meget god innsats for å gjennomføre operasjonene på en sikker og effektiv måte.

ROVCON har vist seg å være et meget funksjonelt og effektivt inntrekkings- og oppkoblingsverktøy. Det ble levert et verktøy i 1999, og ytterligere et verktøy skal leveres 1.juni i år. Nå står Terra Nova i Canada for tur, hvor det skal gjøres 24 inntrekkings- og oppkoblingsoperasjoner. Etter en vellykket generalprøve på Yme skal ROVCON til fulle få vist sine egenskaper på Terra Nova.

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 utdannelsesinstitusjoner, 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, engineeringselskaper, 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 ustillinger 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 oljeselskap:

* 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 ustyr 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
Post: Sandslimarka 251, 5254 Sandsli

Seminar FFU

"IMR, Inspection Maintenance & repair"

Onsdag 31. Januar 2001
Statoil Forus IB Senteret

Foreningen for Fjernstyrt Undervannsteknologi har som formål å stimulere og drive informativ virksomhet innen fagområdet.
Vi har igjen gleden av å invitere til et seminar i regi av FFU. Seminaret er åpent for både medlemmer av FFU og andre intereserte.
Seminaret vi i år fokusere på inspeksjon, vedlikehold og reperasjons (IMR) arbeid hovedsaklig på norsk sokkel. Det har vært mye IMR type arbeid tross den rolige perioden vår bransje har vært inne i den siste tiden. Det viser at det er viktig å fokusere på denne typen arbeid, da det i årene framover vil bli stadig flere "gamle" undervannsinstallasjoner som vil trenge forskjellige former for vedlikehold.
Vi ser også at vår type teknologi stadig får utvidet omfang, og da tenker jeg spesielt innenfor oppdrettsnæringen. Her vil det også i framtiden ligge et marked for IMR bedriftene.
Vi ønsker velkommen og gleder oss til en spennende og diskusjonsrik dag.
Pål Espen Antonsen – Leder i FFU

Foredragsholdere:
Alan Niven, Bennex Aberdeen
Cato Hordnes, Norsk Hydro
Bob Baker, FMC/KS
Tor Lægreid & John Rokstad, ABB Installation
Terje Ingebretsen
Terje Santrø, Sonsub

0800 – 0900 Registering og kaffe

0900 – 0910 Åpning av Pål Espen Antonsen, leder i FFU.
Introduksjon av møteledere:
- Tore Disen, Bennex Subsea
- Trond Eriksen, Oceaneering AS
Debatt leder: Svein Ove Gjersdal

0910 – 0940 "Statoil's IMR filosofi"
Erich Luzi, Statoil

0940 – 1010 "Norsk Hydro's IMR filosofi"
Cato Hordnes, Norsk Hydro

1010 – 1030 Kaffe pause / Stands introduksjon

1030 – 1100 "Snorre B IMR strategy and implementation"
Tor Lægreid & John Rokstad, ABB Installation

1100 – 1130 "FMC/Kongsberg Subsea's IMR filosofi"
Robert Baker, FMC Kongsberg Subsea

1130 – 1215 Panel debatt, ledet av Svein Ove Gjersdal.

1215 – 1315 Lunch

1315 – 1345 " Problems with interfacing equipment to different types of ROV's"
Alan Niven, Bennex Aberdeen

1345 – 1415 "Project REMO"
Terje Ingebretsen.

1415 – 1445 Kaffe / Stands introduksjon

1445 – 1515 " Saipem Zero Accident Philosophy Initiative"
Terje Santrø, Sonsub

1515 – 1600 Panel debatt, ledet av Svein Ove Gjersdal.

1600 – 1610 Oppsummering, kommentarer ved møteledere.

1645 – 1845 FFU's årsmøte (etg. Over foredrags sal)

Deltager avgiter:

FFU medlem:	NOK. 2.500,-
Ikkemedlem:	NOK. 3.500,-
Student/pensjonist:	NOK. 300,-

Deltager avgift innkluderer servering m.m.

Påmelding senest 20.01.00
Etterpåmelding er mulig (kan da ikke garrantere plass), da økes deltager avgiften med NOK. 1.000,-
Påmelding blir sett på som bindende etter påmeldingsfrist og tilbakebetaling utføres ikke, stedsfortreder kan sendes.

For påmelding vennligst kontakt Ingun Meiler (ingun.meiler@npf.no)

Utstillingsmulighet:
Det er muligheter for intereserte firmaer el.l. å stille med informasjons/demo stand hvis ønskelig. Plass vil bli tildelt mot et utstillings honorar:

Vanlig stand (ca. 5-8m2) NOK. 5.000,-

Påmeldingsfrist er satt til 20.01.00 Vennligst kontakt Pål Espen Antonsen 51 83 80 12 / 97 17 69 60 (Paal.Antonsen@Halliburton.com)
Eller Trond Eriksen 51 82 51 08 (teriksen@stavanger.oceaneering.com)