and unconventional engineering are required to obtain feasible structures and projects. The wind industry needs to develop more cost effective solutions than those used in connection with the large bridges and offshore oil-drilling projects because the economical margins are much smaller. This is the challenge at deeper waters and at non-ideal soil conditions.

References


Offshore Service and Maintenance

Three large national and international oil companies are in the front line of the Danish offshore industry with regards to exploration in the the North Sea. Maersk Oil and Gas has handled the Danish oil fields alone for many years, and during the recent years two more operators have joined as oilfield operators, namely Amerada Hess and DONG. Alongside these companies also Denerco Oil is active in production from Danish fields as well as being an operator in two Dutch and one German field. In the wake of these operators several other companies have grown, among these a selection of consulting engineering companies, as well as many production companies locally anchored in Esbjerg.

During the years also a large number of small and several large service and maintenance companies have evolved. A number of these companies are local while others are divisions of larger international companies.

These companies are often rooted in a tradition within the fisheries service business in Esbjerg, a tradition more than 100 years old.

Esbjerg was until recently the centre of a large number of fishing based service industries, which quickly recognised the new opportunities, when Esbjerg was established as base town for the Danish offshore industry in 1966. This later developed and an actual offshore sector is now established with more than 200 companies aligned to the offshore service business.

The service companies have been involved in prolonging the lifetime of and making more efficient the production from Danish oil platforms, increasing the Danish oil and gas recovery, in a remarkably innovative and efficient manner, not seen quite similar elsewhere in Europe. Danish oil production is still increasing its output year by year cf. Figure 1, as one of the few places in the world, the reason being not the least, the resourceful and innovative service companies, assisting the platform operators. The result has been a good contribution to the exports of Denmark cf. Figure 2.

A few basics
Everybody can agree to the fact that Service and Maintenance are important factors during the management of an asset, but can these items be described more exact? In the following we have given a few basics in the terminology used.

Service and maintenance can be described as the combination of all technical, administrative and managerial actions during the lifecycle of an item intended to retain or restore the item to a state in which it can perform its required function.
In remote and often hostile locations as can be found offshore, maintenance is of utmost importance not only in order to achieve prolongation of the life of platforms, but also for the environment and for the general health and safety of the personnel aboard the not easily accessible oil platforms.

Furthermore the up-time of the offshore platforms can be increased through systematic preventive maintenance. Interruptions in the oil supply due to unscheduled platform shutdows are very costly. Experience from the land-based industry, indicate that the loss of production is 10 times as costly, as the actual cost of repairing the errors. The factor increases dramatically offshore. This is the reason why service and maintenance is given such a high priority on the Danish offshore installations, focusing on preventive maintenance rather than repair.

In order to achieve optimal service and maintenance performance on a platform, good practice must be preserved when it comes to the maintenance techniques and processes used. The appointed personnel follow the formal maintenance guidelines and the management must always be focused on developing improved maintenance practices and procedures.

Maintenance is hence a complex discipline, involving many parties and many processes.

In the following chapter of ON/OFF Yearbook articles about the topic offshore service and maintenance are presented.

**Figure 1**

**North Sea Crude Production: 1990 - 2020**

**Figure 2**

**North Sea Crude Exports: 1990 - 2020**
On oiled Wheels – A Motor Car Analogy

By Jan E. Q. Hoejer, Amerada Hess

People want the safest and best cars at the lowest prices, people want their car to start and bring them safely to work every day – without “paying fortunes” on service checks. Though a little more complex, in principle oil platforms are built and operated on the same philosophy.

Service checks
Syd Arne has entered its 6th operational year, and systems start to degrade and the maintenance strategy and execution need to adapt as time goes. The Syd Arne maintenance setup was built around Reliability Centred Maintenance (RCM) – in general that enforces the need for constant adapting to the operational profile, modifications and improved maintenance methods. Therefore service intervals and areas of interest change as time goes – the goal is to maintain a safe production and operation without “paying fortunes”.

Risk Based Inspection
Risk based inspection of vessel, pipelines and structure is an area where Amerada Hess has changed the maintenance philosophy. This is a step up for more safe production due to the fact that inspection and maintenance are adapted to the risk. By the end of 2004 Syd Arne achieved approval from the Danish Energy Agency (DEA) as the first and so far only operator on Danish continental shelf to include vessels in the RBI. The RBI program will ensure inspection on systems that need inspection and at same time make it more cost efficient.

Competence and skills
Operating a platform safely, establishing a high uptime and at the same time doing it cost effectively set a demand for a mixture of experience, competencies and skills from operating people to maintenance people. Syd Arne is operated on a Self Managed Team Concept (SMT) which consists of this mixture. The experienced operator has the ability to foresee operational changes that effect production and to focus the attention on systems that need maintenance. The technicians have competencies and skills to conduct first line maintenance which ensures a safe and stable production. Specialist maintenance and campaign maintenance are normally done by contractors. This mixture gives a flexible and motivated organisation that always is able to encounter the challenges of operation and maintenance.

Goal and business
Jan E. Q. Hoejer of Amerada Hess explains about the philosophy: “In Amerada Hess we have the philosophy always to challenge how we operate in all areas, setting new goals for achieving a better business - how can we keep and improve the safety records. We also challenge our contractors to improvements. All in all this is about being able to adjust and focus on goals.”

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Service and Maintenance – Through Development, a safe Approach to Success

By Lars Erik Jørgensen, Semco Maritime

In 2004 Semco Maritime launched the Ascendant 2007 project in order to maintain and develop the market position of the company. Many of the tools used in developing the Ascendant project are similar to the tools described in the SAE / RCM standard (Reliability-Centered Maintenance) with the objective to determine the best policy and to manage the consequences followed by that policy.

Even though Semco Maritime is not owner or operator of assets requiring maintenance and thus does not have the need to run a RCM system, the company has decided to use RCM similar tools in order to perform optimally in a constantly changing market.

Essential questions for RCM evaluation were:
1. What are the functions and associated desired standards of performance of the asset in its present operating context (functions)?
2. In what ways can it fail to fulfil its functions (functional failures)?
3. What causes each functional failure (failure modes)?
4. What happens when each failure occurs (failure effects)?
5. In what way does each failure matter (failure consequences)?
6. What should be done to predict or prevent each failure (proactive tasks and task intervals)?
7. What should be done if a suitable proactive task cannot be found (default actions)?

During the evaluation process each of the above questions must be “satisfactorily” answered and in order to do so information shall be gathered, and decisions shall be made and all information and decisions shall be documented in a way that makes the information and the decisions fully available and acceptable to the management. This ensures that the decisions made are in line with company policies in some cases that might result in amendment of the policies in order to cope with the gathered process parameters.

Using the process described above on any part of a company i.e. production, maintenance and/or engineering, the process gives management all the necessary information in relation to the asset enabling management to set-up a “RCM” plan for the business/operation in question.

Development is often set to be equal to new projects, big budgets and significant prestige. Semco Maritime has found that development also comes through maintenance of operations resulting in small “projects”, with low budgets and almost no prestige. Lars Erik Jørgensen of Semco explains: “It is projects of this nature we have combined and managed by the Ascendant Project which is meant to maintain and extend our market position and overhead and used as the driving force in development of new ideas, subsequently leading to operational changes, new projects and new activities.”

When it comes to actual maintenance activities the driving force should be as set out in the company maintenance policy and here the SAE / RCM standard becomes a very useful tool not only in establishment of the system but also when it comes to assessment of a RCM system already in place.

However, every one will probably agree that only through new investments and new projects, facility owners will be able to maintain or hopefully increase their turnover. Hence if one wants to maintain turnover one should also maintain the maintenance system and one of the ways to do that is through development. Development of new methods, new tools, new systems and amended maintenance policies.

- Development of new methods and new tools i.e. how the actual work is being conducted using a different type of approach and using tools developed by the mainte-
nance personnel enabling them to improve safety and reduce plant downtime.

- Development of new systems i.e. changing any existing system such as PM-systems and CBM-systems into a RCM based system.

- Development and maintenance of a given system should not be limited to handling any new equipment that has been installed and to what equipment has been demolished. Development and maintenance should also, as mentioned above, include development of new physical methods and tools thus maintenance budgets should include money earmarked for continuous development projects i.e. projects that could originate from ongoing yearly evaluations of the maintenance system.

It has often been said that “Anytime a structured, planned maintenance program is implemented you are taking active steps to ensure that the asset is reliable and will perform as intended when required”. Lars Erik Jørgensen elaborates about Semco’s role: “Semco Maritime can be that active step due to the great experience we have gained working with many operators of oil and gas installations as well as rig operators. Not only do we have the experience, we also have the capability to assist any operator offshore/onshore domestically and abroad with engineering support to any existing maintenance system including evaluation of different types of maintenance system such as Preventive Maintenance Systems, Condition Based Maintenance Systems and RCM systems resulting in new maintenance procedures, rescheduling of existing maintenance activities and improvement activities.”

“Both as single source of supply on maintenance contracts as well as on consultancy, Semco Maritime will always involve our highly skilled technicians whose great experience enables them to be operational swiftly in any kind of maintenance campaign or to participate in long term relations on planned or risk based maintenance work.”, Lars Erik Jørgensen sums up.

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New Visions of Industrial Engineering
By Business Development Manager
Verner Andersen, Pon Power

During an interview with the energy specialist company Pon Power, the talk quickly moves to reduction of energy consumption of offshore structures and power plants in general.

So what is the best way to reduce the fuel-consumption costs of a power plant?

Business Development manager Verner Andersen has a stern answer: “The Pon Power Solution: Apply Pon Power generator sets with Dual-fuel kit. This is an extension kit that can be fitted to a diesel engine to allow it to run on both natural gas and diesel fuel, and it works!”

High Oil Prices
Oil prices fluctuate continuously, but in recent years the price of a barrel of crude oil has only tended to increase sharply. This has a financially adverse effect on many businesses. The consequences also affect customers that run diesel engines: due to the rising fuel costs production costs keep on increasing. Since a given amount of energy from natural gas costs less than the same amount of energy from diesel fuel, generator sets running on natural gas can reduce production costs.

This was Pon Power’s starting point in searching for a solution for its customers. The result was the dual-fuel engine. This is a conventional engine modified to run on diesel fuel as well as natural gas. Extensive research and tests on the Caterpillar 3500B electronic engine series resulted in the Dual-Fuel generatorset.

Dual-fuel generatorsets are able to run on 65 % gas
Verner Andersen enlightens us “The innovative dual-fuel generator sets work in conjunction with a gas train that is also fit to some of our gas engines. The main principle of the system is to add natural gas to the engine’s air intake system. This natural gas is mixed with the intake air in a venturi type carburettor, between the air filter and the turbo compressor. The engine itself does not need to be modified and is still capable of running 100% diesel.

With the dual-fuel mode activated and gas supplied to the engine, the Electronic Control Module of the electronic engine immediately decreases the amount of injected diesel to meet the actual requirements for engine load and speed. Depending on the actual load, gas quality and environmental conditions, natural gas can be used as a substitute for up to 70 % of diesel fuel. The dual-fuel system provides full control of the amount of supplied gas, thereby making diesel substitution fully programmable. This means that for every load the optimal gas/diesel-ratio can be set.

Dual-fuel application substantially reduces fuel costs and therefore production costs. Moreover, the basic engine is still a diesel engine, so no compromises are made in relation to the engine’s power, speed or stability.

Advantages offered by the Pon Power dual-fuel genset:
- Low fuel-consumption costs
- The reliability and stability of a diesel engine, with the advantage of natural gas as a low-cost fuel
- Fully programmable gas/diesel ratio
- Innovative product, designed by Pon Power’s Caterpillar experts
- Payback time on investment is significantly reduced
- Comprehensive service by Caterpillar’s worldwide dealer network.

Business practice
According to Verner Andersen, the first customer to order a dual-fuel genset has already taken delivery. A company in West Africa, executive producer in Nigeria, requested a replacement for one of its generator sets. One of the client’s demands was to reduce production costs. With a natural gas supply available on site, the step to dual-fuel seemed obvious.
Possible Applications
Businesses in all kinds of sectors and industries can use the dual-fuel system, provided a gas supply is available. Examples include factories, on board LNG (Liquid Natural Gas) carriers, Floating Production Storage and Off-loading (FPSO), ships with a relatively small radius of action (such as ferries and pilot boats) or trains with diesel locomotives.

Questions and Answers as stated by Pon Power
• Which genset ratings can be delivered on dual-fuel?
The dual-fuel application is available on the Caterpillar 3500B series gensets, with ratings varying from 590 ekW (3508B) up to 1600 ekW (3516B).
• How does a dual-fuel genset respond to transient loads?
The basic engine of the genset is still a diesel engine. When a transient load is applied to the engine it will respond similar to the diesel-only model.
• What is the maximum gas percentage at partial loads?

When the genset is partially loaded, the maximum allowable gas percentage rises slightly, up to 70%.

• What kinds of gasses are suitable for dual-fuel application?
The recalled results are obtained with Groningen Natural Gas, with a methane-index of about 80. Please contact us to find out if the composition of your natural gas is suitable for this application.

Pon Power Oil & Gas BV
Pon Power is the official Caterpillar dealer for Power Systems in the Netherlands, Norway and Denmark. The company specialises in energy conversion and management for all kinds of uses. Pon Power designs, builds and installs engines for oil & gas installations, ship propulsion and auxiliary power, complete emergency power generators (units), continuous energy supplies (generator sets) and systems for combined heat and power equipment (total energy principle). Pon Power also offers a wide range of servicing possibilities and the tried and tested quality that is essential for a dependable energy supply.
From Fisheries to offshore Service

By Anders Klastrup, Peter Harbo A/S

The company Peter Harbo A/S in Esbjerg was established in 1973 and started as a service company for the fisheries with ropes, wires and other iron articles. It was exiting times where concepts such as service and good co-operate partners for costumers as well as contractors were established as the key stones in the company.

Therefore it was not difficult for the company to understand the demands and wishes for service and ability to deliver around the clock from the offshore business, which the company joined 10 years later. The challenges were many, also within tasks far away from the daily routines – but they were received and solved. Every day when the employees meet at work it is the goal to “face the challenge and solve it!” as managing director Claus Harbo, the son of the founder, puts it.

Today the company Peter Harbo A/S includes service and trade to the industry, the marine and offshore business in Denmark as well as abroad. Service and trade activities to the fisheries industry were merged with the company Perfect Fishing Gear in Esbjerg, which today is owned 60 % by Peter Harbo A/S.

Peter Harbo A/S has a department in Fredericia which covers a complete test and rigging workshop together with a sewing workroom for manufacturing of round slings, lashings and special products.

The company is confident that it has a flexible and professional firm, which is ready to fulfil any task within the lifting gear business, no matter whether it is intended for the industry, marine or offshore sectors. The company participates in various committees within relevant business areas, to ensure that it is always in the front line concerning development and the rigorous demands to professional lifting gear.

The goal is to be a good, flexible and in all respects professional co-operating partner, who participates actively in the development of the business. The company wishes to make a difference to the offshore customers who as a first priority have good service, day and night, all week, year round at competitive prices.

Recently Peter Harbo A/S has carried out a line of expansions of their service assortment, as outlined below:

The Canadian company Insulmastic has appointed Peter Harbo A/S, Esbjerg as their new distributor in Denmark and Greenland.

“The reason for choosing Peter Harbo A/S as distributor was obvious, as they have long and valuable experience within the marine-, fishing- and offshore industry”, said Mr. Mario Galindo from Insulmastic and continued, “we look forward to this new collaboration with Peter Harbo A/S and we are confident, that they will represent our company in a professional and innovative way”.

Sales representative Anders Klastrup from Harbo A/S expresses the mutual understanding with Insulmastic: “We are very pleased being able to present the strong product ranges of NoSpray and Insulmastic. The products are complementary as special products to our present product range of lifting gear, wires, fibre ropes, chains, services and test facilities”.

The service products in question are NoSpray anti splash tape, CanSeal tape, CanFix tape and Petrowrap tape.

NoSpray Protection System is an aluminium/glass cloth jacketing system designed to prevent the flammable spray of hot oil, fuel or the like which can come in contact with hot surfaces thus causing fires in vessel engine rooms. The product is available in tape format and is coated one side with a silicone adhesive for ease of installation and superior adhesion. The tape can be used as an alternative to double piping or cover plates. The product complies with new SOLAS regulations effective as from 1 July 2003, which is mandatory for all vessels. NoSpray is approved by DnV,
Lloyd’s Register, ABS, ClassNK and CCS. The class is protection of life at sea!

Another new service product is CanSeal, which is a marine tape used for sealing hatch covers on ships or the like. The tape is a heavy duty sealing tape manufactured with extraordinary strength, adhesion and flexibility. At a full 5 mm thick and reinforced with fibreglass mesh, CanSeal marine tape assures that the cargo arrives damage free. The tape is available in rolls.

CanSeal-R is a premium quality roll-type marine tape recommended for moderate weather conditions. The tape is available in rolls.

For making emergency repairs, the CanFix quick repair kit is a complete system to a wide variety of pipe materials. CanFix consists of a patented, fibreglass cloth impregnated with water activated resin that sets in minutes with no measuring, mixing, or messy cleanup. Each kit contains a roll of CanFix cloth, a tub of epoxy for filling and sealing, a pair of latex gloves, and complete instructions for use.

Typical repair applications are: riser exhaust, leaking hydraulic lines, water cooling hoses and fluid lines, leaking steam lines and fittings, corrosion protection coating, repair of broken tool handles etc, emergency repairs to fuel lines, etc. The system withstands pressure of 60 bars.

PetroWrap is an anti-corrosion tape system used to protect deck equipment, hydraulics, steel pipes, flanges, valves, marine pilings and structures, or any other equipment which is subject to corrosion. Composed mainly of petrolatum and specific anti-corrosion agents, the tape system is formulated to provide economical long-term protection from water, salt, alkalis, and acids and requires no maintenance. PetroWrap will not crack, peel or harden; it is non-toxic and non-polluting; and can be applied on wire brushed surfaces; repels water, salt, alkalis and acids; protects new or corroded surfaces; withstand temperatures -40°C to 65°C.

All products are available from the Peter Harbo stock in Esbjerg.

Peter Harbo A/S will strive for continued growth within offshore services, offering new products and services to satisfy the offshore customers.

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Intelligent Valve Management and Service

By Michael Bjerrum, Score Denmark

Throughout the years the valve service requirements of the oil and gas industry have developed into a need for a complete integrated range of services covering the full life span of a specific product.

In order to cover these requirements in respect of valves and related equipment the Score Group of Companies has developed the Intelligent Valve Management concept in close cooperation with various customers, operators and end-users.

The Intelligent Valve Management (IVM) concept provides a framework for plant maintenance and ensures compliance with the applicable safety and statutory requirements and also ensures best possible long term value and plant operability.

An approach to IVM can comprise of a review on existing data-sheets and P&ID’s in order to establish commonality and generate a valve matrix. Subsequently a criticality assessment can be carried out in order to determine the required stock level to be procured and maintained.

Once the valve population has been recorded it opens the possibility of benchmarking the performance of each specific valve, thus enabling to decide whether it would be feasible to upgrade the valve and thereby prolong the lifetime leading to reduced cost of ownership.

Field service and On-Site valve maintenance can comprise anything from a single specialist conducting acoustic leakage monitoring on riser valves to large teams carrying out major valve related shutdown work supplying own workshop containers and special tooling. Typical work scope includes valve and actuator trouble shooting, seized valves, emergency sealing, re-certification and routine valve maintenance to name a few.

The Score Group operates fully independent from all valve and actuator manufacturers and strives to offer cost effective solutions for the client. The flexibility offers a foundation for enhancing the supply chain in respect of quality, availability and commercial benefits for the client.

An approach to IVM can comprise of a review on existing data-sheets and P&ID’s in order to establish commonality and generate a valve matrix. Subsequently a criticality assessment can be carried out in order to determine the required stock level to be procured and maintained.

In order to maintain and develop the very high service level that clients require today, training and education are given high attention. The Score Group has developed a training software tool named V.I.T.A.L. (Valve Intelligence for Training and Learning), which comprises on animation of all sorts of valve and actuator types, and includes technical information and addresses all safety, environmental and quality issues. V.I.T.A.L. is used in a comprehensive training program, which all Score individuals undergo during their continuous development, which is also available to clients for both general introduction to valves and in-depth training.

For a single ex-stock valve requirement all the way to a totally integrated project solution, Score has a service tailored. Furthermore resources and advanced technical capability are available to develop an IVM strategy for companies, irrespective of size or complexity of needs.
The next chapter of the Yearbook will feature articles with focus on automation and supervisory technology within the offshore industry.

IT & Automation systems on the platforms in the North Sea and worldwide are aging gradually, considering that some of the larger North Sea platforms were built 20-30 years ago using the automation technology available at that time.

The platforms are still working efficiently and producing large amounts of oil and gas, not the least due to systematic maintenance. However some of the computers and the installed software are quite antiquated, bearing in mind the short life span of the IT hardware and software of today. It can hence be difficult to find spare parts for servicing components or relevant software update patches to system software. Furthermore it can be difficult to find employees, who still have the required technical knowledge of the installed operating systems and systems software.

For these reasons the operators of the systems at the North Sea and worldwide, constantly spend large amounts of money upgrading their systems to newer systems, with continuous focus on dependable hardware and software.

Furthermore a search for new areas for automation of exploration and production processes on the offshore platforms is taking place these years.

Danish offshore industry has a solid background within automation and supervisory technology, based on a solid background within IT and automation competences. The knowledge built-up has been made throughout the last 20-30 years, within a series of Danish companies and Danish subsidiary companies of international conglomerates, targeting both national and international markets.

Automation and supervisory technology plays an important role within the offshore wind industry as well. One example is the fitting of the fluctuating electricity output from offshore wind farms into the grid.

**The Danish automatic Tripod Platform**

One good example of superb Danish offshore innovation entrepreneurship is the automatically operated tripod satellite platform, used for smaller marginal fields.

*Cont. page 42*
In the continuing effort to reduce overall costs and keep the operational costs of oil production at a minimum especially for remote and hostile small marginal fields, several alternatives have been developed by the Danish operators in the North Sea. Especially Maersk Oil & Gas AS has been at the forefront in this technology, concepts from whom, have been adopted also by the Danish operator DONG, and with international recognition from major oil & gas operators worldwide. RAMBØLL has been the external consultant.

The tripod satellite platform is basically a light-weight three-legged substructure, with minimum topside facilities cf. the picture given below.

The platform is designed for unmanned operation with all power and shutdown operations controlled either automatically and/or via remote radio signals from the main platform, thus ensuring a low-cost and safe exploration.

Also installation of the particular tripod platform used in the Danish part of the North Sea is done in quite a cost-effective way, allowing for installation by a medium size drilling rig in connection with drilling of the wells, all in one go without demobilizing the rig. Crane barges can be scarcely available, and the method is very cost- and time-effective, as the drilling rig is available on the site anyway. The jacket construction is shown below.

With more than 10 years multiple operation sites in the North Sea as reference, the satellite tripod platform is today proven successful technology. Both from an installation but also very importantly from an operational point of view given the automatic mode of operation, the tripod satellite platform today stands as a good testimony to Danish offshore engineering craftsmanship, with international recognition as a low-cost and safe solution for marginal sites.
Advanced SCADA Systems for Wind Power Plants

By Thorben Thim,
Product Marketing Manager, Vestas

Why so much focus on SCADA?
The complexity of wind power SCADA systems has been growing with the acceptance of wind power as an important part of the electrical grid. The first step was basic control and monitoring of single turbines in large groups. Now that wind turbines are being considered as active power plants, they face new requirements for dynamic grid support.

As wind power plants must now provide more reliable power, the SCADA system has become much more critical than before. Interconnection agreements are normally defined at a single point on the MV or HV system. As a result, plant regulation is needed to control all the turbines as a single unit to provide compliance at the interconnection point.

However, grid compliance is not the only driver for more advanced SCADA systems. Offshore wind power plants typically face very rough operating conditions that empha-
size the importance of the SCADA system. Access to offshore wind turbines is not only costly, it is also controlled by weather and sea conditions that may prevent service visits for several days. By continuously recording and processing data from the turbines, the SCADA system enables operators and service engineers to anticipate problems and, if necessary, diagnose and correct faults remotely from a PC hundreds of kilometres away.

Additional project-specific issues also encourage the focus on wind power SCADA systems, for example:
- Aviation lights, marine lights and foghorns
- Ice detection
- Lightning detection

Other issues that push towards more advanced SCADA systems are requirements such as:
- Power plant forecasting for power trading and other purposes
- Preventive maintenance
- Interface for third-party high-level SCADA systems
- Substation monitoring and control integration
- Advanced reporting

These requirements can make the reliability and availability of the SCADA system very critical.

**What should a reliable SCADA system achieve?**

Lack of control over the wind power plant because of a SCADA system fault can have serious consequences, for example if a plant has to meet certain grid requirements at the substation.

Both the network infrastructure and the SCADA software and hardware design philosophy are therefore very important. Through good control and diagnostics, the SCADA design must ensure that the wind power plant operates at its peak, but within safe limits and according to the required interconnection settings.

**What has Vestas done?**

Vestas has identified several important areas in designing VestasOnline™ Business, its advanced power plant SCADA system:
- Power plant server
- Power plant controller
- Third-party equipment
- SCADA client software
- Communication infrastructure
- Power plant reporting.

The VestasOnline™ Power Plant Server manages the continuous collection of data from each turbine in a wind power plant

**Power Plant Server and Power Plant Controller**

VestasOnline™ Business is built around the Power Plant Server, a dedicated industrial computer connected to the turbines by fibre-optic links. The Power Plant Server stores all the turbine data in a central database and uses the data to create customisable reports and alarm messages. Users view the reports and control the plant from remote PCs connected to the server by a local network, a secure internet connection or a modem.

Another cutting-edge feature of Vestas Online™ Business is the Power Plant Controller, a unique stand-alone embedded controller that provides active and reactive power regulation, power ramping, voltage control and other power management
features. The Power Plant Controller is a stable and redundant system that has its own grid monitoring equipment and is able to control substation equipment as well as the turbines.

**SCADA client software**

The VestasOnline™ Business client application is a standard software package with extensive optional tools for designing project-specific screens. Examples are substation layouts showing breaker status, with buttons for operating breakers, and dispatch control screens showing grid control parameters. The SCADA client can be used to control several power plants without reconfiguration, since all project-specific screens, graphics and parameters are downloaded the first time the SCADA client connects to the server.

**Communications infrastructure**

The communications infrastructure is a very important part of the entire power plant design. If the communication between the turbines and the central SCADA server or controller breaks down, the availability of the power plant might be at risk. Vestas therefore offers a redundant communication infrastructure based on a daisy-chain design as standard. Even if a communication loop breaks down, the plant’s grid compliance is normally not at risk, since the power plant module will take the loss of communication into account. No data is lost, either: the SCADA server simply collects the missing data from the affected turbines once communications have been re-established.

**Third-party equipment**

Vestas has addressed the growing need to interface with third-party systems such as substations, network communications equipment, high-level SCADA systems and grid control equipment. VestasOnline™ Business supports the iSNMP, DNP3 and Modbus communications protocols. Optionally, other OPC-compliant equipment can be integrated using site-specific interfaces.

**Power plant reporting**

A simple SCADA system may do very little filtering of the data. VestasOnline™ Business, by contrast, is a high-level system that provides information in the right form, to the right people, at the right time. The combination of standard hardware and software modules with project-specific customisation creates a strong foundation for sophisticated reporting with high data integrity. Integration of, for example, Vestas MetPanel, Vestas GridPanel and the Power Plant Controller allows the generation of reports on lost production due to power plant regulation constraints, grid drops, scheduled maintenance and environmental control schemes.

**Conclusion**

Vestas has created a flexible modular SCADA system based on standardised, reliable components — both hardware and software — with a proven track record. By keeping customisation to a minimum, this approach increases reliability and stability, and simplifies service and maintenance. The result is a SCADA system that provides true high-end functionality and performance, combined with excellent reliability and low costs for commissioning and day-to-day maintenance.
Reduction of Risk through high Integrity Automation

By Director Jan Ilsoe, ABB A/S

Today safety has become one of the most important parameters in the process industry

In 2003 the investment in Safety Systems worldwide was 641 million USD and this figure is expected to grow to 905 million USD in 2008. (Source: ARC Advisory Group)

The reason for this annual average growth rate at 7.1% is among other things related to:
• Increasing O&G investments in upstream activities, LNG plant, receiving terminals, and transportation construction
• New investments in Asia and sustained modernization particularly in the Middle East and Eastern Europe
• New international standards IEC 61508 & IEC 61511
• OSHA’s adoption of safety standards as good engineering practice
• Awareness of the availability of proven safety technology
• Conversion of relay, general purpose PLCs and solid state logic to microprocessor based safety systems

Another reason and probably the most important factor is that the process companies now are more concerned than ever about several issues. The issues cover loss of life and limbs for persons in and outside the production areas, damage to plant and equipment, environmental damage, loss of production and fear of litigation.

To reduce these risks, the process companies today install High Integrity Automation Systems. ABB is a leading supplier of automation systems and to the offshore industry ABB has numerous experiences from decades of challenging tasks worldwide.

As ABB sees it, the requirements for today’s safety systems are:
• Possibility for Control and safety delivered in a single environment for eliminating interfacing, cost and complexity, and widen the functional scope.
• Possibility for combining safety critical loops with control applications to facilitate maximum utilization of process equipment within defined safety boundaries during changing production modes.
• Reliability, Availability, and Scalability taking appropriate actions, all while minimizing risks.
• Real-time plant asset management for increasing plant availability and safety integrity through early detection of performance problems and efficient remediation processes.

Supplier’s reputation, TÜV certification, and ease of implementation are the major criteria for the process industry companies when selecting a safety system.

Jan Ilsoe informs us, that these market criteria are fulfilled by ABB and ABB’s Safety Systems “Industrial IT Extended Automation System 800xA Safety” and “Safeguard 400”.

He adds: “Today ABB is the third biggest supplier of safety systems worldwide and is number one in Europe. Together with ABB’s world-class competences within Functional Safety Management, ABB is considered as the market leader within safety.”

ABB has obtained their position after more than 25 years of experience in designing, implementing, and maintaining fault-tolerant, programmable, safety systems for oil and gas, petrochemicals, fine chemicals, and power generation applications. The company developed the first programmable electronic safety related logic solver in 1979 for Mobil/Statoil and has today more than 500,000 I/O’s and 1000 controllers installed worldwide.

Jan Ilsoe continues: “ABB is also the most complete supplier of safety systems on the world market today:
• Wide Controller portfolio
Industrial IT Extended Automation System 800xA improves process availability while reducing the risk to overall plant operation by providing a common environment for production control, safety supervision, and production monitoring. Within this environment, System 800xA offers a complete Safety Instrumented System (SIS) solution, complying with the IEC 61508 and IEC 61511 standards and covering, not only the logic solver, but also entire safety loops, consisting of field instruments, central controllers and field actuators. Systems 800xA also provides safety solutions that are easily scalable from a few loops to complete safety systems.

The SIS realization is achieved by utilizing dedicated controllers or via SIL designated applications within the same controller as process control. By utilizing common hardware and software, System 800xA reduces costs. As Jan Ilsoe puts it, in this way the objectives of both systems are achieved: “maximum plant availability and minimum risk.”

With safety applications such as emergency shutdown systems, fire and gas systems, and burner management, 800xA Safety delivers safe reliable operation of “any industrial process.”

Besides delivery of the Safety Integrated Systems, ABB also assists in the practical implementation of all phases of the IEC 61508 / 61511 safety lifecycle for both existing and new facilities by applying proven techniques and working methods including:

- Safety Integrity Level (SIL) assessments
- Software tools supporting the safety lifecycle
- Identification of safety critical elements / functions
- Safety lifecycle audits
- Independent validation and verification
- Hardware / software design
- System integration Support for strategies to implement IEC 61508 / 61511
- Support for in-house training and awareness programs.

Jan Ilsoe concludes: “ABB is the market leader within Safety.”

A Need for High Integrity

Example

The incident...
During the recommissioning hydro cracker unit after routine shutdown, a 20 ton low pressure separator vessel exploded, heard 30 km away, with a subsequent fire.

The cause...
Design issues
Access to operating procedures
Sensor problems
Change Management

The cost...

Reduction of Risk through high Integrity Automation
3D Scanning Technology for offshore Purposes

New scanning technology for easy construction of 3D models of production plants and offshore production facilities

By Chartered Surveyor Morten Thoft Christoffersen, COWI A/S

A relatively new scanning technology known as terrestrial laser scanning is rapidly rendering that trusted tool of the surveying fraternity – the tape measure – obsolete. According to COWI, this technology enables fast, easy construction of precision 3D models without the surveyor having to be close up to what he is measuring.

Millions of Points
Terrestrial laser scanning creates a point cloud composed of thousands or millions of XYZ points with a resolution as little as 1x1 mm. The laser scanner is capable of collecting thousands of point’s pr. second. Point clouds can be registered from different scan setups, depending on the skills of the job and the different point clouds can be joined into a common geo-orientated point clouds.

It has not before been possible to measure objects with such clarity of detail. The points form a point cloud from which accurate 3D models can be generated.

Terrestrial laser scanning enables to take on assignments that not previously have been undertaken; for instance, measuring complex objects such as process facilities on offshore platforms.

Using the old technology to generate 3D models of this type of object would have been costly and time consuming.

Provides an overview
The new technology should find favour particularly in the oil industry, where highly complex plants are in operation and where having production facilities lying idle during modernisation or renovation is an option best avoided. A 3D model offers an overview of obstacles and advantages that are difficult to identify on conventional drawings.

The scanning data is an important basis for the design procedures and data can easily be used for as built documentation, interference check, and similar. The scanning data helps the designers identifying important tie-in points and speed up the design procedures. Any new design can be checked. Importing the new design into the point cloud data, designs can easily be checked for any inter-
ference with the existing environment. This interference check is an important feature for optimizing the design in relation to reliability and validation of data.

The technology has already been used in the process industry for a period and will soon become a natural integrated part of documentation and engineering design projects in the offshore sector, where the use of the technology is growing.

COWI states that they with success have used this 3D laser scanning technique offshore for Maersk Oil and Gas and on projects in Denmark and abroad.

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**Cleaning detergents**

*Environment – Efficiency and Economy*

MASAVA KEMI has since 1970 been ahead of the development of environmental friendly cleaning detergents. Main product line: Water based detergents for cleaning, degreasing and disinfection used for applications on rigs, ships, tanks and in engineering etc. for separation of oil and degreasing before painting. The products produced by MASAVA KEMI are useable on all water stands surfaces and with a number of excellent properties:

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- Certified and approved according to HOCNF, CHARM, Achilles and FPAL
- Fast separating according to IMO, for use in oil separators
The North Sea’s wireless Bridge

By Editor Jens Michael Damm,
Lindpro A/S

When a vessel casts off, it is not only goodbye to friends and relatives. It is also hello to a totally different way of life, with communication to shore being decidedly constrained.

So long as a vessel is within 30 nautical miles from shore, the VHF band can be used. The big drawback of that is that everyone can listen in. Short-wave radio or MF/HF communication can be used across the globe, but the quality leaves something to be desired, and it can be difficult to find the right frequency.

Communication via satellite is good, reliable and popular. The only drawback is the cost.

Broadband and satellite
On the North Sea production fields the major operators have a permanent satellite broadband connection that keeps them in constant contact with head office and suppliers worldwide. The operators typically pay a fixed fee for the connection, giving them unlimited communication.

Anyone overflying the production platforms in the Siri and Syd Arne fields will see ESVAGT’s orange-red standby/rescue vessels. Quietly attentive - like a bee circling a flower - they hover less than one nautical mile from the platforms, ready to respond if disaster strikes or a vessel ventures too close to the platforms.

ESVAGT’s standby/rescue vessels typically have a crew of between six and twelve. The crew work at sea for periods of two to four weeks. They would normally use satellite communication when calling home. But the price is high - very high.

That problem has now been overcome to the employees’ great satisfaction.

Invisible bridge
The solution has been invented by Lindpro a/s in Esbjerg. The firm specialises in the supply of total communication solutions, among other things. The challenge in the North Sea was solved in close collaboration with ESVAGT and the platform operators on the Siri and Syd Arne fields.

“We have simply created a wireless bridge between ESVAGT’s vessels and the production platforms. Data and voice transmitted from the vessels are routed onto the operators’ network via a receiver on the platform. Here, the messages are received by the permanent broadband connection and can now utilise some of the platform’s spare broadband capacity”, says Bjarne Kjeldsen, Technical Manager at Lindpro in Esbjerg.

The wireless connection from the vessel to the platform has a range of one nautical mile. That is sufficient as the vessels rarely stray beyond that range; however, this form
of communication can only be used when the vessels are stationed in a specific position. The platforms have yet to be fitted with receiving antennae that cover all four quarters of the globe.

**Security**

Security is the byword in the operators’ network, and they are therefore not keen to ‘let others in’. ESVAGT has nevertheless succeeded in gaining access to the network by hiring a PC from the operator. It is a stand-alone PC designed exclusively for communication from vessel to platform. The PC has a host of security features, making it impossible to access the platform’s systems.

**Contented employees**

“This solution naturally does not come for free, but important is that we open new communication dimensions for the employees in this way, enhancing their job satisfaction. Both we and our customers benefit from this”, says Operations Manager Ole Ditlev Nielsen, ESVAGT.

The price for borrowing capacity from the operators’ communication line is negotiated every time ESVAGT enters into new agreements.

The wireless connection that Lindpro has developed is based on Zyxel technology. All equipment is enclosed in watertight steel boxes that are resistant to the harsh North Sea environment.

**New prospects**

Bjarne Kjeldsen expects wireless communication to become increasingly popular, eventually making it a critical competitive factor in the maritime world.

“Imagine that a port such as Esbjerg establishes a wireless network with large broadband capacity that all vessels calling at the port can use. That would be an additional service and could be the deciding factor that makes Esbjerg the preferred port of call rather than another Danish port. You will recognise the system from hotels. Businesspeople choose hotels based on the facilities they offer”, says Bjarne Kjeldsen.

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Automation Competence as the Lever for increasing Profits

By Aksel Nielsen and Claus Tomzak, AN Group A/S

Introduction
It is no secret that one of the best ways to develop, innovate and improve business is to share knowledge and to benefit from the experience of others.

For the last 20 years there has been an extensive growth in production efficiencies in the industrial sector via the various usage of innovative thinking, new methodologies, models and technology. The whole range of improvements and business reengineering has among other things been possible due to the use of consultants/specialists, use of best practice and via the sharing of cross-industrial knowledge.

The manager of the AN GROUP, Aksel Nielsen states: “We believe that there is a growing opportunity for the oil and gas sector to benefit from these improvements made in the industrial sector, and we hope that the oil and gas companies will grab that challenge.”

Development and experience in the process industry
Aksel Nielsen further states: “The industry sector shows an attitude and willingness to make best practice and knowledge available to others. This is as an example, partly done via the extensive use of corporation involving customers, consultants/specialists and suppliers – a process that more and more is build on openness and collaboration. Other ways are open business forums, where typically people from the manufacturing industry get together to learn about some of the latest experiences and best practice in the field of automation, integration of systems and related issues.

Best practice from the industrial sector could certainly kick-off a process of innovation and change in the oil and gas sector.”

Challenges for the Oil & gas sector
Some of the constant challenges, the oil & gas sector faces, are the demand for increased throughput (optimised production), avoidance of down-time, minimising risk, secure a high level of health and safety. Most of these issues are equally important for the industry sector.

Aksel Nielsen further believes that with the establishment of Offshore Center Denmark (OCD) and the initiatives taken towards networking, easier access to information, sharing experience etc., his company will experience collaboration between Danish consulting companies and suppliers in order to strengthen the competitive position for Danish companies nationally and internationally and thereby creating jobs.

AN GROUP’s services and competences
AN GROUP are partners regarding Industrial Engineering and Contracting in relation to development, optimization, engineering and implementation of process plants/production systems competences.

AN GROUP’s approach to projects is to look at the Business Processes and functionality of the needed processes before actually assessing the technology needed for the optimization. The competencies includes:

• Production optimization - analysing, structuring and defining needs and opportunities to optimize business processes
• Production IT & integration
• Functional requirement specifications
• Technology assessment
• Systems integration/programming
• Process plants/mechanical engineering
We use AutoCAD, AutoPlant
• Process automation & instrumentation, including SCADA- & failsafe systems, engineering/programming
• Electrical engineering
• Project management
• Validation of process plants
• Consultancy services such as tender/procurement related to the above areas

Selected references in the oil and gas sector (1984–2001)
AN GROUP has participated in a number of oil and gas projects in Denmark, Norway, Spain and Saudi Arabia.

Among these projects are:
• An on-shore consultancy project for DONG, containing development of specifications and tender material for SCADA systems for the whole control system of the Danish Main Gas Distribution Net
• Consultancy jobs on Shell and Statoil refineries.
• A series of consultancy jobs for Maersk Oil & Gas and Maersk Contractors as well as for the Norwegian Oil Directorate
• Developing specifications and the purchase of utility systems for the Oseberg C. platform

Conclusion
“It is my hope that we can initiate a constructive dialogue with the oil and gas industry, as successful companies are always looking for ways to improve and optimize. And as we all know the best way to learn and improve is from the experiences of others”, Aksel Nielsen conclusively states.
The Danish offshore industry is currently busier than ever. Especially within the offshore oil and gas sector, the far majority of activities is based around Esbjerg. A recent study showed that more than 5,000 people are employed by the offshore oil/gas industry in a radius of 50 km within Esbjerg. In order to ensure the industry’s demands for quality and effectiveness, these people need the proper form of education for their job.

Looking at the other parts of the offshore sectors e.g. offshore wind, a similar busy picture appears. Over the next 5 years an expected investment of EURO 7 billion is expected to be made in offshore wind farms in the North Sea, according to a study done in 2005 under the Offshore Center Danmark co-sponsored EU POWER project (cf. page 94).

This calls for a massive increase in people working with offshore projects and thus a correlative need for educations.

Education offshore can be divided into 3 main areas:
• Safety training for anyone working offshore
• Vocational training for skilled workers
• Master and bachelor education for engineers etc.

With more than 40 years of experience from offshore projects, Danish educational institutions and offshore companies have developed a strong tradition of educating people for working with offshore projects. Educational institution active in the field are found nationwide, but the majority are based Esbjerg. Represented are:

• Several institutions offering safety training for offshore oil/gas workers, offshore wind workers and employees in the remaining maritime sector
• 2 universities offering master and bachelor modules for a range of offshore relevant educations
• 3 major schools offering vocational training for skilled workers in offshore relevant areas
• A wide range of private companies educating their current or future employees on many levels
• Several private companies offering different offshore relevant education modules for primarily people employed by other companies

In the next chapter of the Yearbook we will present articles from a few of the institutions offering offshore relevant educations.
About the education

Esbjerg based education centre EA Vest has launched a new education aimed towards the offshore sector - "Technical Manager Offshore". The education is a 3-year short-cycle higher education with the possibility of switching to Operation Technologist Offshore after 2 years.

Torben Dahl explains about the new education: "As a Technical Manager you are qualified to operate on management level, be in charge of running and maintenance of technical plants and installations, as well as you can carry out jobs within design and project planning of technical plants within offshore and industry."

The new Operation Technologist is qualified to be in charge of analysis, to plan and come up with solutions to operation and maintenance of larger mechanical plants offshore or in offshore related companies and within the industry. The education is a part of Technical Manager Offshore.

Structure of the education

The compulsory ranges of subjects during the first 3 semesters of Technical Manager are as follows:

General
- Technical mathematics and physical sciences
- Project work
- Information Technology
- Chemistry
- Mathematics
- English
- Practical work

Business I
- Organisation
- Project management
- Working environment
- Quality control

Automation and Process Analysis
- Process analysis
- Automation

Electro Technology I
- Electro technique
- Electrical calculations and installations

Mechanical Technology I
- Engine theory
- Boilers
- Turbines
- Hydraulics
- Pumping units
- Materials technology

At 4th and 5th semester:
- Electro Technology II
- Operation of electrical installations

Job opportunities

Technical Manager Offshore: Manager of technical installations within industry or offshore. Coordinator of cross-functional projects. Design of technical installations. Managerial tasks with staff, environment and safety.

Operation Technologist Offshore: Maintenance of larger mechanical plants offshore. In charge of daily running of machinery, energy and process engineering plants.
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Training offshore

By Mr. Eigil Jensen – Director of Survival Training Maritime Safety

Since the early start of the offshore industry, training has been developed against the different challenges the industry has met. The safety training has been a natural and important part of the competence the offshore workers were endowed with before leaving for the job.

The workplaces situated far away from shore in an often rough environment have demanded such training. The operators and the authorities have together determined the frames for the safety training like emergency- and evacuation plans are a natural part of the operator’s setup. From the elementary courses which deal with sea survival and fire fighting the courses have developed in direction against more specific courses dealing with special and new equipment. Lifeboats have developed against freefall lifeboats, mob boats have developed against powerful water jets fast rescue boats and parts of the lifesaving equipment at the installations and oil rigs have been changed in line with the development.

Evacuation suits are placed at the lower deck provided workers are forced to leave the platform from there. An evacuation suit gives the person possibility to reduce loss of heat at stay in water and protection against hypothermia.

A lifeboat is constructed to in an emergency situation to evacuate up to 50 persons. The boat can be used even in burning surface because the boat is equipped with sprinkler system for sprinkling and cooling of the boat. The boats can be sealed gas tight and there are oxygen supplies on board for minimum 10 minutes to all on board. Man over board boats are equipped with pick up nets and on certain types will be found with buoyancy balloons if the boat should capsize.

Latest the wind turbine industry has gone offshore and the industry expects a strong growth in offshore wind turbines the next 15-20 years. Safety training to wind turbine people who are supposed to work offshore is like the existing training to offshore workers however with the exception that the transport to and from the wind turbine platforms can not take place in the same manner as in the oil and gas industry. In the wind turbine industry you use transfer with boat and helicopter. Helicopter transfer is done by hoisting people to and from the platform by means of helicopter hoist. Transfer by boat can be a challenge for people who never have been at sea. Transfer exercises are a natural part of the safety training so people have gained the right technique before entering a platform from a boat.

Authorities in the different North Sea countries also leave their stamps on the education. Often there are involved more authorities in connection with the regulations etc. In the Danish sector the Danish Energy Agency, Danish Maritime Authority and the Factories Inspectorate are the instances who take care of the regulations. The operators will be consulted and the authorities lean against the experiences and knowledge those companies have obtained.
How should you keep and develop the knowledge and competence wind- and offshore workers have? Which training model is the best? Should on board training be practiced or should the training facilities ashore be used? There is not one answer to that, because we are different individuals who learn at different ways. The fact that one learning environment is good for a person can be the opposite for another person. Should the elementary safety training take place ashore and the advanced training at the work place?

New learning methods have shown up. Today on board training exists. You can participate in training by following an electronic training program, answer questions and return your answers to a company who is authorized by the authorities to control and correct the answers. Learning by doing is another example on learning method which enables the person to test his knowledge and experience in a real situation. At the practical training the training situation will be made as realistic as possible under the circumstances. Whichever form of education you choose it is important that you will get your learning proficiencies as fast as possible so it will not be encapsulated training which will disappear again if you are not using the acquired knowledge.

At upcoming wind turbine projects the industry faces new challenges. The wind turbines get bigger and bigger to give profitability and because the expenses in connection with construction of offshore wind turbines are considerable bigger than wind turbine ashore; the wind turbines are tested and tried out before being sent offshore to reduce costs to maintenance and service far away from shore. Technical solutions show up and there will continuously be working on doing the work as safe and efficient as possible.

If the accident occurs qualified help will be far away. Therefore it is important that the training given contains the lifesaving first aid with the emphasis on the equipment which will be on board. At an offshore installation there will be a well equipped hospital and there will be a nurse employed to take care of the lifesaving first aid. At a wind turbine platform the crew receive an advanced first aid training special aimed at the equipment which will be on board. The standby vessels observe the safety zones and are ready for immediate intervention should the accident occur. On board the ships there are also hospitals like on the oil rigs and the crew are trained in lifesaving first aid.

To work safely far away from shore under prevailing weather conditions training and attitude to safety are important factors which encourage our effort and luck with the tasks. Undoubtedly if you stop thinking and work safely the luck will soon come to an end.
“Across is ahead” – that is the philosophy behind a new initiative which is going to be launched shortly. The Department for Maritime Innovation and Research, which has just begun its activities at the University of Southern Denmark Esbjerg, has as one of its finest tasks to be the driving force behind the setting-up of the Blue University.

The Blue University is to become an exciting and creative platform for collaboration between all the various knowledge environments in Denmark active in the maritime field in some way or another. This could for instance be fields like offshore technology, maritime medicine, engine design, or maritime economics.

“Innovation and creative thinking is the key to Denmark’s future”. These are the magic words that can be heard everywhere today. Given the fact that Danish knowledge environments in general are small from an international perspective it is important to create dynamic synergies through collaboration across the boundaries of traditional disciplines. Furthermore do new challenges in the maritime field call for inter-disciplinary ways of thinking and doing, such as ‘security and risk management in open organizations - as those in the maritime and offshore industries’, ‘the human factor and technology’, ‘intelligent e-work platforms with the instantaneous integration of information flows from multiple land and sea based sources’, ‘environmental management’ and so on.

Creating an inspiring environment for the meeting between economists, engineers, natural scientists, psychologists and other experts from universities and leading consulting companies working with the maritime perspective, that is what the Blue University is about. The role of the Department for Maritime Research and Innovation will be to facilitate the exchange of knowledge and ideas between the various knowledge environments through structuring the platform of collaboration. This can be done for instance by organizing an annual Blue University conference and founding a journal both having this inter-disciplinary vision as their particular value. Another interesting perspective could be linking research and education resources in new ways.

Kristen D. Nedergaard continues “The first step was to invite all relevant stakeholders to a seminar in November at the University of Southern Denmark. The scope that day was to discuss how to materialise the vision of the Blue University. A fruitful discussion resulted and the outcome was used to provide a platform for the coming work.”

Following this an official opening with the attendance of the Danish Deputy Prime Minister Bendt Bendtsen took place late December in Esbjerg and the center is now ready to begin its practical work.
Gas Hazards Research at Aalborg University Esbjerg

By Bjørn H. Hjertager,
Aalborg University Esbjerg

Gas explosions and fires are credible events in plants that handle flammable gases. This is particularly so on offshore platforms. The evidence of the devastating consequences is the accident on the Piper Alpha platform that occurred in the North Sea in 1988. 168 people were killed and the platform was completely destroyed due to gas explosions and fires. This and other accidents have intensified the research into the behaviour, prediction and mitigation of these hazards. The so-called JIP test and research programmes were carried out by oil companies, authorities and research institutions in countries surrounding the North Sea.

Since the establishment of Aalborg University Esbjerg (AUE) in 1995 and start-up of the MSc programmes in Chemical Engineering and Oil and Gas Technology in the late 90's gas hazards analysis has been part of the curriculum. The research group CHEFF (Chemical Fluid Flow Processes) has been in charge of these courses. Research into the area has been directed towards improving and extending the Computational Fluid Dynamics (CFD) methods for analysing gas dispersion, gas explosions and gas fires. One PhD study has been completed (Peter Naamansen) and one is currently running (Jørgen Osenbroch). The CFD codes that are used in this area tend to be specialised ones. At AUE the code developed by Professors Bjørn H. Hjertager and Tron Solberg and co-workers named EXSIM has been the core of the analysis. In fact all students in the MSc chem. engineering and oil and gas technology programmes are trained in and use this code in various gas hazards situations.