

# 2006

Yearbook – Offshore Industry in Denmark

# ON/OFF

## Danish Offshore – competence, research and development

With 7,000 km of coast line, the ocean has always played an important role for Denmark. Since the age of the Vikings, the Danes have taken advantage of the ocean and more recently Denmark has shown the way for the offshore industry.

The earliest find of oil in the North Sea was made 40 years ago when Dansk Undergrunds Consortium (DUC) drilled their first exploration well. Oil production from the Danish North Sea was started in 1972 and since then Danish offshore oil and gas activities have increased steadily. Today, Denmark is an oil exporting country, producing roughly twice the amount of oil it is using. A solid build-up of world-class Danish knowledge has taken place over the past decades, with a focus on keeping overall cost of oil production at a minimum for marginal oil fields, while at the same time keeping a tremendous focus on health, safety, environment and quality (HSEQ). *Cont. page 3*

HSEQ - Health Safety Environment and Quality .....	13
Offshore Wind Energy .....	21
Offshore Service and Maintenance .....	30
Offshore Automation and Supervisory Systems .....	41
Education .....	53
Logistics in the Offshore Industry .....	65
Subsea Exploration and Production .....	72
Offshore Center Danmark Projects .....	87
Danish Offshore Companies .....	103

[www.offshorecenter.dk](http://www.offshorecenter.dk)



Offshore Center Danmark

# Your assets - our responsibility



## Services and Technologies

### Inspection, Testing and Underwater Technology

- Advanced NDT services
- Condition monitoring
- Integrity of flexible pipe
- Automated sub-sea inspection down to 600 m.

### Asset Integrity Management and Consulting Services

- Materials & corrosion engineering, computer modelling
- Risk Based Inspection planning and operation (RBI)
- Maintenance optimisation (RCM)
- Pipeline Integrity Management (PIM)
- Corrosion management.

### Materials and Structural Analyses and Modelling

- Design, verification, design review and reassessment
- Virtual simulation
- Response analyses for hazard / extreme events.

### Offshore Wind Turbines

- Inspection of monopiles, towers, nacelles etc.
- Advanced automated inspection of blades
- Approved full-scale blade test centre (type-testing).

### About FORCE Technology

- International technological consultancy and service provider
- Customer base consists of e.g. the oil and gas industry, the maritime industry, the energy and process industry, the pharmaceutical and food industry and the engineering industry
- Experience in transforming specialised knowledge into practical solutions since 1918
- Companies in Denmark, Sweden, Norway, Russia, Holland, Canada, USA and Brazil.

FORCE Technology  
Park Allé 345  
2605 Brøndby  
Tel. +45 43 26 70 00  
force@force.dk  
www.forcetechnology.com





Cont. from page 1

Also during the 1990's Danish offshore pioneered in a new area - offshore wind. The first offshore wind farm in the world was erected in 1991 and has since been followed by many more. Today, 60 % of the worlds installed offshore wind capacity is located in Danish waters. The experience has made Danish companies leading in the field of offshore wind.

This Danish offshore yearbook reflects development and competences of the Danish offshore industry. The basis of the book has been a wide range of development and technology activities undertaken by the members of Offshore Center Danmark during the past years.

The book has been divided into a number of topics each with a selection of articles, and is completed by a description of each member of Offshore Center Danmark.

Offshore Center Danmark operates through initiatives and activities which develop the knowledge and promote co-operation between all the active partners in the Danish offshore sector: Offshore industry companies, consultants, educational institutions and governmental institutions.

We hope that you will enjoy reading the ON/OFF Yearbook.

*Peter Blach*

*Director, Offshore Center Danmark*



---

**Offshore Center Danmark**

**ON/OFF Yearbook**

**February 2006**

Editor: Morten Holmager mh@offshorecenter.dk

Graphic production: Jan C Design & Kommunikation

## Growth within the offshore industry through knowledge and competence build-up

The centre coordinates projects, good ideas and creates financing for realization of them in order to secure the ability and operation of Danish offshore companies.

Offshore Center Danmark was established in 2003 by the industry and institutions as a knowledge and competence centre for Danish offshore. The centre relies on private contributions as well as governmental funding. The organization is member based and currently counts 131 members. Offshore Center Danmark main focus areas are offshore oil/gas and offshore wind, but also other offshore sectors (such as wave energy and the maritime area) are a part of Offshore Center Danmark's activities.

Offshore Center Danmark is naturally located in the Danish offshore capital - Esbjerg. The centre works for the benefit of the entire Danish offshore industry.



**Offshore Center Danmark**

# Content

Development through Cooperation .....7  
By Johnny Søtrup, Mayor

Centred thinking on 'Knowledge Hill' - Scandinavia Offshore .....8  
By Darius Snieckus

## HSEQ - Health Safety Environment and Quality .....13

Supervision by the Authorities of Health and Safety on Offshore Oil and Gas Installations .....14  
By Hans Erik Christensen, M.Sc., Senior Health and Safety Specialist, Danish Energy Authority

Focus on back related Illnesses – An important Element of Work Place Assessments .....17  
By QM/HSE Superintendent Jesper Braagaard Nielsen, Maersk Contractors

SURVIVAL is growing .....18  
By Bo D. Johanson, SURVIVAL A/S Training Center Esbjerg

Safety at Sea .....19  
By Ole Ditlev Nielsen, Esvagt

## Offshore Wind Energy .....21

DNV Global Wind Energy's Role in the Offshore Wind Industry ...22  
By Tove Feld and Josef Tadich, DNV Global Wind Energy

Wave Forces, Wave Run-up, and detailed Flow on and around Wind Turbine Foundations, determined by NS3 .....24  
By Erik Damgaard Christensen and Erik Asp Hansen, DHI Water & Environment

A2SEA - An international Marine Installation Company .....26  
By Martin Huss, A2SEA, Denmark

Research leading to new Offshore Design Methods .....28  
By Helge Gravesen and Søren Sørensen, Carl Bro as

## Offshore Service and Maintenance .....30

On oiled Wheels – A Motor Car analogy .....32  
By Jan E. Q. Hoejer, Amerada Hess

Service and Maintenance – Through Development, a safe Approach to Success .....34  
By Lars Erik Jørgensen, Semco Maritime

Dual-Fuel .....36  
By Business Development Manager Verner Andersen

From Fisheries to Offshore Service .....38  
By Anders Klastrup, Peter Harbo A/S

Intelligent Valve Management and Service .....40  
By Michael Bjerrum, Score Denmark

## Offshore Automation and Supervisory Systems .....41

Advanced SCADA Systems for Wind Power Plants .....43  
By Thorben Thim, Product Marketing Manager, Vestas

Reduction of Risk through high Integrity Automation .....46  
By Director Jan Ilsoe, ABB A/S

3D Scanning Technology for Offshore Purposes .....48  
By Chartered Surveyor Morten Thoft Christoffersen, COWI A/S

The North Sea's Wireless Bridge .....50  
By Editor Jens Michael Damm, Lindpro A/S

Automation Competence as the Lever for Increasing Profits .....52  
By Aksel Nielsen and Claus Tomzak, AN Group A/S



## Education .....53

Technical Manager Offshore .....54  
*By Torben Dahl, EA Vest*

Training Offshore .....56  
*By Mr. Eigil Jensen – Director of Survival Training  
Maritime Safety*

The Blue University – Innovation across Disciplines .....58  
*By Kristen D. Nedergaard, Head of Dep. of Maritime Research  
and Innovation, University of Southern Denmark*

Gas Hazards Research at Aalborg Universitet Esbjerg .....59  
*By Bo D. Johanson, SURVIVAL A/S Training Center Esbjerg*

Scaffolding Offshore .....60  
*By Development Manager Jørgen Stephansen, AMU-Vest*

Danish Employment Service also focus on the North Sea .....61  
*By Flemming Vendler, Regional Manager, AF Ribe Amt*

EUC Vest has introduced Re-education  
entirely on the Companies' Conditions .....62  
*By Poul-Arne Callesen & Steffen S. Nielsen, EUC Vest*

## Logistics in the Offshore Industry .....65

Nysted Offshore Wind Farm - A logistic Challenge .....66  
*By Poul Skjærbæk, R&D Department, Siemens Wind Power A/S*

Winter Rescue in the Arctic .....68  
*By Technical Director Claus Omann, Viking Life-Saving Equipment*

The Snohvit Experience .....69  
*By Director Jørn Bøllund, Blue Water*

There is a Woman behind (almost) Everything .....70  
*By Kim Haagen Andersen, Danish Air Transport (DAT)*

## Subsea Exploration and Production .....72

The Engineer's Secret Dream/Nightmare .....75  
*By Marianne Winther, DONG*

Automated Ultrasonic Inspection Technology .....78  
*By Asger Mulvad Jensen, FORCE Technology*

Examples of Developments within Subsea Engineering  
and Design of Subsea Structures .....80  
*By Nils Fog Gjersøe, LIC Engineering A/S, Esbjerg Department*

Design of Foundations for Offshore Wind Turbines .....82  
*By Researcher Brian Juul Larsen, Aalborg University*

Subsea Structures .....84  
*By Professor B. Mutlu Sumer and Professor Jørgen Fredsøe,  
Technical University of Denmark*

## Offshore Center Danmark Projects .....87

CMS2: Crisis Management Simulator 2 .....88

Small Scale LNG transport .....90

Decommissioning of offshore Platforms in Esbjerg .....91

Increased Oil Recovery from the Chalk Fields in the  
Danish North Sea Sector .....92

POWER - Pushing Offshore Wind Energy Regions .....94

Offshore Wind Turbines situated in Areas with  
strong Currents .....96

Boarding Offshore Wind Turbines .....98

Flooded member detection by ROV .....100

Drilling chip logistics .....101

## Danish Offshore Companies .....103



## Employees for tomorrow's offshore industry are trained in Esbjerg

Esbjerg is the unchallenged offshore capital of Denmark. The North Sea is our neighbour, and we are home to some of the most important companies in the offshore industry – and have fine relations with the rest. Our research and educational institutions ensure that Esbjerg will continue to supply qualified manpower to all levels of the offshore industry.

### Targeted training and education at all levels

EUC Vest and Erhvervsakademi Vest cooperate on offering education and training programmes that are tailored to meet the demands that the offshore industry makes of its employees:

- Blacksmith with offshore focus
- Upper secondary examination with offshore focus
- Higher Offshore training programme for production technicians and fitters
- Technical Manager – offshore
- Supplementary training at all levels

### Engineering and upper secondary examination with offshore focus

With the blacksmith programme and the upper secondary technical examination with offshore focus we utilise the professional and facility-related competencies we have to shape our well-established study programmes to include offshore competencies.

A person who has graduated from our blacksmith programme holds all the competencies and has taken the safety courses necessary to get a job on the North Sea without further ado. The upper secondary technical graduate who has majored in offshore science is fully equipped for further education in the offshore industry.

### Offshore programme at bachelor level

Technical Manager offshore is a three-year further education programme with focus on offshore science that admits students with a vocational degree or an upper secondary level examination. The students decide their future career as a Technical Manager through the subject they choose to major in. Production technicians and fitters may supplement their degrees in offshore science with an additional education programme at bachelor level.

### Supplementary training at Kursuscenter Vest

Welders, electricians, blacksmiths or technicians who want supplementary training aimed directly at the offshore industry can find what they are looking for at Kursuscenter Vest. We also offer courses that are tailored to the needs and demands of individual companies.

**Read more about our programmes at [www.eucvest.dk](http://www.eucvest.dk), [www.eavest.dk](http://www.eavest.dk) and [www.kursuscentervest.dk](http://www.kursuscentervest.dk)**

ERHVERVS  
AKADEMI | VEST



TEKNISK GYMNASIUM  
- et godt gymnasievalg

KursusCenter  
Vest

A graphic element for KursusCenter Vest, consisting of a thick, orange, curved line that forms a partial arch or a stylized 'C' shape.

# Development through cooperation

Welcome to the ON/OFF Yearbook. I am convinced that the book will be a valuable source of information and inspiration for the many companies and individuals who are familiar with and have links to the Danish offshore sector. The purpose of the book is to promote Danish expertise in this area and to create growth and development through cooperation within the Danish offshore industry.

Everything points to considerable expansion in the Danish oil and gas fields in the coming years. More than DKK 20 billion is expected to be invested in oil and gas extraction in the Danish sector of the North Sea over the next five years.

Esbjerg is the indisputable centre of Danish oil and gas activities. The offshore industry has had a striking effect on Ribe County ever since oil and gas exploration in the Danish North Sea sector was established in the port of Esbjerg in 1966.

At first, many people undoubtedly believed that the Danish oil adventure would be short lived. And throughout my period as Mayor, there has been somewhat sombre talk that North Sea oil will only last for the next 30 years or so. These views are still prevalent, but are now tinged with optimism.

Such optimism stems in part from the discovery of new deposits and, not least, from the industry's ability to develop technologies capable of increasing the degree of extraction from existing fields.

There is also considerable political interest in the Danish oil and gas sector. Not only because of high oil prices but also due to considerable activity and constant improvements in extraction levels.

Thanks to its coastal location and harbour, innovation and international relations have been important factors for Esbjerg throughout the city's history – even before others in the region knew the meaning of the word innovation.

Had it not been for these two factors, Esbjerg would never have grown to its present size and strength so quickly. In record time, Esbjerg has developed from being a dry and windswept dot on the map to becoming an enterprising, vibrant and innovative city in constant growth.

The city was created by energetic, enterprising people who recognised the opportunities it offered. This has applied throughout the history of Esbjerg, from the early fishing industry and other trades that developed around the harbour to the well-known brands and thriving business sectors of today.

The offshore industry has developed in Esbjerg in much the same way, and the city is presently the third largest producer of oil and gas in Europe. Over the years, we have successfully established an innovative and thriving international environment in Esbjerg for the drilling sector.

Today, many Danish and foreign companies have offices in Esbjerg and a growing number of our own local companies are looking to markets outside the Danish sector and making tremendous achievements.

Denmark is currently manifesting itself internationally, purposefully and united, with offshore activity as one of our core competences – by gathering know-how and networks in Esbjerg through Offshore Center Denmark

The offshore wind farms provide an excellent example of how many years' experience in offshore activities within oil and gas extraction will also in the future be a valuable trump card in drawing large orders and significant activities to the city, thus ensuring continued regional development. ■

*Johnny Søtrup*  
Mayor





# Centred thinking on 'Knowledge Hill' - Scandinavia Offshore

from: Offshore Engineer  
by: Darius Snieckus  
Friday, August 26, 2005

**Keeping the Danish offshore industry joined up and developing the technology needed to keep pace with a fast changing sector, Offshore Centre Denmark has quickly become a practised 'facilitator'. Director Peter Blach tells Darius Snieckus about efforts to get offshore companies, universities, consultants and governmental agencies all pulling in the same direction.**

Over the course of an hour, Peter Blach will energetically discuss access to offshore wind turbines, environmental considerations in decommissioning disused production platforms, electronic tagging of drill pipes and increased oil recovery from Chalk fields. The director of Offshore Centre Denmark (OCD), like the liaison organisation he runs, has over the last five years built up a far-ranging and informed remit as the North Sea oil and gas industry worked its way through one of the most transformative periods in its history.

'We are the third largest producer of oil and gas of Europe. Granted it's a long way up to number two, but this means that for the foreseeable future the offshore oil and gas industry will continue to take up something like 75% of our time and resources,' states Blach, who was part of OCD's founding group of 50 company representatives that sat down in 2000, government and industry funding secured, to 'map out where the Danish offshore sector should be going'.

Wind turbines, near omnipresent onshore in the Danish countryside, occupy the minds at OCD most of the rest of the time. Though it is a market that is treated as 'emerging, still rather small', wind energy is nonetheless one on which close tabs are being kept as its use continues to grow in line with European governments' commitment to the take up of windpower as part of the 'renewables' component in their respective energy supply policies.

*Cont. page 10*

*Like the sculpture "People by the Sea" by Svend Wiig Hansen, we are focusing on offshore, - says Peter Blach.*





## POWERHOUSE – STRENGTH IN EVERY LINK



Pon Power A/S  
Øresundsvej 9 · DK-6715 Esbjerg N  
Tel. +45 76 14 64 00 · Fax +45 76 14 64 01  
[www.pon-cat.com](http://www.pon-cat.com)  
[www.ponpoweroilandgas.com](http://www.ponpoweroilandgas.com)

Autoriseret MaK-forhandler



### Your Offshore Power Partner

Pon Power Oil & Gas provides you with the best engines, all the original spare parts and much more. Our POWERHOUSE has highly trained staff and valuable knowledge of installation, operation and servicing of power systems for all power needs.

Pon Power Oil & Gas is ISO 9001 certified, and our services include:

- 24-hour service
- Advanced test and workshop facilities
- Day-to-day delivery of spare parts
- Worldwide dealer network
- Individual service agreements

We call it Powerhouse



Some attention is also paid to the maritime sector, particularly in supply and transport vessel designs and tanker technology, and services, which Blach describes as a 'long running hunt'. Tidal energy, perhaps in cluster with windpower, he notes, is the most likely addition to OCD market research 'within five years'.

From the outset, OCD's mission statement has been rooted in 'connections'. Networking, knowledge management, technology development projects, and consultancy were foreseen as its four main functions, along with maintaining a growing database of invitations to tender, R&D programmes, education and positions vacant, as well as contacts in its 125 member companies, a 'yellow pages' made up of 'offshore players, academic bodies, state institutions, SMEs' off Denmark - together accounting for 95% of national offshore sector turnover.

'Networking is hugely important as any industry body will tell you, so we have sector working groups - 25 member companies in oil and gas, around 20 in the wind turbines group, another 25 in maritime

- that meet quarterly and each have a chairman,' he continues. 'There is a lot of collaborative activity generated this way.'

Partly funded by the Danish ministry of science and technology, OCD also plays a key role in industry knowledge management. Along with building the database embedded in its own offshorebase.dk website, the centre has been deputised by government to disseminate information to the country's offshore sector companies. 'Getting all of the intelligence out of the universities and companies and into the larger industry, from thesis papers on up, is very important,' argues Blach, a point borne out by the more than 1000 papers collected on its database over the last 24 months. 'So much of this knowledge might otherwise be lost,' he adds.

Conferences, seminars and what translates from the Danish as 'Going Home' meetings, held at the end of the business day, have grown to become another facet of OCD's knowledge management role.

*Cont. page 12*



## Forging ahead with offshore activities

[www.dong.dk](http://www.dong.dk)

DONG has been partner in all exploration activities in Denmark since 1984 and participate in licences in Norway, the UK and the Faroe Islands. We own 50 per cent of Nunaoil, who is active in Greenland.

DONG produces oil and natural gas in the Danish part of the North Sea with interests in five producing fields. In Norway we produce from four fields and participate in 26 licences. Our production exceeds 50,000 barrels per day.

To secure and enlarge the future supply of natural gas we have acquired 10 per cent of the major Norwegian field Ormen Lange gas field.

**DONG**  
energy for more

# Solar Offshore

– a sea of knowledge

Solar Offshore is a special department in Solar A/S, one of the largest electrical wholesalers in Northern Europe.

Solar Offshore was formed in 1981 in the light of the growth of Danish offshore industry in Esbjerg and is today the leading supplier to both the offshore and the marine business. Today we have our domicile at Solar A/S in Vejen, where we can give our customers direct access to the largest and most efficient central warehouse in Denmark.

**According to the motto  
"Solar gives you possibilities",  
the customer will receive:**

## The right item

- at the right time
- in the right place
- in the right quantity
- and with the right technical support

Especially within the offshore/marine area the ability to deliver the correct goods is a condition for having success as a supplier. We have therefore spent many resources on being able to offer a very attractive product programme that includes everything from special offshore cables, panels, junction boxes, and luminaires to engines, alarm systems etc., Ex-equipment for hazardous areas being our speciality. With strong agencies, a wide range of products, and not least a large central warehouse to support us, we are able to deliver the solutions that our customers require within a very short time.

At the same time our well-trained staff is also able to provide technical support regarding ATEX regulations and the use of electrical equipment in hazardous areas.

Solar Offshore does not simply deliver equipment, we bring the customer efficient and value added services. This is the Solar Philosophy. The keyword is availability – whether it concerns equipment, knowledge, staff or services.

*For further information reference is made to [www.solardis.com](http://www.solardis.com), where information about Solar's concepts, management, results etc. is available.*



**solar**  
Solar A/S

Solar Offshore  
Industrivej Vest 43  
DK-6600 Vejen  
Telephone +45 76 96 21 50  
Telefax +45 76 96 21 60  
offshore@solar.dk

If networking is the head and knowledge management the hands, development projects are the heart of OCD. Acting as 'coordinator' and financial manager, the centre currently has eleven projects under way - five in oil and gas, two in wind energy - all supported by some combination of backing from the European Union, Danish state, or various consortia of companies that 'share an interest in investigating a particular area of new technology'.

### **Greener decom**

Topping the list of development projects is an exploration of 'environmentally friendly decommissioning technologies'. With the Port of Esbjerg keen to bring decommissioning activities into its longterm expansion plans - and some 600 fixed platforms standing in the North Sea, OCD is overseeing a project that aims to find 'new and more cost effective methods' for dismantling these installations led by Ospar's 1998 Sintra declaration on 'environmentally responsible' removals.

'The complete removal of the installations, with existing technology, is quite expensive, and it is therefore imperative that new and more cost effective methods for dismantling these installations are considered through analysis and research,' states Blach. Complete, the results of the 36-month project and selection of short-listed concepts will be presented at an open seminar sponsored by OCD, Aalborg University Esbjerg, and contractor Rambøll, with the university hoping to spin out project findings into courses for personnel involved in decommissioning. Among the other project participants are: Maersk Contractors, FORCE Technology, DNV, Esbjerg Oilfield Services, Promecon, and Uniscrap.

'We are not looking at the biggest platforms off Norway and the UK, we don't see a market for ourselves there,' he acknowledges. 'But we feel when it comes to the smaller platforms and the Danish knowledge of environmentally friendly approaches to offshore activities, we may be able to leverage a place for some of our companies in the future decommissioning market.'

Starting from a field of 25 concepts, the decommissioning project has whittled it down to 'three different methods for three different size platforms'. Blach reckons the chosen field-to-shore concepts will prove to be of 'real use in the North Sea as a whole but only specifically for the huge number of small UK, Norwegian, Danish and Dutch installations that will have to be removed eventually'. Local steel specialist Promecon is cutting its decommissioning teeth with a pilot project running at the Port of Esbjerg that involves dismantling, cleaning and recycling a flare tower from a 'major Danish

oil field'. Considered a 'living development project', it is designed to 'begin building expertise for the larger platforms hoped to be ahead'.

### **Electronic drilling chips**

Also in development is an electronic chip for drilling pipes' RF/ID tags that is able to handle extreme long-term mechanical stress under HP/HT drilling conditions in the North Sea. In an incubator-style set up, alarms technology specialist Laybourn Trading & Technology - a one-man operation - teamed up with Maersk Contractors through OCD to advance development of a chip that could stand 500 bar/178°C conditions while sending out an 'I am chip number' signal for use in identifying age, use, and service record of individual pipe joints. Field tests have just been completed 'with great success', says Blach.

### **Boarding offshore wind turbines**

Offshore access to wind turbines is the modus vivendi of another development project under OCD's wing. Taking its start from the 'significant economic, technical and environmental challenges' posed by windfarm development, participants Vestas, Rambøll, Viking Life-Saving Equipment, Grumsen, Sea Service, and Fabricom decided the issue of boatlanding at turbines was an area where costs could be cut in safely transferring personnel and equipment to carry out maintenance on offshore wind farms, particularly with an eye on the harsh climatic conditions.

The project has since designed a newbreed vessel that can handle large variations in wave height. It also advanced work being done on Viking's collapsible Selstair access system (see Viking Adds to life savings). Originally built for the Petrojarl Varg FPSO off Norway in 1997, the net-enclosed, collapsible aluminium staircase is being adapted for installation on supply vessels so that it can be 'hoisted up' to the wind turbine topsides.

### **Looking forward**

Funding from governmental bodies being slim, one of the greatest values represented by OCD is 'helping the Danish offshore industry to help itself', offers Blach. Having grown at a clip in its first five years, OCD is intent on keeping to the role of 'facilitator' that has worked so well to this point for the centre, located in the science and technology park known aptly in Esbjerg as 'Knowledge Hill'. 'We are a hub,' he concludes. 'We get things going and then let the universities and industry put their heads together on projects that benefit everyone. For us, it continues to be about looking forward five or ten years and anticipating the issues and areas of R&D where the Danish offshore industry can contribute most.' ■



# HSEQ – Health Safety Environment and Quality

HSEQ, QHSE, Safety Awareness, Constant Care - these are some of the different names used to describe what basically covers the same concept. The area that deals with Health, Safety, Environment and Quality - an area covered in the next chapter of the Yearbook, referred to here as HSEQ.

The HSEQ concept is of particular importance in the traditional offshore oil and gas industry. This can in part be attributed to some tragic events such as the Alexander Kielland incident in 1980 where 123 men lost their lives as a Norwegian hotel platform capsized. Also the Piper Alpha incident in 1998 must be discredited to some of today's focus towards HSEQ. There, a gas blow out evolved into a disaster which caused the lives of 167 offshore workers, completely demolished the platform and caused the operator of the platform to cease all activities in the North Sea. In the Piper Alpha case, an inquiry later concluded that disaster could have been avoided on several occasions throughout the incident, had different actions been taken by some of the people involved.

Happily, and we like to think, also due to special attention to HSEQ by Danish operators, such incidents have not occurred in Danish territorial waters.

HSEQ is about avoiding incidents as the above mentioned taking place. The concept has evolved gradually over the past 40 years, starting with development of Quality standard guidelines issued to ensure



the same quality of produced goods. Later, focus on Environment was introduced and since the 1990's the Health and Safety area have been increasingly important factors.

When considering HSEQ in the Danish offshore sector the following standards are worth to mention:

DS/EN ISO 9000 series (including the ISO/TS 29001 standard developed specific to the oil and gas industry)	Quality
DS/EN ISO 14000 series	Environment
DS/OHSAS 18000 series	Health and Safety

The above standards set guidelines for each their area of HSEQ. However, one important aspect cannot be covered by these standards: Attitude. The attitude of the persons involved, be it the management, labours or authorities, is in the end the most important aspect in the HSEQ concept. In general, Danish offshore workers are acknowledged worldwide for their attitude towards HSEQ. HSEQ is accepted as an essential and necessary element in the Danish Offshore Industry and this undoubtedly carries some credit to the fact that working offshore in Denmark can be considered very safe compared to many onshore jobs. ■



# Supervision by the Authorities of Health and Safety on Offshore Oil and Gas Installations

*By Hans Erik Christensen,  
M.Sc., Senior Health and Safety Specialist,  
Danish Energy Authority*

Health and safety on offshore oil and gas installations on the Danish continental shelf are regulated by an offshore safety act and regulations under the act. Supervision of compliance is assigned to the Danish Energy Authority.

## The Danish Energy Authority

Since 2005, the DEA has been a regulatory body under the Danish Ministry for Transport and Energy. The DEA has duties, nationally and internationally, in relation to production, supply and consumption of energy.

The Energy Resource Division of the DEA is responsible for supervision and enforcement of regulations related to oil and gas activities. The division is divided into two units, the Offshore Installations Unit which supervises health and safety on offshore installations and the Resources Unit, which supervises the companies' resource management. Each unit has a manager who reports to the DEA's director general.

## Regulations

Health and safety are regulated by the Offshore Installations Act from 1981 and regulations under this act which mainly transpose EU directives. Thus, health and safety requirements are basically the same all over the North Sea, but come out in different ways in the various countries.

The legislation has over the years developed into a patchwork of various regulations which has become very user-unfriendly. In accordance with the Danish government's



policy of a simple and transparent set of regulations requiring less administrative burdens for the companies, a modernisation project was initiated in 2003. A new map of more user-friendly and transparent regulations was completed in 2004.

An effect of this was a need for a new and modernised act. Consequently, the Offshore Installations Act will be superseded by the Offshore Safety Act which was passed by the Danish Parliament ("Folketing") in December 2005. The act will come into force on 1st July 2006.

The Offshore Safety Act is founded on the companies' own responsibility for setting high health and safety standards through reduction of risks to a level as low as reason-

ably practicable – the ALARP principle.

To ensure that the ALARP principle is implemented the companies must establish and maintain a health and safety management system which documents that the ALARP principle is applied and that the management system of the company is adequate to ensure this. These principles are not new; they have been used by the offshore industry in the North Sea countries for several years.

Consequently, a new set of regulations will be rolled out during the coming years. Regulations on management of health and safety will come into force at the same time as the act while other regulations will be updated during 2006 and 2007. In the meantime, the present regulations will be kept into force under the new act.





All regulations are – and will be – goal-setting regulations. This is in line with other North Sea countries.

Many of the regulations are – and will be – supported by guidelines that show how to comply with the regulations. Furthermore, the regulations require the use of internationally recognised standards, e.g. ISO standards and API recommendations.

All regulations are made in cooperation with the offshore industry and the offshore trade unions.

### **Supervision**

The DEA's supervision of health and safety on offshore installations are based on three elements.

The first element is the permissive system which is also known from the other North Sea countries. During the lifetime of an offshore field a set of approvals and permits are needed from the DEA before the next step in the process of development and operation can be made. For mobile offshore units a permit is required before the unit can commence operation. This permit is limited to a maximum of 5 years. Through the permission system the DEA will be confident that the offshore installations are built and will be operated in compliance with the legislation.

The second element is supervision by inspection of the physical health and safety conditions offshore and audits of the oil and gas companies' health and safety management systems offshore as well as onshore. There will be an increased focus on audits of the health and safety management systems under the new offshore safety act to emphasise the obligations of the companies to ensure a high level of health and safety. The DEA visits the offshore installations on a regular basis. Fixed installations are visited once every 8 months in average and additionally when required by specific situations, e.g. accidents. Mobile offshore installations are inspected once a year in average if they are operating in Denmark for a longer period of time.

The third element is assessment of certificates issued by recognised classification societies stating that the installations and equipment on them are verified to comply with statutory requirements and recognised standards.

The DEA focuses on health and safety performance indicators in its supervisory activities. Development in performance is followed closely by checking indicators such as overdue preventive maintenance of safety critical equipment, lack of compliance with standards and procedures, accidents, occupational illnesses and near miss incidents like gas leaks.

During inspection the DEA puts much emphasis on participation from the workforce in matters regarding health and safety. Thus, the DEA frequently assess the function of the safety representatives offshore.

### **Other authorities**

The DEA co-operates with other authorities such as the Danish Maritime Authority (DMA), the Danish Environmental Protection Authority (DEPA), and the Civil Aviation Authority (CAA) who have co-ordinated responsibilities on the offshore installations. The DEA co-operates with offshore safety and health authorities in the other North Sea countries through bilateral and multilateral contacts and activities. Important issues are mutual recognition of safety training and harmonising health and safety requirements to mobile offshore units crossing borders. ■

# In the ascendant



## Semco Maritime – your offshore partner

Semco Maritime is an engineering and contracting company serving the oil and gas industry worldwide with bases located in many parts of the world.

Semco Maritime has gained comprehensive know-how and valuable experience as a total supplier and contractor for the oil and gas industry. We offer you competencies and capabilities within the following disciplines:

- Steel structure and piping
- Electrical
- Instrumentation
- Communication
- Automation
- Fire fighting systems
- Component sales
- Manpower – personnel & consultants

Semco Maritime provide specialized expertise on integration of equipment and processes. Furthermore we have a range of concepts and products developed and designed through the past for the purpose and benefit of our customers.

# Focus on back related Illnesses – An important Element of Work Place Assessments

By QM/HSE Superintendent Jesper Braagaard Nielsen, Maersk Contractors

## Introduction

During the past years, Maersk Contractors have exercised an increased focus on occupational health issues which also have been an increasing demand over the same period of time introduced by both the authorities and our clients. Maersk Contractors have continually complied to this increasing demand through our Health and Safety Policy incorporating internal requirements for developing and implementing means of safeguarding our employees' working environment.

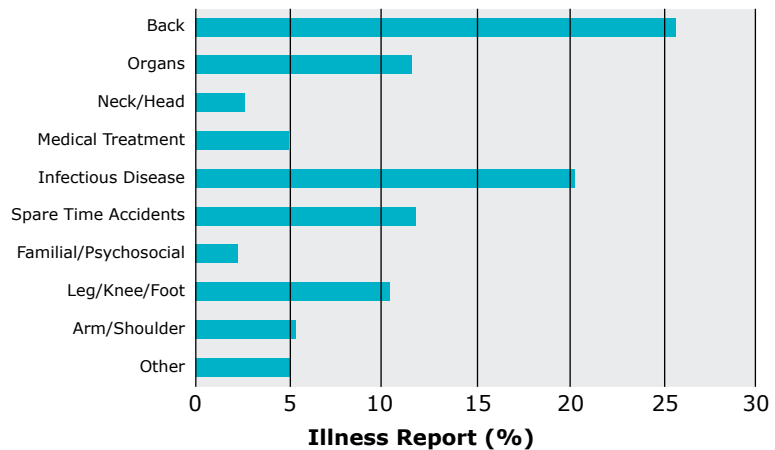
The Working Environment Management System, which is integrated in Maersk Contractors' General Management System, details the requirements for carrying out work place assessments. These assessments are supported by questionnaires encompassing both physical and psychosocial working environment aspects and which all personnel are invited to complete.

Analysis of illness statistics is an important element of the work place assessment. A significant element in Maersk Con-

tors' procedures for carrying out work place assessments is the monitoring and analysis of illness statistics relating to individual rigs.

Illnesses in this context are defined as all types of illness being reported by personnel during their home period. It is very important to note that these reports of illnesses are not necessarily connected to the person's job and stay on the rig but may well originate from the person's previous work history or from activities which have taken place during the person's home period.

Main Causes of Absence



## Causes of reported illnesses

Looking at the illness reports received within a 3-year period from offshore personnel working on Maersk Contractors' rigs in the Danish sector of the North Sea.

Fig. 1 shows that approx. 26% of illness reports are related to 'Back-problems'. In order to reduce this number of back related illness, Maersk Contractors decided to initiate a project with the objective to identify the root cause of back related illness in conjunction with the company's rigs operating in the Danish North Sea.





# SURVIVAL is growing

By Bo D. Johanson, SURVIVAL A/S Training Center Esbjerg

## Research Unit of Maritime Medicine

1 June 2005, Maersk Contractors initiated a project in cooperation with the Research Unit of Maritime Medicine of the University of Southern Denmark to perform a study on one rig in the Danish North Sea.

The project will be based on:

- Job analyses in relation to a number of identified work tasks with increased risk of developing back related injuries. The analysis will lead to eliminating the risk elements in the job tasks or training in correct ergonomic execution of the job.
- Initiation of further precautions that will lead to increased attention among Maersk Contractors employees towards ergonomics and working environment in general. The outcome of these precautions will increase the awareness on ergonomics and working environment in general.
- Implementation of interviews with the absent employees by telephone based on a uniform and open personnel policy.

The expected outcome of the project should lead to a greater understanding of the importance of ergonomics throughout the Maersk Contractors organisation, and reveal the possible needs for alternative and innovative thinking in terms of ergonomics and working environment.

Depending of the outcome of the project, Maersk Contractors' will consider further cooperation with the Research Unit of Maritime Medicine to several rigs and to upgrade the project to a PhD study. ■



## A member of Offshore Center Danmark is becoming one the worlds largest.....

By purchasing 70% of the stocks in the Dutch Global Safety Group (GSG), SURVIVAL A/S Training Center Esbjerg (SURVIVAL) is becoming the world's largest provider of safety training onshore, offshore and in the air.

The purchase means an increase of 300 specialist educated instructors with an expected total turnover for 2004 of 440 million Danish kroner.

GSG has amongst other customers within the offshore industry, the aircraft industry, the chemical sector and the military. GSG at the moment trains approx. 80.000 persons a year.

Global Safety Group is identical with Nutec Norge, Nutec England and MTC Holland (Nutec Rotterdam).

## Business as usual

Also included in the bargain is the British International Maritime Security (IMS), which deals with security-evaluations of vessels and ports.

The organization chart for the new company is not yet ready, therefore until further notice everything will be "business as usual", Director of global business development Torben Korsgaard points out. He welcomes IMS and Global Safety Group to the Falck-owned SURVIVAL A/S.

"This acquisition allows us to serve our customers from the best suitable location according to the needs of the customer and to offer "best practice" at a competitive quality and price", he states.

In excess of the divisions in Norway, Belgium, Holland and UK, the purchase of Global Safety Group results in offices in Brazil, Abu Dhabi, Trinidad and Malaysia. ■

# Safety at Sea

By Ole Ditlev Nielsen, Esvagt

“It is the objective of the company that there in all parts of the organization are taken any realistic measures to maximize safety onboard the company’s vessels”. The brief statement is made by Operations Manager Ole Ditlev Nielsen from the international offshore support vessel operator ESVAGT and is followed up by an elaboration.

The above mentioned policy has been the safety policy of ESVAGT for more than two decades. A number of safety strategies implemented by ESVAGT have supported this:

- Promotion of personal awareness and motivation concerning safety at work including special awareness of the individual responsibility for own safety
- Identification and acquisition of the best possible and most suitable safety equipment available
- Development and execution of relevant and realistic training programs as well as schedule regular exercise activities to establish relevant work and safety procedures
- Working out detailed descriptions of work and responsibilities for personnel engaged in activities involving particular risks

“Never the less the bottom-line is the commitment of the management. If the management does not support the safety culture entirely, things will not work”, explains Ole Ditlev Nielsen.

During more than 20 years of operation most of the ESVAGT vessels have been purchased on the second hand market, converted and put into service in the very competitive offshore market. Despite a very extensive rebuilding some natural limitations will exist.

Therefore and in order to meet tomorrow’s challenges ESVAGT decided to invest in modern tonnage and new buildings.



In 1999 and 2000 ESVAGT took delivery of the two multipurpose standby/anchor handling vessels ESVAGT OBSERVER and ESVAGT CONNECTOR. Both vessels have had an excellent performance with various activities in primarily the North Sea area.

In 2001 a modern trawler type fishing vessel was bought and converted.

In 2002 ESVAGT bought two new purpose built standby vessels.

In 2004 two purpose built new buildings were delivered.

In January 2006 2 more vessels of the Observer-class will be added to the fleet, and 4 more new buildings have now been ordered for delivery in 2007.

All these vessels are and will be approved to work as safety standby vessels in the Norwegian, UK, Dutch and Danish sectors.

Building new vessels gives an excellent opportunity to design the vessels to a high safety and environmental standard from the beginning.

Noise and vibrations have always been a challenge in smaller vessels. The vessels will without problems meet IMO requirements – 5 Db and DNV “Comfort Class”. Choice of azimuth system will support low noise level onboard, and as most standby vessels are operating up to 95% of the time on the azimuth this will be very comfortable for the crew. Mock-ups (1:1 size) of both the bridge and

the galley have been made. A project group of crew members, Danish Maritime Authorities, Danish Maritime Occupational Health Service and an ergonomic has been established and involved to achieve best working environment for all the new buildings.

Looking at previous incidents reported in ESVAGT slips, trips and falls are a major challenge in vessels. Almost all ladders in ESVAGT vessels have now been changed even if the old type is fully approved by authorities. They still created unsafe situations, which was not acceptable. Ladders in the new vessels will be of new improved types.

Sea keeping capabilities have been tested in a tank, and the tank test was very satisfactory, but more important the vessels have proven to be state of the art in real life regarding sea keeping capabilities, thus supporting launching and recovering of the FRC (Fast Rescue Craft) in adverse weather.

Most modern equipment in navigation, communication and surveillance has been installed.

Low NOX emission is obtained due to the machine configuration (diesel electric).

All together the vessels will meet a new standard within the smaller type of standby vessels and thus ESVAGT can provide the highest standard within the industry also in the future. ■





# Simply indestructible

*LINE-X is well suited as paint and protective membrane in the offshore industry*



The offshore industry has a need for paint and corrosion protection which can resist extreme loads. Wind, weather, chemicals and wear put up demands for paint with special properties.

## Dries within 30 seconds

LINE-X is almost impossible to wear out and is a recommended alternative to traditional paint. LINE-X is thus well suited for offshore purposes. As a decisive characteristic LINE-X dries in short time. Exceptional properties, which makes it suited for:

- Corrosion protection
- Non-skid walkways
- Other areas with need for high durability
- Coating of pipelines
- As chemical and oil membrane



## Joint free membrane

LINE-X consists of an elastomeric urethane, which is applied by spraying and will lay itself as a dense and joint free membrane, capable of binding aluminium, steel, wood, reinforced concrete, glass fibre, foam and other materials. Furthermore, LINE-X

- Can be applied in layers several cm thick
- Is approved for containers for storage of drinking water
- Shapes according to the surface
- Can be stepped on 30 seconds after application



## Used by Pentagon

Among other things, LINE-X is used for protective layer against bomb fragments in the headquarters of the American Department of Defence, Pentagon. LINE-X is also tested on the offshore installations of Mærsk Oil & Gas.



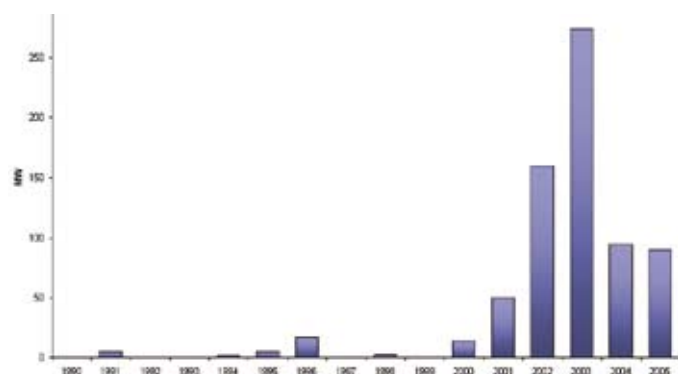
# Offshore Wind Energy

For thousands of years humans have drawn benefits of the wind. First as mean of power for sailing ships, later for pumping of water and grinding of grain and more recently for generation of electricity. The first wind turbine for electricity production was built in 1887 (12 kW by Chares F. Brush) and several turbines have since been erected. But it was not until the oil crisis in the 1970's that the technology gained a real foothold. The recent years focus on peaking oil reserves has fuelled the wish of countries in the Western World to become more independent of oil based electricity and thus increased the interest in wind energy. Today wind power is the fastest growing energy source in the World. Traditionally, wind turbines have been placed throughout the country side in windy locations such as hilltops and near the coastline, but in the early 1990's a new type of location was taken into use - the ocean.

There are several advantages of placing wind turbines offshore vs. onshore including: more wind, more space and fewer concerned parties (e.g. no neighbours). It was advantages such as these that inspired the Danes to establish the first offshore wind farm in the World - Vindeby (11 turbines, 5 MW). The wind farm was erected in 1991 in southern Denmark (1 mile off the coast of Lolland). Vindeby proved a success - production analysis have shown that electricity production is 20 % higher than it would have been for a similar wind farm located on a typical onshore location (Vindeby produce in average 11.2 GWh/year), while environmental analyses have shown that the wind farm has had no considerable negative impacts on marine life. Since Vindeby more offshore wind farms have followed.

Currently (January 2006) offshore wind farms are limited to only six countries:

- Denmark: 423 MW
- The United Kingdom: 214 MW
- Ireland: 25 MW
- Sweden: 23 MW
- The Netherlands: 19 MW
- Germany: 9 MW (2 test turbines)



"Global offshore wind installations".



Current (red) and planned/under construction (white) offshore wind farms.

As seen, operating offshore wind farms are so far limited to Western Europe. The six countries operate a total of 365 offshore wind turbines distributed among 21 wind farms - the two biggest being Horns Rev (80 turbines, 160 MW) and Nysted (72 turbines, 166 MW) in Denmark. In total 8 offshore wind farms have been constructed in Danish waters.

In addition to the existing 8 offshore wind farms 2 more, each of 200 MW, are currently being planned. One will be located 10 km west of the existing Horns Rev offshore wind farm. The tender for Horns Rev II was won by Energy E2 who expects to have the park operational in 2009. The other planned offshore wind farm will be located close to the existing wind farm in Nysted. The tender for development has been selected at the Danish Energy Authority early 2006. The park can be expected to be operational in 2010/2011

Danish energy policy has a goal of major expansions of offshore wind farms. Thus it has been formulated that by the year 2030, 3/4 of all Danish wind energy (a ratio equivalent to 4,000 MW) must be produced by offshore wind farms. This is expected to result in the ability to cover half the Danish electricity demand through wind energy, under the assumption that the goal is met.

Future prospects within offshore wind farms are vast. Capacity of several thousands of MW have been planned - the far majority located in Western Europe. A recent study under the Offshore Center Danmark connected EU POWER project (cf. page 94), found planned investments for the North Sea to be of about EURO 7 billion over the next 5 years. Some of the biggest expansions planned, are located in The United Kingdom and in Germany.

Besides the offshore wind farms planned in Western Europe a number of countries outside Western Europe are also planning to adopt offshore wind energy in their grids. These include China, USA, Canada and Japan.

All in all, offshore wind energy is a market with a large potential, and a market where much of the technology is concentrated around Northern Europe and Denmark in particular. ■



# DNV Global Wind Energy's role in the Offshore Wind Industry

By Tove Feld and Josef Tadich,  
DNV Global Wind Energy, Copenhagen



There is a general awareness that moving wind farms offshore represents a 'game change' to the wind industry. Offshore the consequences of failure are inherently larger in magnitude, requiring the design, installation and operation of offshore wind farms to be carried out with a relatively greater attention to detailed design and quality assurance in comparison to onshore wind farms.

Additionally, the industry increasingly requires optimized and cost-effective offshore designs to make the projects economically viable and attractive to investors. Due to these large investments, 3rd party verification and certification services are becoming increasingly popular for owners, investors and insurance agencies to minimize their residual risk as well as safe guarding their investment for the project's life.

## Providing the Design Basis

Until quite recently, the existing standards in the offshore oil and gas industry were not completely applicable to offshore wind projects, with a different loading basis that focused on wave dominated loading rather than the wind dominated loading of offshore wind turbines. As a result, DNV has attempted to bridge this gap with the development of new 'state-of-the-art' design standards and guidance specifically developed for the offshore wind turbine industry.

The first standard to be released (issued June 1st 2004) was DNV-OS-J101 'Design of Offshore Wind Turbines Structures'. This standard has been based on DNV's experience from participation in numerous offshore wind projects, as well as a well established experience basis in the maritime and offshore industries. The main challenge for DNV during the standard's development phase was to establish a sound basis for the development of projects both technically and economically that would be recognized by all stakeholders in the project, namely: owners, manufacturers, finance, insurance and regulative authorities.

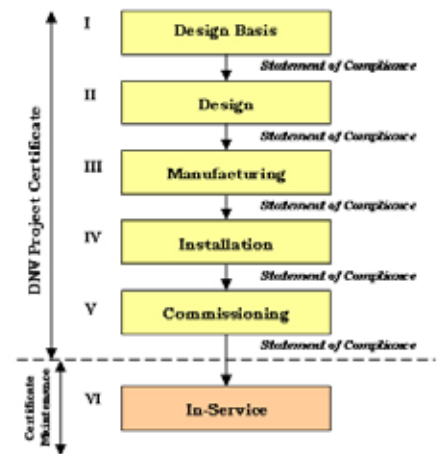
Throughout the standard's development input from key wind industry stakeholders, as well as supervision by an international technical committee, ensured transparency during its development and paved the way for wider industry acceptance.

The outcome for DNV-OS-J101 is a design standard that facilitates optimised and cost effective designs as well as living up to the safety levels required by both regulative authorities and other stakeholders. In addition, the standard recognises the fact that the structures are unmanned and that the pollution risks to the environment are significantly less than the offshore oil and gas industry, again providing further basis for more cost effective designs.

DNV-OS-J101 emphasises a holistic life cycle approach, beginning with the site specific conditions and ending with the decommissioning phase. This standard covers the support structure, foundation as well as the site-specific approval of the integrated structure for various foundation designs. The standard includes state-of-the-art information on numerous detailed design considerations for each phase of the project and currently provides the basis for numerous offshore wind projects throughout the world.

The next and latest standard to be released in the series is DNV-OS-J102 'Design and manufacture of wind turbine blades', that focuses on one of the more critical and complicated components of the wind turbine: the blade. As wind turbines become larger and increasingly complex, particularly for the offshore market due to higher associated maintenance and replacement costs, DNV believes that there will be an increased focus on individual component optimisation and reliability.

The design and testing of wind turbine blades is to some extent covered by the current IEC WT-01 certification scheme, however with the high levels of innovation and



Overview of the DNV Project Certification scheme

change characteristic of the industry today, DNV believes there is a greater general need for detailed interpretation and guidance for wind turbine blades.

Composite materials in particular are used extensively in modern wind turbine blade design, and DNV believes that the complexity of structural substantiation will increase with increasing turbine sizes and structural optimisation. Both areas are key considerations of this new standard.

As a result this new DNV standard provides detailed guidance and supplementary standard interpretation throughout the blade development program, consolidating the vast amount of international experience present in the industry today, and providing a basis for blade designs for the future. Future projects for DNV Global Wind Energy include the development of guidance for other major components.

### Assurance in the Design

Project certification is recommended to commence during data acquisition for soil, wind and wave site specific investigations. An early consensus on the site specific loads will have a beneficial impact on the project costs, minimising the project's risk for a costly redesign due to revised loadings resulting from any alterations in the site conditions.

DNV's experience show that a step-by-step certification approach will minimize the total project risk, as the verification is performed in parallel with project development. Project certification can include the following elements: The wind turbine, the support structure, the offshore substation, as well as associated cables and J-tubes. An overview of the project's certification phases is shown at the figure.

Upon completion of Phase I through V the Project Certificate, valid at the time of commissioning of the offshore wind farm, will be obtained. For the In-service Phase, the Project Certificate is maintained based on the results of annual surveys and inspections. After a five year period a more comprehensive 'renewal survey' has to be carried out to prolong the validation of the Project Certification for another five years.

For project certification, the wind turbines shall also always have a type approval according to a recognized certification scheme (typically Dutch, Danish or IEC). Additionally, there may be local National requirements for the project specific approval scheme. Being offshore a site specific approval of the wind turbine is also required. In addition to the rigorous process of wind turbine type certification, project certification will also verify that the selected turbine is fit for offshore purposes.

### Discussion

There is a general consensus in industry today that offshore wind turbines can now competitively produce power for the commercial market, as a result the wind energy industry is paying greater attention to offshore developments.

Going offshore is expensive. Due to the high level of investment, as well as the site specific nature of the projects, there is an increasing demand for optimized support structure designs for each individual offshore location. In order to reduce their risk as well as safeguarding their investments owners, investors and insurance organizations will continue to require independent third party certification and assurance services, with the trend being that site specific project certification is specified in the contractual documents right from the start.

DNV believes that the establishment of a rigorous design basis in conjunction with the relevant third party quality assurance services helps create the trust and confidence that is needed between stakeholders, creating the environment that accelerates and sustains the development of the offshore wind industry. ■

# Wave Forces, Wave Run-up, and detailed Flow on and around Wind Turbine Foundations, determined by NS3

By Erik Damgaard Christensen and Erik Asp Hansen, DHI Water & Environment

A large number of offshore wind farms are at present under construction. Observations from the Horns Rev wind farms (which have been installed) have clearly shown that the wave run-up can be quite significant. Previously, run-up on circular cylinders has been studied experimentally and mathematically for moderate periodic and irregular waves. Only a few studies have focused on the extreme run-up that can be seen when wind turbine foundations are under the influence of breaking waves. Figure 1 shows an example of calculated run-up on a wind turbine foundation after the impact of a breaking wave.

Studies of the run-up have shown that the run-up is quite sensitive to the state of breaking, the bathymetry around the foundation, and the configuration of possible scour protection.

The wave impact and run-up was modelled with DHI's in-house CFD model, NS3. NS3 is a numerical model, which solves the full three-dimensional Navier-Stokes equations including modelling of the free surface, based on the so-called VOF (Volume Of Fluid) concept. The model is designed especially for modelling of refined flow problems, such as eddies around structures, details of run-up on structures, etc. The model is developed with the purpose of calculation of forces on structures and dynamic flow-structure interaction as for example vortex induced vibrations, VIV. The model includes a sediment transport module and allows for updating of the bathymetry (morphological evolution for the study of scour or back-filling of trenches). The combination of the flow

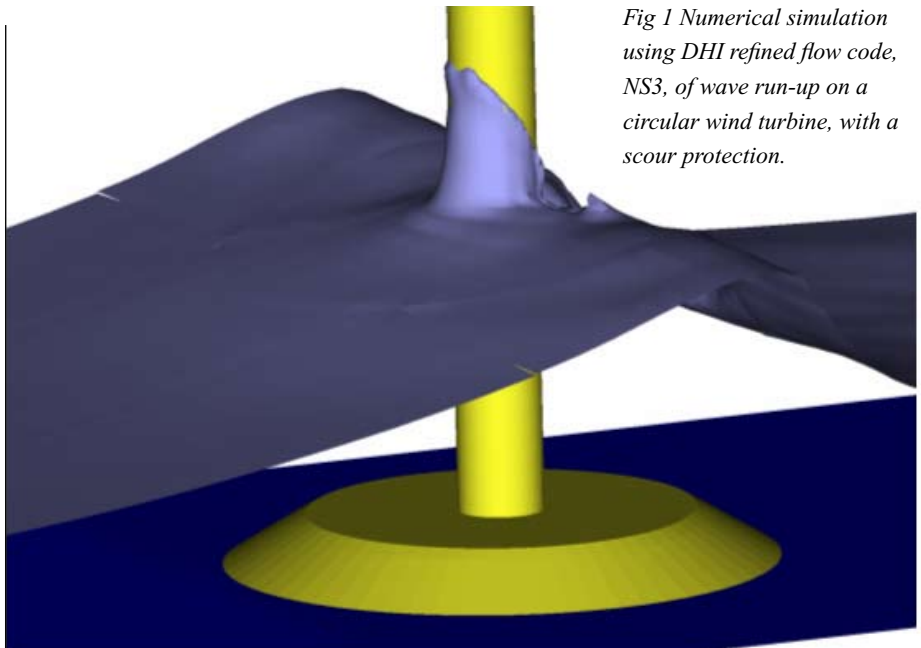


Fig 1 Numerical simulation using DHI refined flow code, NS3, of wave run-up on a circular wind turbine, with a scour protection.

module and the sediment transport module is used for the quantification of scour around structures. Figure 2 illustrates a snapshot of the complicated flow around a wind turbine with a scour hole exposed to wave-current action.

Apart from the use in specific design cases, NS3 is used in extensive research programmes for loads on wind turbine foundations and scour analyses. NS3 has been combined with DHI's wave model 'MIKE21 BW' in order to simulate the total process, when waves travel from deep water until they hit the wind turbines creating wave run-up and wave forces. Basic test examples of a vertical circular cylinder have shown excellent agreement with measurements from physical model tests. It is straightforward to simulate other kinds of designs of the foundations, such as tripods, floating structures, or ice cones. The method estimates both the correct wave kinematics at the structure and time variation of forces and overturning moments.

Today's load estimation is primarily based on the relatively simple Morison equation type formulations, which have been used in the offshore industry since the 1950s. In this formulation the loads on a structure are described by two empirical load coefficients, one for the drag load,  $C_D$ , and one for the inertia load,  $C_M$ , and the undisturbed flow field. Undisturbed means the flow field that would have been present without the structures. However, Morison equation cannot describe the forces from breaking waves, and cannot with adequate accuracy describe the forces on complex foundations, unless the empirical coefficients,  $C_D$  and  $C_M$ , are determined for the same geometry and the same wave condition. The tools for improving both the accuracy in hydrodynamic load calculations as well as the wave kinematics are thus available as state-of-art numerical simulation programs. It is anticipated that such tools will become the state-of-practice within the next few years. ■



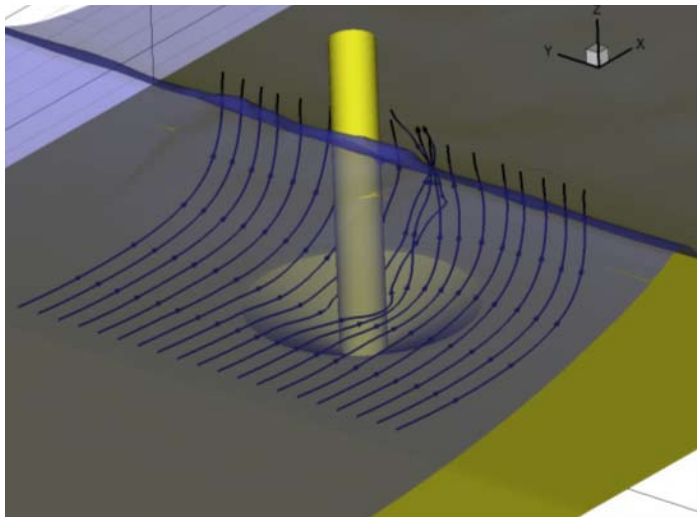


Figure 2 Numerical simulation using DHI refined flow code, NS3. Snapshot of the complicated flow around a wind turbine with a scour hole exposed to wave-current action.



## Basis course in offshore wind energy

Together with HIH Vind Offshore Center Danmark offers a basic course in offshore wind energy. The course is adapted for employees or job-seekers with a need for knowledge about the most common terms in the offshore wind sector.

The course provides the participants with basic knowledge about offshore wind energy. Topics include: market prospects, how does a wind turbine work, offshore foundations, installation, service and maintenance, adoption to the grid system, authorities, organizations and legal frames, HSEQ and environmental aspects.

The course runs over 2 days and consists of lectures from a range of specialists. The course is held twice a year in Esbjerg and Herning.

Course programs and further info can be found at [www.offshorecenter.dk](http://www.offshorecenter.dk) under the menu Uddannelse (in Danish) or by contacting Offshore Center Danmark: +45 3697 3670 / [info@offshorecenter.dk](mailto:info@offshorecenter.dk).



Offshore Center Danmark

## VALVE AUTOMATION - SETTING FUTURE STANDARDS



**VALTOR** OFFSHORE

“Your Single Source Supplier”

- Documented Quality:**
- DS/EN ISO 9001:2000
  - ATEX 94/9 EC
  - PED 97/EC Module H

**VALTOR OFFSHORE A/S**  
 Oddesundvej 5 · DK-6715 Esbjerg N  
 Phone: +45 7514 4411 · Fax: +45 7514 4499  
[info@valtor.dk](mailto:info@valtor.dk) · [www.valtor.dk](http://www.valtor.dk)





# A2SEA – An international Marine Installation Company

A2SEA A/S offers services to the wind turbine industry within transport, installation and servicing of offshore wind turbines. Since the establishment of the company in 2000, A2SEA's market share of installed offshore wind turbines has grown to 70%. Today A2SEA operates two identical crane vessels that have been specially developed for its services. A2SEA has its headquarters in Denmark, but also has offices in the UK and Germany.

*By Martin Huss, A2SEA, Denmark*

A2SEA's approach is based on the concept of a 'crane vessel with legs'. This technology involves purpose-built vessels fitted with a high-reaching, heavy-lift crane and four retractable legs that extend to the seabed. The company has obtained European and American patents for the concept – the no jacking out of the water aspect and the idea of converting an existing cargo vessel to an efficient crane vessel. A2SEA's objective is to become the preferred international marine installation company for delivering a complete package for transport, installation and support of offshore wind farms.

## **A2SEA Background**

As stated in the Kyoto agreement signed in 1997, a certain level of energy must be produced from renewable sources. Several European states have already outlined plans of action in order to achieve the Kyoto goals. Following the Kyoto agreement, the Danish government, in cooperation with the Danish power suppliers, produced an action plan for offshore wind turbines on a large scale. Based on the plan, Kurt E. Thomsen, owner of Danish Crane Consultants, worked out a total concept for transport, installation, operation and maintenance of offshore wind turbines.

As a consequence, A2SEA was founded in the year 2000 by Kurt E. Thomsen. Its overall target was to supply the wind turbine industry with solutions to transport and installation of wind turbines and foundations and to provide transport solutions for the operation and maintenance of offshore wind turbines.

The principles applied were new and aimed at carrying out these tasks in a decisively more safe, economic and uniform way than more traditional methods.

In 2001 A2SEA received its first major order to transport and install 80 turbines at Horns Rev for Vestas Wind Systems A/S. To realise the idea and concept of the company based on this order share capital was issued to a total of DKK 64 million in late 2001. In December 2001 and April 2002 Ocean Hanne (now SEA POWER) and Ocean Ady (now SEA ENERGY) were launched from Ørskov Stålskibsværft.

In August 2002 the Horns Rev project was finished successfully and in late 2002 a new order to transport and install 72 wind turbines at Nysted for Bonus Energy A/S was received. At the same time the share capital was expanded to DKK 74 million. The Nysted project was finished successfully in July 2003. In the spring of 2003 another two wind turbines were also transported and installed in a Danish project.







In autumn 2003, a meteorological mast was successfully installed in Ireland. This was a new type of project for A2SEA, where a 48 tonne monopile was driven into the seabed. On top of the monopile a 65 metre met mast was installed. The project was carried out as a turnkey project with one Danish and two UK subcontractors. The project was the beginning of tendering in partnership with other contractors for the driving of monopiles for offshore wind turbines.

In 2004, A2SEA won its first contract in the UK for the transportation and installation of 24 wind turbines. This project started in



March and finished successfully in May. Also in 2004 a major retrofit project was carried out at Horns Rev in Denmark. The project, which took place during the months from July to November, comprised taking down and subsequent re-installation of all nacelles and blades after onshore retrofit performed by Vestas.

### Shareholders

The company is on firm financial ground with a share capital of €10 million. Most of the company's share capital was invested by two important Danish investors: Dansk Kapitalanlæg Aktieselskab and Lønmodtagernes Dyrtdsfond (a pension fund).

### Market View

The early offshore wind farms have been sited near to the shore. However, to improve the financial outcome of planned and future wind farms, sites will be moved even further offshore. Here they will be out of sight and hundreds of wind turbines can be accommodated, including increasingly larger turbines both in terms of size and generating capacity. Moving further offshore into deeper waters with a more hostile environment with regards to currents, tides waves and wind presents

new challenges in terms of logistics and safe, cost-effective installation methods.

Denmark has pioneered offshore wind farms, followed by Sweden and the UK. At the end of 2003 a total of 250 wind turbines (equivalent of 520MW) had been installed. Based on already announced projects, in five to seven years from now at least 2,000 offshore wind turbines are expected to be operating in northern Europe producing more than 5,000MW. This will mean the installation of roughly 1,700 more offshore wind turbines.

### Future Expectations

A2SEA is prepared for a growing market in the years to come. Martin Huss explains: "The company's challenge is to meet an expected increase in the number of installed wind turbines each year from a current level of 100–200 rising to 600–700 annually. The company comprises a team of employees who take the same approach to their work as the company's founder Kurt E. Thomsen. During the era of Christopher Columbus, it was necessary to hire convicted criminals in order to man vessels that ventured into unknown waters and territories. At A2SEA we do it willingly..." ■



# Research leading to new Offshore Design Methods

By Helge Gravesen and Søren Sørensen, Carl Bro as

The utilization of wind power has resulted in design of large offshore wind farms on still growing water depths. Technical challenges are met through research and development of a design basis including accurate description of the loads and dynamic responses. The results are immediately utilised in engineering projects.

The experience drawn from the pilot- and demonstration projects forms the basis for developing new codes of practice including design in a technical border-area, in which different dynamic loads simultaneous are at work in a harsh offshore environment. At the same time, development is driven in search of limiting the costs, as costs in general are significantly higher for offshore than for on-shore conditions, not at least due to an expensive sea-shore power cable connection.

## Research on loads to offshore wind turbines

In connection with the Danish demonstration projects, research programs were initiated within the framework of the energy research corporation, PSO. The programs concerned ice loads, wave loads, and combination of nature loads for offshore wind turbine

foundations. The results from these research programs form a basis for optimizing the construction of foundation and turbine tower beyond what can be achieved with traditional load combination.

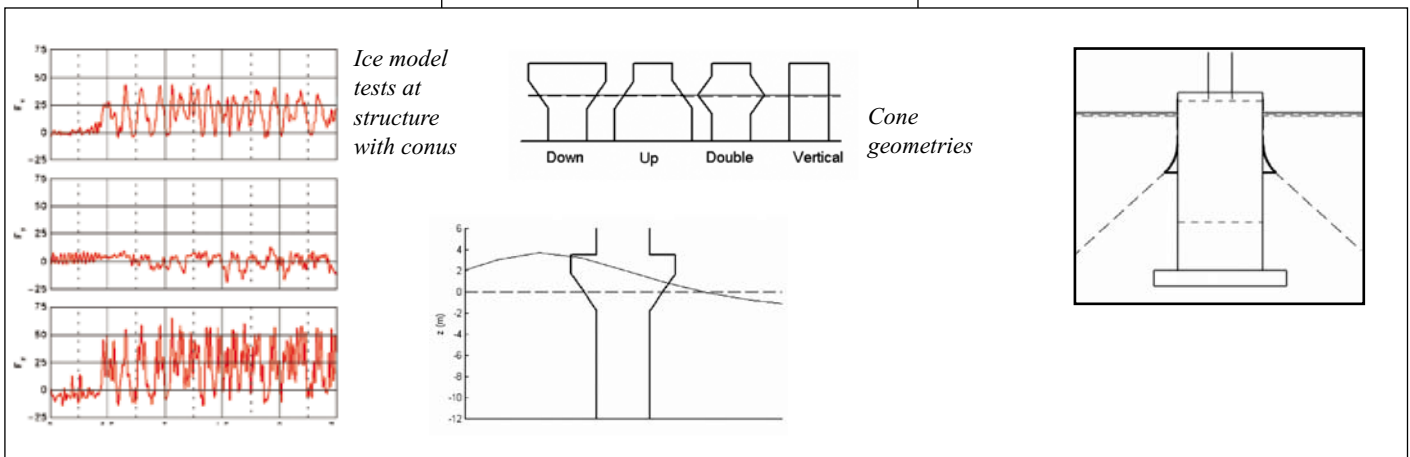
Heavy ice is created each say 5 years in the inner Danish waters and the Baltic Sea. The foundations for offshore wind turbines should be designed taking this aspect into account as a vertical structure is exposed to quite substantial loads from drifting ice floes. Based on a model test programme defined by Carl Bro, Canadian Hydraulics Centre has carried out ice model tests (in scale 1:26). The test programme included different foundation geometries like double sided cones as well as down breaking and up breaking cones, which induce breaking failure of the ice due to bending instead of crushing or mixed crushing/buckling failure of the ice for a vertical cylinder geometry.

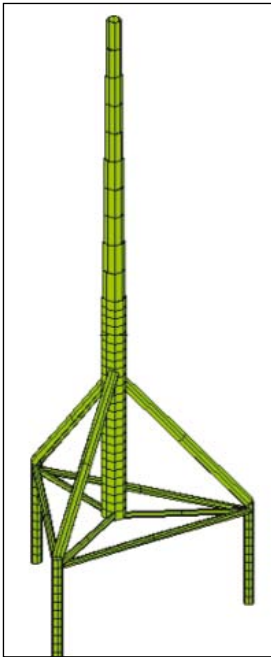
The results of this research have proven that the ice loads to a sloping surface is much lower than that to a vertical structure. In addition, significant improvements have been obtained in connection with the required vertical extension of the cone and the dynamic character of ice load for both vertical and sloping structures.

Introduction of a foundation with an ice cone resulted in increased wave loads on the foundation, and also the effect of steep, close to breaking waves needed to be investigated. Wave flume model tests at Aalborg University have confirmed that traditional design principles based e.g. on the Morison equation have to be updated with due account to the steep and asymmetrical wave profile. On the other hand, it has been found that the phase shift induced by a complex foundation structure with an ice cone reduces the wave forces compared to traditional estimates.

The most recently developed, and most accurate 2-D wave Boussinesq model has been used to describe the time series for wave kinematics as well as the associated wave load time series. The wave model was developed by Prof. Per Madsen and Dr. Harry Bingham at the Technical University of Denmark.

The calculation procedure has proven very robust and capable of simulating wave loads to even quite large and complex structures. It represents a significant improvement compared to traditional offshore practice on more shallow waters, which are typical for most new sites appointed to offshore wind farms. Based on the calculated pressure and velocity distribution, the wave load to arbitrary foundation geometries may be calculated. The





*Tripod, Mode analysis, extreme load and fatigue load analysis*

results for the complex cone foundation have been verified by results from wave flume model tests. Through this, a key problem for offshore wind farms has been solved.

Loads on wind turbine, tower and foundation need to be described as load time-series. Due to varying frequency content and response these loads may not be simply added to each other. Accordingly, a series of simulations including the complete turbine dynamics with simultaneous loads from wind and waves (or wind and ice) are carried out.

The statistical output is then analysed and usually a simple robust combination rule for the loads is verified by the simulations. In this way the simulations may also be generalised to e.g. different water depths. The latest progress even allow for analysis of dynamic interaction between the wind and the wave load to rather flexible foundations on deeper water.

The results mentioned above have been compared to a field test programme performed on Middelgrunden Offshore Farm. Even though the wave heights and associated loads were quite limited, the field tests showed a fine agreement with the predicted values. Even in the complex steel-concrete composite structure used as foundation for Middelgrunden the strains in the composite structure were measured to be close to the strains calculated during the design process with a complex non-linear numerical model (ABACUS).

By means of the above-mentioned improvements, a new level of understanding for design of offshore wind turbine foundations has been achieved. Lacking aspects, where improvements are still required, include effects of non-linear damping from water, soil and ice, a direct wave load module superimposed on the Boussinesq modelling, better modelling of intensive breaking waves, better modelling of steep 3-D waves, and due account to risk of freak waves.

### **Foundation at larger water depths**

When offshore turbines are located at larger water depths, say 20-50 m, the design and construction is dominated by the dynamic effects. However, the above-mentioned models have also been implemented for turbine projects at larger water depths even at sites with difficult foundation conditions.

A detailed analysis of the conventional foundation concepts, including gravity structures, monopiles and tripods, has confirmed the need for an advanced dynamic analysis and an advanced procedure to determine wave loads. The extreme loads at both the stand still condition, and at the extreme operational condition, as well as the fatigue loads are all very dependent on the various modes of the total structure. The combined weight of nacelle and the wings is a key element for the first mode vibration and the permitted lowest resonance frequency, so this is an important factor.

Foundations on larger water depths are also influenced by an increasingly larger distance from nacelle to foundation level, which results in strong requirements for obtaining the required stiffness to limit the dynamic response to a convenient level. For a monopile on say water depth exceeding 30 m this results in the need for quite large foundation dimensions, which is why foundation alternatives with a more material optimised structure like a tripod shows to be competitive. The tripod structure has further shown

to be much less sensitive to weak bottom soil conditions, because the overall stiffness is highly influenced by the longitudinal stiffness of the supporting piles. Accordingly, the local soil conditions may determine which type of foundation is most feasible.

The gravity structures require a heavy structure and a large foundation area, which should make this type of the foundation less competitive at deeper water. The most recent experiences however show that they are competitive up to water depths of about 20 m and possibly also for even deeper water in case the soil conditions are favourable for this type of structures.

### **Future offshore alternatives**

The development of the wind turbines to multi MW types has made it feasible to utilise offshore sites even though the associated costs from deeper foundations, establishment of a cable connection service and maintenance are far larger than onshore. The reduced requirements from noise and visual impacts etc. in addition to the larger wind resource and lower turbulence is favouring this development.

Even more advanced alternative foundation systems have been considered on the basis of the vast experience within the offshore industry, including floating systems moored either by conventional cables or through tethers like in tension leg platform. A preliminary analysis indicates that such alternatives may only be feasible at water depths exceeding 60 m. There is still lacking substantial research, not to construct the foundations safely, but to find solutions, which are feasible with the limited economical margin for offshore wind farms. The additional fatigue loads to turbines needs still to be better addressed.

The development of offshore wind power is at an early stage, but a strong and demanding process has been initiated. It is a challenging area demanding a high competence for all the players in the field. New development

# Offshore Service and Maintenance

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

Gravesen, H., Sørensen, S.L., Bingham, H., Tarp-Johansen, N.J., Pedersen, J., and Vølund, P. (2003): "Consequences of steep waves and large wave forces to offshore wind turbine design", 2003 European Wind Energy Conference. Madrid, Spain.

Gravesen, H., Pedersen, B., Sørensen, S.L., and Vølund, P. (2003): "Ice forces to wind turbine foundations in Denmark", POAC'03, Trondheim, Norway. Paper No. 187.

Danish Energy Agency / Risø (2001): "Danish recommendation for technical approval of offshore wind turbines". Helge Gravesen, member of editorial board and part time editor. ■

Three large national and international oil companies are in the front line of the Danish offshore industry with regards to exploration in 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.



# Offshore Service and Maintenance

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

Gravesen, H., Sørensen, S.L., Bingham, H., Tarp-Johansen, N.J., Pedersen, J., and Vølund, P. (2003): "Consequences of steep waves and large wave forces to offshore wind turbine design", 2003 European Wind Energy Conference. Madrid, Spain.

Gravesen, H., Pedersen, B., Sørensen, S.L., and Vølund, P. (2003): "Ice forces to wind turbine foundations in Denmark", POAC'03, Trondheim, Norway. Paper No. 187.

Danish Energy Agency / Risø (2001): "Danish recommendation for technical approval of offshore wind turbines". Helge Gravesen, member of editorial board and part time editor. ■

Three large national and international oil companies are in the front line of the Danish offshore industry with regards to exploration in 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 shutdowns 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. ■

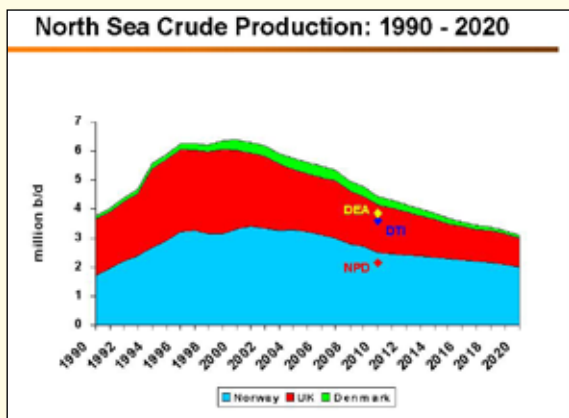


Figure 1

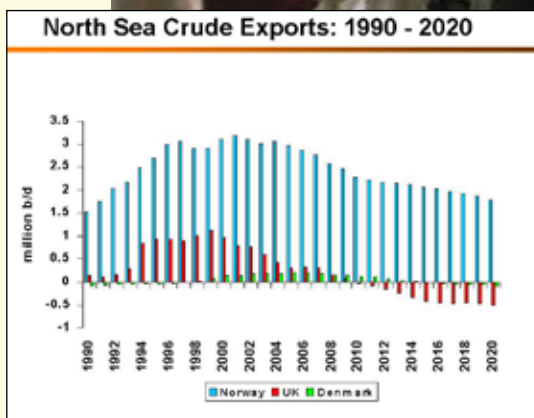


Figure 2

# 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.

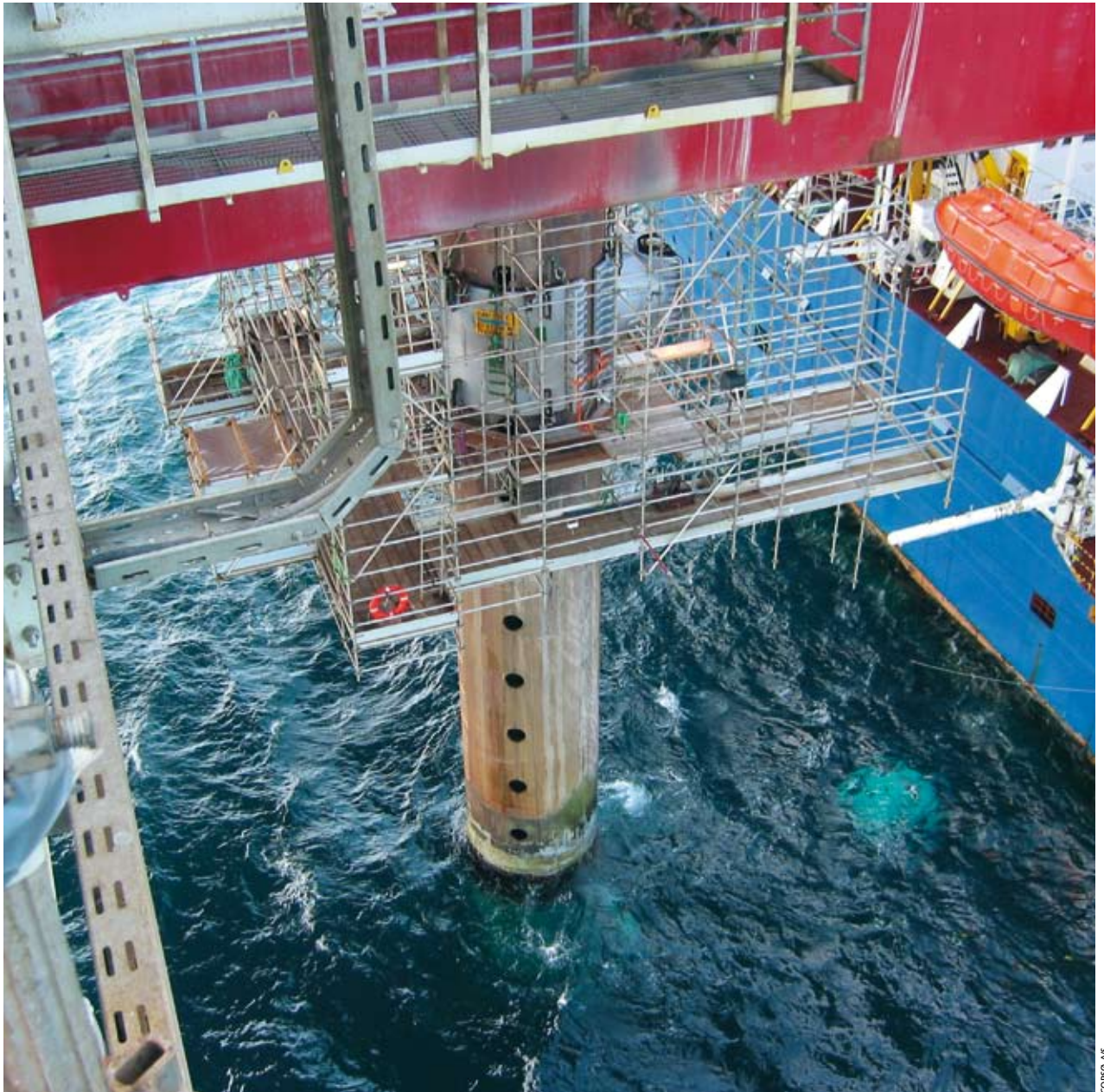
This mixture gives a flexible and motivated organisation that always is able to encounter the challenges of operation and maintenance.

## 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.”

At home one goal is to ensure we can start the car every morning and get safely to work.... ■





COFISO AS

## Your competent steel partner

As a department of Promecon, which has a total staff of more than 400 employees, we can, whenever required, draw on this considerable capacity for the involvement of major projects or when peak situations occur.

Promecon as  
Sahara 4  
6700 Esbjerg  
Tel. 76 11 55 00  
Fax 76 11 55 01  
[www.promecon.dk](http://www.promecon.dk)

# 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 in 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. ■

[www.angroup.dk](http://www.angroup.dk)

## New Visions of Industrial Engineering





# Dual-Fuel

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 generator set.

## Dual-fuel generator sets 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:

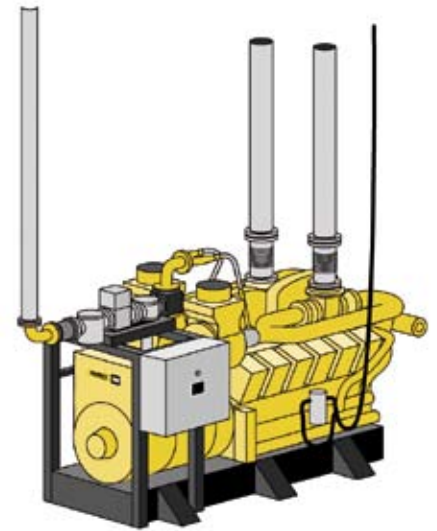
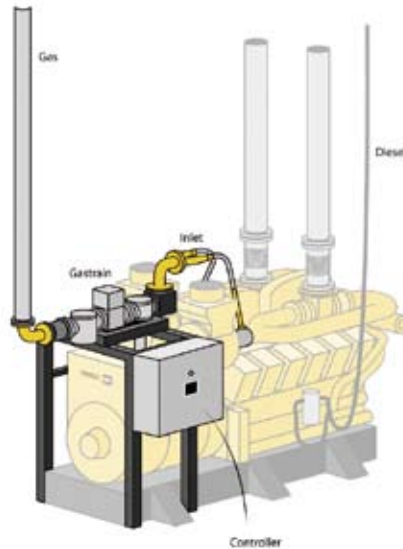
- Low fuel-consumption costs
- The reliability and stability of a diesel engine, with the advantage of natural gas as a low-cost fuel
- Fully programmable gas/diesel ratio
- Innovative product, designed by Pon Power's Caterpillar experts
- Payback time on investment is significantly reduced
- Comprehensive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



The generator set on dual-fuel is connected to both a diesel fuel and a natural gas supply. The gas train filters the gas, brings it to the correct pressure, and is equipped with solenoid valves and a governor. The dual-fuel controller measures several engine- and environmental conditions, based on which it controls the valves and the governor, to regulate the amount of supplied gas.



### 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.

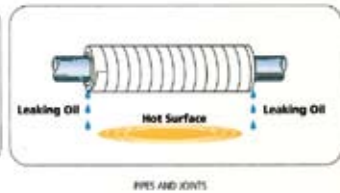
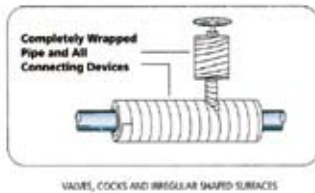
“The reason for choosing Peter Harbo A/S as distributor was obvious, as they have long and valuable experience within the marine-, fishing- and offshore industry”, said Mr. Mario Galindo from Insulmastic and continued, “we look forward to this new collaboration with Peter Harbo A/S and we are confident,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

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. ■

## Risk Control Sea-Cables & Pipelines

## HVDC / HVAC / FO / PIPELINES



# CT OFFSHORE

Sub-sea Cable Network & Pipelines



### CONSULTING SERVICES FROM CTO

CT Offshore is fundamentally a "practical" consultancy, providing project management, client representation, damage and stabilisation assessments, maintenance and survey activities all, related to subsea installation of HVAC and HVDC Fibre optic cables and pipelines.

#### Services:

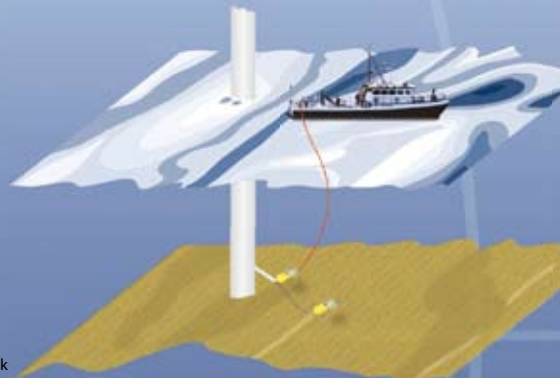
- Project management
- Desktop study and route engineering
- Burial assessments analysis
- Elaboration of tender documentation
- Evaluations of quotations
- Procedure evaluations
- Rock cutting, ploughing, jetting
- Supervising installation repair maintenance post lay burial
- Risk assessments
- Damage control
- Site representative
- On board representative
- Maintenance

### OPERATION & MAINTENANCE

What is the status of your subsea structure and network offshore?

#### Fast Response Support Vessel

- ROV Support
- Survey Support
- Dive Support
- Inspection and Maintenance Service
- Fast Crew Support
- Light PLIB-work
- Transit Mode 23-25 kn (2 x 1020 bhp)
- Operation Mode 0-6 kn (jet + bow-thruster)



[www.ctoffshore.dk](http://www.ctoffshore.dk)

Phone +45 64 87 27 26 · Fax +45 64 87 27 80 · E-mail: [mail@ctoffshore.dk](mailto:mail@ctoffshore.dk)

# 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.

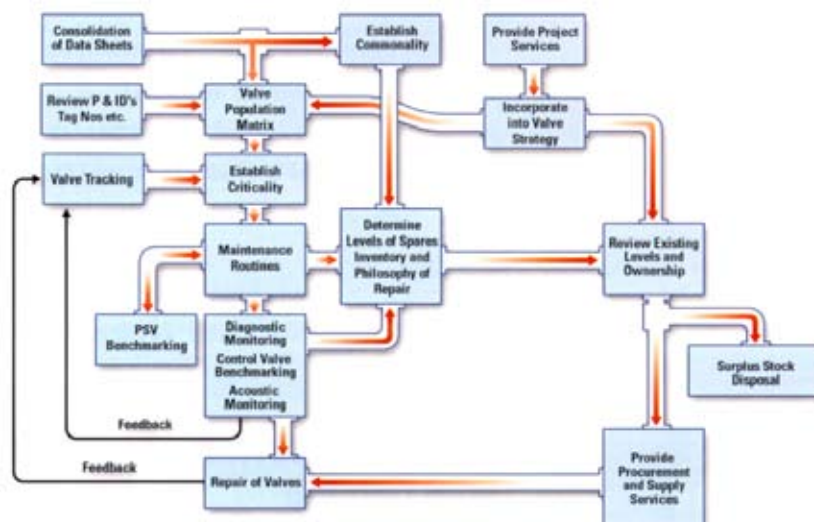
The Score Group operates fully independent from all valve and actuator manufacturers and strives to offer cost effective solutions for the client. The flexibility offers a foundation for enhancing the supply chain in respect of quality, availability and commercial benefits for the client.

In order to maintain and develop the very high service level that clients require today, training and education are given high atten-



tion. The Score Group has developed a training software tool named V.I.T.A.L. (Valve Intelligence for Training and Learning), which comprises an 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. ■



# Offshore Automation and Supervisory Systems

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*





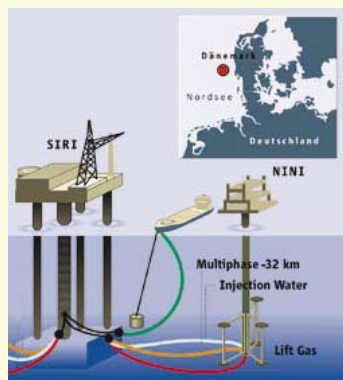
In the continuing effort to reduce overall costs and keep the operational costs of oil production at a minimum especially for remote and hostile small marginal fields, several alternatives have been developed by the Danish operators in the North Sea. Especially Maersk Oil & Gas AS has been at the forefront 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

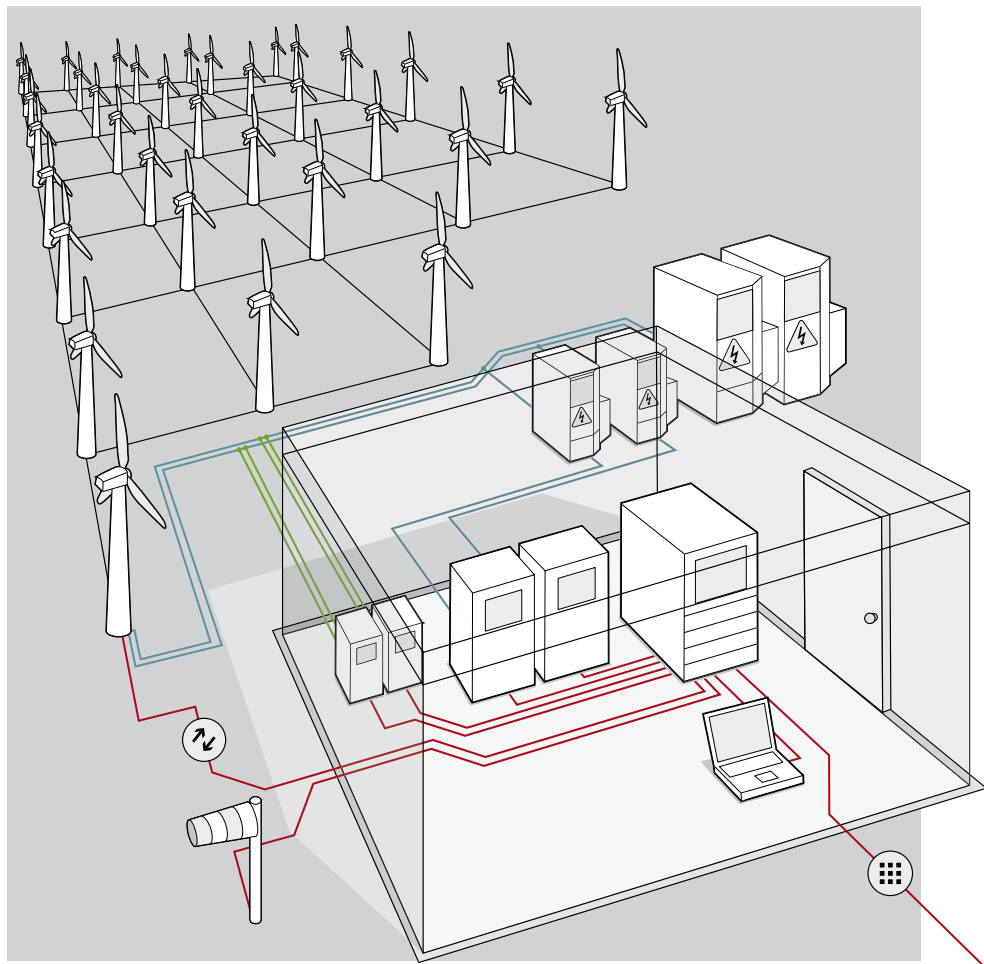
By Thorben Thim,  
Product Marketing Manager, Vestas

## 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 fog-horns
- 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

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

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.



### **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.

*The VestasOnline™ Power Plant Controller provides extensive power management features such as active and reactive power regulation, power ramping and voltage control*

### 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™ Busi-

ness, 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



- Safety transmitters
- Fire & Gas system integration
- Third party certification
- Firm Evolution and R&D strategy
- Global organization – local expertise

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.”

## 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...

> \$30 million US dollars

Source: [www.hse.gov.uk](http://www.hse.gov.uk) / [www.csb.gov](http://www.csb.gov)

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.” ■





# 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

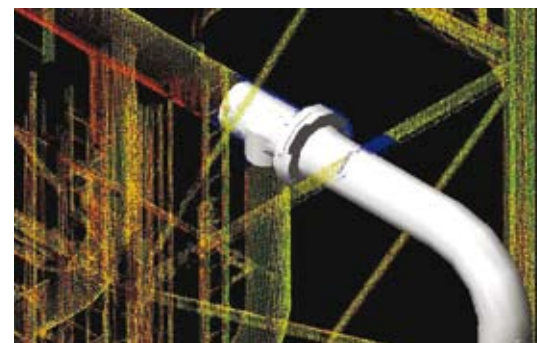
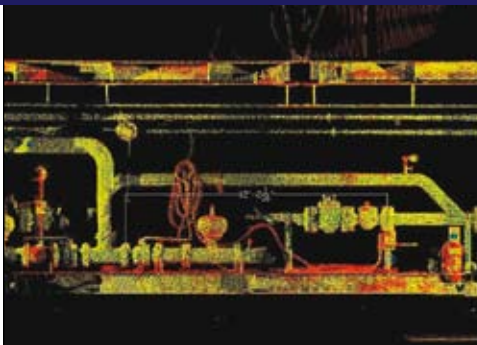
The new technology should find favour particularly in the oil industry, where highly complex plants are in operation and where having production facilities lying idle during modernisation or renovation is an option best avoided. A 3D model offers an overview of obstacles and advantages that are difficult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



## MASAVA KEMI ApS

Cleaning products for all purposes



## 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:

- Highest ranking in efficiency and environment due to reports from users and authorities
- Danish development and environmental safe
- Contain no petrochemical solvents
- Do not liberate poisonous gas, and can be used in closed rooms
- Not inflammable
- Certified and approved according to HOCNF, CHARM, Achilles and FPAL
- Fast separating according to IMO, for use in oil separators



Masava Kemi ApS · Nordre Ringvej 18 · 5700 Svendborg · Denmark · Telefon +45 6610 9060 · [www.masavakemi.com](http://www.masavakemi.com) · [masava@masavakemi.dk](mailto:masava@masavakemi.dk)



# 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 addition-



al 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. ■



**www.OffshoreBase.dk**  
*Your link to the Danish Offshore Companies*

- Search for companies
- News
- Available positions
- Events
- Invitation for tenders
- Technology development projects
- Education
- Links

**OffshoreBase** is the new focal point for the Danish offshore companies and institutions! Here you will find potential Danish partners and suppliers whom match the exact qualifications, certifications, etc., which you are looking for. But more than this, you may also find information about – What is written in the media? – Which conferences and seminars are being held? – Which courses may you attend in Denmark?

Within OffshoreBase.dk you will furthermore get an insight into the many technologically challenging development projects undertaken by the centre on behalf of its members.

Visit [www.OffshoreBase.dk](http://www.OffshoreBase.dk)



**Offshore Center Danmark**

# 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.■

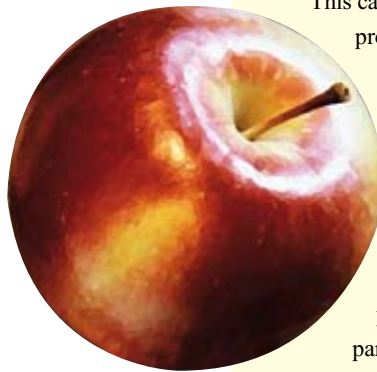
# Education



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 institutions 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. ■



# Technical Manager Offshore

By Torben Dahl, EA Vest

## 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

### Mechanical Technology II

- Ventilation
- Refrigeration technology
- Gas technology
- Offshore technology
- Maintenance

### Business II

- English
- Business economics

### Power and environment

- Environmental technology
- Environmental management
- Machinery directive
- Alternative forms of energy

The course will vary between lectures, assignment work and project work. The quantity of project works will increase during the course. If the student wants to become an Operation Technologist, he has to complete semester 1, 2 and 3 of Technical Manager Offshore and a special 4th semester where a specialized project is done. EA Vest offers various modules as a support of the project. These modules will give the student qualifications within offshore or within the industry. The education is completed with a final exam project as a thorough study and a further process of the specialized project. During 5th and 6th semester of Technical Manager Offshore the student will follow specialized projects, which will give further qualifications within offshore or more industrial ranges. During 6th semester the student will carry out a specialized assignment at their own choice. The final exam project is at bachelor level.

### 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. ■

# Let us verify your competence

Practice makes perfect  
- and saves lives.

Welcome to a lifelong  
learning process.

((●))  
**SURVIVAL**  
TRAINING CENTER ESBJERG

Uglviggårdsvej 3  
DK-6705 Esbjerg Ø

Tel.: (45) 76 12 13 14  
Fax: (45) 76 12 13 13

survival@survival.dk  
www.survival.dk



## Falck

### Worldwide Provider

Safety Training  
Security Assessments  
Risk Management Solutions

- Belgium
- Brasil
- Denmark
- Indonesia
- Ireland
- Malaysia
- Norway
- The Netherlands
- Trinidad
- United Arab Emirates
- United Kingdom

# 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 an-

swers. 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. ■

# The Blue University – Innovation across Disciplines



*By Kristen D. Nedergaard, Head of Dep. of Maritime Research and Innovation, University of Southern Denmark*

“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. ■





# Scaffolding offshore

*By Development Manager Jørgen Stephansen, AMU-Vest*

## Introduction

AMU-Vest offers a wide range of educations within different business areas. Being situated in Esbjerg, offshore-related courses naturally play a large role within the activities, with health, safety, environment and quality (HSEQ) issues being some of the leading factors.

As an example of the activities, AMU-Vest is leading in the training of scaffolders in Denmark, always keeping ahead with regards to new developments. Since the large hook-ups in the Tyra Fields in the early nineteen-eighties, AMU-Vest has been educating scaffolders. The instructors are experienced in the work routines performed offshore, and dialogues between contractors and instructors on a regular basis allow adjustment to the ever changing needs of the industry.

At AMU-Vest a large dummy platform is situated, where the students are practising their skills. The realistic conditions, under which the training is performed, help the students to decide whether or not to pursue a career as a scaffolder.

## Safety and Work Environment

The author of this article, Jørgen Stephansen, has just returned to AMU-Vest after a one year deployment as a Safety Advisor on various production platforms in the Danish offshore sector. It has been important to bring himself and the AMU-Vest courses up to date on the most recent development within Safety and Work Environment.

One of the initiatives in which he was involved, was the introduction of aluminium scaffolding. The reduced weight makes the scaffolders job routines less strenuous and

gives cause to less attrition, allowing them to stay longer in the business.

A number of experienced scaffolders are assisting in the introduction of this new technology. They work as instructors on the different platforms and are regarded a good asset by foremen as well as scaffolders.

Extensive dialogues with these instructors as well as with Mærsk Olie & Gas have inspired the development of a new course "System Scaffolding Offshore", being the superstructure to the existing scaffolding course "Tubes and Couplers".

These courses along with the more traditional AMU-Vest courses within quality, safety and work environment help to ensure that the educational level of the workmen on the offshore installations remain on a satisfactory level. ■



# Danish Employment Service has focus on the North Sea

*By Flemming Vendler, Regional Manager, AF Esbjerg*

Employees in the oil and gas industry must be of a certain character. Besides from the professional competences and the right attitude towards stability and safety, working in a close team situated more than 200 km off shore puts up high demands to the individuals personal character.

Danish Employment Service Esbjerg (AF Esbjerg) is fully convinced that recruitment of new employees often routes outside of Danish Employment Service system. The need to assess new employees and estimate whether they will meet the complex demands for work on an offshore installation, is greater than it is within most other industries. Thus the route to employment on the North Sea often goes through similar jobs onshore.

Due to the special qualifications and work patterns the sector attracts employees from all over the country. Most employers however, are situated in the Danish offshore capital, Esbjerg, where AF Esbjerg has its domain.

After the decrease in the fishery sector during the past decades, the offshore sector has become the main industry in the city during the same period. In addition, the sector is on a national level one of the best examples of a competence cluster where companies corporate and create consortiums in order to be able to handle bigger assignments.

AF Esbjerg wishes to support that development.

## **AF, the central forum**

The Regional Labour Market Council and AF Esbjerg have for a long time paid close attention to the offshore sector in order to be able to support the supply of the necessary qualified work force. Among other things, this happens by offering educational update



modules to skilled workers such as welders as well as educations to surface treatment workers, insulation workers and scaffold workers which are among the most requested types of employees on the North Sea.

The website of AF Esbjerg, [www.jobnet.dk](http://www.jobnet.dk), features a section devoted to the offshore sector where interested can find information about which qualifications are needed to possess the different jobs in the oil and gas industry. Furthermore, a section with a CV archive containing both potentials for job rotation and unemployed whose qualifications and interests are directed towards the offshore sector is under development. The archive contains both persons with relevant professional educations and persons who can undertake service jobs with cleaning and catering onboard offshore installations.

Offshore companies have both predictable long-term needs for employees and more acute short-term recruitment needs. Regardless of the time span, AF Esbjerg wishes to be the central forum for all enquiries about recruitment and re-qualification of new employees.

## **AF Esbjerg wants to be challenged**

The offshore world is operational and without long lines of command in order to make quick decisions. In compliance with that, AF Esbjerg offers itself as co-operation partner. Flemming Vendler, Regional Manager of AF Esbjerg, explains: "We want the industry to make use of us and to challenge us. Inform us of your needs and we will do our very best to fulfil them. At AF Esbjerg consultant Brian Damsgaard have the breadth of view over the supply of relevant work force."

As a natural consequence of its close co-operation to the offshore sector, AF Esbjerg have joined Offshore Center Danmark, who among other things coordinates development projects and acts as a central coordinator of innovative efforts within the sector.

AF Esbjerg wishes to do its very best to ensure that the national and international development opportunities for the offshore sector are supported by access to qualified labour force on all levels. ■



# EUC Vest has introduced Re-education entirely on the Companies' Conditions



*By Poul-Arne Callesen & Steffen S. Nielsen,  
EUC Vest*

EUC Vest is the largest provider of re-education in the south-western part of Denmark. The centre is provider of a number of courses within service and crafts relevant for the offshore industry.

The offshore industries demands for re-education are crucial to EUC Vest and the centre does its utmost at all times to meet the demands, which the companies have both for the contents as well as the form of re-education.

As an example EUC Vest has just opened a new centre for Automation & Control in

Esbjerg, based on the demands from the industry. By opening the centre, EUC Vest wished partly to strengthen the re-education area within automatics and process technology and partly to make re-education more flexible.

This meant, among other things, that EUC Vest now has said goodbye to a long-standing tradition of cancelling courses, due to lack of participants. In the "old days" a minimum of 10-12 participants was necessary for the centre to be able to go through with a course. Now it is guaranteed that the course will be carried out, and more courses will take place at the same time in the Centre of Automatics and Control.

During 10 weeks in the spring and 10 weeks in the autumn, EUC Vest carries out five basic courses comprising hydraulics, pneumatics, electricity, and PLC. The centre still adheres to a combination of theory and practice, however, the students must be prepared to assume a greater responsibility than earlier and to work more independently.

The Centre of Automatics and Control is a specially organized educational environment where the teacher goes from hydraulics to pneumatics to electricity and fault-finding. Thus, the students must accustom themselves to be together with students who are attending other courses. This is viewed as an open and inspiring environment for students as well as for apprentices.



The flexibility is reflected both in the enrolment as well as in the form and contents of the courses. Thus the students are offered to enrol on a Thursday and begin the course on the following Monday – in other words at a very short notice. Furthermore a week-course may be split up into a certain number of day-courses. The contents of the course are very much adapted to the demands the companies make on the students' participation in a course.

It is important, however, to emphasize that even though the centre is of course manned with qualified teachers, the whole concept calls for a high degree of independency and for the individual student to show initiative and energy. Self-instructing teaching materials and neighbour training are a natural part of the everyday life in the centre.

The principle is that the individual student talks to the teacher on the first day about the course which has been chosen and about the qualifications the student possesses. For example the student may in fact be competent

in a way which makes it possible to shorten the course for this particular student.

Furthermore, because of the flexibility, the offshore industry has already shown a considerable interest in the concept, among other things due to the fact that it makes it easier for employees at sea or on platforms to attend courses while they are ashore.

The background of the centre is among other things a wide experience in instrumentation, regulation, and hydraulics in connection with ships and offshore installations. Those are typical examples of the demands which the offshore industry has for the employees. These courses will be held as ordinary courses at a duration of 3, 5, or 10 days. But the concept will constantly be developed so that some of the courses which are held today as ordinary courses will be flexible in the future.

The centre disposes of a modern equipment park that matches the demands, which the trade makes on automatics and process tech-

nology today and is constantly in contact with leading suppliers of state-of-the-art technological equipment for on- and offshore.

The centre is also capable of offering courses aimed at new or existent equipment with a view to applying the customers own documentation material in connection with making repairs, preparation, running-in, logic fault-finding, and preventive maintenance.

Company adapted courses can be held at a duration ranging from 1/2 day to long-term courses. The courses can be held as normal day courses or – at request – as evening or weekend courses.

If the centre becomes the success expected, the concept will be extended to other trades. In the future the centre will be the dynamo in the development of CBT, Computer Based Training, where the education is based on the Internet. ■



[www.offshorecenter.dk](http://www.offshorecenter.dk)

*Danish offshore knowledge portal*

- Development projects
- Business forums
- Virtual knowledge library
- Education offshore
- Offshore events
- Daily updated offshore news

The website is in Danish  
- for English please use  
[www.offshorebase.dk](http://www.offshorebase.dk).



Offshore Center Danmark



WATER & ENVIRONMENT

Agern Allé 5  
DK-2970 Hørsholm,  
Denmark

## WORLD-WIDE WATER

Scour protection  
Offshore wind farms  
Marine pipeline design  
LNG terminals & facilities  
Laboratory tests, GLP studies  
Biodiversity surveys and monitoring  
Metocean design and operability data  
Decommissioning and cessation evaluation  
Environmental risk assessment, spill simulation  
Modelling fate and effects, toxicity testing (OSPAR)  
Monitoring, model testing, CFD and numerical modelling

[WWW.DHIGROUP.COM](http://WWW.DHIGROUP.COM)

## DNV GLOBAL WIND ENERGY

Independent 3rd Party Providing:

- Accredited Type Certification of Turbines
- Accredited Project Certification of Wind Farms
- Ship Impact Analysis
- ISO 9001 and 14001 Certification
- Verification of CO<sub>2</sub> - Emissions

DNV Global Wind Energy is operated in technical co-operation with RISØ National Laboratory

To learn more, visit [windenergy.dnv.com](http://windenergy.dnv.com)  
or contact us at: [windenergy@dnv.com](mailto:windenergy@dnv.com)

MANAGING RISK



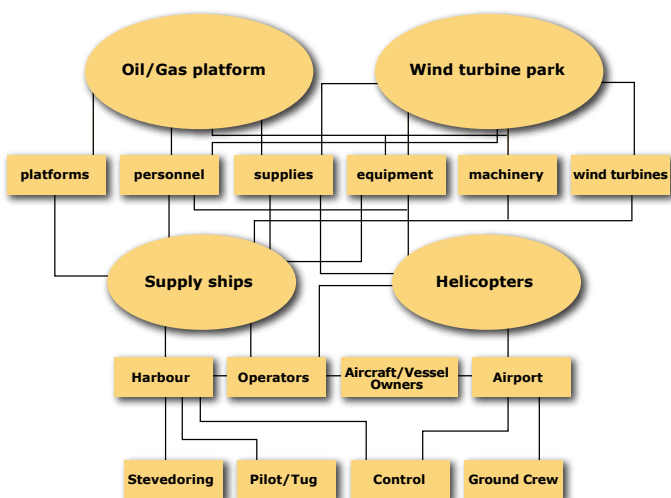
# Logistics in the Offshore Industry

Offshore installations, whether they are oil and gas installations or offshore windturbine parks provide a complex environment for logistics. Providing resources to offshore personnel, such as water flooding additives, food and drinking water, spare parts, new offshore installations, the list is endless of the various material, equipment and personnel which are transported daily from and to the Danish economic zone.

Esbjerg Harbour is the third largest offshore harbour in Europe after Aberdeen and Stavanger. A host of subcontractors, service companies and sub-suppliers are based at the harbour. Drilling rigs and production platforms are in constant need of supply. There are also facilities for transport of wind turbines which require broad quay areas and specialized ships. Specialized ships are in service for transporting equipment and supplies to the offshore installations.

At the airport, helicopters transport personnel and supplies while airplanes connect Aberdeen, Stavanger and other destinations to the offshore supply chain.

The complexity of offshore logistics may be seen in the figure below where the supply chain is dependent on all agents working together. A break in the chain can lead to a complete halt in the supply system. Logistics is therefore about assuring that the system runs smoothly, and providing a cost effective transportation system which delivers on time. Safety and environmental issues are also involved so that resources and personnel are transported with a minimal safety risk.



An example of specialized transport used to solve offshore logistical problems is the Esvagt Alpha, implemented to transport electricians and their equipment to the offshore wind turbines when work was at its height at Horns Rev. The ship's capacity for special lifts was used to transport heavy loads and was used as a work platform for electricians and other personnel. Its ability to maintain a constant position close to the windmills was an enormous advantage.

Another example is the contract received by Blue Water to transport a gas production platform for the French contractor Technip from Singapore to the Caspian Sea in 2004. The platform was built in modules and shipped as such from Singapore through the Indian Ocean, the Red Sea, the Suez canal, the Mediterranean Sea, the Baltic Sea and finally through the Russian Don Volga river system. The largest modules were 88 meters long, 16,7 meters broad and 13,5 meters high with a displacement of 3,15 meters. This maximum dimension was taken into consideration the dimensions of the river locks. The modules were transported on specialized heavy-lift ships and prams.

Two quite different examples, but both demonstrating the complexity of offshore logistical operations, the topic of the next chapter in the Yearbook. ■



# Nysted Offshore Wind Farm – A logistic Challenge

*By Poul Skjærbæk, R&D Department,  
Siemens Wind Power A/S*

In October 2001, Siemens Wind Power was awarded the contract for the world's largest offshore wind farm, the Nysted project in the Baltic Sea.

The contract comprised a series of challenges. Siemens had previously installed other offshore projects, including the world's first offshore wind farm at Vindeby with 11 450 kW turbines in 1991, the Middelgrunden offshore project with 20 2 MW turbines in 2000, and the Samsø offshore project with 10 2.3 MW turbines in 2002, but the sheer magnitude of the 72-turbine project at the Nysted Wind Farm was in a class of its own.

Already at an early stage it was clear that this project was not "just another job". The first challenge was to find suitable harbour facilities for the discharge of components. All harbours close to the wind farm site are either very small or subject to heavy ferry traffic which would put severe restrictions

on the installation efficiency. The overall time frame for the project dictated that all 72 units should be installed over a period of maximum 80 days, offering slightly more than one day per turbine including all downtime. This requirement and the restrictions on the local harbours called for a new installation set-up which could combine the use of a remote harbour and efficient installation at an attractive cost.

After a detailed analysis of available installation vessels, the special built installation vessel, Ocean Ady was chosen for the job. Ocean Ady is a modified container ship, fitted with four supporting legs and a lattice boom crane. Previously, Ocean Ady had been used for offshore wind turbine installation using a setup where two complete turbines were installed per round trip. In order to reach the required installation rate, the vessel was modified to meet a capacity requirement of 4 complete wind turbines.

One of the modifications was a special rack for stacking four rotors on top of each other.

Placed on the deck, the rack was more than 12 meters high, requiring special attention to safe working conditions both during loading and installation off shore. In order to ensure that all operations would work and that all working processes would be safe, a complete mock-up of the rotor rack was made well in advance of the start-up of the installation works. Based on the experiences from the mock-up, a series of modifications were introduced in order to obtain the best possible working environment.

The port of Nyborg was selected as the base harbour for the discharge of components due to very good accessibility both by road and by sea. Furthermore, the port of Nyborg offered more than 60,000 m<sup>2</sup> of storage and assembly area right at the quayside, providing the basis for an optimum flow of goods throughout the vessel loading process. The total supply of turbines and equipment at the quayside required more than 700 truck loads, obviously requiring a high degree of flexibility at the unloading area. The only disadvantage of the port of Nyborg was that

## Facts about Nysted Offshore wind farm:

Owner:	E2, DONG, Sydkraft
Operator:	E2, SEAS Transmission
Project Rating:	165.6 MW installed capacity
Turbine type:	Siemens 2.3 MW Combistall
Service provider:	Siemens Wind Power A/S



it was located more than 80 nautical miles from the wind farm site, resulting in an 11-hour run at favourable weather conditions.

At the harbour area, a flow arrangement was established whereby pre-assembled tower sections, nacelles and blades would meet at the quayside in order to be ready for loading onto the installation vessel immediately upon arrival. When everything operated optimally, the installation vessel was loaded with 4 complete turbines in less than 12 hours.



On May 11th 2003, the first turbine installation commenced at Nysted Wind Farm, and after fine-tuning of the work procedures during the first two round trips, the installation pace reached the required 1 turbine installed per day. When the weather conditions were optimal, a round trip could be done in 72 hours, equalling 18 hours per turbine installed including transportation to and from the site and loading of the vessel. On the 79th day from the start up of the installation, the 72nd and last turbine was delivered to its final destination at Nysted Wind Farm.

The commissioning works commenced as soon as the first turbine had been installed and proceeded on parallel to the installation. Grid connection was established in the

beginning of July 2003 and on July 13th, the first power was exported to shore. By the end of August, all turbines had been commissioned and were in automatic operation. Following a three-month adjustment and testing period, the project was taken over on December 1st 2003, one month ahead of schedule.

Project background: Nysted Offshore Wind Farm is located on the North side of the Femern Belt, approximately 10 km from the Danish shore. The wind farm is located due south of a restricted Ramsar area, which limits the direct accessibility from the shore to the wind farm. All transports to and from the wind farm has to be carried via designated routes outside the Ramsar area. The project is owned by a consortium of Danish E2 and DONG and Swedish Sydkraft. For the construction of the wind farm, Per Aarsleff was awarded the contract for foundations, Siemens Wind Power the contract for the wind turbines, ABB the contract for the electrical infrastructure and Pirelli the cable connection to shore. ■

#### Key dates:

October 8th 2001: Contract awarded to Siemens Wind Power A/S

May 11th 2003: First turbine installed on site

July 13th 2003: The first power is exported to shore

August 31st 2003: All turbines are commissioned

December 1st 2003: The wind farm is taken over by the owners

# Winter Rescue in the Arctic

By Technical Director Claus Omann,  
Viking Life-Saving Equipment

**Leading life-saving appliance supplier, VIKING Life-Saving Equipment, has developed a new evacuation system specifically designed for frozen waters and harsh arctic environments.**

## Rescue difficulties in winter Arctic weather

At present there is a great deal of international interest in the arctic regions, but severe winters limit rescue operations. Fog and winter ice make evacuation by helicopter unsafe and the use of free fall lifeboats impossible. In response, VIKING has modified its already proven offshore chute system to cope with the special conditions encountered when evacuating by chute directly onto a ship.

## Combined winter/warm season solution

The new design incorporates a counterweight system that compensates for the heave of the vessel even in the heavy seas encountered in arctic waters. The chute is kept taut without the use of electrical power.



“The new solution uses a compensating weight integrated into the system’s container onboard the platform. The boarding platform remains deactivated and the chute is stabilised by the counterweight. Evacuees directly board the rescue vessel swiftly and safely,” says VIKING Norway’s technical manager, Lars Bjoland.

Lars Bjoland goes on to continue “In warmer seasons when evacuation by liferaft is possible, the innovative VIKING system functions as other standard chute systems. The boarding platform, which is deactivated for direct vessel rescue, deploys and keeps the chute taut using weights. VIKING is the only



company we know of that offers a system that is stable in all climatic conditions.

Norway’s sales manager, Liudmila Velichko said “The oil and gas industry is increasing its activity in harsh Arctic waters. VIKING has successfully met new requirements for safety systems capable of operating in low temperature areas.”

## Systems already on duty in the Sakhalin Fields

VIKING has delivered four SES-2C Arctic evacuation systems for installation on fixed floating platforms operating in the Sakhalin Fields. The platforms will be equipped with chutes designed to evacuate 140 people in 10 minutes to sea level, some 28 metres below.

## Meets offshore regulations

All VIKING offshore evacuation systems are constructed according to specifications outlined in SOLAS, MODU, the Norwegian Petroleum Directorate rules and NORSOK in Scandinavia, where the systems are built. Local regulations are reviewed by VIKING before delivering equipment to other parts of the world. ■



# The Snohvit Experience

*By Director Jørn Bøllund, Blue Water*

Since the offshore industry came to Esbjerg in the early seventies, Blue Water has taken part in the "North Sea Adventure". The Blue Water freight forwarders and shipping people soon adopted the challenge of serving the offshore industry with international transport and logistic solutions.

The Blue Water Shipping is today represented with its own offices in 19 countries among which you will find many oil and offshore centres around the world.

Close to the North Sea, Blue Water is present in Denmark, Scotland, England and the Netherlands. In the Caucasian and Caspian regions Blue Water offices are established in Azerbaijan, Kazakhstan and Georgia, and in the Middle East Blue Water started up its own office in Dubai back in 1990. Other offices working for the oil and gas industry are those situated in Houston, Texas and Singapore and the activities also involve Blue Water people in Brazil, Russia and France as well as a worldwide agency network.

*Loading of offshore equipment on vessel chartered by Blue Water*

It is important for Blue Water to be an all-round freight forwarding and shipping supplier. It means that all kinds of freight services are offered such as airfreight, sea transport, road and rail services as well as warehouse handling, storage, stevedoring, customs broking etc.

"Whether a small courier envelope or a large heavy lift project you will easily find a Blue Water department capable of dealing with your job" states director Jørn Bøllund of Blue Water.

One of the heavy transports carried out lately is the so-called Snohvit project in Norway.

Loading of the first of three shipments of coiled tubing reels took place in Houston on 3.2. - a cargo of 59 reels each weighing 49 tons and with a volume of 5000 m<sup>3</sup>.

It was indeed a large and very interesting assignment says Thomas Bek, the General Manager of Blue Water Houston, who had chartered the vessel m/s "Hanna C" for the project, through the shipping line BBC, destined for Technip's temporary base at Tromsø, Norway where the welding of the coils (intended for later use in the North Sea) will take place.

Blue Water stevedore foreman, Per Jensen, was sent to Tromsø to attend the discharging operation. Discharging started immediately upon arrival and the reels were loaded directly on stepframe trailers, mainly by use of the vessel's crane and transported to the newly established base close to the quayside.

The discharging took 26 hours - and not 4 days as expected according to the local newspaper, explains Per Jensen.

The final user of the coils is Statoil who will use them in connection with the LNG Snohvit project, which is in progress in the Barents Sea off Hammerfest in Norway.

Two additional shipments were performed in April and May.

Jørn Bøllund concludes "Through regular training of the staff and continuous trimming of all logistic solutions, Blue Water Shipping will always be a professional transport partner for the oil and energy industry. Consequently the company received two certificates in late 2004 confirming that quality and environmental management correspond with ISO requirements." ■



# There is a Woman behind (almost) everything

*By Kim Haagen Andersen,  
Danish Air Transport (DAT)*

There is a woman behind everything – almost. In any case, flight attendant Vibeke Broeng and pilot Sylvia Dank are some of those staff members from the relatively young Danish airline company, Danish Air Transport, who many of the passengers between the oil towns Esbjerg in Denmark and Stavanger in Norway have already come to know.

“Yes, there was a time when people really noticed you and if both the captain and the first officer were woman, they would say: “What? A whole female crew!” But now it is much more common and in the cockpit it makes no difference whether you are a man or a woman”, Sylvia Dank says with a smile.

She is captain on the company’s Beech 1900D, which is still active on the route even though a larger plane was introduced on several routes on Norway’s national day, 17 May 2005. The new plane is a Saab 340A with room for 33 passengers and this almost doubles the capacity on the route and enhances the service and comfort significantly, which is a great advantage to the increasing number of passengers that has discovered this fast and comfortable route between the Danish and Norwegian oil towns.



On the new plane you are being served by Vibeke Broeng and her colleagues. She has worked as an au pair in the US, been backpacking in Australia, and has worked as a bartender in a Danish provincial town. She has also sailed with her father on a freighter from Amsterdam to Africa, and spent eight weeks at a guide training school. But she is at her best in the air and came to DAT after eight years with My Travel.

When you set up an airline company in Denmark, you really have to have drive and adventure in your blood. That was exactly what Jesper and Kirsten Rungholm had when they founded DAT in 1989, and the spirit





from those days still has a great impact on the staff. It was also that spirit which attracted Vibeke Broeng.

“I have experienced more at DAT than during my eight years with a large airline company, so I’m really happy here. You fly from A to B like the others do, but you have much more contact with the passengers than on a charter plane. You often meet old acquaintances from previous flights and that gives a wider sense of presence, a sense that pervades the entire company. Sometimes it is almost like a family outing because many of the passengers fly the route regularly”, Vibeke Broeng explains.

Danish Air Transport’s headquarters lies in Kolding Airport near the east coast of Jutland, but many of the planes depart from

the airport in Esbjerg on the west coast. The fleet of aircrafts, which consists of 13 planes, both operates scheduled service and charter service as well as air freight service, and it is also possible to launch a plane on short notice for air transport demanding tasks of any kind. Thus both the Beech and the SAAB are ready for new tasks when they are not flying the popular route between Esbjerg/Billund and Stavanger.

“We have no concrete plans regarding new routes, but with this quality-increasing step on our route to Stavanger we hope to maintain our present passengers and attract new ones who will continue to choose the fastest route between Esbjerg/Billund and the Norwegian western land” says Bjarne Rasmussen, Route Manager of DAT. ■

## Base Facilities, Bonded Storage, Freight Forwarding, Offshore Containers...



# BLUE WATER

[WWW.BWS.DK](http://WWW.BWS.DK)

Trafikhavnskaj 11, P.O. Box 515, DK-6701 Esbjerg  
**Tel: +45 79 134 144**, Fax: +45 79 134 677,  
 E-mail: [bwsebj@bws.dk](mailto:bwsebj@bws.dk)

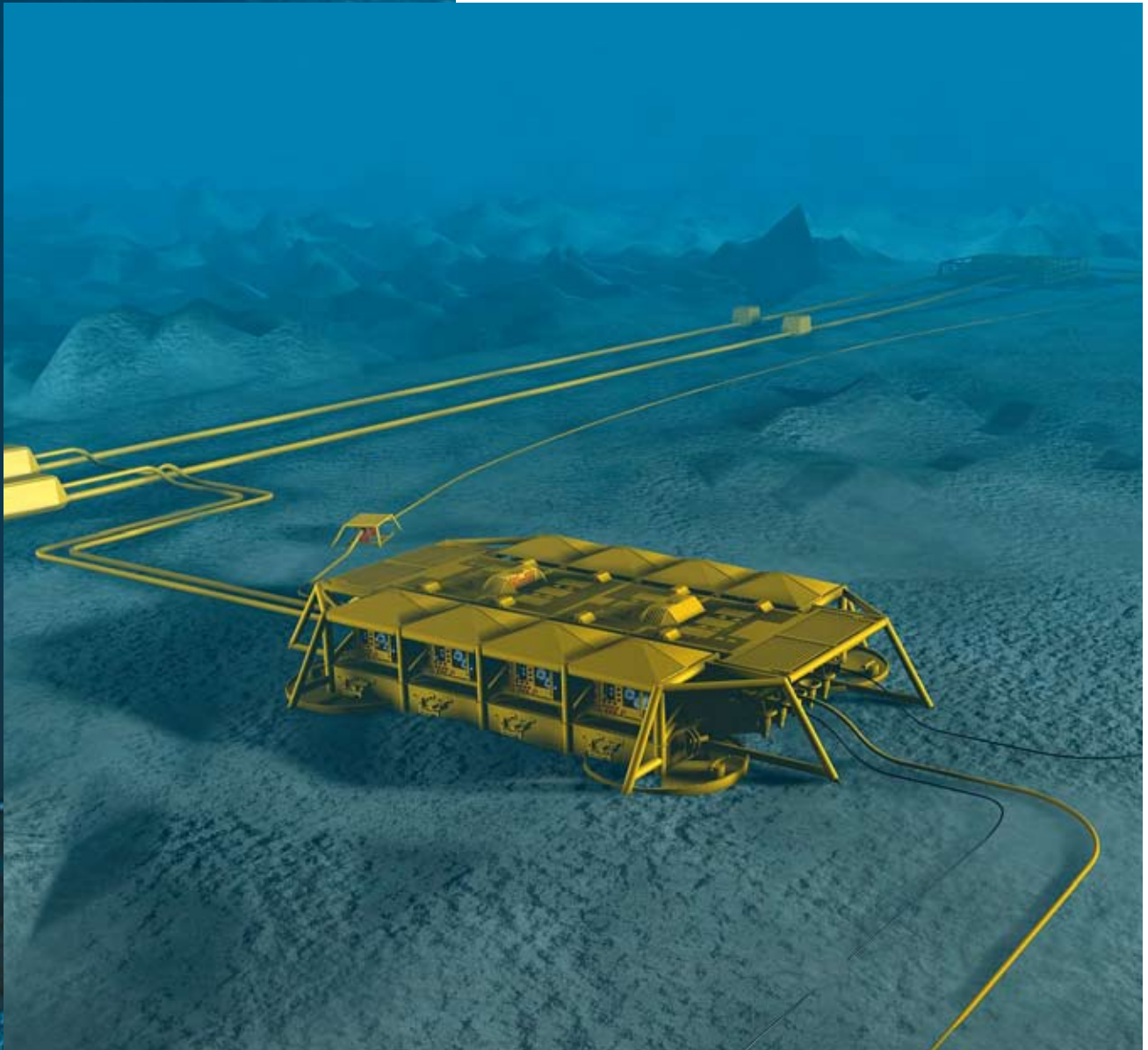
Blue Water offices in : Denmark, Greenland, Faroe Islands, Iceland England, Scotland, Ireland, the Netherlands, France, Spain, USA, Brazil, Russia, Lithuania, Poland, Georgia, Azerbaijan, Kazakhstan, U.A.E, Singapore and China

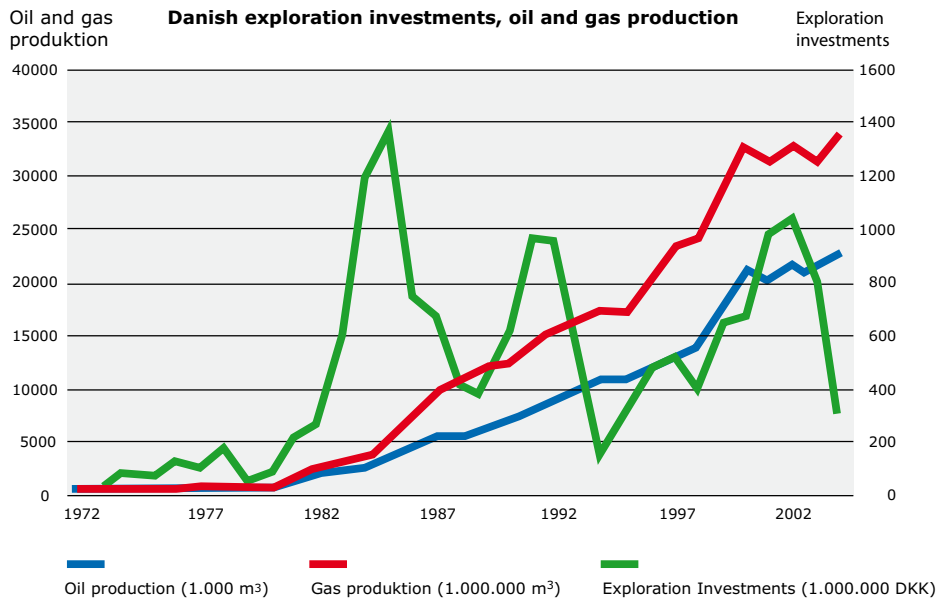


# Subsea Exploration and Production

Subsea development has in the later years taken a massive push world-wide to develop new technologies, in order to extract more oil from the underground offshore. Even in the mature North Sea region, this development continues to break new technological ground.

Service providers are hence seeing more and more orders for their technologies as operators are faced with placing more of their well-head and production systems on the sea floor. Remotely Operated Vessels (ROVs or small submarines) are being utilized more and more for offshore developments around the world, and new technology is being implemented to allow operators to inspect and retrofit subsea flowlines with new processing equipment without necessitating costly taps into existing flowlines or wells.





Technology advances are not limited to installation and operation tools, but extend to the area of pipelines as well. Subsea pipelines are breaking new records in length on the North Sea with new projects appearing as a steady pace.

The Danish offshore industry has been active in the Exploration and Production field since the sixties when the Dansk Undergrunds Consortium (DUC) made the first oil exploration wells in the North Sea. In 1972 Denmark became an oil producing country when production was started on the Dan field. Since then E&P activities have increased rapidly.

While production of both oil and gas has increased steadily over the years, investments in exploration have been more fluctuating. Part of the explanation is the Danish Licensing Rounds where new licenses for E&P activities are awarded. The 2 recent rounds took place in 1994/95 (4th round) and 1997/98 (5th round). After both these periods, an increase in Exploration investments was seen. Applications for the 6th Licensing Round have recently ended and licenses are expected to be awarded in spring 2006. It is likely that yet another increase in Exploration investments will take place because of this.

When it comes to subsea structures, a lot of experience has been gained over the past 35 years in the offshore oil/gas industry. Some of this experience can also be used within other areas such as offshore wind turbines. Problems for instance with scour and corrosion are similar whether it occurs on a subsea oil/gas structure or on a subsea offshore wind turbine foundation. With plans for offshore wind investments of close to Euro 7 bn for the North Sea area over the next 4 years it is likely that there will be more synergies between the two industries in the future.

### Danish Subsea Technology

The Danish subsea industry is largely based on companies working offshore in laying cables, subsea pipelines and installations, underwater inspection, subsea connectors, and consultancy in subsea design.

Oil production in the Danish North Sea sector operates at depths of approx. 60 meters with all process technology occurring on the platforms. Subsea technology centres on jackets, foundations, oil and gas pipelines, valves, cables and subsea inspection.

Some examples of Danish subsea technology are given below. The South Arne field operated by Amerada Hess has an integrated oil platform which processes the oil and gas produced. A subsea oil tank stores the oil until a shuttle oil tanker pumps the oil to its tanks via an offshore loading system.

DONG operates three fields Siri, Nini, and Cecilie with subsea tie-ins of oil and gas production pipes from Nini and Cecilie to a subsea oil tank at the base of the Siri platform.

Most Danish subsea technology is however based on transport of oil and gas from Mærsk Oil and Gas platforms. Some main examples are:

- The Tyra West gas export pipeline pumping gas over a 100 kilometer subsea pipeline to the NAM operated F3-FB platform in the Netherlands.
- Over 200 km subsea pipeline pumping produced oil from the Gorm platform to the onland Filsø pumping station and onwards to Shell's Fredericia refinery.
- The Tyra West gas subsea pipeline to DONG's Nybro gas treatment plant. The pipeline is 230 km long.
- Further to this, is a complex grid of interfield pipelines.

In addition the Amerada Hess operated field Syd-Arne connects a 300 km subsea gas pipeline to the gas treatment plant in Nybro.

Subsea is hence a mature technology in Denmark, with the Danish offshore industry looking abroad to offer their expertise within the rapidly developing international subsea area. ■

# Survival Training Maritime Safety



**B**eing part of the Esvagt group, we work with latest safety and survival equipment. We work closely with our clients in order to find the best solution to their needs and satisfaction.

By following the guidelines for education and training laid down by the Danish Maritime Authority, our quality system helps us performing the best safety training in accordance with our clients' requirements.

At the STMS training centre, the clients are in focus. We offer a wide range of courses, many of which are tailor-made to our clients' requirements. Our flexibility is our strength.

Your concern is our challenge and we are able to arrange a full course package including transport, accommodation and provision of meals at a competitive price.

We have 25 years of experience in offshore and maritime courses and are able to deliver STCW and OLF training.

Please refer to our homepage for further information: [www.stms.dk](http://www.stms.dk)

**STMS**  
Adgangsvejen 1  
DK 6700 Esbjerg  
Tel: +45 76 11 47 50  
Tel: +45 76 11 47 05  
[www.stms.dk](http://www.stms.dk)

# STMS



Next start of education will be 30<sup>th</sup> August 2006.

We will start 4<sup>th</sup> semester on 1<sup>st</sup> February 2007, which especially is for production technologists, installation contractors etc. Please do not hesitate to contact us if you need more information.

## Technical Manager Offshore

### TECHNICAL MANAGER OFFSHORE

**3-year short-cycle higher education:** a new challenging education where focus will be: Running and maintenance of technical plants, project management, working environment, environment management, Offshore technology and alternative forms of energy.

### GOOD JOB OPPORTUNITIES

**Many opportunities both On and OFF shore:** Manager of technical installations both within industry or offshore. Managerial tasks with staff, environment and safety. Design of technical installations.

### IN COOPERATION WITH THE TRADES AND INDUSTRIES

**Education where you are close to the real trades and industries:** During the education you will meet the representatives from the business community in many ways as they are both active advisers to the content of the education as sparring partner for your projects.

### FURTHER INFORMATION

**[www.eavest.dk](http://www.eavest.dk):** Or contact Søren Pedersen [spe@eavest.dk](mailto:spe@eavest.dk) or phone +45 7613 3254

**We develop talent!**

Business Academy WEST is a regional cooperation between Esbjerg Business College and EUC Vest. Also the business colleges in Tønder, Ribe and Varde and the agricultural school Riber Kjærgaard are part of this cooperation.

Sp. Kirkevej 103, DK-6700 Esbjerg, ph. 7613 3200, **[www.eavest.dk](http://www.eavest.dk)**

ERHVERVS  
AKADEMI | VEST



# The Engineer's secret Dream/Nightmare

By Marianne Winther, DONG

**On the surface of the sea there is no trace of the many high-tech installations and pipes that are being towed into place under the icy waves of the Norwegian Sea. But from deep down in the seabed masses of natural gas are on their way from one of Europe's largest fields, Ormen Lange, which is co-owned by DONG.**

In 1997 Hydro made a find in the sea off Central Norway – a find that, even before production started, made natural gas history. That is due both to the enormous quantities the field holds and to the many technical challenges involved in developing it.

## Underwater landslide

The find was made in a hole created more than 8,000 years ago, when a gigantic



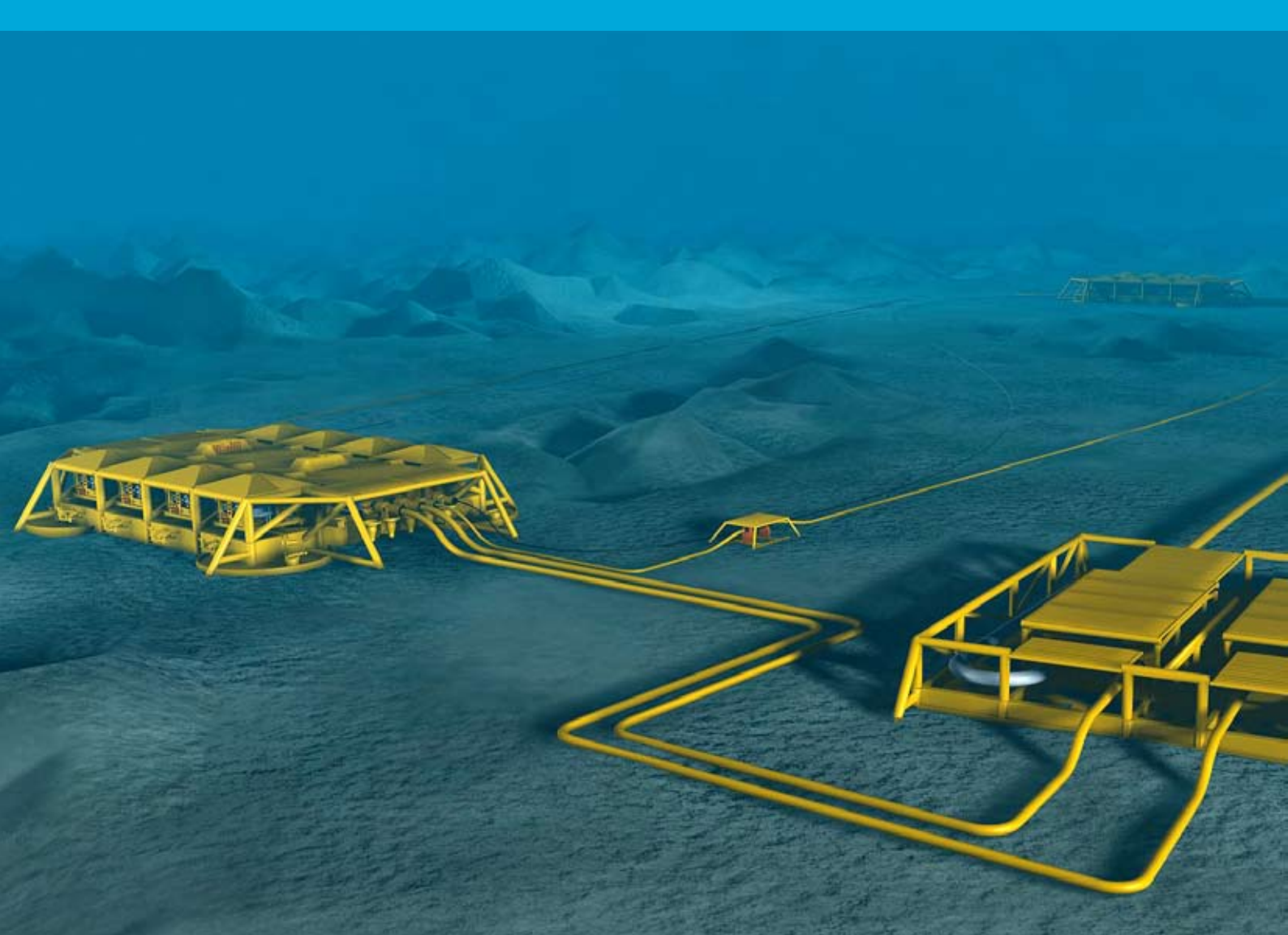
## Facts about the project

- The Ormen Lange field lies about 2,000 metres down in the seabed 850-1,100 metres below the sea's surface.
- When production reaches plateau, DONG's just over 10 per cent share will correspond to the annual consumption of around one million homes.
- Production will start on 1 October 2007.
- Hydro will be the operator in the development phase and Shell in the production phase.
- The partners in Ormen Lange are Hydro (18.0728 per cent), Shell (17.0375 per cent), Petoro (36.4750 per cent), Statoil (10.8441 per cent), DONG (10.3420 per cent) and ExxonMobil (7.2286 per cent).
- The total investment is around USD 10 billion.
- Langeded consists of 100,000 concrete-coated steel pipes, each with a length of 12 metres and a weight of 16 tonnes. About one million tonnes of steel and 375,000 m<sup>3</sup> of concrete will be needed.
- When the work is at its height, about 10,000 people will be working on the project.
- Two million m<sup>3</sup> rocks have been removed to make way for the shore installation at Nyhamna.
- To provide accommodation in Nyhamna Hydro has built Norway's largest hotel, with room for 2,200 people and a canteen seating 1,000 people at a time. The hotel and work-site offices cover an area of 60,000 m<sup>2</sup>. The buildings will be completed in 2006 – and in 2007 demolition will begin.

landslide caused an area the size of Iceland to shift away from the Continental Shelf and out into the Norwegian Sea. The Ormen Lange field lies in the middle of this enormous hole. In Norwegian the name means a long serpent, which, according to Nordic mythology, wound around the earth. The gas from the Ormen Lange field will be transported to the hungry European natural gas markets via a new marine pipeline, Langeded.

## Big challenges

To get the Ormen Lange field's enormous gas reserves up, produced and transported presents so many gigantic technological challenges that the project has rightly been termed every engineer's dream/nightmare. The fact is that in this part of the Norwegian Sea, the relatively warm Gulf Stream meets the icy waters of the Greenland Sea, producing extreme currents and wind conditions and towering waves.



It is on the seabed under these waves, at a depth of 1,000 metres, that the work of developing the field and pipeline to the shore is taking place. And everything must be done by remote-controlled tools because humans cannot work at that depth.

The gas will be produced from 24 wells on the seabed, and glycol (anti-freeze) will have to be added to it at the wellhead to prevent ice and hydrates from forming in the pipeline, for deep down in the Norwegian Sea, the temperature is just around freezing point all year round.

### Facts about Hydro

Hydro is an integrated aluminium and energy company.

The company also has extensive activities within production of oil, gas and electricity and within transport and trade in energy all over Europe.

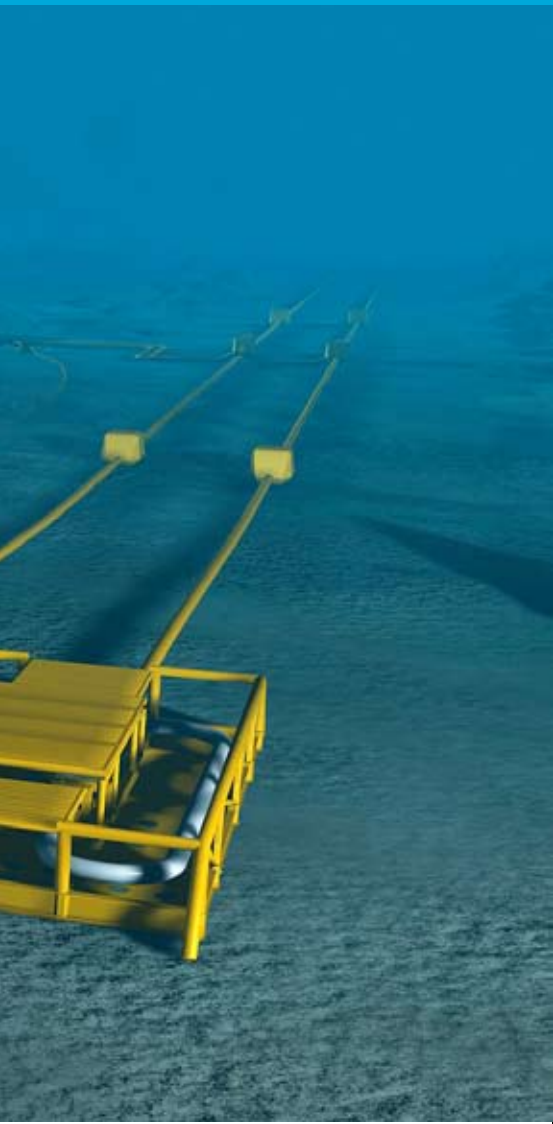
Hydro is the operator of 15 oil and gas installations with a total production of about 980,000 barrels of oil equivalents per day, making the company one of the largest offshore companies in the world. In 2004 the company's own production of oil amounted to 572,000 barrels per day. Hydro has the Norwegian Continental Shelf as its main base, but is producing oil and gas in Angola, Canada, Russia and Libya as well and also has activities in the Mexican Gulf and Iran.

In 2004 the company had 35,000 employees and operating revenue of NOK 155 billion.

### The Ormen Lange gas is of importance to DONG

With its share of the Ormen Lange field, DONG is strongly placed in the European gas market, where the company has customers in Denmark, Sweden, Germany and the Netherlands. Søren Gath Hansen, Executive Vice President of DONG's exploration and production company, says, "Today, we have largely only gas from the Danish sector of the North Sea, but production is expected to fall there shortly, so we need gas from other sources. With the gas from Ormen Lange, we shall have increased our own production from 2007 by about 30 per cent of our present gas sales."

On their 120-kilometre journey to the shore, both the gas pipeline and the glycol pipes will have to negotiate an uneven submarine landscape with hills up to 60 metres in height. In some places the hills will be drilled through to make way for the pipes, while in others, large quantities of stone will be laid between the hills to support the pipeline and glycol pipes. This work will also be remote-controlled.



The gigantic shore installation, where the gas will be treated, is under construction at Nyhamna, which is near Molde. From the shore installation the treated gas will be sent out through the Lange-led pipeline, while the condensate will be exported by tanker.

### The world's longest marine pipeline

With a length of 1,200 kilometres, Langeled will be the world's longest marine pipeline. It will go from the gas treatment plant in Nyhamna, via the Sleipner field in the North Sea, to Easington on the east coast of England. The work on the pipeline is giving rise to a lot of shipping along the route for a couple of years and will require a goodly portion of the world's total steel production and its entire fleet of laying vessels.

But when the gas starts flowing from Ormen Lange in the autumn of 2007, all trace of the gigantic engineering work out on the field will be completely hidden beneath the waves. ■

## Basic course in offshore oil/gas



Offshore Center Danmark offers 2 basic courses in offshore oil/gas. The courses are independent of each other and are adapted for employees with a need for knowledge about the most common terms in the offshore sector.

### Production

The Production course provides the participants with basic knowledge about offshore production of oil/gas. Topics include: what is oil and gas, geology, the oil adventure in the North Sea, how is oil/gas extracted, what is happening on the platform and distribution of oil/gas.

### Safety

The Safety provides an overview of the authorities, organizations and the legal frames within the offshore oil/gas area. The course also introduces the important area HSEQ (Health, Safety, Environment and Quality).

Both courses run over 2 days and are held twice a year in Esbjerg.

The courses are also offered as company specific courses where both the Production and Safety course are combined into one 2-day course. This can be held at the premises of your company and results in an economic benefit when your company has more 10 or more people attending the course.

Course programs and further info can be found at [www.offshorecenter.dk](http://www.offshorecenter.dk) under the menu Uddannelse (in Danish) or by contacting Offshore Center Danmark: +45 3697 3670 / [info@offshorecenter.dk](mailto:info@offshorecenter.dk).



Offshore Center Danmark

## ESBJERG OILTOOL A/S

ASTM/API/ANSI

Håndværkervej 67 · 6710 Esbjerg V  
Tlf. 75 15 64 00 · Fax 75 15 61 43  
E-mail: [EOT@Esbjergoiltool.dk](mailto:EOT@Esbjergoiltool.dk) · [www.estool.dk](http://www.estool.dk)



- RØR, FITTINGS, FLANGER
- BOLTE, PAKNINGER
- FILTRE
- VARMEBEHANDLING



# Automated ultrasonic Inspection Technology

## Automated ultrasonic Inspection Technology for Subsea Structures moves towards increasing Depth and more flexible Systems

By Asger Mulvad Jensen,  
Force Technology



### **Demands for ROV assisted inspection**

In view of future demands for ultrasonic inspection of subsurface structures of offshore platforms FORCE Technology in year 1999 started design for upgrading of its P-scan diver assisted subsea inspection system which was based on the old P-Scan system 3. The new design should include arrangements for a ROV assisted version of the subsea inspection system built on the new digitized P-Scan system 4.

A team of FORCE Technology specialists in offshore inspections and diver-assisted operations conducted the design process. One of the practical elements was design and construction of a tool skid that could be mounted underneath a ROV with manipulators. The tool skid should include the whole subsurface inspection system and also do the very critical cable handling in a safe manner. In the final construction is the

scanner placed on a platform shaped similar to the component to be inspected and in which a selected calibration block is integrated to enable in-water calibration check. The P-scan system 4 is placed in electronics' pressure bottle. One cable is connected to the ROV's umbilical, and all communication is through this cable.

The detailed development and construction of instrumentation and inspection procedures was elaborated in close connection with preparations for ultrasonic inspection of girth welds on the legs of the Siri platform. Siri sits on 55 metres depth in the Danish sector of the North Sea.

The development program tested the subsea P-scan units for water pressure corresponding to an operational depth of 400 meters (test pressure 600 meters). The pressure level was selected by FORCE Technology, because other platforms in the North Sea

have structures much deeper than Siri. A successful demonstration of performance was conducted with the subsurface equipment placed in the 170 m<sup>3</sup> test tank in the FORCE laboratories in Denmark. In order to simulate real field conditions the operating personnel was working from a control room installed in a container. Operation of scanner and ROV manipulators was done using cameras only.

The subsea inspection system and the team was mobilised to Siri in July 2000, where a total of 83 meters of welds were inspected. The same welds were also inspected in June 2002. In year 2004 jacket holes on Siri legs were inspected with the same subsea system but with different probe set up.

In 2003 Statoil contacted FORCE Technology because the Heidrun maintenance people knew that a ROV operated P-scan subsea inspection system had been tested for operation depth of 400 meters. The Heidrun platform is placed off the Norwegian coast in 360 meters of water.

The tension legs of the Heidrun platform are 24" diameter pipes constructed by welding together 12 meter long sections with a wall thickness of 38 mm. These tension legs were examined very detailed during the production phase. Now, these welds should be inspected again with the best possible subsea technology.

In the first half of 2003 inspection procedures were developed and the inspection ability of personnel and the ultrasonic system was demonstrated by dry tests on the aluminium-coated welds in a sample section of a tension leg.

The inspection procedure included a full volumetric inspection using puls-echo

technique for detection and TOFD for sizing of defects if any. In order to confirm that no water has entered the legs (Flooded Member Detection), a separate probe for this purpose was fitted to the scanner. It was possible to inspect up to 5 welds in a normal 12-hour shift. The inspected welds were located in depths ranging from about 60 meters to 325 meters, and at that time this was probably a depth record for automated ultrasonic inspection.

In August 2003 the FORCE team arrived at Heidrun with the system for the first inspection and returned to Heidrun in 2004 and 2005 for inspecting welds on other tension legs.

### **Diver assisted pipeline inspection**

The development of the ROV version has also improved the diver version of the subsea system which is now more handy and with a deeper range.

In August 2003 FORCE Technology was called for a quick mobilisation for inspection of a damaged oil pipeline at a depth of 52 meters in the North Sea. Inline calliper inspections had disclosed two 15 mm deep dents pressed in the concrete coated steel pipe. Concrete and corrosion protection materials were removed from a two meters long pipe section and the damaged steel pipe prepared for detailed inspection.

The FORCE technician arrived on the diver supply vessel (DSV) with P-scan system 4 configured for diver assisted subsea inspection. The damaged pipe section was divided in 9 sectors to be inspected for defects. The diver mounted the scanner on the pipe, and his operations were viewed on deck via the diver's video camera. The subsurface

instrumentation was connected with the PC topside onboard the DSV by a cable, where the technician controlled the movement of the scanner. He could view the processed data and evaluate pipe condition simultaneously with progress of the scanner.

The pipe inspection continued successfully until the 9th sector should be scanned. At that time all computers controlling position-keeping systems of the DSV broke down. Divers were taken on board and the subsurface P-scan units left on the bottom with its surface cables tied to a marker buoy. The DSV sailed to its home station for repair and returned after two days. The diver went down to the subsurface instrumentation while the FORCE team connected the P-scan cable to the PC on deck and completed inspection of the 9th sector without further delays.

### **Development for the future**

The performance of the ROV assisted automated subsurface ultrasonic inspection system is expanded concurrently with demands set by customers and their subsurface structures. The ultrasonic processor PSP-4, the heart of P-Scan system 4, has now been upgraded to incorporate Eddy Current meaning that the system is able to do both techniques in the same scanning. Further more the system is now pressure tested for operational working depth of 1000 metres. For the future FORCE Technology is now working on scanner designs for subsea automated inspection of more complex geometries like node welds.

The basis for such development is scanner systems developed by FORCE for inspection of welds in the nuclear industry. This may push the development towards a flexible subsea inspection system suitable for almost any requirement. ■

# Examples of Developments within Subsea Engineering and Design of Subsea Structures

By Nils Fog Gjersøe, LICengineering A/S, Esbjerg Department

Subsea Engineering is a very challenging technological area, due to the huge effects posed by complex subsea conditions including currents, waves, temperatures, dynamic loads, corrosion, biological effects as well as shipping traffic.

LICengineering challenges these effects and is a company started more than 25 years ago by 5 PhD's from the Technical University of Denmark. The company today has offices in Copenhagen and in Esbjerg and operates worldwide.

A large part of the engineering activities is focused on subsea pipeline design including related structures. Furthermore monopile foundations for large offshore wind turbines as well as minimal oil and gas platforms for the Southern North Sea have been designed and are now in operation. During recent years design and supply of specialised components for the subsea oil and gas market has become an increasing activity.

During the last decade a number of subsea structures has been installed in the Danish North Sea as part of new oil and gas installations. The majority of structures are intended for protection of subsea valves and other components which are part of the major oil and gas installations. The structures provide protection against dropped objects from ships or cranes in the vicinity of platforms and against fishing activities where the structures are placed on the seabed in areas away from platform complexes. The structures are designed to deflect fishing gear, but for safety the design is typically made strong enough to resist hooking of fishing gear from large trawlers.

The majority of these structures have been designed by LICengineering, some of them in cooperation with other design companies. The company has assisted with supervision



during installation activities and during yearly inspections offshore.

During the latest 5 years LICengineering has been highly involved in design of monopile foundations for offshore wind turbine developments. Completed projects include the first two large wind farm developments offshore UK. Assistance and follow-on engineering has been supplied on these projects during

onshore fabrication and offshore installation activities. As a further development within these designs, monopile foundation designs for minimal oil and gas platforms in the Southern North Sea have been supplied for a major operator.

In the North Sea area one of the main design issues is the erodible seabed conditions due to high wave and current activity in com-





ination with shallow water depth. This requires special design technique in order to allow water movements to pass the structures without generating deep holes below the structures. At the same time easy and safe access shall be provided. The structures have been designed to minimize scour occurrence and furthermore design of scour protection has been included where appropriate. The designed structures have proven to fulfil these requirements.

A growing area for LICEngineering engagement is design and supply of specialised steel components for the subsea oil and gas market. Presently this includes supply of mechanical latching systems for support of flexible risers

and the associated bending stiffeners as part of large new deepwater field developments.

Another example of supply of subsea components not relating to oil and gas is a series of smaller subsea structures for measurements of porpoise occurrence in areas proposed for wind farms and a series of structures for measurement of fish migration in the inner Danish waters and in Northern Norway. The structures were designed and supplied including field tests. These structures included an acoustic release system enabling pick-up of the structures without subsea intervention.

Other designs include wellhead protection structures in the North Sea and Qatar

waters and pipeline end manifold (PLEM) structures. Furthermore, a number of smaller structures has been designed and used scientifically for acoustic measurements of wave kinematics near a major platform complex in the North Sea.

LICEngineering is also involved in repair engineering and structural re-evaluation of existing subsea pipelines and structures in the North Sea. ■



## Safety & Environmental Excellence

### Safety first!

Nothing is more important than the safety of our employees. Continuous safety and environmental training is an important part of our work life. This benefits our employees, their colleagues and families – and the environment!

### Getting better – and better

We continuously seek to develop safer, more efficient and energy-conserving concepts, processes and techniques. We believe there is always room for improvement, and we encourage our employees to challenge existing systems and concepts. Amerada Hess was the first oil company in

Denmark to have its offshore installation ISO 14001 environmental certified (in 2002) and OHSAS 18001 health and safety certified (in 2005).

### Part of a greater whole

The Danish company is part of the US energy company Amerada Hess Corporation whose 11,000 employees explore and develop oil and gas deposits world-wide. We have worked in the North Sea since 1963, and with first oil at South Arne in 1999 we have also established a strong presence in Denmark.

Photos: Bent Sørensen/ Medvind

Amerada Hess  
Østergade 26 B  
DK-1100  
Copenhagen K  
Phone  
+ 45 33 30 12 33



[www.hess.com](http://www.hess.com)

# Design of Foundations for Offshore Wind Turbines

By Researcher Brian Juul Larsen,  
Aalborg University

The knowledge on what to teach future engineers, entrepreneurs, developers and architects comes through research. Both the research that Archimedes, Newton and Einstein did. But also the cutting edge research that is performed at the universities today is used on a daily basis.

At Aalborg University there has been a focus on coastal and offshore related researching in recent years, not the least what happens subsea.

Brian Juul Larsen explains: "In particular we have worked a lot on offshore wind turbines. We have been involved in many aspects of the design all the way from the tip of the wings to meters beneath the sea bed. Within the field of hydraulics we provide calculations and model tests on wave forces, run-up, scour and scour protection."

In general the design conditions differ from location to location. Therefore it is usual to make individual tests on a given design proposed at a given location. In recent years Aalborg University have tested several offshore wind farm projects. The most recent is the ongoing London Array West project. ■



## **Forces**

Knowledge on what horizontal wave forces can be expected on the tower of the turbine during the expected lifetime is of great importance in the design face. At the hydraulics laboratory several scaled model tests have been made to find the horizontal wave forces on various types of foundation for turbines. Strain gauge pairs are mounted in two different heights above the still water level. The moment in two different heights is thereby found, and from these you can calculate the horizontal wave force and the height above sea bed that it has attacked the structure. To verify the measurements they are often compared to e.g. Boussinesq simulations.

## **Run-up**

Platforms and boat landing devices sometimes live a rough life during storms. The wet zone is much more than just half the waveheight, or as abbreviated  $H/2$ . Firstly the higher order wave peaks are higher than  $H/2$  above the still water level. Secondly water will run up the structure when the waves hit it. And thirdly the impact will create some splash ("white water") in and around the impact zone. Run-up is defined as the "green water" level on the surface of the pile. "It is the part that is most harmful to the structure and it is that part that we can measure" explains Brian Juul Larsen. He continues: "At the hydraulics laboratory of Aalborg University we have used capacitance gauges to measure the water level on the surface of the structure. Splash is not taken into account but it is not so forceful due to lack in mass / inertia. Variation in run-up around a pile has been investigated. Tests showed that the run-up only was 40% of the run-up on the front in an angle of  $135^\circ$  of the incident wave."

### **Scour**

Current only.  
Unidirectional  
current.

### **Scour**

When new obstacles are placed on the sea bed a local change in the sediment transport is practically unavoidable. A certain amount of scour around the foundation of the turbines should be taken into account. It is commonly accepted that if the sediment size allows any lifting at all over time the scour depth around a pile will become 1.3 times the pile diameter.

### **Scour Protection**

Instead of increasing the size and the price of the foundation itself - to take scour into account - it is usually cheaper to protect the sea bed at the edges of the foundation from scour occurrence. Placing a layer of stones around the structure is so far the most common solution. The two main questions asked concerning protection material are:

- How big a stone size is needed?
- How big a volume is needed?

**Scour Protection**  
Slightly damaged  
protection.

Though current is the parameter to be concerned about when it comes to scour, it is our observation at Aalborg University that it is the wave related particle motion that is of most danger to the protection stones. However for severe damage a strong current is needed to carry the lifted stones away from the area. Naturally the needed stones size varies a lot from environment to environment, and a general statement is difficult to name. When it comes to the volume of the protection material some might say that it should be the same as the volume of the scour hole you would have if you didn't make any protection. "We consider that thumbs rule to be slightly conservative. Once scour at the edges of the structure is prevented nothing more is needed", Brian Juul Larsen explains.

### **Run-up**

Wave breaking on pile. Creating run-up and splash. (And slamming forces).



### **Forces**

View down a wave flume. From the left: Pile mounted on force measurement device and three wave gauges.





# Subsea Structures

Research on hydrodynamic Processes at/around at Coastal, Maritime & Structural Engineering Section, Technical University of Denmark

By Professor B. Mutlu Sumer and Professor Jørgen Fredsøe, Technical University of Denmark, Department of Mechanical Engineering, Coastal, Maritime & Structural Engineering Section

The research group Coastal, Maritime and Structural Engineering Section, Department of Mechanical Engineering at the Technical University of Denmark (formerly part of ISVA (Department of Hydrodynamics and Water Resources)), has been active in marine (coastal/offshore) and hydraulic engineering over the last 30 years.

Their research activities related to hydrodynamic processes at/around subsea structures cover the following specific areas:

## Flow around and forces on cylindrical structures and flow-induced vibrations -

Forces on and vibrations of marine pipelines, correlation, vortex-flow regimes, effect of irregular waves.

**Scour/local erosion around marine structures -** Scour below pipelines, scour around windmill foundations, scour around slender piles/pile groups, large piles, scour at breakwaters and complex structures such as subsea structures. Scour protection; Interaction between seabed and protection work.

**Liquefaction of marine soils -** Mechanics of liquefaction, sinking/flotation of marine objects in liquefied soils under waves, mathematical modelling and assessment of liquefaction potential / pipeline flotation under waves. Counter measures.

Of these specific topics, scour/local erosion is one of the most important design considerations with regard to subsea structures such as marine pipelines, subsea templates protecting valve stations, etc. When a structure is placed in a marine environment, the presence of the structure will change the flow pattern in its immediate neighbourhood, resulting in one or more of the following

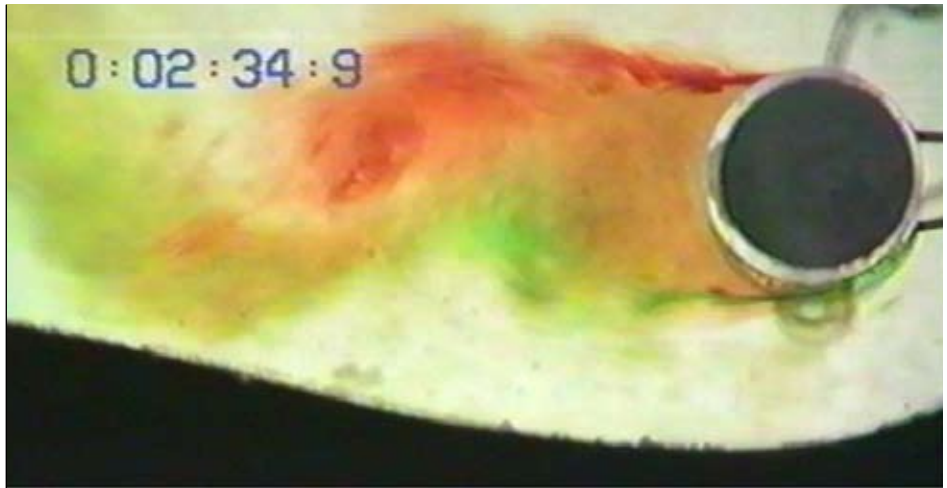


Figure 1. Seabed scour below a pipeline. Flow visualization of the lee wake.

phenomena: the contraction of flow; the formation of a horseshoe vortex in front of the structure; the formation of lee-wake vortices (with or without vortex shedding) behind the structure; the generation of turbulence; the occurrence of reflection and diffraction of waves; and the pressure differentials in the soil that may produce “quick” condition/liquefaction allowing material to be carried off by currents. These changes usually cause an increase in the local sediment transport capacity and thus lead to scour/local erosion. The scour is a threat to the stability of the structure.

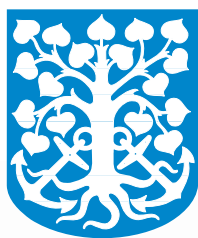
Fig. 1 displays the downstream side of the scour hole that has formed below a pipeline in a laboratory test. The figure illustrates the lee-wake of the pipeline over the scoured bed visualized, using a two-color flow-visualization technique. Flow is from right to left. The pipeline initially sitting on a sandy bed is undermined by the flow. Vortex shedding (visualized in the photograph) eventually controls the scour process. Large scour holes lead to suspended spans of pipelines. The latter, which may be subject to vortex-induced-vibrations, is a serious threat for pipelines. This threat may be in the form of losing pipe’s protective concrete coating as a result of vortex-induced vibrations, or in the form of damage associated with the fatigue life. The results of the work in the previously

mentioned research areas have been published in international journals and conference papers including three books (Fredsoe and Deigaard, 1992, Sumer and Fredsoe, 1997, and Sumer and Fredsoe, 2002; the publisher’s web site [http://www.worldscibooks.com/series/asoe\\_series.shtml](http://www.worldscibooks.com/series/asoe_series.shtml) can be consulted for more information).

The research group has participated in many national and international research programs over the years, several of which have been coordinated by our group, such as SASME (Surf and Swash Zone Mechanics, 1997 – 2000, <http://vb.mek.dtu.dk/research/sasme/sasme.html>), SCARCOST (Scour Around Coastal Structures, 1997 – 2000, <http://vb.mek.dtu.dk/research/scarcost/scarcost.html>), LIMAS (Liquefaction Around Marine Structures, 2001-2004, <http://vb.mek.dtu.dk/research/limas/limas.html>), EPCOAST (Exploitation and Protection of Coastal Zones, 2005-2008, <http://vb.mek.dtu.dk/research/epcoast/epcoast.html>).

## References:

- Fredsøe, J. and Deigaard, R. (1992). *Mechanics of Coastal Sediment Transport*, World Scientific.
- Sumer, B.M. and Fredsøe, J. (2002): *The Mechanics of Scour in the Marine Environment*. World Scientific.
- Sumer, B.M. and Fredsøe, J. (1997): *Hydrodynamics Around Cylindrical Structures*. World Scientific. ■



## Esbjerg Kommune



# The Municipality of Esbjerg

## - takes good care of the oil and gas industry

- Sites** The Municipality of Esbjerg sells attractively situated, fully serviced industrial sites to all types of companies within the oil and gas industry.
- Offices** The Municipality of Esbjerg also provides an advisory service for investors wishing to start businesses within the oil and gas industry. The Municipality is ready with the answers to all types of questions concerning: the purchase of land – electricity, water and heating supplies – taxation – town planning – environmental clearance, and so on.
- Factories** The Municipality of Esbjerg can put you in contact with private firms of estate agents, accountant and solicitors, and with banking firms, concerning the purchase or leasing of:
- office space
  - productions plants
  - warehousing facilities
  - workshop units.
- Contact** Esbjerg Industrial Development Office  
Mr. Tom Nielsen  
Havnegade 1  
DK – 6700 Esbjerg  
Phone: +45 75 12 37 44  
Fax: +45 75 45 27 01  
E-mail: [esbjergcenter@esbjergcenter.dk](mailto:esbjergcenter@esbjergcenter.dk)  
  
[www.esbjergcenter.dk](http://www.esbjergcenter.dk)

### jobnet.dk

The place where  
people find jobs.  
And jobs find people.



That's smart!

#### If you are an employer:

Jobnet.dk gives you the opportunity to find your new employee or to let employees find you. You can place an add on Jobnet for free or search amongst the 270,000 CV's.

You can also choose to receive an email when there's a CV which matches your demands.

On Jobnet you'll find all types of employees – from all sectors and from the entire country.

#### If you are an employee looking for job:

Jobnet.dk gives you the opportunity to find a new job or to let the job find you. Place your CV on Jobnet and inform which job you would like. Jobnet.dk is the biggest job bank in Denmark. Every day there are between

10,000 and 12,000 available positions in all sectors – there's also a job for you!

You're welcome to contact the Danish Employment Service (AF) in Esbjerg if you have questions.

AF consultant Brian Damsgaard

E-mail: [r09bd1@af-dk.dk](mailto:r09bd1@af-dk.dk)

Tel.: +45 79 12 33 44

Personal inquire by appointment only.

Telephones normally open Monday 14.00 - 15.00 and Thursday 12.30 - 14.00. Deviations to this may occur. In such case it will be announced at the switchboard.

jobnet.dk



– use us on the web

# ESVAGT

## International Offshore Support Vessel Operators

Our fleet comprises 18 units i.e. standby-/rescue vessels 100-300+ (DMA, NMA, UK approved), anchor handling/tug/supply/tanker assist vessels and one specialized survey/research/crewchange vessel

*For further information and inquiries please contact*

# ESVAGT

Adgangsvejen 1 · DK-6700 Esbjerg · Denmark  
Phone: +45 76 11 47 00 · Fax: +45 76 11 47 05  
E-mail: opr@esvagt.dk · www.esvagt.dk



## EXSIM Consultants AS

*- Your Partner in Combustion Hazards Analysis*



**EXSIM Consultants AS offers computational fluid dynamic (CFD) analysis of combustion hazards using the EXSIM code**

### **EXSIM Consultants AS provide**

- Consequence predictions
- Accident Analysis
- Consultancy
- Research & Development
- Courses

### **Combustion Hazards handled are**

- Gas explosions
- Gas dispersion
- Smoke & pollutant dispersion
- Mitigation
- Ventilation
- Fires & Radiation

The EXSIM code is a well validated CFD code for analysing gas explosions, gas dispersion and gas fires in industrial environments. The code has been developed by Telemark Technological R&D Centre in Porsgrunn, Norway with support from Shell Research Ltd., UK and the Commission of the European Communities (CEC).

New developments in EXSIM include

- Statistical loads
- Dispersion
- Fires
- Fluid-structure interactions



**EXSIM**  
Consultants AS

EXSIM Consultants AS  
Kjølnes Ring, N-3918 Porsgrunn,  
Norway

Tel: +47 35 57 40 00  
info@exsim-consultants.com  
www.exsim-consultants.com



# Offshore Center Danmark Projects

One of the main activities of Offshore Center Danmark is development projects. Through its members Offshore Center Danmark continuously receives new ideas for innovative development projects. Offshore Center Danmark assists its members in making these ideas grow into concrete projects and helps seeking project funding. During the project Offshore Center Danmark typically takes the role as project coordinator - making sure all the practical issues throughout the project are fulfilled. In most cases Offshore Center Danmark projects are followed by a public event, such as a conference, where the project results are presented.

The next chapter of ON/OFF Yearbook presents the development projects currently undertaken by Offshore Center Danmark.



*Project meeting*



Offshore Center Danmark

# CMS2: Crisis Management Simulator 2

## Leonardo da Vinci Training in Crisis Management



The project is an EU project in developing an on-line course for personnel involved in the crisis management of an oil spill. This could include national coast guards and emergency preparedness agencies, port officials, navy, army, and maritime schools.

### Project Partners

Project partners include Offshore Center Danmark as the project coordinator, and four partners from Norway, Spain, Estonia, and Italy.

Offshore Center Danmark works exclusively with project management but receives technical support from Admiral Danish Fleet and

hired consultants. Port of Esbjerg and South Danish University's Maritime Institute will help in testing the product once the internet course is developed.

1. From Norway **RKK Rogaland** is a technical college with about 600 students who educates young people in all areas of offshore technology including safety and crisis management. The discipline areas are engineering and maritime programs.
2. The Spanish partner is the "**Centro Jovelanos**" **Integral Maritime Safety Training Centre** which is part of the Spanish Safety and Rescue Agency (SASEMAR), a gov-



ernmental body affiliated to the Ministry of Public Works, Transport and Infrastructure through the Spanish Directorate. The centre, which started in 1993, is designed as an integral service centre for training and consultancy. Its' activities are mainly focused on training in maritime safety and marine pollution fighting, VTS operations, safety and environmental response, fire-fighting and pollution prevention and combat.

3. The Estonian partner is **Estonian Maritime Academy** which is a state applied higher education institution. Tallinn Maritime School was established in 1918, and the academy is the legal successor to the school since 1992. It is the only maritime school in Estonia and trains 1250 students as navigators, ship officers, and ship engineers, and within areas of hydrography, hydro-meteorology and port and shipping management.

4. The Italian partner is **Seicom Italia**, which is a web software development company. Its mission is to enable its clients to fully understand the potential of the internet, by proposing effective projects and translating them into business opportunities. They develop websites, and solve various forms of Net and e-commerce based problems. Seicom Italia will develop the on-line training software for the project.

### The Challenge

Each time an oil spill occurs, it has a significant impact on the marine environment and on the nearby coastlines. The marine and coastal ecosystems are detrimentally affected, and economic consequences are enormous.

Maritime traffic is increasing in European waters, which in turn increases the chances for shipping accidents and subsequent oil spills. This makes it essential to have a well functioning European oil spill preparedness and expertise based on cooperation among European maritime member countries. On the basis of recent well-known accidents at sea, e.g. Erika and Prestige, the main objective



of the project is to develop a training concept, which may be used in training situations of individuals, organizations, authorities and shipping companies, who usually participate de facto in responding to environmental disasters and incidents of oil spill at sea. The challenge is to develop new tools and facilities in the process of improving local and international readiness in responding to oil spills in marine environments.

### The Outcome

The training module will by means of a pedagogical catalogue of simulated scenarios facilitate interdisciplinary and international European readiness. Through the use of ICT, the training concept will be developed so that the participants can carry out their contribution to the training scenarios while they are on-the-job.

The pedagogical catalogue will consist of a series of courses tailored to be conducted by means of the website. It will contain a library of variable parameters such as wind, visibility, financial resources, involvement of the press etc. The courses are conducted on-line so that participants and instructors carry out their tasks in relation to responding to an oil spill and providing the environment by the use of the pedagogical catalogue and ship- and oil spill simulators stimulating the situation. Each college partner will develop a training course typical for its region within the framework of the overall course design.

### Objectives

- To generate a low cost, non-destructive platform providing a full-scale environment for training response to incidents of oil spill at the management level.
- To enable participants to stay in their daily surroundings while controlling the same resources, which are also available to them in situations of actual oil spills.

### Target groups

- Educational institutions and maritime training centres
- National and local environmental authorities
- Coast guard authorities
- Shipping companies
- Harbour authorities
- Police and offshore operators

### Expected results

- A learning content management system on the web
- A training module containing the following
  - Interactive homepage as a platform for oil spill training sessions
  - Cases illustrating already known incidents of oil spill at sea
  - Frame for the operational plan
  - Guidelines for national and international co-operation
  - Visualised scenarios
  - Meteorological observatory
  - Library of selected sensitive areas ■



# Small Scale LNG transport

A growing market for the future energy supply is Liquid Natural Gas (LNG) transport. Currently natural gas provides 25% of all energy consumption in the world and the International Energy Agency has forecast that gas demand will grow at a faster rate than oil in the coming years. LNG is natural gas, which has been refrigerated to a cryogenic liquid at a temperature of under -161° Celsius. An Offshore Center Danmark development project is currently looking into the challenges and opportunities of this emerging market.

International energy analysts, have stated that the growth of LNG in the period 2005-2009 will increase by US\$ 67 Billion. Expenditure on LNG facilities will increase from US\$ 7.2 billion in 2004 to US\$ 17.5 billion in 2009.

Currently world LNG transport is exported from South East Asia, the United States, the Middle East and some African countries like Algeria and Nigeria. Import terminals are primarily situated in Japan and the United States.

In Europe there are only 11 LNG terminals at the moment but with many new terminals on the way. Export of LNG is set to start from Norway by 2006 from the Snøvit field in the Barents Sea. The primary importer in Europe is France due to significant lack of domestic supply, but also Spain and Italy are major importers. Germany and the UK are potential major importers in a future LNG import market.

A development and research project for small scale LNG transport in Europe based on natural gas production from the North Sea, will the market and the technology available to develop this energy source. The primary concern in Europe is safety at liquefaction terminals and import terminals, which has an effect on the location of terminal sites.

While large terminals and LNG transport ships exist in the European market area, the development of small scale transport system which is economically feasible would be

beneficial to the European countries in a future where natural gas is predominant over oil as an energy source. Currently economies of scale are making possible the development of huge liquefaction trains at terminals but small terminal sites along European shoreline (in harbours, bays, beachheads) in the future will also be considered as an alternative to meet the demand for energy consumption.

The project, partly financed by the Danish Ministry of Science and Technology (VTU) runs from 2005 to 2007. It is designed as a pilot project to analyse the future market for small scale transport of liquefied natural gas (LNG) and identify low-cost, secure and environmentally friendly Danish methods for near-shore transportation of LNG. While the project focuses on the economic feasibility of such methods in the future, technical aspects of small scale transport will also be considered. A SWOT analysis will be the basis of the project result. ■

## Pilot project in small scale LNG Transport

Project Coordinator  
Offshore Center Danmark

### Partners

COWI A/S  
Aalborg University ( Esbjerg Institute)  
Danish Hydraulic Institute

### Supporting Companies

York Refrigeration ApS  
Endress & Hauser



# Decommissioning of offshore Platforms in Esbjerg

Esbjerg in Denmark has for many years been known as a reliable and competent partner, when it comes to repair and revamping of offshore oil rigs.

In the latest development, the companies in Esbjerg have decided to look into reserving a large permanent quay site alongside the harbour area in Esbjerg for rig repair work. Also an investigation is being made to reserve a neighbouring area for decommissioning of small and medium-sized platforms.

Rig-repair has for many years been a well-established trademark of Esbjerg, and hence decommissioning of platforms is also considered interesting. The Danish oil and gas industry is well-known in relation to good standards for environmental, safety, working environment and certification deliveries to the offshore operators.

In a series of development projects over the past five years, undertaken with Offshore Center Denmark as umbrella organization, decommissioning has been investigated.

A number of Esbjerg companies and institutions have been involved, with the goal of preparing low-cost, safe and environmental friendly methods for disposal of worn-out offshore platforms.

A number of these companies are now considering joining forces to scrap the platforms in the most efficient and environmental-friendly way. As a result, Ribe County has just launched an initial environmental hearing in respect of establishing a permanent rig-repair site and a possible decommissioning site. Until now only positive feed-back has been received.



Also on a pilot project, several companies have already joined forces to decommission a smaller offshore structure on the quay side of Esbjerg Harbour. The experiences from this case will be used to improve the solutions envisaged by the development project.■



## Oil- and Gas Technology Education, Research and Development



### Education

Esbjerg Institute of Technology offers a master education in Oil- and Gas Technology.

The education is international and the language in the education is English.

The education is offered as a full time 2 years education and as a part time education for persons who are in job and want to combine job and education.

For further information: contact Kirsten B. Kirchner on telephone +45 79 12 76 66

or via E-mail: [kbk@aaue.dk](mailto:kbk@aaue.dk)

### Research and development

Esbjerg Institute has extensive collaboration on R&D with companies in the Oil- and Gas sector partly through student projects and partly through R&D projects done by our scientific staff in collaboration with companies. Further the institute has a strong collaboration with Offshore Centre Denmark and supports the Centre's efforts to become technological knowledge centre in the South Danish Region.

For further information: contact Torben Rosenørn on telephone +45 79 12 76 66

or via E-mail: [tur@aaue.dk](mailto:tur@aaue.dk)

## Esbjerg Institute of Technology Aalborg University

Niels Bohrs Vej 8, DK 6700 Esbjerg, Denmark - Telephone: + 4579 12 76 66 - Home page: [www.aaue.dk](http://www.aaue.dk)

# Increased Oil Recovery from the Chalk Fields in the Danish North Sea Sector

Oil in the Danish part of the North Sea is mainly found in chalk reservoirs. Chalk is characterized by having high porosity but low permeability - in other words, it can contain a lot of oil, but the oil is hard to extract. Due to the poor permeability it is only possible to extract a certain amount of the oil - currently the average rate of extraction is around 23%. If it was possible to increase that rate by only 1%, the extra production over a one year period would supply Denmark with enough oil to cover the national oil based energy demand for approximately 2 years. An Offshore Center Danmark project is currently looking into the challenges connected with increasing the extraction rate.

The project objective is to identify and describe the existing and possible techniques enabling to increase oil recovery from the Danish chalk fields by at least 1%. The project will focus on the new Increased Oil Recovery (IOR) techniques which could be used applying the existent knowledge in Denmark and abroad.

The project is funded by Danish Ministry of Science, Technology and Innovation, and is coordinated by Offshore Center Danmark, with partners including Rambøll Oil and Gas, GEUS and Aalborg University (Esbjerg Institute).



Companies supporting the project include DONG E & P, Denerco Oil A/S, Amerada Hess, Baker Oil Tools, and Elsam Engineering.

Work is conducted by GEUS, Aalborg University Esbjerg and RAMBØLL and coordinated by Offshore Center Danmark. Supporting companies lend technical and advisory support where appropriate to them.

At a current stage the prerequisite and screening reports have been written, briefly reviewing the basic tenets of Enhanced Oil Recovery and reservoir engineering methods including PSI (perforation, stimulation, and

isolation), hydraulic fractionation methods and acid injection such as controlled acid injection (CAJ).

A series of EOR and reservoir engineering techniques such as thermal methods, CO<sub>2</sub> injection, other gas techniques, chemicals and MPPM are discussed in the project work. They are analysed according to the following criteria:

- Potential for increased oil production
- Economic costs
- Danish industry advantages
- Safety/Environmental Concerns

Thermal methods include hot water injection, produced water injection, and air injection. Other gas techniques include hydrocarbon gases, inert gases such as nitrogen, and flue gases. Chemicals refer to all chemicals used or considered for EOR techniques. These are extensive and include surfactants, polymers, alkalines, gels, and solvents. MPPM is short for Microbial Permeability Profile Modification and encompasses in situ injection of nutrients to the reservoir micro-organisms.

Access to the reservoir is also included in the study. Three types are used in the Danish North Sea sector: perforation of casings, acid injection, and hydraulic fractionation. It is intended that reservoir and well engineering methods will be combined in the analysis of the EOR techniques.

Technology	Potential for IOR	Economic Cost	Danish Industry Advantages	Safety / Environment
Unit	%	Low/Med./High	Poor/Average/Good	Problems/Unproblematic
<b>EOR Method</b>				
Thermal Methods	?+	Medium/High	Poor	Potential problems
CO <sub>2</sub> Injection	++	High	Poor/Medium	Potential problems Some environmental advantages
Other Gas techniques	? +	Medium	? Medium	Potential Problems
Chemicals	? +	Low High	Poor	Potential problems
MPPM	?	Low	Poor	Unproblematic
<b>Reservoir Access</b>				
Perforation of casings	++	High	Good	Potential problems
Acid Injection	+	Medium (CAJ)	Average	?
Hydraulic Fractionation	+	?	Good	Potential problems

Table 1.1. Describes the distribution of funding of partner hours



## Pilot project Increased Oil Recovery from the Chalk Fields in the Danish North Sea sector

Project Coordinator

Offshore Center Danmark

Partners

GEUS (Geological Survey of Denmark and Greenland)

Aalborg University (Esbjerg Institute)

Rambøll Oil and Gas

Supporting Companies

DONG E&P

Denerco Oil A/S

Amerada Hess

Elsam Engineering

Baker Oil Tools

Examination of the two selected technologies for the IOR have been chosen for further investigation with the adequate laboratory experiments and/or numerical modelling by Aalborg University Esbjerg and GEUS. These are CO<sub>2</sub> injection including CO<sub>2</sub> injection with polymers and CO<sub>2</sub> injection with WAG,

and MPPM (Microbial Permeability Profile Modification).

The project runs from 2005 to 2007 and the results of the project will be presented at an open conference. ■



[www.OffshoreBase.dk](http://www.OffshoreBase.dk)

*Your link to the Danish Offshore Companies*

[www.offshorebase.dk](http://www.offshorebase.dk)

- Search for companies
- News
- Available positions
- Events
- Invitation for tenders
- Technology development projects
- Education
- Links



Offshore Center Danmark



## The VIKING advantage

### Comprehensive offshore solutions

VIKING is an innovator in life-saving equipment for a wide range of offshore installations. Our in depth knowledge of the offshore industry ensures optimal solutions in all phases. From putting together total packages for new buildings, producing custom-designed evacuation systems or personal protective equipment, to professional and convenient servicing and replacement.

- Unique chute or stair based evacuation and embarkation systems
- First class throw overboard and davit launched liferafts
- Extensive line of personal protective equipment
- Total servicing package

See our full range of products on [www.VIKINGSafetyshop.com](http://www.VIKINGSafetyshop.com) or contact one of our worldwide offices for further information.

When you choose VIKING life-saving equipment you choose a sound long term investment.



VIKING LIFE-SAVING EQUIPMENT A/S · Saedding Ringvej 13 · DK-6710 Esbjerg V · Denmark  
Tel. +45 7611 8100 · Fax +45 7611 8101 · [www.VIKING-life.com](http://www.VIKING-life.com)

WHEN IT COMES TO  
**safety**  
THINK VIKING.

# POWER - Pushing Offshore Wind Energy Regions

POWER is a three year project under the ERDF (European Regional Development Fund) supported Interreg IIIB programme. Danish partners are Offshore Center Denmark and EU Vest. The project runs from summer 2004 until summer 2007.

The POWER project unites North Sea regions with an interest in supporting and realising the economic and technological potentials of offshore wind energy. The project assesses environmental and planning as well as acceptance issues of offshore wind farms, supports the development of a reliable supply chain for the sector, and elaborates skills development measures. 37 organisations take part, with representatives from Denmark, Germany, United Kingdom, Netherlands and Belgium. Transnational co-operation between these regions is creating a North Sea competence network for offshore wind energy.

All partner regions face similar problems and opportunities in the sector. A strength of the partnership is the combination of regional expertise in onshore wind energy and in offshore oil and gas industries, which makes exchange of experience and best practise particularly beneficial.

POWER pursues the following objectives:

- To unify offshore wind competence regions around the North Sea
- To exchange experience and to learn from each other
- To set up common strategies and real business to business contacts overcoming economic changes
- To respond to new educational needs on the university and further education levels
- To disseminate the obtained results to others

## Transnational co-operation

Offshore wind energy is by its nature a transnational issue. Because most of the wind energy farms will be erected within the Exclusive Economic Zones, the planning, erection, maintenance and the final removal at the end of the life cycle have to be tackled in a transnational perspective.



*The POWER team at Horns Rev Offshore Wind Farm*

The offshore wind energy technologies and the spatial, economic and educational strategies dealing with offshore wind energy are still in the early stages of development, thus there is a huge demand and need for co-operation.

## Economic Development

Most of the regions involved in the POWER project suffer from high unemployment and economic decline, due to their often relatively peripheral location, the collapse in fish stocks and the decline in the traditional offshore industries. Several of them are EU Objective 2 areas (Esbjerg , Bremerhaven, Lowestoft/ Great Yarmouth, North East England, Husum). Offshore wind energy provides a unique opportunity to regenerate the economies of these coastal communities.

The project partners have identified that offshore wind energy could be an innovative motor for their regional and local development, creating jobs and income for their regions and cities. Therefore transnational co-operation through exchange of their specific experiences, lessons learned from other offshore wind energy projects, best and good practice transfer, common transnational activities and

real projects with tangible outputs in the fields of planning, economic support / supply chain and skills development as well as dissemination will be crucial for the further development of the partner regions and for the North Sea Region as a whole.

## Climate Protection

Wind energy plays an important role in the context of climate protection and the need for a comprehensive change in energy production. In several countries around the North Sea Region (NSR) wind turbines already account for a considerable proportion of electricity supplies. However, onshore wind turbines can be difficult to reconcile with the many existing land interests and this, combined with new wind energy technology, is paving the way for upcoming large-scale offshore wind farms in the NSR.

Especially offshore wind (located in the 12 nautic miles and the Exclusive Economic Zones - EEZ zones) has an enormous potential to contribute substantially to European and global climate protection. The main aim of POWER is to push the use of offshore wind energy power in the participating regions and to enable the public sector to deal with

the multiple challenges. The coastal regions around the North Sea are already confronted with these challenges, some of them are responding with comprehensive future oriented-strategies, combining innovative small and medium sized enterprises with scientific facilities and open-minded public administrations, forming together alliances to push their respective regions towards offshore competence regions.

### New Job Opportunities

The project partners expect that there will be a significant increase in job opportunities in the coming years, which will also result in a higher demand for qualified labour. This has an indirect impact on the respective hinterlands of the coastal areas and thereby supports



## P · O · W · E · R

Pushing Offshore Wind  
Energy Regions

the social cohesion by reducing differences in the development of towns and their rural hinterlands.

The use of more offshore wind energy will also generate new markets in other sectors than the direct offshore wind energy sector (e.g. tourism, aquaculture). These developing markets give the concerned small and medium enterprises and their labour new fields of activities and new job opportunities. This helps to strengthen the economic and social development of the offshore competence regions.

### Supply Chain Studies

One of the first results of the power project is a Supply Chain Study mapping competencies and gaps in the offshore supply chain. The Danish study was carried out by interviews with 20-30 leading offshore wind companies and subsequent analysis. It showed a strong supply chain with only few gaps. Similarly studies were carried out for the East of England and North-Western Germany. A combined study covering the entire North Sea area is currently being conducted.

### Further info on [www.offshore-power.net](http://www.offshore-power.net).

The website features all reports created under the project. On the website it is also possible to sign up for the POWER newsletter. ■

# Offshore Connections

ATCOM ApS delivers professional solutions, based on the clients demands, and which to the greatest extent possible, are based on standard systems and hardware from some of the leading suppliers on the market.

ATCOM ApS is vendor of products from leading suppliers of data transmission and network equipment - wireless as well as cable based.

ATCOM ApS holds special knowledge within areas such as LAN-solutions, Weather monitoring system, VSAT, Wlan, PABX, VoIP, LOS systems and DECT-systems.

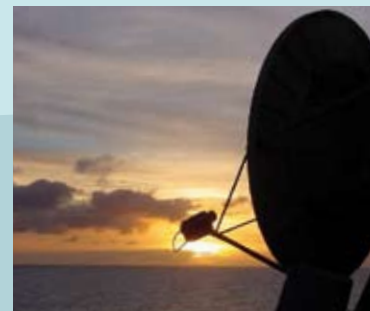
ATCOM ApS implements total solutions within network systems, VSAT, Line Of Sight systems and fibre network (PDH/SDH/ATM/VoIP/FRS). Satellite TV system (CATV).

The company has a number of skilled specialists available, with many years of experience within communication in the offshore sector.

ATCOM ApS undertakes design, installation and service as well as consulting.

Assignment examples undertaken by ATCOM ApS:

- VSAT-installations on rigs and platforms.
- Installation, configuration and maintenance of large telecom systems.
- Installation and configuration of wireless telecom systems on platforms and ships (ATEX approved).
- Automatic Weather Observation Systems (AWOS).
- Remote control systems for VHF/UHF radios via VSAT or Line Of Sight System.
- Mobile Satellite TV systems.



ATCOM ApS Tlf. +45 76123200  
Snedkervej 17 Fax +45 76123299  
DK-6710 Esbjerg V Email: [atcom@atcom.dk](mailto:atcom@atcom.dk)





# Offshore Wind Turbines situated in Areas with strong Currents

**Scour around marine structures is a well known problem. Despite of this, no reliable way to predict scour development exists. A development project under Offshore Center Danmark took the challenge to provide recommendations for prediction of scour around offshore wind turbine monopole foundations situated in areas with strong currents.**

The offshore wind industry is expected to boom in the near future with plans for installation of several thousand wind turbines in the North and Baltic Sea. The majority of these turbines will be situated on erodible seabeds in environments characterized by strong influence of tides, wind-induced currents and breaking waves. When placing wind turbines in such conditions a scour hole will develop around the foundation. It is eminent to take this into account during project design.

The literature features numerous studies on scour development. In order to get an overview and to prepare for the project work, the project team has established a review of existing research and formulas for scour prediction. The three most recent and well-established local scour predicting equations developed by Richardson & Davis, 2001 (HEC-18), Jones & Sheppard, 2000 and Sheppard, 2003 were described in details and later compared to the formulas developed

under the project. An interesting finding in the literature review was the lack of studies on tidal flow environments. Because of this gap in existing formulas a study of scour formation under tidal environment were performed under the project.

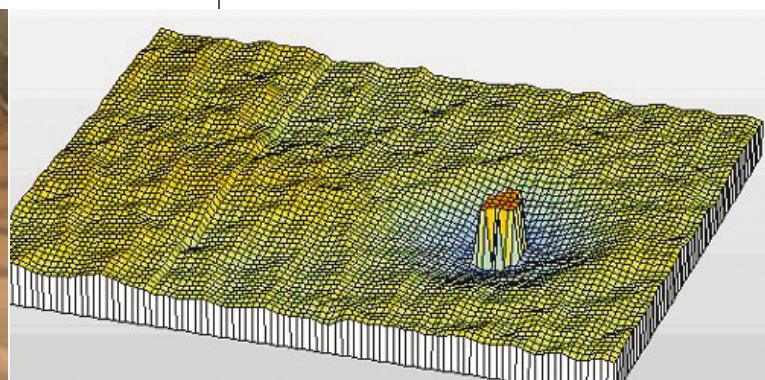
During the project, scour development was studied under various conditions using both scale model tests and numerical simulations.

**Scale model tests were done for the following conditions:**

- Breaking waves
- Non-breaking waves
- Tidal current
- Unidirectional current
- Breaking waves with unidirectional current

**Two different kinds of numerical simulations were done:**

- Simulation of scour formation from breaking waves using Navier-Stokes solver NS3



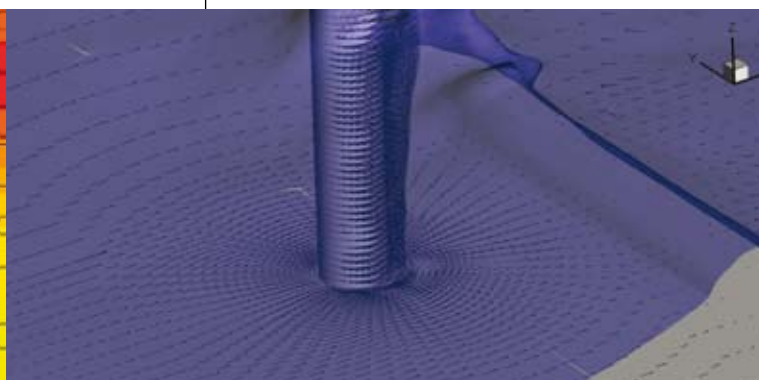
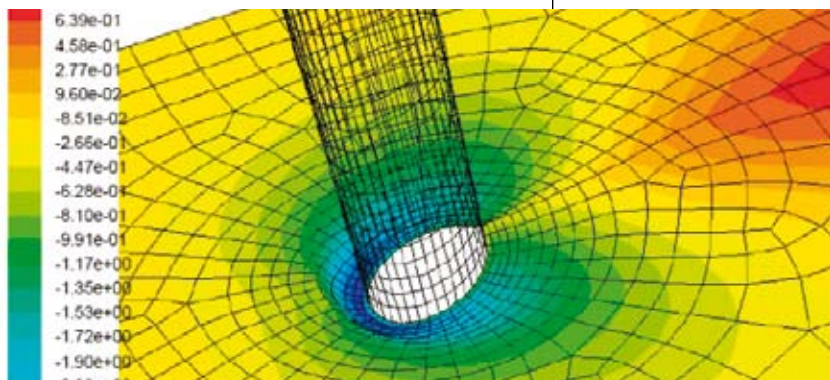
- Simulation of scour formation from unidirectional and tidal current using FLUENT 6.2

**Some general conclusions from the project:**

- 1) Tidal scour seem to yield marginally larger scour depths
- 2) Breaking waves yield significant less scour than a strong current

The project team also chose formulae for prediction of scour as well as outlined methods for estimation of parameters (water depth, flow velocity, marine growth etc.).

The project, partly financed by the Danish Ministry of Science and Technology (VTU) ran from May 2004 to January 2006. The results will be presented at a conference in Esbjerg in February 2006. ■





# Boarding offshore Wind Turbines - a logistic challenge

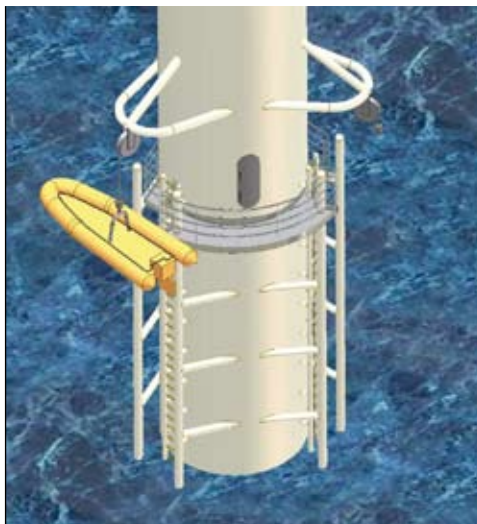
The harsh environment offshore has proven a major challenge to maintainers of offshore wind turbines. Not only do the conditions imply a greater focus on the service aspects of the operation, it could also mean lower availability of the turbines due to access challenges. Increasing availability to offshore wind turbines can have a direct impact of the earnings of the turbines. With this motivation Offshore Center Danmark seized the initiative to start and coordinate a logistical development project aimed at finding safe and economical methods for transportation of service personnel and material to the offshore wind turbines.

The project, partly financed by the Danish Ministry of Science, Technology and Development (VTU), was completed in 2004, after a project period of more than one year. The results of the project were made available to the offshore wind turbine industry and the educational institutions, on a session attended by more than 100 attendees at the "Offshore Wind turbine – Surrounding Facilities" conference at Aalborg University in Esbjerg.

Offshore wind turbines are a segment of the wind turbine business growing rapidly these years. It is also a type of installation that holds great logistical, technical, environmental and economical challenges. Considerable knowledge from the offshore oil and gas related business can be used during the installation of offshore wind turbines, but the area also holds its unique challenges. An excellent example is boarding of the wind turbines, which is partly similar to what is known from oil drilling platforms, but partly has its own characteristic features.

During the task of making offshore wind turbines a reliable and cost-effective energy source, safe access to the installations is an essential component.

In connection with the considerations to be made, it is vital to take into mind that the transfer of personnel and equipment to the



*Fig. 1  
Hydraulic crane by Grumsens Maskinfabrik*

wind turbines should be done as safely as possible taken into account the heavy sea conditions that often exist at an offshore wind farm.

Additionally the economic part of an optimal transfer mode is significant. Availability figures for an onshore wind farm is typically more than 97%, whereas the figures offshore can be substantially lower due to the relatively complex current and wave conditions at sea. In case the access conditions can be improved and hence the availability figures offshore can be increased just a few percentages, this would have a direct impact to the earnings of the wind farm and the total pay-back period of the wind farm. Given that an offshore wind farm such as the the new and extended Horns Rev farm will produce app. 4% of Denmark's total electrical power consumption, this is a key element.

A series of Danish and foreign firms have participated in the development project, with focus on boarding offshore wind turbines and with a large Danish wind farm producer as the reference participant and anchor for the project.

During a panel discussion with the audience, the developers presented and argued for their solutions.

One of the firms was Grumsens Maskinfabrik in Esbjerg (fig. 1), who has developed a crane for wind turbines. The crane has a hydraulic, pressure-compensated winch, which can catch and lift the service crew's landing boat. The company stated that they were positive on the project outcome and the possibilities they were given to analyse the advantages and drawbacks of their method.

Another company who made a presentation was the significant Danish supplier of Life-Saving Equipment for marine usage - Viking Life-Saving Equipment (fig. 2). The company has recently bought a Norwegian company specialised in offshore evacuation and landing systems. It was within this company that an exciting solution of the problematic nature of secure and easy access to the offshore wind turbine was found. The offshore access system consisted of a collapsible spiral stair case, which would be adapted from oil & gas installations to offshore wind farms. Viking stated:



*Fig. 2 Selstair by Viking*



Fig. 3  
Wave compensated boat by  
Sea Service



“The advantage of our development project is that it has been tested successfully over several years within the very demanding offshore oil and gas industry. During the course of the development project, we have made some adjustments in order to develop a more generic method, and it is this method we think can be used for offshore wind farms.”

A number of other methods were also presented, among these a boat with some quite incredible stability characteristics from the Danish company Sea Service (fig. 3).

Finally, the Dutch company Fabricom gave a presentation of their OAS - Offshore Access System (fig. 4). This method had been successfully tested on an oilrig installation in Qatar for transfer of personnel, and the inventor Reinout Prins informed the audience that the project had given him some valuable future input on down-sizing the solution to smaller scale offshore wind turbine installations.

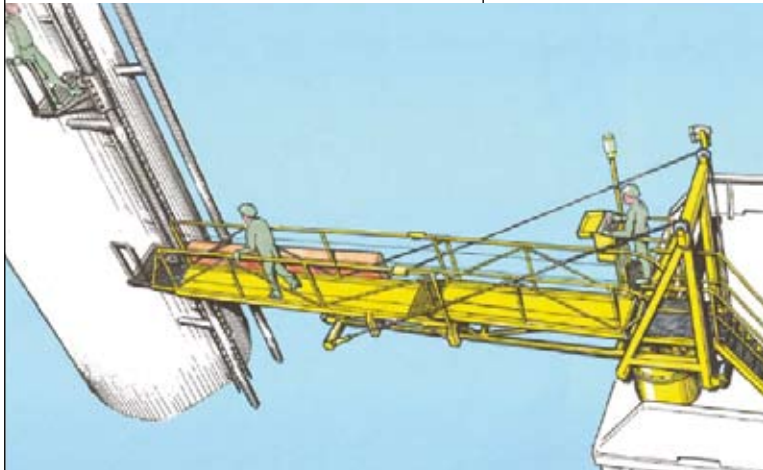


Fig. 4  
Offshore  
Access System by  
Fabricom

In addition to the access methods developed in connection with the project, the traditional access method via boat landing was examined in order to have a reference. The results from the development project were not envisaged as the suggested solution for actual projects, but as a description of generic methods of landing in-

cluding advantages and drawbacks, which later will be adapted to actual conditions. Conclusive findings for the different access methods are summarized in the table below. ■

	Selstair	Vindturbine crane	Wave compensated	Traditional boat landing	Offshore Access System
Advantages	No serial production Nonsensitive to marine growth Flexible Easy inspection Not site specific Can be used omnidirectional Non-dependent on tide	Nonsensitive to marine growth Flexible DP class vessel not required Non-dependent on tide	No serial production Flexible Non-dependent on offshore mechanical systems Less offshore maintenance required Not site specific DP class vessel not required 100% redundant Non-dependent on tide	Non-dependent on offshore mechanical systems Simple structure Less offshore maintenance required May be used omnidirectional DP class vessel not required	No serial production Nonsensitive to marine growth Non-dependent on offshore mechanical systems Less offshore maintenance required Not site specific May be used omnidirectional Non-dependent on tide
Disadvantages	DP class vessel required Remote control of crane Maintenance offshore required Back-up vessel required Interface between stair and platform	Serial production Remote control of crane Maintenance offshore required Supply vessel required Training of personnel required	Traditional boat landing required Back-up vessel required Marine growth	Serial production Marine growth Supply vessel required Training of personnel required	Back-up vessel required

[www.OffshoreBase.dk](http://www.OffshoreBase.dk)

*Your link to the Danish Offshore Companies*



Offshore Center Danmark

# Flooded member detection by ROV

Flooded member detection is an inspection method which is utilized for analyses of offshore steel structures, where pipe sections are used. These structural elements (members) are analysed for possible lack of water resistance which may indicate water leakage at the weldings, which are then selected for closer inspection. The method today is only undertaken by the use of ultrasound, if and when divers are used. This however requires a so-called "living" A-scan in order to be useful and so a radioactive source is instead used when a ROV (Remote Operated Vehicle) is required for inspection purposes. Through development of the inspection equipment it was possible to use ultrasound for ROV. This entails the improvement of safety and handling of ROV in comparison

with the use of radioactive sources. The interest in such equipment which uses ultrasonic waves for ROV purposes is significant among many international underwater equipment operators.

OCD and FORCE Technology had in 2003 and 2004 undertaken a feasibility study in order to map the possibility in using ROV for flooded member detection. The result of the project and the subsequent product development, has now guaranteed the use of Flooded Member Detection with the aid of ultrasonic waves when using remote operated vehicles, so that the problems of safety and handling of radioactive sources is eliminated. The project was completed in 2004 and has today been commercialized by FORCE Technology.

## Project team

Offshore Center Danmark  
FORCE Technology



## An ocean of experience focusing on the future

Continuing a century of service to the global oil and gas industry, Vetco is delivering innovative solutions for complete subsea field developments. These groundbreaking systems combine the reliability of field-proven products with the next generation of technology to reduce our customers' total cost of ownership.

- Industry-leading MS family of metal sealing subsea wellheads for all applications in any water depth
- Standardized subsea production systems for conventional and horizontal completions, including HPHT and beyond
- World class, long-distance subsea controls, compatible with private or internet systems
- Field-proven subsea processing systems now available with new VIEC technology
- HP WITS and PTP systems for more reliable wellbore intervention
- Field-proven systems for delivering electrical power subsea

Contact: Per Bak  
Vetco Gray Denmark  
Maadevej 37, P.O. Box 373,  
6700 ESBJERG, Denmark  
Tel: +45 7610 1000  
Fax: +45 7610 1010  
Email: per.bak@vetco.com



# vetco

[www.vetco.com](http://www.vetco.com)

# Drilling chip logistics

Drilling pipes are under extreme long-term stress under HP/HT drilling conditions in the North Sea. Electronic chips for drilling pipes, so called RF/ID tags can be used to essentially make dumb iron smart, by using the tag to identify age, use and service record of the individual drilling pipe and hence making drilling faster and more efficient.

In a development project over 3 years sponsored by Maersk Contractors and the alarm technologies specialist Laybourn Trading & Technology (LTT), Offshore Center Danmark is an incubator-style setup, administers a project to advance a chip that could stand 500 bar/178 DEG. C. conditions, while sending out a "I am chip number" signal.

Numerous in-situ offshore tests have been completed, with a lot experience gained on the way. Success is now at hand and the commercialization of the product has been initiated.

LTT is a one-man operation, and it was necessary to help the company all the way from financing, through development, project administration, field tests, patenting and commercialization. The project is considered a good example of how an offshore center can make a difference, and a demonstration of how a very large oil company is able to work closely together with even a one-man operation, when the idea is right.

## Project team

Offshore Center Danmark  
Laybourn Trading & Technology  
Maersk Contractors



## A strong team of specialists

*- with a global perspective*

Are you aware that Deloitte has a locally placed Tax Department in Esbjerg which is specialised in helping both Danish and international offshore companies?

- Our assistance covers both companies which are taxed according to the Danish Corporate tax act and companies which are taxed according to the Danish Hydrocarbon tax act.
- We have also experience with handling the reporting process to the Danish tax authorities regarding the employees regardless whether they are taxed according to special low tax rules or to the ordinary tax rules.

Our Tax Department in Esbjerg is working closely together with other tax departments in Deloitte in Denmark and abroad.

As with all of our services, our long-term goal is to build a strong relationship with you and your assignees that is designed to help you meet your global business objectives.

### Contact persons:

Tax partner Tom Eriksen  
Email [teriksen@deloitte.dk](mailto:teriksen@deloitte.dk)

Tax consultant Anette Vium  
Email [avium@deloitte.dk](mailto:avium@deloitte.dk)

# Deloitte.

Audit • Tax • Consulting • Corporate Finance •

Frodesgade 125  
DK-6701 Esbjerg Tel. +45 79 12 84 44  
[www.deloitte.dk](http://www.deloitte.dk)

Member of  
**Deloitte Touche Tohmatsu**







# Offshore Center Danmark Members

Offshore Center Danmark is a member based organization currently counting 131 members. As a member a series of favourable offers are available:

- Possibility to participate in business forums. Currently five forums have been established: HSSEQ (Health, Safety, Security, Environment and Quality), Offshore oil/gas installations, Offshore Wind, Decommissioning and Internationalisation. Each forum counts 15-25 companies and institutions and has about 4 meetings a year – often with locations rotating amongst the members and with special invited guests giving relevant presentations.
- Possibility to participate in special arrangements (conferences, seminars etc.) at a reduced price.
- Many options to network with the other partners in the industry.
- Possibility to participate in Offshore Center Danmark's development projects. Offshore Center Danmark typically takes the role as project coordinator and is also available to help find funding for projects.
- Possibility to make use of Offshore Center Danmarks competencies within consultancy, network to the industry and funding for development projects.
- Listing in [www.offshorebase.dk](http://www.offshorebase.dk) - a database featuring more than 500 Danish offshore companies. Only members of Offshore Center Danmark achieve full listing.
- Access to the Tender section of [www.offshorebase.dk](http://www.offshorebase.dk). Here it is possible to find and post tenders on various development projects in the offshore industry.
- Access to the Virtual Library of knowledge portal [www.offshorecenter.dk](http://www.offshorecenter.dk). Here it is possible to find offshore relevant publications from companies, universities, authorities etc., as well as documentation and minutes of meetings from the board, the business forums and all the projects.

The next chapter of ON/OFF Yearbook presents the members of Offshore Center Danmark.



## Offshore Center Danmark

# Offshore Center Danmark Members

A/S Oil Power  
A2SEA A/S  
ABB A/S  
Amerada Hess ApS  
AM-gruppen A/S  
AMU-Vest  
AN Group  
Arbejdsformidlingen Esbjerg  
Atcom A/S  
Atkins Danmark A/S  
Baltec International Ltd., Scandinavia  
BG Bank, Esbjerg  
Billund Kommune  
Blue Water Shipping  
Blåbjerg Kommune  
Blåvandshuk Kommune  
Bramming Kommune  
Brørup Kommune  
BTM Consult ApS  
Bureau Veritas  
Carl Bro A/S  
COWI  
CT Offshore ApS  
Dan-Equip A/S  
DAN-EX Electric A/S  
Danish Air Transport  
Danish Marine & Offshore Group  
Dansk Industri  
Dansk Svejse Teknik A/S  
DDH Consulting A/S (Hedeselskabet)  
Deloitte Statsautoriseret  
Revisionsaktieselskab  
Den Danske Vedligeholdelsesforening  
DENERCO OIL A/S  
Det Norske Veritas  
DHI - Water & Environment  
DONG  
DTU, Department of Mechanical Engineering  
Endress+Hauser  
Energi E2 A/S  
Erhvervs Akademi Vest  
Esbjerg Erhvervscenter  
Esbjerg Havn  
Esbjerg Kommune  
Esbjerg Offshore Base K/S  
Esbjerg Oilfield Services A/S  
Esbjerg Oiltool A/S  
Esbjerg Safety Consult A/S  
Esvagt A/S  
EU Vest

EUC Vest  
Fanø Kommune  
FH Montage  
Fire-Protect A/S  
Fiskeri- og Søfartsmuseet  
Fjord & Fjord  
Foga Aps  
FORCE Technology, Esbjerg  
Forskningsenheden for Maritim Medicin  
Fyns Kran Udstyr A/S  
Gardit A/S  
GEUS, Danmarks og Grønlands Geologiske  
Undersøgelse  
Grindsted Kommune  
Gulf Offshore Leasing Denmark Aps  
H. J. Hansen Recycling Industry Ltd.  
Helle Kommune  
Hempel A/S  
HH-Consult  
Holsted Kommune  
Hydropower Grene A/S  
Hytør  
Industrialiseringsfonden for Udviklings-  
landene  
JobInVest ApS  
Jutlandia Terminal A/S  
Jørgen Kynde Isoleringsfirma  
Kongstad Safeman  
Laybourn Trading & Technology, L.T. & T.  
LHJ Consult A/S  
LICEngineering A/S  
Lindpro  
Line-X Denmark  
MacArtney A/S Underwater Technology  
Madsens Maskinfabrik ApS  
Maersk Contractors  
Masava Kemi  
Ministeriet for Videnskab, Teknologi og  
Udvikling  
MT Højgaard a/s  
Mærsk Olie og Gas AS  
Niels Winther & Co.  
NIRAS A/S  
Nordsø Elektronik A/S  
Ocean Team Scandinavia  
Odfjell Well Services A/S  
Olesen & Jensen  
Persolit A/S  
Peter Harbo A/S  
PNE Teknik A/S

Pon Power A/S  
Promecon  
QA Consulting A/S  
RAMBØLL  
Ribe Amt  
Ribe Kommune  
Ribe Maskinfabrik  
Rovsing Dynamics A/S  
Sanistål A/S  
Score Danmark A/S  
Selco A/S  
Semco Maritime  
SGS Danmark A/S  
Siemens A/S  
Siemens Wind Power A/S  
Solar Offshore  
STMS - Survival Training Maritime Safety  
Sturnus Engineering  
SURVIVAL A/S Training Center Esbjerg  
Syddansk Universitet  
Uniscrap, Åbenrå  
Valtor Offshore A/S  
Varde Kommune  
Vejen Kommune  
Vestas Northern Europe, Offshore Afd.  
Vetco Gray Denmark  
Viking Life-Saving Equipment A/S  
Vindmølleindustrien  
VSB Industri- og Stålmontage A/S  
Welcon A/S  
YIT A/S  
Ølgod Kommune  
Aalborg Universitet Esbjerg

Offshore Center Danmark currently counts 131 members.

Membership can be obtained through [www.offshorecenter.dk](http://www.offshorecenter.dk) under the menu Medlemslogin (in Danish) or by contacting Offshore Center Danmark: +45 3697 3670 / [info@offshorecenter.dk](mailto:info@offshorecenter.dk).



Offshore Center Danmark



## A/S Oil Power

Boven 2  
6700 Esbjerg  
Phone: +45 75 12 55 55  
Fax: +45 75 12 57 09  
E-mail: oilpower@oilpower.dk

### Contact Person:

Kjeld Christensen  
E-mail: kvc@oilpower.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Repair and maintenance services; Hydraulic equipment; Pumps

### Profile:

Oilpower Hydraulics A/S can offer expertise in the following fields:  
Construction and service of hydraulic systems; Remanufacturing of pumps, motors and cylinders; Manufacturing of hydraulic winches; Subsea technology; Hydraulic pump units; Industrial assembling; Advising and sale of hydraulic components; Importer of Palfinger - Cranepower Marinercranes; Importer of Bauer Hydraulics; Importer of RAC Hydraulic fittings.

## A2SEA A/S

Karetmagervej 11  
7000 Fredericia  
Phone: +45 75 92 82 11  
Fax: +45 75 92 63 75  
E-mail: sales@a2sea.com

### Contact Person:

Johnny Lykke  
E-mail: JRL@a2sea.dk

### Competencies:

Industry Sector: Offshore Wind; Maritime  
Industry Role: Service Provider  
Industry Expertise: Maritime transport; Offshore wind turbines - installation; Offshore wind turbines - service

### Profile:

A2SEA A/S, located in Fredericia, have developed a unique concept for transportation and installation of offshore wind turbines. The method, which has already been applied at several offshore wind farms, is fully developed, tested and patented internationally. A2SEA's vision is to become the preferred international contractor for effective transportation, installation and service of offshore wind turbines.

## ABB A/S

Emil Neckelmanns Vej 14  
5220 Odense SØ  
Phone: +45 65 47 70 70  
Fax: +45 65 47 70 71  
E-mail: abb.dk@abb.com

Advertisement  
page 119

### Contact Person:

Jan Ilsoe  
Direct Phone: +45 65 47 71 00  
E-mail: jan.ilsoe@dk.abb.com

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Supplier;

### Manufacturer:

Industry Expertise: Safety equipment; Compressors and power supply; Manpower services and leasing; Construction; Cranes and crane accessories; Navigation; Courses and Career Training; Pumps; On- and offshore base facilities; Contractors; Process units; Rope and wires; Inspection and classification; Valves; Consulting; Offshore wind turbines - nacelle and electrical parts; Planning; Supply of goods and services; Firefighting and fire safety equipment; Diesel motors and generators; Hydraulic equipment; Electrical and electronic equipment; Communication; Water treatment; Instrumentation; Project planning; Repair and maintenance services

### Profile:

ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs around 103,000 people.  
In Denmark we are around 850 employees.

## Amerada Hess ApS

Østergade 26B  
1100 København K  
Phone: +45 33 30 12 33  
Fax: +45 33 30 12 99

Advertisement  
page 81

### Contact Person:

Annette Bjørke  
E-mail: annette.bjorke@hess.com

### Competencies:

Industry Sector: Oil and Gas  
Industry Expertise: Well services

### Profile:

Amerada Hess ApS is a part of the American oil and gas company Amerada Hess Corporation, which has about 11,000 employees world wide. Amerada Hess has been active on the North Sea since 1963 and has since the completion of the South Arne platform in 1999 started to be widely represented in Denmark. In the Danish part of the organization Amerada Hess have approximately 110 skilled, dynamic and engaged employees working at the main office in central Copenhagen and on Syd Arne.

## AM-gruppen A/S

Høgevej 21  
6700 Esbjerg Ø  
Phone: +45 70 10 77 01  
Fax: +45 75 47 10 09  
E-mail: kontakt@am-gruppen.dk

### Contact Person:

Bent Madsen  
E-mail: bm@am-gruppen.dk

### Competencies:

Industry Sector: Safety and Environment  
Industry Role: Consultant; Educational Institution  
Industry Expertise: Courses and Career Training; Consulting

### Profile:

AM-Gruppen is a consulting company with 40 employees specialised within working environment.

## AMU-Vest

Sp. Møllevvej 304-306  
6705 Esbjerg Ø  
Phone: +45 79 14 03 22  
Fax: +45 79 14 03 00  
E-mail: inst@esb-amu.dk

### Contact Person:

N.Jørgen Pedersen  
E-mail: njp@amu-vest.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind  
Industry Role: Educational Institution  
Industry Expertise: Courses and Career Training

### Profile:

AMU-Vest is the leading centre for adult education in-service training in Western Jutland.

## AN Group

Mejeribakken 8  
3540 Lynge  
Phone: +45 48 25 10 00  
Fax: +45 48 25 46 40  
E-mail: kontakt@am-gruppen.dk

Advertisement  
page 35

### Contact Person:

Aksel Nielsen  
Direct Phone: +45 48 23 12 01  
E-mail: an@angroup.dk

### Competencies:

Industry Sector: Oil and Gas  
Industry Role: Consultant; Service Provider; Supplier; Manufacturer  
Industry Expertise: Construction; Instrumentation; Manpower services and leasing; Consulting

### Profile:

The people of AN GROUP are specialists within production IT & Automation systems. The services of the company include advisory, consultancy and project deliveries from idea level to fully operational systems.

Regardless of the content of a given project, we always work closely together with our clients to achieve the best possible solution for the customer. The client has a unique knowledge of the company's procedures and goals. That is why we prefer to include the client and thereby get an efficient partner, who gives us valuable and relevant knowledge while working towards an optimal solution.

## Arbejdsformidlingen Esbjerg

Exnersgade 33  
6700 Esbjerg  
Phone: +45 79 12 33 44  
E-mail: af-region.ribe@af-dk.dk

Advertisement  
page 85

### Contact Person:

Brian Damsgaard  
E-mail: r09bd1@af-dk.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Municipality  
Industry Expertise: Manpower services and leasing

**Profile:**

Danish Employment Service (AF) is charged with procuring jobs for jobseekers and ensuring that companies find the labour they need. AF assists all applicants in finding help and guidance on recruitment, job hunting or general information on the labour market.

AF's offices and jobshops are distributed all over Denmark. At the local offices, you can find leaflets, use our PCs or make appointments with AF staff for personal guidance.

**Atcom ApS**

Snedkervej 17  
6710 Esbjerg V  
Phone: +45 76 12 32 00

Advertisement  
page 95

**Contact Person:**

Michael Thisgaard  
E-mail: mt@atcom.dk

**Competencies:**

Industry Sector: Service  
Industry Role: Consultant; Supplier; Manufacturer  
Industry Expertise: Communication

**Profile:**

ATCOM ApS delivers professional solutions, based in the customers demands, and which to the greatest extent possible are based on standard systems and hardware from some of the leading suppliers on the market.

ATCOM ApS is vendor of products from leading suppliers of data transmission and network equipment - wireless as well as cable based.

ATCOM ApS holds special knowledge within areas such as LAN-solutions AWOS, VSAT, Wlan, PABX, LOS systems and DECT-systems.

ATCOM ApS implements total solutions within network systems, VSAT, radio chains and (PDH/SDH) and fibre network. The company has a number of skilled specialists available.

ATCOM ApS can undertake installation as well as act as consultant.

ATCOM ApS is Danish-owned and was founded in 2000. The company was established on the basis of many years of experience within communication in the offshore sector.

Examples of assignments undertaken by ATCOM ApS:

- VSAT-installations on rigs and platforms.
- Installation, configuration and maintenance of large telecom systems.
- Installation and configuration of wireless telecom systems on platforms and ships (ATEX approved).
- Weather observation systems (AWOS).
- Remote control systems for VHF/UHF radios via VSAT and radio chains.

**Atkins Danmark A/S**

Nordre Dokkaj 7  
6700 Esbjerg  
Phone: +45 76 12 44 00  
Fax: +45 76 12 44 05

**Contact Person:**

Finn Ewert Christensen  
Direct Phone: +45 76 12 44 10  
E-mail: finn.ewert.christensen@atkinsglobal.com

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Safety and Environment  
Industry Role: Consultant  
Industry Expertise: Planning; Consulting; Project planning

**Profile:**

Atkins has worked within oil and gas since 1975. Today Atkins has 400 oil and gas experts distributed over 11 offices in Europe, the US, the Middle East and Asia. Atkins works on all stages in typical oil and gas projects. From conceptual design through project management, pre-design, planning and commissioning to decommissioning.

**Baltec International Ltd., Scandinavia**

Bagvej 6  
5700 Svendborg  
Phone: +45 60 65 46 84

**Contact Person:**

Carl-Ove Thor  
E-mail: thor@baltec.de

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Supplier; Manufacturer  
Industry Expertise: Offshore wind turbines - service; The Ampelmann - safe connection between boat and platform; Repair and maintenance services; Navigation; Maritime transport; Safety Equipment; Transportation equipment; Consulting

**Profile:**

Baltec International is building to-days Offshore Service Catamarans with tomorrow's technology. And if you want we build your catamarans in aluminium. We fit your demands to our revolutionary Ocean Runner design. We would also like to inform you about the connection platform - the Ampelmann. For your safety.

**BG Bank, Esbjerg**

Kongensgade 58  
6700 Esbjerg  
Phone: +45 76 13 68 00  
Fax: +45 76 13 68 81  
E-mail: esbjerg@bgbank.dk

**Contact Person:**

Harald Grønlund  
Direct Phone: +45 76 13 68 41  
E-mail: hagr@bgbank.dk

**Competencies:**

Industry Role: Consultant; Service Provider  
Industry Expertise: Consulting; Banking and insurance services

**Profile:**

BG Bank is the third biggest bank in Denmark with departments all over the country. BG Bank offers a complete program of financial services within banking, mortgage credit and research.

**Blue Water Shipping**

Trafikhavnvej 11  
Postboks 515  
6701 Esbjerg  
Phone: +45 79 13 41 44  
Fax: +45 79 13 46 47  
E-mail: bwsebj@bws.dk

Advertisement  
page 71

**Contact Person:**

Kurt Skov  
E-mail: kskov@bws.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
Industry Role: Service Provider  
Industry Expertise: Automotive transport; Offshore wind turbines - service; On and offshore base facilities; Stevedoring; Maritime transport; Air transport

**Profile:**

Blue Water is an international shipping, transport and freight forwarding company with head office in Esbjerg. Blue Water was established in 1972 and employs 540 people in Denmark.

**BTM Consult ApS**

I C Christensens Allé 1  
6950 Ringkøbing  
Phone: +45 97 32 52 99  
Fax: +45 97 32 55 93  
E-mail: btm@btm.dk

**Contact Person:**

Birger T. Madsen  
E-mail: btm@btm.dk

**Competencies:**

Industry Sector: Offshore Wind  
Industry Role: Service Provider  
Industry Expertise: General Information

**Profile:**

BTM Consult ApS, BTM-C, is an independent consultancy company specialized in services regarding renewable energy. BTM-C believes it is vital that its advice should be impartial and guards this independence carefully. The staff at BTM-C has been working with wind energy utilization since 1979.

**Bureau Veritas**

Østbanegade 55/2/tv  
2100 København Ø  
Phone: +45 77 31 10 00

**Contact Person:**

Peter Balleby  
E-mail: peter.balleby@dk.bureauveritas.com

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Educational Institution  
Industry Expertise: Consulting; Courses and Career Training; Inspection and classification; Construction

**Profile:**

With its network of 500 offices and more than 12.000 quali-

fied technical experts in more than 120 countries, Bureau Veritas Group is niquely placed to support customers with services that generate high added value and are intended to guarantee the legality and conformity of their operations, reduce the risks they incur, and measure and improve the performance of their organisation.

### Carl Bro A/S

Granskoven 8  
2600 Glostrup  
Phone: +45 43 48 60 60  
Fax: +45 43 63 65 67

#### Contact Person:

Trine Borum Bojsen  
E-mail: tbb@carlbro.dk

#### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Safety and Environment  
Industry Role: Consultant  
Industry Expertise: Safety Equipment; Repair and maintenance services; Instrumentation; Construction; Contractors; Inspection and classification; Firefighting and fire safety equipment; Electrical and electronic equipment; Manpower services and leasing; Consulting; Offshore wind turbines – service; Project planning; Planning

#### Profile:

Carl Bro Group is an international technical consultancy company based in Denmark, Sweden, the UK and Ireland where we have a number of subsidiary offices. We provide consultancy services in the fields of building, transportation, water, environment, energy and industry.

### COWI A/S

Parallelvej 2  
2800 Kongens Lyngby  
Phone: +45 45 97 22 11  
Fax: +45 45 97 22 12  
E-mail: cowi@cowi.dk

#### Contact Person:

Johnny Mikkelsen  
Direct Phone: +45 45 97 27 49  
E-mail: jmi@cowi.dk

#### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Safety and Environment  
Industry Role: Consultant  
Industry Expertise: Consulting; Project planning; Manpower services and leasing; Repair and maintenance services; Inspection and classification; Well services; Instrumentation; Communication; Recycling; Construction; Firefighting and fire safety equipment; Process units; Offshore wind turbines – rotor; Offshore wind turbines – foundation; Offshore wind turbines – tower; Planning; Offshore wind turbines - nacelle and electrical parts.

#### Profile:

COWI provides engineering assistance in all phases of development, operation and decommissioning of offshore fields.

### CT Offshore ApS

Jernbanegade 32/st/th  
5450 Otterup  
Phone: +45 64 87 27 26  
Fax: +45 64 87 27 80  
E-mail: mail@ctoffshore.dk

Advertisement  
page 39

#### Contact Person:

Paw Cortes  
E-mail: pc@ctoffshore.dk

#### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime  
Industry Role: Consultant; Service Provider  
Industry Expertise: Offshore wind turbines - installation; Consulting

#### Profile:

Offshore Consulting Team. -Company Expertise- Elaboration of tender documentation- Evaluation of Quotations & Project budget- Project management offshore- Offshore representatives- Installation supervisors- Offshore Construction work- Offshore wind turbine installation- Offshore Cable installation.

### Dan-Equip A/S

Taurusvej 18  
6700 Esbjerg  
Phone: +45 75 45 10 55  
Fax: +45 75 45 10 82  
E-mail: dan-equip@dan-equip.dk

#### Contact Person:

Knud Pedersen  
Direct Phone: +45 76 11 50 70  
E-mail: kp@dan-equip.dk

#### Competencies:

Industry Sector: Service  
Industry Role: Supplier  
Industry Expertise: Pipes and plates

#### Profile:

Stockholder and supplier of: Pipes - ASTM/DIN, Fittings - ASTM/DIN/JIS, Flanges - ASTM/DIN/JIS, Valves - ASTM/DUN/JIS, Bolts - ASTM/DIN, Structural pipes and sections - ASTM/API/DIN.

### DAN-EX Electric A/S

Grønlandsvej 11  
4681 Herfølge  
Phone: +45 56 21 35 00  
Fax: +45 56 21 35 01  
E-mail: mail@dan-ex.dk

#### Contact Person:

Finn Simonsen  
E-mail: f.simonsen@dan-ex.dk

#### Competencies:

Industry Sector: Service  
Industry Role: Consultant; Service Provider; Supplier  
Industry Expertise: Consulting; Electrical and electronic equipment.

#### Profile:

The Danish EX-center. We are specialist in EExi. Our experience is your safety. - Flameproof Electric Equipment - EExde-Distributionboards - EExde-Switchboard & panels

- EExe-Terminalboxes in polyester and stainless steel - EExde-Controlpanels - EExp-Pressurized panels - EEx-Alarm equipment - EExi-Intrinsic Safety.

### Danish Air Transport

Kolding Airport  
Lufthavnsvej 7  
6580 Vamdrup  
Phone: +45 75 58 37 77  
Fax: +45 75 58 37 22  
E-mail: info@dat.dk

#### Contact Person:

Gitte Eriksen  
E-mail: gitte@dat.dk

#### Competencies:

Industry Sector: Service  
Industry Role: Service Provider  
Industry Expertise: Air transport

#### Profile:

DAT is a Danish airline delivering everything from fixed scheduled flights to charter and transport assignments. Our business foundation is a bit unusual since it is not based on an aim of becoming a large airline with impressive aircraft. We work with aircraft and flight because we like it. When we choose aircraft type for our fleet, we take into consideration not merely needs and financial circumstances but to a much larger extent our knowledge of the aircraft's comfort, safety, and strength. That is one of the reasons why we deliver a very high level of dependability; or to put it in a different way: We fly on time and keep our appointments.

### Danish Marine & Offshore Group

Nørremarksvej 27  
9270 Klarup  
Phone: +45 98 31 77 11  
Fax: +45 98 31 77 55  
E-mail: mf@tofko.dk

#### Contact Person:

Mogens Tofte Koch  
E-mail: mk@tofko.dk

#### Competencies:

Industry Sector: Oil and Gas  
Industry Role: Industry Association

#### Profile:

Danish Marine & Offshore Group is an association whose members are Danish companies offering products, process equipment and services to the offshore industry. The motto of the association is: 'together we are strong' and their purpose is to create a cooperation between the members so they can support and complement each other and through that gain various advantages for the customers.

### Dansk Industri

H.C. Andersens Boulevard 18  
1787 København V  
Phone: +45 33 77 33 77  
Fax: +45 33 77 33 00  
E-mail: di@di.dk

#### Contact Person:

Anne Mette Høiler  
E-mail: amh@di.dk



**Competencies:**

Industry Role: Industry Association  
 Industry Expertise: Consulting; General Information

**Profile:**

The Confederation of Danish Industries (Dansk Industri - DI) is a private organisation funded, owned and managed entirely by currently 6,400 companies within the manufacturing and service industries.

**Dansk Svejse Teknik A/S**

Helgolandsgade 17  
 6700 Esbjerg  
 Phone: +45 75 13 13 99  
 Fax: +45 75 13 13 94  
 E-mail: dst@dst-as.com

**Contact Person:**

Max Storgaard  
 E-mail: ms@dst-as.com

**Competencies:**

Industry Sector: Oil and Gas  
 Industry Role: Service Provider  
 Industry Expertise: Repair and maintenance services; Welding equipment; Construction

**Profile:**

Dansk Svejse Teknik A/S is a Danish company in the business of manufacturing mainly components and solutions for the offshore- and processindustry.

**DDH Consulting A/S (Hedeselskabet)**

Natur & Vandmiljø  
 Ringstedvej 20  
 4000 Roskilde  
 Phone: +45 46 30 03 10  
 Fax: +45 87 28 10 01  
 E-mail: hedeselskabet@hedeselskabet.dk

**Contact Person:**

Preben Boock  
 Direct Phone: +45 46 30 08 14  
 E-mail: pb@hedeselskabet.dk

**Competencies:**

Industry Sector: Safety and Environment  
 Industry Role: Consultant  
 Industry Expertise: Consulting

**Profile:**

DDH has more than 1,000 employees and is one of Denmark's leading companies in the nature and environment sectors.

DDH offers consultancy services, service and maintenance, operations, contractor services and commercial trade within forestry, landscape, landscape gardening, environment and energy.

Internationally, the group has activities in a large number of countries, primarily in Scandinavia, Germany, Poland and the Baltic States besides in United Kingdom and Ireland, as well as a number of developing countries.

**Deloitte  
Statsautoriseret Revisionsaktieselskab**

Frodesgade 125  
 6700 Esbjerg  
 Phone: +45 79 12 84 44  
 Fax: +45 79 12 85 45  
 E-mail: esbjerg@deloitte.dk

Advertisement  
page 101

**Contact Person:**

Tom Eriksen  
 E-mail: teriksen@deloitte.dk

**Competencies:**

Industry Role: Consultant; Service Provider  
 Industry Expertise: Banking and insurance services; Consulting

**Profile:**

Deloitte works with a wide range of both private and public organisations. We offer a range of support services including:

- Auditing
- Accounting
- Tax
- Relocation
- Information technology
- Environment
- Management consultancy

In Denmark the history of Deloitte goes back to 1901 to the very beginning of the profession in Denmark. Today we have 2,150 employees throughout the country in 20 cities of which 4 are in Greenland. We serve more than 13,000 clients and we are part of Deloitte Touche Tohmatsu, which has 120,000 people in around 150 countries.

**Den Danske Vedligeholdelsesforening**

Vedligeholdshuset  
 Prinsessegade 83  
 7000 Fredericia  
 Phone: +45 75 91 44 55  
 Fax: +45 75 91 44 56  
 E-mail: ddv@ddv.org

**Contact Person:**

Svend Åge West  
 E-mail: west@jensen.mail.dk

**Competencies:**

Industry Sector: Service  
 Industry Role: Consultant; Service Provider

**Profile:**

Den Danske Vedligeholdelsesforening (DDV) was established in 1978 with the declared purpose of creating a forum for exchange of experience between Danish companies within the area "maintenance".

**DENERCO OIL A/S**

Kongevejen 100C  
 Postboks 110  
 2840 Holte  
 Phone: +45 45 46 95 00  
 Fax: +45 45 46 95 15  
 E-mail: denerco@denerco.dk

**Contact Person:**

Flemming Kolkjær Sørensen

Direct Phone: +45 45 46 95 01  
 E-mail: fks@denerco.dk

**Competencies:**

Industry Sector: Oil and Gas

**Profile:**

DENERCO OIL is a privately held upstream oil and gas group participating in 10 licences in the Danish, German and Dutch part of the North Sea.

The group's considerable investments since 1986 have resulted in participation in five producing oil fields: Syd Arne, Siri, Nini, Cecilie and Lulita.

In 2001 the company became operator for the first time when acquiring a 50 % interest in the largest German offshore exploration licence B 20 008/64.

In 2003 DENERCO OIL was awarded a 50% interest in and the operatorship of two Dutch offshore exploration licenses.

**Det Norske Veritas**

Bavnehøjvej 6  
 6700 Esbjerg  
 Phone: +45 79 12 86 00  
 Fax: +45 79 12 86 01  
 E-mail: esbjerg@dnv.com

Advertisement  
page 64

**Contact Person:**

Jørgen Traun  
 Direct Phone: +45 79 12 86 10  
 E-mail: jorgen.traun@dnv.com

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Safety and Environment  
 Industry Role: Service Provider  
 Industry Expertise: Courses and Career Training; Inspection and classification; Offshore wind turbines - service

**Profile:**

Our primary service has since the start up of the first Danish oil and gas fields been verification of offshore installations and pipelines. In this job our independence is the key, we are an independent body who provide our services without being influenced through ownership, commercial connections or any other way. In addition to this we have an increasing number of activities onshore among other things in connection with major building and construction jobs and lately pressure equipment installations. We have over a period of well over 20 years built a strong competence in the major subject areas, but also drawn on a broad international network to guarantee an optimum service to all our customers no matter where the job is.

**DHI - Water & Environment**

Agern Alle 5  
 2970 Hørsholm  
 Phone: +45 45 16 92 00  
 Fax: +45 45 16 92 92  
 E-mail: dhi@dhi.dk

Advertisement  
page 64

**Contact Person:**

Vagner Jakobsen  
 Direct Phone:  
 E-mail: vj@dhi.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Safety and

## Environment

Industry Role: Consultant; Service Provider; General Institution; Research Institution

Industry Expertise: Offshore wind turbines – service; Instrumentation; Water treatment; Consulting; Offshore wind turbines – foundation; Offshore wind turbines - installation

### Profile:

DHI is an independent, self-governing, research and consulting company transferring knowledge of water into value for our customers. With respect to design optimization, environmental impact assessment, and environmental management of large-scale offshore projects (oil & gas as well as wind farms), DHI possesses a body of experience and an array of advanced problem solving tools, which are unsurpassed worldwide. We support project owners, developers, designers, contractors, consultants and authorities. We offer a wide range of services including:

Metocean monitoring systems;  
Data for design and operation;  
Model testing (wave loads, scour protection);  
Baseline studies (hydrographic, sediment, biological, chemical);  
Assessment of seabed conditions;  
Modelling of contaminant fate and effects;  
Decommissioning and cessation evaluation;  
Laboratory tests, GLP studies;  
Biodiversity surveys and monitoring;  
Pipeline design incl. landfill;  
LNG terminals;  
Monitoring, model testing, CFD and numerical modelling.

## DONG

Agern Alle 24-26  
2970 Hørsholm  
Phone: +45 45 17 10 22  
Fax: +45 45 17 10 44  
E-mail: dong@dong.dk

Advertisement  
page 74

### Contact Person:

Lars Bruvold  
E-mail: lbv@dong.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Safety and Environment  
Industry Expertise: Well services

### Profile:

DONG E&P is the operator of the Siri field together with the Cecilie and the Nini fields. DONG E&P carries out exploration and production of oil and gas in Denmark, Norway, United Kingdom, Faroe Islands and Greenland and carries out inspection, maintenance and repair of all offshore oil & gas transmission pipeline systems in the Danish Sector.

## DTU, Department of Mechanical Engineering

Bygning 403  
Nils Koppels Allé  
2800 Kongens Lyngby  
Phone: +45 45 25 13 86

### Contact Person:

Preben Terndrup Pedersen  
Direct Phone: +45 45 25 13 86

### Competencies:

Industry Role: Consultant; Educational Institution; General

## Institution; Research Institution

Industry Expertise: Consulting; Courses and Career Training

### Profile:

Technical University of Denmark, Department of Mechanical Engineering

## Endress+Hauser

Poppelgårdvej 10-12  
2860 Søborg  
Phone: +45 70 13 11 32  
Fax: +45 70 13 21 33

### Contact Person:

Kasper Adersen  
Direct Phone: +45 39 55 81 28  
E-mail: kasper.adsersen@dk.endress.com

### Competencies:

Industry Sector: Oil and Gas  
Industry Role: Supplier; Manufacturer

### Profile:

Endress+Hauser is a leading supplier of measuring instruments and automation solutions for the industrial process engineering industry.

## Energi E2 A/S

Teglhølm  
A.C. Meyers Vænge 9  
2450 København SV  
Phone: +45 44 80 60 00

### Contact Person:

Per Hjelmsled Pedersen  
E-mail: php@e2.dk

### Competencies:

Industry Sector: Offshore Wind

### Profile:

ENERGI E2 is a leading, Danish production and energy trading company supplying competitive electricity and heat services in selected countries in Europe. E2 owns and operates seven large and ten small power stations and CHP plants in Eastern Denmark and has a share in a number of hydropower plants in Sweden and Norway. In addition to this E2 owns wind turbines in Sweden, Greece and Spain and is involved in the development of the UK offshore wind energy sector as well as a huge wind energy project in the German part of the North Sea.

## Erhvervs Akademi Vest

Spangsbjerg Kirkevej 103  
6700 Esbjerg  
Phone: +45 76 13 32 00

Advertisement  
page 10

### Contact Person:

Eise Pedersen  
Direct Phone: +45 76 13 32 70  
E-mail: etjp@eavest.dk

### Competencies:

Industry Sector: Oil and Gas; Service  
Industry Role: Educational Institution  
Industry Expertise: Courses and Career Training

### Profile:

At Business Academy WEST we have today 10 different short-cycle higher education programmes with approx. 550 students and approximately 20 nationalities are represented. The Business Academy WEST is a school with a large number of students, but we are still focusing on the nearness between students and teachers as being of high priority.

## Esbjerg Erhvervscenter

Havnegade 1  
6700 Esbjerg  
Phone: +45 75 12 37 44  
Fax: +45 75 45 27 01

Advertisement  
page 85

### Contact Person:

Tom L. Nielsen  
E-mail: tln@esbjerg erhvervscenter.dk

### Competencies:

Industry Role: Service Provider; Industry Association

### Profile:

Esbjerg Chamber of Commerce & Industry - The unifying centre for trade and industry in Esbjerg.

Esbjerg Chamber of Commerce & Industry is an association of companies, organisations, education centres etc. with the joint purpose of promoting trade and industry in Esbjerg.

Our mission is to create a solid basis for growth and development and to make it attractive to run and establish a business in Esbjerg.

## Esbjerg Havn

Hulvejen 1  
6700 Esbjerg  
Phone: +45 75 12 41 44

### Contact Person:

Ole Ingrisch  
E-mail: oi@portesbjerg.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment

### Profile:

The Port of Esbjerg is Denmark's western gateway.

In 2004 supply vessels made more than 700 calls at the port of Esbjerg and offshore related companies in Esbjerg numbered upwards 250 representing a total turnover of DKK 6.5 billion.

## Esbjerg Offshore Base K/S

Nordre Dokkaj 7  
6700 Esbjerg  
Phone: +45 75 13 10 22

### Contact Person:

Ole Kristensen  
E-mail: ok@eob.dk

### Competencies:

Industry Sector: Oil and Gas; Service  
Industry Role: Service Provider; Supplier; Industry Association

Industry Expertise: Compressors and power supply; Manpower services and leasing; Diesel motors and generators; Drilling tools/supplies; On and offshore base facilities; Air transport; Automotive transport; Tanks and storage equipment; Maritime transport; Supply of goods and services; Cleaning of tanks; Chemicals and drilling mud; Stevedoring; Transportation equipment; Consulting

**Profile:**

Esbjerg Offshore Base (EOB) is closely connected with the oil and gas activities in the Danish part of the North Sea. EOB's most important task is - 24 hours a day - to be available for service for the oil companies, operators and other partners, in order to secure that the search for and production of oil and gas can take place under the best conditions possible.

**Esbjerg Oilfield Services A/S**

Staget 1  
Postboks 1093  
6701 Esbjerg  
Phone: +45 75 12 57 11  
Fax: +45 76 13 24 01  
E-mail: eos@eos.as

**Contact Person:**

Kjeld Jespersen  
Direct Phone: +45 76 13 24 25  
E-mail: kj@eos.as

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Supplier; Manufacturer  
Industry Expertise: Cranes and crane accessories; Planning; Manpower services and leasing; Leasing of tools/equipment; Job/career placement; Repair and maintenance services; Pipes and plates; Supply of goods and services; Welding equipment; Scaffolding; Project planning; Inspection and classification; Construction; Consulting

**Profile:**

Offshore construction, NDT services, fabrication of spools, pipes and fittings, pressure vessels and containers, CE marking capabilities. Offshore labour trades (certified welders).

**Esbjerg Oiltool A/S**

Håndværkervej 67  
6710 Esbjerg V  
Phone: +45 75 15 64 00  
Fax: +45 75 15 61 43  
E-mail: eot@estool.dk

**Advertisement**  
page 77

**Contact Person:**

Alfred Sørensen  
Direct Phone: +45 79 15 10 25  
E-mail: alfred@esbjergoiltool.dk

**Competencies:**

Industry Sector: Oil and Gas  
Industry Role: Supplier  
Industry Expertise: Supply of goods and services; Planning; Wellheads and X-mas Trees; Leasing of tools/equipment; Pipes and plates; Valves

**Profile:**

Stockholders of: Pipes and Tubulars in ASTM/API Qualities - Flanges and Fittings in ASTM/API Qualities - Studbolts in ASTM/API Qualities - Gaskets in ASTM/API Qualities - Valves

- Heat Treatment Consumables. Service/Rental: Heat Treatment - Hot-tapping - Heat treatment in Furnaces.

**Esbjerg Safety Consult A/S**

Fiskerihavnsgade 30  
6700 Esbjerg  
Phone: +45 75 12 24 12  
Fax: +45 75 12 11 31  
E-mail: mail@safetyconsult.dk

**Contact Person:**

Ib C. Nielsen  
E-mail: icn@west-marine.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Safety and Environment  
Industry Role: Consultant; Supplier; Educational Institution  
Industry Expertise: Consulting; Courses and Career Training; Manpower services and leasing; Safety Equipment; Air transport; Project planning; Inspection and classification; General Information

**Profile:**

Esbjerg Safety Consult A/S offers high quality professional consultancy and instruction in Health, Safety, Environment, and Quality assurance (HSEQ). We have a proven record and wide experience in these areas from the offshore industry, offshore windparks and the armed forces. Our portfolio is based on fully documented concepts applied by leading companies all over the world. Our consultants have a wide experience in working with HSEQ management and in cooperating with civil authorities on both national and international levels. We offer high quality services matching the financial resources our customers wish to invest in HSEQ. Investing in HSEQ matters contribute towards increased efficiency, improved working environment, and a reduction in overheads.

**Esvagt A/S**

Adgangsvejen 1  
6700 Esbjerg  
Phone: +45 76 11 47 00  
Fax: +45 76 11 47 05

**Advertisement**  
page 86

**Contact Person:**

Ole Ditlev Nielsen  
Direct Phone: +45 76 11 47 16  
E-mail: opr@esvagt.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider  
Industry Expertise: Safety Equipment; Offshore wind turbines - service; Maritime transport

**Profile:**

Operating stand-by/rescue and supply vessels. Designing and manufacturing of rescue equipment.

**EU Vest**

Niels Bohrs Vej 6  
6700 Esbjerg  
Phone: +45 36 97 35 00  
Fax: +45 36 97 35 01  
E-mail: euvest@euvest.dk

**Contact Person:**

Per Rask Jensen  
Direct Phone: +45 36 97 35 03  
E-mail: prj@euvest.dk

**Competencies:**

Industry Sector: Service  
Industry Role: Consultant; Service Provider  
Industry Expertise: General Information; Consulting

**Profile:**

Business Development Centre West (EU Vest) was established in 1997 as a public partnership institution (I/S) and is a co-operation between the municipalities of Blaaby, Blåvandshuk, Bramming, Brørup, Esbjerg, Fanø, Helle, Holsted, Ribe, Varde, Vejen and Ølgod and the county of Ribe - located on the west coast of Jutland in Denmark.

EU Vest is a public non-profit organisation where all income is used for activities and services for the SMEs in the region.

EU Vest has the overall objective of promoting innovation and growth within the regional business community.

With 16 employees in offices in Esbjerg and Brussels, EU Vest has the aim to raise capital and to advise in the areas of product development, IT, export, management, employment development and EU-projects in private businesses.

**EUC Vest**

Sp. Møllevej 72  
6700 Esbjerg  
Phone: +45 79 13 45 11  
E-mail: eucvest@eucvest.dk

**Advertisement**  
page 6

**Contact Person:**

Poul Arne Callesen  
E-mail: pahc@eucvest.dk

**Competencies:**

Industry Sector: Oil and Gas  
Industry Role: Educational Institution  
Industry Expertise: Courses and Career Training

**Profile:**

EUC Vest offers a wide range of educations within skilled craftsmanship, service and in-service training.

**FH Montage**

Måde Industrivej 21  
6705 Esbjerg Ø  
Phone: +45 76 12 44 44  
Fax: +45 76 12 44 40  
E-mail: flemming@fh-montage.dk

**Contact Person:**

Flemming Høgsberg  
E-mail: flemming@fh-montage.dk

**Competencies:**

Industry Sector: Service  
Industry Role: Service Provider  
Industry Expertise: Scaffolding; Pumps; Pipes and plates

**Profile:**

We carry out various tasks onshore as well as offshore in Denmark, Norway, Sweden and Germany. We can offer our service, expertise and experience in the following areas:

Pipe welders; Pipe Fitters; Pumping activity; Service



engineers; Stainless Steel industry; Shoer apparatus; Stainless Steel; Mounting of ventilation; Carpenters/Joiners; Scaffolding construction.

## Fire-Protect A/S

Hjulmagervej 15 B  
7100 Vejle  
Phone: +45 75 75 46 64  
Fax: +45 75 85 46 64  
E-mail: mail@fire-protect.dk

### Contact Person:

Pieter Mouritsen  
E-mail: pm@fire-protect.dk

### Competencies:

Industry Sector: Service; Safety and Environment  
Industry Role: Consultant; Service Provider  
Industry Expertise: Manpower services and leasing; Leasing of tools/equipment; Courses and Career Training; Consulting; Inspection and classification; Firefighting and fire safety equipment

### Profile:

Fire-Protect A/S is the only Danish company specialised in onshore and offshore application of passive fire protection. We are therefore in a position to provide the very best solutions when you need to protect your crew, valuable equipment or steel structures in areas at risk of fire.

Choosing Fire-Protect A/S as your business partner, you are assured of the correct application of our products, the highest level of professional service and a wellqualified and very experienced workforce.

We have worked on large projects worldwide, and our customers have expressed their satisfaction with our services. Our approach is characterised by attention to detail, professional service and flexibility. We are well aware that the foundation of our business is customer satisfaction, and our future lies in our ability to ensure future projects from our customers – a philosophy for which we are often rewarded when existing customers contact us with new projects.

## Fiskeri- og Søfartsmuseet

Tarphagevej 2  
6710 Esbjerg V  
Phone: +45 76 12 20 00  
Fax: +45 76 12 20 10  
E-mail: fimus@fimus.dk

### Contact Person:

Morten Hahn-Pedersen  
E-mail: mhp@fimus.dk

### Competencies:

Industry Sector: Oil and Gas; Maritime  
Industry Role: Research Institution

### Profile:

It's natural for a town by the sea, a town that owes its origin and its growth to its harbour, its shipping and fishing to have a maritime museum. Esbjerg is no exception: the Fisheries and Maritime Museum was opened on the occasion of Esbjerg Harbour's centennial in 1968.

The Fisheries and Maritime Museum is the largest institution of its kind in Denmark focusing on Danish fisheries and marine biology, the tidal wetlands (Wadden Sea), west Jutland coastal shipping and the North Sea offshore

industries. So the theme of the museum can truly be said to be "people and the sea".

Like any other state museum, the Fisheries- and Maritime Museum is committed to collection, registration, preservation, research and consultancy within its particular field of work. This work consumes the majority of the museum's resources, but all this is not really apparent to the museum's visitors. However, these activities form the basis for the museum's informative work, for the books, articles, lectures, videos, films etc.

## Fjord & Fjord

Jernbanegade 18  
6740 Bramming  
Phone: +45 76 76 60 00  
Fax: +45 75 17 30 42

### Contact Person:

Keld Fjord  
E-mail: keld@fjord-fjord.dk

### Competencies:

Industry Sector: Oil and Gas; Service; Safety and Environment  
Industry Role: Service Provider; Educational Institution  
Industry Expertise: Project planning; Consulting; Courses and Career Training

### Profile:

Fjord & Fjord is a professional advisory- and consultant company. Our field of activity is safety and working environment both offshore and onshore.

We are a professional health service organization similar to the EHS and deliver products on a 100% liberal term and we know that we are no better than our last performed assignment.

Our products are:

- Safety and Project Management
- Education in safety and behaviour
- Offshore Safety and Environment
- Safety handbooks, folders and posters
- Construction Safety Adviser
- Teambuilding

## Foga Aps

Trafikhavnsvej 19  
6700 Esbjerg  
Phone: +45 75 45 11 44  
Fax: +45 75 45 11 76

### Contact Person:

Jenny Knudsen  
E-mail: fish.info@foga.dk

### Competencies:

Industry Sector: Maritime; Service  
Industry Role: Service Provider  
Industry Expertise: Navigation

### Profile:

FOGA's aim is to supply assistance of experienced fishing skippers as marine advisers to the offshore-industry and to contribute with establishing communication between the fishery and offshore industry and thereby create a cooperative environment.

## FORCE Technology, Esbjerg

Østre Gjesingvej 7  
6715 Esbjerg N  
Phone: +45 76 10 06 50  
Fax: +45 75 45 00 86  
E-mail: info@force.dk

Advertisement  
page 2

### Contact Person:

Niels Aage Giversen  
Direct Phone: +45 76 10 06 65  
E-mail: nag@force.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Educational Institution; General Institution; Research Institution  
Industry Expertise: Inspection and classification; Consulting; Courses and Career Training; Construction

### Profile:

Quality Systems - Non-destructive testing (NDT) - Materials - Corrosion - Design - Calibration - Welding - Environment - Radiation safety - Condition monitoring/maintenance - Polymer materials - Flexible pipes - Crane bearing maintenance - Concrete - Coating/painting - Evaluation of overtrawlability - Underwater vehicles - Dynamic potisioning - Risers and conductors - Marine operations - Seakeeping - Wind and current loads - Serviceability and safety - Pressure equipment.

## Forskningsenheden for Maritim Medicin

Østergade 81-83  
6700 Esbjerg  
Phone: +45 79 18 35 61  
Fax: +45 79 18 22 94  
E-mail: vny@fmm.sdu.dk

### Contact Person:

Vibeke Nygaard  
Direct Phone: +45 79 18 35 61  
E-mail: vny@fmm.sdu.dk

### Competencies:

Industry Role: Consultant; Educational Institution; Research Institution  
Industry Expertise: Consulting

### Profile:

The Research Unit of Maritime Medicine (RUMM) in Denmark is a research unit with statutory duties. From 1992 to 1999, RUMM was an institute under South Jutland University Centre in Esbjerg, and it was then called the Institute of Maritime Medicine. As of January 2000, the institute was reconstructed into an independent research unit attached to the University of Southern Denmark, Esbjerg.

It is the aim of the Research Unit to assist seafarers, fishermen and employees on marine platforms with expertise within the specific fields of safeguarding and developing the best possible working environment, health and safety. The aim is achieved through research, documentation, counselling and training.

## Fyns Kran Udstyr A/S

Fiskebrogade 22  
6700 Esbjerg  
Phone: +45 75 12 36 00  
Fax: +45 75 12 36 21  
E-mail: eku@fyns-kran.dk

### Contact Person:

Poul A. Jensen  
E-mail: paj@fyns-kran.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Supplier; Manufacturer  
Industry Expertise: Rope and wires; Cranes and crane accessories; Offshore wind turbines – tower; Hydraulic equipment; Safety Equipment; Inspection and classification; Leasing of tools/equipment

### Profile:

All kind of steel wire ropes (Randers & Casar), chains, slings, fittings, kenter and accessories - Webbing equipment, lashing - All kind and sizes of ropes - Safety equipment, hoists, cranes, winches, lifting clamps and tackle - Vacuum lifting and components - Lifting magnets, yokes and tools - Mooring buoys and Fender - Ladders, pip clamps, fall protection equipment - Container fittings, escape climbing nets, helideck nets - Blocks, swivels, shackles and general iron ware - Anchoring and mooring systems - Spreaders and grabs.

## Gardit A/S

Erik Glippingsvej 6  
8800 Viborg  
Phone: +45 86 62 44 99  
Fax: +45 86 61 11 99  
E-mail: gardit@gardit.dk

### Contact Person:

Ib Johanson  
E-mail: ij@gardit.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Service  
Industry Role: Service Provider  
Industry Expertise: Surface treatment and corrosion resistance; Repair and maintenance services; Painting and coating services; Firefighting and fire safety equipment; Manpower services and leasing; Project planning; Scaffolding

### Profile:

Gardit A/S has set up a large organisation specialising in surface treatment and corrosion protection of steel and concrete constructions of any sizes. For more than two decades up to 200 specialists have been constantly involved in corrosion control and surface treatments at offshore structures. These specialists know everything there is to know about this highly technical field - and they continue to keep abreast of all new methods and techniques - especially in the North Sea environment.

## GEUS, Danmarks og Grønlands Geologiske Undersøgelse

Øster Voldgade 10  
1350 København K  
Phone: +45 38 14 20 00

### Contact Person:

Statsgeolog Erik Thomsen  
Direct Phone: +45 38 14 24 24  
E-mail: et@geus.dk

### Competencies:

Industry Sector: Oil and Gas  
Industry Role: Consultant; Service Provider; Research Institution  
Industry Expertise: Geotechnical equipment; Geotechnical/ Geophysical services

### Profile:

The Geological Survey of Denmark and Greenland, GEUS, is a research and advisory institute in the Danish Ministry of the Environment. The survey also operates in the private sector. Energy resources is one of five Survey working areas: A special obligation for GEUS is to support governmental action plans and policies in Denmark and Greenland. The aim is to provide data and advice to support a high degree of domestic energy supply. Focus is on the effective exploration and exploitation of Danish national resources of oil and natural gas, and alternatives, notably geothermal energy.

## Gulf Offshore Leasing Denmark Aps

Amerikavej 1, 1. sal  
6700 Esbjerg  
Phone: +45 79 12 88 88  
Fax: +45 75 17 15 65  
E-mail: hbach@mail.dk

### Contact Person:

Helge Bach Nielsen  
E-mail: hbach@mail.dk

### Competencies:

Industry Sector: Oil and Gas; Service  
Industry Role: Service Provider  
Industry Expertise: Supply of goods and services; Leasing of tools/equipment

### Profile:

Gulf Offshore Leasing Ltd, the first company in what was to become the Gridpath Group, was formed on the 9th January 1997. Its main business was the leasing of offshore containers in Doha in Qatar and Esbjerg, Denmark. Gulf Offshore Leasing forms the basis of the companies Leasing Division. Gulf Offshore (Denmark) was formed as a branch office of Gulf Offshore Leasing Ltd in May 2003. Gulf Offshore (Denmark) is managed by Helge Bach Nielsen who is also a Director of the company. The branch office is responsible for offshore leasing and logistics operations in Denmark, Norway and the Netherlands.

## H. J. Hansen Recycling Industry Ltd.

Havnegade 110  
5000 Odense C  
Phone: +45 63 10 91 00  
Fax: +45 63 10 91 01  
E-mail: hjhansen@hjhansen.dk

### Contact Person:

Jørgen Henriksen  
E-mail: jhenriksen@hjhansen.dk

### Competencies:

Industry Sector: Safety and Environment  
Industry Role: Service Provider  
Industry Expertise: Recycling

### Profile:

Protecting the environment and optimizing the utilization of the world's raw materials are two sides of the same coin.

For H.J.HANSEN the idea is not new - for more than 125 years this idea has formed the basis of our recycling business.

## Hempel A/S

Lundtoftevej 150  
2800 Kongens Lyngby  
Phone: +45 45 93 38 00

### Contact Person:

Bo Bluhme  
Direct Phone: +45 45 27 35 10  
E-mail: bb@dk.hempel.com

### Competencies:

Industry Expertise: Surface treatment and corrosion resistance

### Profile:

The HEMPEL GROUP of companies was established in 1915 by Mr J C Hempel with the motto of "Quality and Service", which is still the hallmark of the HEMPEL GROUP. Over the years both content and meaning have been adjusted to meet changing market demands. HEMPEL operates within several strategic segments. These include marine paints, protective coatings, container coatings, decorative paints and yacht paints.

The first HEMPEL factory started production in 1915 in Denmark. The Group has since grown to become a world-wide enterprise comprising 3 global research and development facilities, 18 manufacturing plants, 47 sales offices and more than 130 stock points strategically located on all five continents. In short, wherever you are, HEMPEL is always nearby, ensuring prompt delivery of freshly produced quality coatings supported by HEMPEL's world-renowned service.

## HH-Consult

Glamstervej 22  
6710 Esbjerg V  
Phone: +45 76 10 40 55  
Fax: +45 76 10 40 56  
E-mail: esbj@hh-consult.dk

### Contact Person:

Joan B. Bach  
E-mail: jbb@hh-consult.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Service Provider  
Industry Expertise: Job/career placement; Construction; Consulting; Surface treatment and corrosion resistance; Repair and maintenance services; Manpower services and leasing; Diving and underwater equipment; Welding equipment; Project planning; Safety Equipment; Inspection and classification; Planning

### Profile:

HH-Consult A/S is a company of consulting engineers established in 1984, and is today part of the Holstberg Group A/S with office facilities and subsidiaries in Denmark, Norway and Sweden. HH-Consult employs engineers, inspectors, project managers and other highly qualified professionals within a multitude of disciplines which enables us to provide a wide range of services to the industry.

## Hydropower Grene A/S

Lammefjordsvej 2  
6715 Esbjerg N  
Phone: +45 75 14 44 44  
Fax: +45 74 14 45 45  
E-mail: info@hydropower.dk

Advertisement  
page 121

### Contact Person:

Leif N. Dircksen  
Direct Phone: +45 75 14 44 98 - 244  
E-mail: lnd@hydropower.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Hydraulic equipment; Pumps; Repair and maintenance services; On and offshore base facilities; Cranes and crane accessories

### Profile:

We stock high-quality hydraulic equipment of all distinguished marks and have up-to-date repair facilities including a test rig in our workshop in Esbjerg. ISO 9001.

## Hytor

Glentevej 13  
6705 Esbjerg Ø  
Phone: +45 76 14 19 00

### Contact Person:

Finn Høst  
Direct Phone: +45 76 14 19 21  
E-mail: finn.hoest@hytor.dk

### Competencies:

Industry Sector: Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Repair and maintenance services; Leasing of tools/equipment; Engine cylinders and accumulators; Electrical and electronic equipment; Hydraulic equipment; Offshore wind turbines - nacelle and electrical parts; Instrumentation; Valves; Pumps; Cranes and crane accessories, Contractors; Compressors and power supply

### Profile:

Hytor is a trade and engineering company providing products within the areas of process control, gaskets, high-pressure equipment, compressors, pneumatics and special tools.

## IFU/IO - The Industrialization Fund for Developing Countries

Bremerholm 4  
1069 København K  
Phone: +45 33 63 75 00  
Fax: + 45 33 32 25 24  
E-mail: ifu@ifu.dk

### Contact Person:

Brian Muggeridge Andersen  
E-mail: ban@ifu.dk

### Competencies:

Industry Sector: Development

### Profile:

Description: For the purpose of promoting economic activity in developing countries, IFU has been created to promote

investments in these countries in collaboration with Danish trade and industry. IFU offers capital and advice to joint venture enterprises in developing countries.

## JobInVest ApS

Vestkraftgade 1  
6700 Esbjerg  
Phone: +45 70 30 09 64  
Fax: +45 70 30 09 85  
E-mail: jobinvest@jobinvest.dk

### Contact Person:

Arvid Stück  
E-mail: arvid.stuck@jobinvest.dk

### Competencies:

Industry Sector: Service  
Industry Role: Consultant; Service Provider  
Industry Expertise: Courses and Career Training; General Information; Job/career placement

### Profile:

JobInVest is owned by 3F Billund, 3F Varde, 3F Kongeåen, 3F Esbjerg og 3F Transporthuset Esbjerg.

Our goal is to be active in the development of the labour force in the region.

## Jutlandia Terminal A/S

Europakaj  
PO Boks 151  
6700 Esbjerg  
Phone: +45 75 13 60 22  
Fax: +45 75 13 69 00  
E-mail: mail@jut.dk

### Contact Person:

Peter Sonnichsen  
Direct Phone: +45 75 45 11 11  
E-mail: ps@stevedoring.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Service  
Industry Role: Service Provider  
Industry Expertise: Tanks and storage equipment; Planning; Stevedoring; Maritime transport; Supply of goods and services; On and offshore base facilities; Chemicals and drilling mud; Diving and underwater equipment; Project planning; Repair and maintenance services

### Profile:

You only need one partner in Denmark to take care of all base requirements. Located in Esbjerg - Denmark's gateway to the oil and gas fields in the North Sea. JUTLANDIA can offer the following services: Hazardous and Non Hazardous Chemical Handling and Storage - Drilling Mud Handling and Storage - Pipeyard - Office Accommodation - Warehousing - Stevedoring - Ships Agency - Logistics - Freight Forwarding - Project Freight Forwarding and Management - Customs Clearance - Scandinavian and European Distribution Systems-Rail-Sea-Road - Rail Tracks next to quayside - Chemical Supply - Offshore Containers and Tanks - Bulk Plant Facilities - Own quay-10.5 mtrs depth - Air Freight - Courier.

## Jørgen Kynde Isoleringsfirma

Hammeren 10  
Tarp  
6715 Esbjerg N  
Phone: +45 75 16 81 00  
Fax: +45 75 16 75 30  
E-mail: j.kynde@get2net.dk

### Contact Person:

Jørgen Kynde  
E-mail: j.kynde@get2net.dk

### Competencies:

Industry Sector: Service  
Industry Role: Service Provider  
Industry Expertise: Repair and maintenance services; Manpower services and leasing; Valves; Instrumentation

### Profile:

Jørgen Kynde Isolering is an insulating company with 35 years of experience within the following areas: Technical insulation, sound insulation, establishing cold rooms, delivery and erection of panel walls and ceilings as well as asbestos/fire insulation for both on an offshore facilities.

## Kongstad Safeman

Stærevej 2  
6705 Esbjerg Ø  
Phone: +45 76 11 50 00  
Fax: +45 76 11 50 01  
E-mail: kosa@kosa.dk

### Contact Person:

Susanne Ingemann  
E-mail: si@kosa.dk

### Competencies:

Industry Sector: Safety and Environment  
Industry Role: Consultant; Supplier; Educational Institution  
Industry Expertise: Courses and Career Training; Safety Equipment

### Profile:

As a total supplier of personal safety equipment Kongstad Safeman plays an active role in order to protect the employed in every work situation possible.

## Laybourn Trading & Technology, L.T. & T.

Gilleleje Hovedgade 47  
3250 Gilleleje  
Phone: +45 48 36 18 64  
Fax: +45 48 36 18 14  
E-mail: bl-ltt@mail.tele.dk

### Contact Person:

Bent Laybourn  
E-mail: bl-ltt@mail.tele.dk

### Competencies:

Industry Expertise: Drilling tools/supplies

### Profile:

Laybourn Trading & Technology, L.T. & T. has a thorough knowledge of the offshore. Amongst other things Laybourn Trading & Technology, L.T. & T. has invented electronic chips (RF/ID tags) for drilling pipes logistics.



## LHJ Consult A/S c/o LHJ Consult GmbH

Slukefterweg 15c  
24955 Harrislee  
Phone: +49 4611601200  
Fax: +49 4611601202  
E-mail: lhj@contech-m.com

### Contact Person:

Lars Højlund-Jacobsen  
Direct Phone: +45 51 88 92 25  
E-mail: contact@lhj-consult.com

### Competencies:

Industry Sector: Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Educational Institution  
Industry Expertise: Consulting; Process Safety management; Safety Management; QHSE management systems; ATEX rules; Environmental Accounting; Construction; Courses and Career Training

### Profile:

LHJ Consult is a consulting engineering company founded in 2001 by the company LHJ-Consult GmbH as LHJ Consult ApS, and became a public limited company in 2005. We work nationally as well as internationally. We employ engineers and other highly qualified staffs within the industry e.g offshore, construction, manufacturing, pharmaceuticals, logistics and training and take on many different kinds of projects, from the small to the very large.

## LIEngineering A/S

Østergade 4/st/th  
6700 Esbjerg  
Phone: +45 75 18 16 88  
Fax: +45 75 18 16 40  
E-mail: nfg@liceng.dk

### Contact Person:

Morten Christensen

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Safety and Environment  
Industry Role: Consultant; Service Provider; Supplier  
Industry Expertise: Repair and maintenance services; Diving and underwater equipment; Consulting

### Profile:

LIEngineering is an engineering company specialised in fluid dynamics, structural dynamics, subsea engineering and underwater acoustics. We deliver specialised services comprising analysis, design, project supervision and project administration. We supply specialised components and structures for subsea applications.

## Lindpro

Bådebrogade 1  
6700 Esbjerg  
Phone: +45 76 11 49 00  
Fax: +45 76 11 49 01  
E-mail: esbjerg@lindpro.dk

### Contact Person:

Morten Fals  
E-mail: mf@lindpro.dk

### Competencies:

Industry Sector: Oil and Gas; Maritime; Service  
Industry Role: Supplier  
Industry Expertise: Manpower services and leasing; Well services; Repair and maintenance services; Safety Equipment; Instrumentation; On and offshore base facilities; Communication; Navigation

### Profile:

Lindpro is one of Denmark's leading companies within electrical and process control installations. The company has more than 15 years of experience within the offshore sector.

## LINE-X Danmark A/S

Dalager 4  
2605 Brøndby  
Phone: +45 39 30 33 88  
Fax: +45 39 30 33 99  
E-mail: info@line-x.dk

Advertisement  
page 20

### Contact Person:

Kasper Helger  
E-mail: kasper@line-x.dk

### Competencies:

Industry Sector: Oil and Gas, Offshore Wind, Service  
Industry Role: Supplier; Manufacturer  
Industry Expertise: Painting and coating services, Surface treatment and corrosion resistance

### Profile:

LINE-X is an almost indestructible alternative to traditional paints. Line-X is applied by spray and will place itself as a dense membrane binding together aluminium, steel, wood, reinforced concrete, glass fibre, foam and more.

## MacArtney A/S Underwater Technology

Gl. Guldagervej 48  
6710 Esbjerg V  
Phone: +45 76 13 20 00  
Fax: +45 75 11 72 20  
E-mail: mac-dk@macartney.com

### Contact Person:

Niels Erik Hedeager  
E-mail: neh@macartney.com

### Competencies:

Industry Sector: Maritime; Service  
Industry Role: Consultant; Service Provider; Supplier  
Industry Expertise: Diving and underwater equipment

### Profile:

The MacArtney Group supplies products and engineering solutions to the worldwide Underwater Technology Market.

Our aspiration is to maintain our continued success by using our experience and our understanding of customers' expectation.

## Madsens Maskinfabrik ApS

Morsøgade 85  
6700 Esbjerg  
Phone: +45 75 12 05 33  
Fax: +45 75 12 09 98  
E-mail: MMesbjerg@mail.tele.dk

### Contact Person:

Erik Madsen  
E-mail: mmesbjerg@mail.tele.dk

### Competencies:

Industry Sector: Oil and Gas; Service; Safety and Environment  
Industry Role: Supplier; Manufacturer  
Industry Expertise: Ventilation; Firefighting and fire safety equipment; Construction  
Safety Equipment; Transportation equipment

### Profile:

Madsens Maskinfabrik, Esbjerg ApS is located in the Port of Esbjerg, Denmark's largest fishing and offshore port. Our company produces equipment and machines to the offshore industry as well as to the fish meal industry and the food industry. The production primarily includes the use of stainless steel.

Over the last 25 years our company has upgraded and refined its production facilities and knowledge of stainless steel.

Our keywords are high quality, honesty and co-operation. Since 1987, products to the offshore industry have been developed and today, Madsens Maskinfabrik offers a wide range of products including: Safety showers, hoses reels and foam stations, cabinets for tools and safety equipment, telephone hoods, ducting and dampers, transport baskets, access bridges (aluminium), tubing drifts (plastic). Furthermore, our company develops machines and products by request of the individual customer, and today, the production also includes an increasing use of aluminium.

## Maersk Contractors

Kanalen 1  
6700 Esbjerg  
Phone: +45 76 14 77 00  
Fax: +45 76 14 77 32  
E-mail: esbjerg@maersk-contractors.com

### Contact Person:

Ejnar Sørensen  
Direct Phone: +45 76 14 77 62  
E-mail: eso060@maersk-contractors.com

### Competencies:

Industry Sector: Oil and Gas; Maritime; Safety and Environment  
Industry Role: Service Provider  
Industry Expertise: Safety Equipment; Firefighting and fire safety equipment; Drilling tools/supplies; Contractors; Construction

### Profile:

Maersk Contractors comprises a number of service companies providing various specialised services to the oil industry. Maersk H2S Safety Services: Detection Equipment - Protection Equipment - H2S Safety Courses - Contingency Planning/Consultancy - Equipment Maintenance - Fire Drills. Maersk Technical Services: Ultrasonic Testing - Magnetic Particle Inspection - Eddy Current Testing - Dye Penetrant Testing - Ultrasonic Thickness Measurement - Welding Supervision - Technical Consultancy - Infrared Thermography - Engine Overhaul - Vibration Monitoring - Corrosion Monitoring.

## Masava Kemi ApS

Nordre Ringvej 18  
5700 Svendborg  
Phone: +45 66 10 90 60  
Fax: +45 66 10 90 13  
E-mail: masava@masavakemi.com

Advertisement  
page 49

### Contact Person:

Michael Schmidt  
E-mail: mps@masavakemi.dk

### Competencies:

Industry Sector: Oil and Gas; Service  
Industry Role: Service provider; Supplier; Manufacturer  
Industry Expertise: Cleaning of tanks

### Profile:

MASAVA KEMI has since 1970 been ahead at 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 are useable on all water stands surfaces.

## Ministeriet for Videnskab, Teknologi og Udvikling

Bredgade 43  
1260 København K  
Phone: +45 33 92 97 00  
Fax: +45 33 32 35 01  
E-mail: vtu@vtu.dk

### Contact Person:

Tina Rud Mogensen  
E-mail: trm@vtu.dk

### Competencies:

Industry Role: Government Agency

### Profile:

The Ministry of Science, Technology and Innovation was created in November 2001 in extension of the former Ministry of Information Technology and Research to comprise the universities (research and education), industrial research and Denmark's policy on technology and innovation.

The object of the Ministry is to promote the interaction of trade and industry, centres of research and education and to strengthen coordination in pursuance of industry and research policy.

## MT Højgaard a/s

Knud Højgaards Vej 9  
2860 Søborg  
Phone: +45 39 54 40 00

### Contact Person:

Bente Østerbye  
Direct Phone: +45 22 70 96 67  
E-mail: bost@mthojgaard.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind  
Industry Role: Service Provider; Supplier  
Industry Expertise: Offshore wind turbines – foundation; Construction

### Profile:

With more than 5,000 employees and annual sales of just under DKK 7.4 billion, MT Højgaard is Denmark's leading contractor.

We work with customers across Denmark, and, as frontrunner in the development of efficient construction processes, we routinely bring both large and small contracting projects to successful completion. For us, the customer always comes first. Whatever you're building.

## Mærsk Olie og Gas AS

Kanalen 2  
6700 Esbjerg  
Phone: +45 75 45 13 66  
Fax: +45 79 11 18 26

### Contact Person:

Kurt Normann Nielsen  
Direct Phone: +45 79 11 10 40  
E-mail: knn@maerskoil.dk

### Competencies:

Industry Sector: Oil and Gas

### Profile:

Mærsk Olie og Gas AS (Maersk Oil) is a company owned by A.P. Møller – Mærsk A/S, and is part of the A.P. Møller – Maersk Group.

Maersk Oil was established in 1962, when Mr A. P. Møller was awarded the concession for oil and gas exploration and production in Denmark. In 2003, the concession period was extended from 2012 until 2042 and terms and conditions were adjusted as of 1 January 2004.

## Niels Winther & Co.

Nordre Dokkaj 1  
6700 Esbjerg  
Phone: +45 75 12 83 55  
Fax: +45 75 12 86 17  
E-mail: info@nielswinther.dk

### Contact Person:

Henrik Otto Jensen  
Direct Phone: 76 12 23 60  
E-mail: hoj@nielswinther.dk

### Competencies:

Industry Sector: Maritime  
Industry Role: Service Provider  
Industry Expertise: Maritime transport

### Profile:

Niels Winther & Co. was founded as authorized shipbrokers and shipowners in 1931. Since that time the company has developed by responding directly to the varied requirements of the shipping industry.

This background as shipbrokers and shipowners has provided us with a sound foundation for the expansion of our shipping services offered by the company.

Niels Winther & Co is today a fully independent shipping company which provides high quality services and representation for many of the worlds best known companies.

## NIRAS A/S

Skolegade 30  
Postboks 122  
6701 Esbjerg  
Phone: +45 75 13 50 22  
Fax: +45 75 13 49 68

### Contact Person:

Henning Andersen  
Direct Phone: +45 79 14 61 10  
E-mail: han@niras.dk

### Profile:

With its 900 employees NIRAS is a large consulting engineering company in Denmark. The company was founded in 1956 and since then has expanded through natural growth and acquisition of other companies.

The growth and mergers have enriched NIRAS with a large number of competencies, both within the usual and the specialised engineering disciplines, project management and the development of human resources. We are therefore in a good position to undertake and lead very large projects both in Denmark and at an international level.

We combine our competencies across our business areas and we work with external business partners when the assignment requires it. Our main business areas are:

- Agriculture
- Building and industry
- Civil works
- Energy
- Environment
- Management sciences
- Social sciences
- Transportation

## Nordsø Elektronik A/S

Vesterhavsgade 147  
6700 Esbjerg  
Phone: +45 75 12 07 44  
Fax: +45 75 12 42 73  
E-mail: nordsoe@nordsoe-el.dk

### Contact Person:

Lars Bakken Jepsen  
Direct Phone: +45 28 14 67 56  
E-mail: lbj@nordsoe-el.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
Industry Role: Service Provider

Industry Expertise: Offshore wind turbines – service; Electrical and electronic equipment; Pumps; Instrumentation; Navigation; Firefighting and fire safety equipment

### Profile:

NORDSØ Elektronik do electromechanical, electric & electronic services on board ships of all kinds, as well as offshore & onshore services.

Our workshop are equipped with up-to-date instruments to meet the technical requirements of today.

We are specialists in maintenance, service, overhaul, rewinding, etc. of electric motors, generators AC/DC as well as pump repairs.

We are specialists in navigation equipment such as: VHF, Satellite TV, Ecco Sounder, Sonar, Radar, Fishfinding equipment etc.

We are sole agent for SAM ELECTRONIC / STN ATLAS Radars & navigations equipment in Denmark.

We do service around the clock, all year round since 1919.

## Ocean Team Scandinavia

Vesterhavsgade 56  
6700 Esbjerg  
Phone: +45 75 18 00 77  
Fax: +45 75 18 10 56  
E-mail: ots@oceanteam.dk

### Contact Person:

Jens Peter Thomsen  
E-mail: jpt@oceanteam.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Pumps; Hydraulic equipment; Instrumentation

### Profile:

Our company is independent and is continuously developing. - We are specialist in providing "total purity package solutions" within lubeoil- & process systems on- & offshore. We are result driven and provide a high quality service utilising a small team which is focused on the needs of the client.

## Odfjell Well Services A/S

Trafikhavnskaj 7 st.  
6700 Esbjerg  
Phone: +45 76 12 90 12  
Fax: +45 76 12 91 12  
E-mail: os@ows.no

### Contact Person:

Bjarne Winum  
E-mail: win@ows.no

### Competencies:

Industry Sector: Oil and Gas  
Industry Role: Service Provider; Supplier  
Industry Expertise: Drilling tools/supplies

### Profile:

Odfjell Well Services Rental department is one of Norways leading suppliers of drilling equipment. For rental purpose we stock a wide range of tubulars (drillpipe, drillcollar & tubing) as well as related accessories and handling equipment.

Odfjell Well Services Casing department is Norways leading supplier of tubular running services to the oil and gas industry.

## Offshore Center Danmark

Niels Bohrs Vej 6  
6700 Esbjerg  
Phone: +45 36 97 36 70  
Fax: +45 36 97 36 79  
E-mail: info@offshorecenter.dk

### Contact Person:

Peter Blach  
Direct Phone: +45 36 97 36 70  
E-mail: pb@offshorecenter.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Consultant; Service provider; Educational Institution; Industry Association  
Industry Expertise: General Information; Project planning; Planning; Courses and Career Training; Banking and insurance services; Consulting

### Profile:

Offshore Center Danmark is a member based organization with a main purpose to strengthen the Danish offshore industry on the global market. Key areas are oil and gas, offshore wind power and the maritime sector.

OCD's main activities are centered towards:

- Network - OCD help establish contact between offshore companies, universities and other educational institutions, consultants and authorities. This is done through work shops, conferences etc.
- Knowledge - OCD collects, develops and disseminates knowledge within the Danish offshore industry.
- Projects - OCD coordinates development projects and help companies establishing funding for projects.
- Education - OCD works close together with educational institutions and also provide offshore related courses for the offshore industry.

## Olesen & Jensen

Ørnevej 1  
6705 Esbjerg Ø  
Phone: +45 75 14 22 55  
Fax: +45 75 14 20 53  
E-mail: oj@o-j.dk

### Contact Person:

Kenn Pedersen  
Direct Phone: +45 76 14 01 78  
E-mail: kp@o-j.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Service  
Industry Role: Service Provider  
Industry Expertise: Diesel motors and generators; Cranes and crane accessories; Drilling tools/supplies; Ventilation; Pumps; Instrumentation

### Profile:

Olesen & Jensen A/S is a modern electrical company, founded in 1919, the company has 130 employees, divided over 3 sections, installation, electronic and electromechanic. Our workshop can offer every kind of electromechanic services, including overhaul, repair, rewind, varnish etc. of motors and generators. Total overhaul of all types of pumps. Dynamic balancing. (up to 1600 kg.) Laser alignment SPM measurement of bearings. Vibration measurement. Test of motors / generators, full load, up to 630 KW / 6000 VOLT. Test of pumps, included pressure and flow measuring (16 bar - 2400 M3h.) All tests are documented. All instruments are calibrated The workshop is equipped with a 20 T capacity overhead traversing crane facility. Our customers are power plants, offshore industry, ships, factories and privates. 24 Hours service.

## Persolit A/S

Tarp Byvej 147  
6715 Esbjerg N  
Phone: +45 70 20 06 13  
Fax: +45 70 20 06 31

### Contact Person:

Kurt Ø. Hansen  
E-mail: koeh@persolit.dk

### Competencies:

Industry Sector: Service; Safety and Environment  
Industry Role: Consultant; Service Provider; Supplier; Manufacturer  
Industry Expertise: Construction; Instrumentation; Insulation; Leasing of tools/equipment; Supply of goods and services; Manpower services and leasing; Ventilation

### Profile:

Persolit A/S is a Danish engineering, manufacturing and contracting company with 60 years of experience in technical insulation onshore/offshore all over the world. Persolit A/S has lately successfully carried out manufacture and installation of sound proofed Drillers Cabins on rigs, sound proofing of ducting, engines, compressors etc. Furthermore soundproofing of controlrooms, accommodations, workshops etc has been carried out.

## Peter Harbo A/S

Olievej 4  
6700 Esbjerg  
Phone: +45 75 13 08 44  
Fax: +45 75 13 07 35  
E-mail: salg@harbo.dk

### Contact Person:

Claus Harbo  
E-mail: ch@harbo.dk

### Competencies:

Industry Sector: Oil and Gas; Service  
Industry Role: Consultant; Service Provider; Supplier; Manufacturer  
Industry Expertise: Repair and maintenance services; Rope and wires; Leasing of tools/equipment; Offshore wind turbines – installation; Offshore wind turbines – tower; Cranes and crane accessories

### Profile:

Supply of all kinds and sizes of the following: Wire ropes, wire rope filings and slings, chains and chain accessories, webbing and roundslings, shackles in all sizes and rigging screws, polypropylene ropes up to 96 mm on stock. Lifting equipment, hoists and winches up to 35 ton c/w hydraulic power packs for rental. All sizes of blocks, sheaves, swivels for rental. Test and recertification of chainslings, hoists, winches, blocks. Escape climbing nets, helideck nets, ladders. Test equipment for cranes and life boats. Water bags, loadcells etc. (Water weight agent) Fall Protection Systems. Mooring bouys and fenders in all sizes for all purposes.

## PNE Teknik A/S

Magnoliavej 10  
Dyrup  
5250 Odense SV  
Phone: +45 63 10 02 70  
Fax: +45 63 10 02 71  
E-mail: email@pne-teknik.dk



**Contact Person:**

Esben Erichsen  
 Direct Phone: +45 63 10 02 72  
 E-mail: ee@pne-teknik.dk

**Competencies:**

Industry Sector: Oil and Gas  
 Industry Role: Supplier; Manufacturer  
 Industry Expertise: Valves; Safety Equipment

**Profile:**

PNE Teknik supply products and technical solutions for the engineering industry, offshore and maritime industry. Our concept is the optimum solution for each individual job. Our partners are leading suppliers of castings, forgings and industrial products. We are always able to find the item required as well as the supplier of the product most suitable for a specific job. Thus the technically best solution is usually the most profitable one - and we always aim to be cost-minded on behalf of our customers. PNE Teknik have emerged from P.N. Erichsen A/S. We have currently adapted the delivery programme to the existing requirements and will also in future be a reliable and trustworthy business partner.

**Pon Power A/S**

Øresundsvej 9  
 6715 Esbjerg N  
 Phone: +45 76 14 64 00  
 Fax: +45 76 14 64 01  
 E-mail: info@emo.geveke.com

**Contact Person:**

Verner Andersen  
 Direct Phone: 76 14 64 46  
 E-mail: verner.andersen@pon-cat.com

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
 Industry Role: Service Provider; Supplier; Manufacturer  
 Industry Expertise: Repair and maintenance services; Electrical and electronic equipment; Construction; Manpower services and leasing; Diesel motors and generators

**Profile:**

Caterpillar dealer for Denmark, offering Caterpillar and MaK diesel and gas engines, after sales services, switch-boards, re-powering and general manpower. - High quality products - Prompt delivery of all Caterpillar spare parts to ports and airports - Consultants in installation, repairs and maintenance - Qualified general manpower available for quick turnout - Individual service contracts.

**Promecon**

Sahara 4  
 6700 Esbjerg  
 Phone: +45 76 11 55 00  
 Fax: +45 80 60 22 45  
 E-mail: mail@promecon.dk

**Advertisement**  
 page 33

**Contact Person:**

Esben Marcussen  
 E-mail: ebm@promecon.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service  
 Industry Role: Service Provider; Supplier; Manufacturer  
 Industry Expertise: Project planning; Repair and maintenance

services; On and offshore base facilities; Supply of goods and services; Manpower services and leasing; Pipes and plates; Contractors

**Profile:**

Promecon carries out all forms of steel structures and industrial installations and has more than 60 years' experience in the Scandinavian and international markets. Promecon has 400 committed employees and delivered sales of approx. DKK 400 million in 2003.

**QA Consulting A/S**

Vesterhavsgade 44  
 6700 Esbjerg  
 Phone: +45 75 45 38 33  
 Fax: +45 75 45 38 55

**Contact Person:**

Flemming Kristensen  
 E-mail: qa@qaconsulting.dk

**Competencies:**

Industry Sector: Oil and Gas; Safety and Environment  
 Industry Role: Consultant  
 Industry Expertise: General Information; Consulting; Construction; Safety Equipment; Planning; Manpower services and leasing; Inspection and classification; Project planning

**Profile:**

QA Consulting is based in Esbjerg, where our practical mix of some 30 engineers, marine engineers, and technical personnel in the first 20 years of our existence has primarily been serving the pulsating offshore industry.

We provide more than 37,000 man/hours per year for jobs requiring our core competences within maintenance. All our service activities are thoroughly documented via our efficient hour/job management system. Our present activities take place in close contact with local industry and are split into three categories: Providing skills (Manpower), major involvement in project, and handling minor ad hoc jobs.

The QA Consulting of the future is expecting growth within the offshore industry and a spin-off effect in other branches requiring efficient maintenance systems.

**RAMBØLL**

Olie og Gas Divisionen  
 Willemoesgade 2  
 6700 Esbjerg  
 Phone: +45 79 13 71 00  
 Fax: +45 79 13 72 80

**Advertisement**  
 page 124

**Contact Person:**

Kai B. Olsen  
 Direct Phone: +45 79 13 71 20  
 E-mail: kbo@ramboll.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime; Service; Safety and Environment  
 Industry Role: Consultant  
 Industry Expertise: Consulting; Offshore wind turbines - installation; Maritime transport; Inspection and classification; Construction; Firefighting and fire safety equipment; Hydraulic equipment; Instrumentation; Recycling; Planning; Project planning; Pumps; Manpower services and leasing; Repair and maintenance services; Process units; Surface treatment and corrosion resistance; Offshore wind turbines - foundation; Electrical and electronic equipment; Offshore

wind turbines - tower; Geotechnical equipment

**Profile:**

RAMBØLL offers overall solutions in design and engineering for all types of oil and gas installations. The continued expansion of activities and installations in the Danish sector of the North Sea has given RAMBØLL a solid experience in the offshore disciplines jackets, topsides and pipelines. The offshore experience has resulted in an increasing number of assignments on onshore oil and gas installations, systems and storage facilities. New activities within offshore wind turbine structures are also products on this knowledge.

**Ribe Maskinfabrik**

Industrivej 4  
 6760 Ribe  
 Phone: +45 76 88 14 88  
 Fax: +45 75 42 13 04  
 E-mail: info@ribemask.dk

**Contact Person:**

Ole Jørgensen  
 E-mail: oj@ribemask.dk

**Competencies:**

Industry Sector: Offshore Wind; Maritime; Service  
 Industry Role: Supplier; Manufacturer  
 Industry Expertise: Construction; Pipes and plates

**Profile:**

Ribe Maskinfabrik A/S is part of RM-Gruppen who is a globally oriented company within metal manufacturing and sourcing. RM-Gruppen has own offices and production facilities in Europe as well as Asia.

**Rovsing Dynamics A/S**

Marielundvej 41  
 2730 Herlev  
 Phone: +45 46 90 72 00  
 Fax: +45 44 84 60 40

**Contact Person:**

Kåre M. Rasmussen

**Competencies:**

Industry Sector: Oil and Gas; Maritime  
 Industry Role: Service Provider; Supplier  
 Industry Expertise: Instrumentation

**Profile:**

ROVSING Dynamics A/S, headquartered in Herlev (the suburbs of Copenhagen), Denmark, has over the last 10 years developed a unique product, the OPENpredictor™ Predictive Maintenance Information System, which allows on-line machinery health prediction through the use of sophisticated electronic and computer technology.

ROVSING Dynamics has developed a family of early machine fault detection algorithms with automatic fault diagnosis capabilities, which provides predictive maintenance through detection of most machine faults almost as soon as they develop and presents the identified fault(s) and location to the operator in clear text.

The system can be used on almost any type of rotating machinery.

## Sanistål A/S

Ørnevej 3  
6705 Esbjerg Ø  
Phone: +45 76 14 63 00  
Fax: +45 75 14 31 11  
E-mail: esb@sanistaal.dk

### Contact Person:

Ole Rimme  
E-mail: ori@sanistaal.dk

### Competencies:

Industry Sector: Oil and Gas; Maritime  
Industry Role: Supplier; Manufacturer  
Industry Expertise: Valves; Supply of goods and services;  
Pipes and plates

### Profile:

Steel, Bars and Plates, Joists and Hollow Sections, Pipes, Fittings, Valves, Flanges, Galvanized Steel, Bolts and Chains, Stainless Steel and Metal, Machinery and Tools. Certified according to ISO 9002.

## Score Danmark A/S

Østre Gjesingvej 14  
6715 Esbjerg N  
Phone: +45 75 13 82 83  
Fax: +45 75 13 92 22

### Contact Person:

Michael Bjerrum  
E-mail: michael.bjerrum@score-group.com

### Competencies:

Industry Sector: Oil and Gas; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Hydraulic equipment; Instrumentation;  
Supply of goods and services; Leasing of tools/equipment;  
Valves; Repair and maintenance services

### Profile:

As an international organisation, Score provides a worldwide around the clock range of valve, actuator and gas turbine services. Being open for business a full 24 hours per day, our technical sales and customer support staff, aided by teams of specialist engineers, are always on hand to assist our customers with even the most difficult and urgent enquiries. Score Group plc is employee owned, and remains independent of all valve manufacturers and suppliers. The Group formed in 1982 to provide valve repair and re-certification services, now employs over 500 personnel worldwide.

## Selco A/S

Postboks 113  
Betonvej 10  
4000 Roskilde  
Phone: +45 70 26 11 22  
Fax: +45 70 26 25 22

### Contact Person:

Steen L. Andersen  
Direct Phone: 36 95 32 29  
E-mail: steen.andersen@selco.com

### Competencies:

Industry Sector: Service  
Industry Role: Supplier

### Profile:

SELCO manufacture and sell electronic equipment for power generation, alarm annunciation and indication of discrete signals. SELCO products are designed to operate in harsh environmental conditions and are suitable for use in both land and off shore applications.

## Semco Maritime

Stenhuggervej 12-14  
6710 Esbjerg V  
Phone: +45 79 16 66 66  
Fax: +45 75 15 65 80

Advertisement  
page 16

### Contact Person:

Jan E. Hansen  
Direct Phone: +45 79 16 65 51  
E-mail: jeh@semcomaritime.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime;  
Service  
Industry Role: Consultant; Service Provider; Supplier;  
Manufacturer  
Industry Expertise: Supply of goods and services; Project planning; Diesel motors and generators; On and offshore base facilities; Repair and maintenance services; Electrical and electronic equipment; Hydraulic equipment; Manpower services and leasing; Planning; Navigation; Firefighting and fire safety equipment; Job/career placement; Communication; Valves; Consulting; Scaffolding; Pipes and plates; General Information; Ventilation; Welding equipment

### Profile:

From its North Sea Base in Esbjerg, Semco Maritime provides service for the international offshore industry via subsidiaries and agents throughout the world. The services are ranking from detailed design through procurement, manufacturing, and installation to on-going maintenance and service agreements with all major operators in the area.

## SGS Danmark A/S

Nitivej 10B  
P.O. Box 26  
2000 Frederiksberg  
Phone: +45 36 93 33 00  
Fax: +45 36 93 33 01

### Contact Person:

Jan Ilsoe  
E-mail: jan.ilsoe@sgs.com

### Competencies:

Industry Sector: Offshore Wind  
Industry Role: Consultant; Service Provider  
Industry Expertise: Inspection and classification

### Profile:

SGS is the world's leading inspection, verification, testing and certification company. SGS is recognized as the global benchmark for quality and integrity. With 42,000 employees, SGS operates a network of about 1,000 offices and laboratories around the world.

## Siemens A/S

Borupvang 3  
2750 Ballerup  
Phone: +45 44 77 44 77  
Fax: +45 44 77 40 29  
E-mail: post@siemens.dk

### Contact Person:

Torben Ekvall  
E-mail: torben.ekvall@siemens.com

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Electrical and electronic equipment

### Profile:

The Siemens group in Denmark is part of the international Siemens concern, which with more than 430,000 employees in 190 countries is one of the worlds biggest corporations within electronics and electro technique. The company solves assignments within the areas: energy, industry, information, telecom, traffic, hospital equipment, hearing aids, light sources, linen goods and electric installations. Based within the intensive research and development effort of the concern an extensive range of highly technological products and services are offered.

## Siemens Wind Power A/S

Borupvej 16  
7330 Brande  
Phone: +45 99 42 22 22  
E-mail: bonus@bonus.dk

### Contact Person:

Poul Skjærbæk  
E-mail: psk@bonus.dk

### Competencies:

Industry Sector: Offshore Wind  
Industry Role: Supplier; Manufacturer  
Industry Expertise: Offshore wind turbines – rotor; Offshore wind turbines – service; Offshore wind turbines - tower

### Profile:

With the acquisition of Bonus Energy A/S December 1, 2004, Siemens entered the rapidly growing wind energy business. The financial strength and the turnkey experience of Siemens Power Generation combined with the technical know-how of Bonus Energy will create an even stronger player in the global wind energy market: Siemens Wind Power.

## Solar Offshore

Industrivej Vest 43  
6600 Vejlen  
Phone: +45 76 96 21 50  
Fax: +45 76 96 21 60

Advertisement  
page 11

### Contact Person:

Kristen Guldager  
Direct Phone: +45 76 96 21 51  
E-mail: kgu@solar.dk

### Competencies:

Industry Sector: Oil and Gas; Offshore Wind; Maritime  
Industry Role: Supplier  
Industry Expertise: Communication; Electrical and electronic equipment; Navigation

## Profile:

Solar Offshore is part of Denmark's largest electrical wholesale company, A/S Nordisk Solar Compagni. Solar Offshore has existed since 1981, and from our offices and store rooms we can offer you a complete range of electrical material, Ex-equipment for hazardous areas being our speciality. Solar Offshore has a number of agencies enabling us to provide you with e.g. lighting equipment, cables, cable glands, switchboards, junction boxes, electrical heating, speakers, and other approved products within the shortest possible time of delivery.

## STMS - Survival Training Maritime Safety

Adgangsvejen 1  
6700 Esbjerg  
Phone: +45 76 11 47 50  
Fax: +45 76 11 47 05  
E-mail: ej@stms.dk

Advertisement  
page 74

### Contact Person:

Egil Jensen  
Direct Phone: +45 76 11 47 51  
E-mail: ej@stms.dk

### Competencies:

Industry Sector: Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Service Provider; Supplier; Educational Institution  
Industry Expertise: Courses and Career Training

### Profile:

STMS – (Survival Training Maritime Safety) is a result of many years of cooperation between ESVAGT and the marine rescue unit of the Maritime University of Denmark. STMS today utilizes this knowledge and offers a wide range of courses – with direct relevance to the offshore industry. Courses include obligatory offshore courses, wind turbine courses, FRB-courses as well as Search & Rescue (SAR) courses. Furthermore STMS offers individualized team building courses, which often are made in cooperation with external consultants.

## Sturnus Engineering

Naverland 2, 1  
2600 Glostrup  
Phone: +45 43 42 54 28  
Fax: + 45 43 42 54 29  
E-mail: SEDK@SEDK.DK

### Contact Person:

Jørgen Egil Hammer  
E-mail: sedk@sedk.dk

### Competencies:

Industry sector: Oil and Gas; Maritime  
Industry role: Consultant  
Industry expertise: Construction; Diesel motors and generators; Drilling tools/supplies; Engine cylinders and accumulators; Hydraulic equipment; Offshore wind turbines - rotor Pipes and plates; Process units; Pumps; Surface treatment and corrosion resistance; Tanks and storage equipment; Valves; Welding equipment

### Profile:

STURNUS ENGINEERING is an engineering company who has had big success in solving development and construction tasks within machine and mechanical problems.

## SURVIVAL A/S Training Center Esbjerg

Uglvigårdsvvej 3  
6705 Esbjerg Ø  
Phone: +45 76 12 13 14  
Fax: +45 76 12 13 13  
E-mail: survival@survival.dk

Advertisement  
page 55

### Contact Person:

Stig Vide Petersen  
E-mail: svp@survival.dk

### Competencies:

Industry Sector: Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Educational Institution  
Industry Expertise: Courses and Career Training; Safety Equipment; Firefighting and fire safety equipment

### Profile:

SURVIVAL is an international Fire, Rescue, and Training Center. We offer a broad range of standard and specially developed courses within fire and rescue, both onshore, offshore and in the air! Our sea survival courses and HUET take place in our indoor training pool with artificial waves, wind and sound effects. We are located near Esbjerg Airport and only 6 km from the city center of Esbjerg.

## Syddansk Universitet

Niels Bohrs Vej 9  
6700 Esbjerg  
Phone: +45 65 50 41 14  
Fax: +45 65 50 10 91  
E-mail: sdu@sdu.dk

### Contact Person:

Svend Ole Madsen  
Direct Phone: 65 50 15 12  
E-mail: som@sam.sdu.dk

### Competencies:

Industry Role: Educational Institution; General Institution; Research Institution

### Profile:

Knowledge is one of the prerequisites for growth in Denmark, where social welfare and competition within industry are increasingly dependent on research, highly skilled workers, and an industry with a flair for innovation and renewal.

The University of Southern Denmark, with campuses located in the southwestern part of Denmark - i.e. Funen and Southern Jutland - is a research and educational institution with deep regional roots and an international outlook. Reaching even further south, the university offers a number of joint programmes in co-operation with the University of Flensburg and the University of Kiel. Contacts with regional industries and the international scientific community are strong.

Every day approximately 1,100 researchers in Odense, Kolding, Esbjerg and Sønderborg are engaged in the search for new knowledge and insight, while 15,000 students are working to further their education. The University of Southern Denmark offers comprehensive programmes in four different faculties - Humanities, Science and Engineering, Social Sciences, and Health Sciences. It incorporates 33 institutes, 29 research centres, and a well-equipped university library.

## Uniscrap, Åbenrå

Kilen 29  
6200 Aabenraa  
Phone: +45 74 62 27 87  
Fax: +45 74 62 27 47  
E-mail: info@uniscrap.dk

### Contact Person:

Mogens Møller-Hansen  
E-mail: mmh@uniscrap.dk

### Competencies:

Industry Sector: Safety and Environment  
Industry Role: Service Provider  
Industry Expertise: Water treatment; Recycling

### Profile:

Uniscrap A/S is a Danish owned waste and recycling company, who was created in 2002 by merger of Dansk Genvinding A/S, Uniscrap A/S Genvindingsindustri and Dansk Flaskegenbrug A/S.

## Valtor Offshore A/S

Oddesundvej 5  
6715 Esbjerg N  
Phone: +45 75 14 44 11  
Fax: +45 75 14 44 99  
E-mail: info@valtor.dk

Advertisement  
page 25

### Contact Person:

Peter Toft  
E-mail: pt@valtor.dk

### Competencies:

Industry Sector: Oil and Gas; Maritime; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Repair and maintenance services; Hydraulic equipment; Leasing of tools/equipment; Instrumentation; Supply of goods and services; Valves

### Profile:

During its almost 20 years in the business, Valtor Offshore A/S, with head office located at Esbjerg, has become acknowledged in many parts of the world for reliable and quality-proof supplies of all kinds of valves, actuators and related process equipment for the petrochemical industry. Valtor Offshore A/S has specialised in development and supply of valve automation and in creating individual solutions of specific problems for the customers. Over the years Valtor Offshore A/S has built up its own product servicing department furnishing all kinds of valves, actuators, positioners etc. Service takes place at Valtor Offshore or on location at the customer, depending on the nature of the operation.

## Vestas Northern Europe, Offshore Afd.

Herningvej 5-7  
6920 Videbæk  
Phone: +45 97 30 00 00  
E-mail:

### Contact Person:

John Friis Løndal  
E-mail: joflo@vestas.com

### Competencies:

Industry Sector: Offshore Wind; Maritime; Service; Safety and Environment  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Offshore wind turbines – rotor; Offshore



wind turbines – service; Offshore wind turbines – tower; Offshore wind turbines - nacelle and electrical parts

**Profile:**

Vestas is the world leader in wind technology and a driving force in the development of the wind power industry.

Vestas' core business comprises the development, manufacture, sale, marketing and maintenance of wind power systems that use wind energy to generate electricity.

**Vetco Gray Denmark**

Mådevej 37  
6700 Esbjerg  
Phone: +45 76 10 10 00  
Fax: +45 76 10 10 10

**Advertisement**  
page 100

**Contact Person:**

Per Bak  
Direct Phone: +45 76 10 10 76  
E-mail: per.bak@vetcogray.com

**Competencies:**

Industry Sector: Oil and Gas; Service  
Industry Role: Service Provider; Supplier; Manufacturer  
Industry Expertise: Valves; On and offshore base facilities; Drilling tools/supplies; Repair and maintenance services; Well services; Wellheads and X-mas Trees; Leasing of tools/equipment

**Profile:**

Competencies within: ISO 9002/ISO 14001 Certification  
- Wellheads & X-mas Trees - Exploration Systems incl. Mudline - Wellhead Maintenance - Chokevalves - Gate- and Checkvalves - Controlvalves - Grayloc Clamp Connectors - Oilfield Machine shop & Warehouse - Cutting of API Threads, API Q1 Certified - Thread Cutting on Tubing & Casing - License for all Premium Threads VAM, Antares NKK - Portable Grayseal Machines.

**Viking Life-Saving Equipment A/S**

Sædding Ringvej 13  
6710 Esbjerg V  
Phone: +45 76 11 81 00  
Fax: +45 76 11 81 01  
E-mail: viking@viking-life.com

**Advertisement**  
page 93

**Contact Person:**

Claus Omann  
E-mail: co@viking-life.com

**Competencies:**

Industry Sector: Maritime; Service; Safety and Environment  
Industry Role: Supplier; Manufacturer  
Industry Expertise: Safety Equipment

**Profile:**

When it comes to safety – think VIKING. Having learnt valuable lessons through our more than 40 years of existence in the maritime business, VIKING stands for quality, reliability and safety. The VIKING group is your global business partner. With a network of approx. 270 servicing stations and a world-wide representation via local subsidiaries, we aim to satisfy the individual requirements of all customers. Based in Denmark and operating local business all over the world, we are proud to claim that the sun never sets on VIKING. We are open 24 hours a day, 7 days a week, all year round.

**Vindmølleindustrien**

Vester Voldgade 106/1  
1552 København V  
Phone: +45 33 73 03 30  
Fax: +45 33 73 03 33  
E-mail: danish@windpower.org

**Contact Person:**

Bjarne Lundager Jensen

**Competencies:**

Industry Sector: Offshore Wind  
Industry Role: Industry Association  
Industry Expertise: Courses and Career Training; General Information

**Profile:**

The Danish Wind Industry Association (DWIA) is a non-profit association whose purpose is to promote wind energy at home and abroad.

The association was founded in 1981. DWIA today represents 99.9 per cent of Danish wind turbine manufacturing measured in MW and more than 122 companies with activities in the Danish wind industry. For more details go to our list of members.

We publish information about wind energy. Printed publications include our annual report.

We are also engaged in advocacy. See our news section and policy section for more details.

The association is a member of the European Wind Energy Association, EWEA.

**VSb Industri- og Stålmontage A/S**

Vandværksvej 42  
Assentoft  
8900 Randers  
Phone: +45 86 49 51 44  
Fax: +45 86 49 42 47  
E-mail: post@vsb-industri.dk

**Contact Person:**

Flemming Werk  
Direct Phone: +45 20 73 51 44  
E-mail: fw@vsb-industri.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Maritime  
Industry Role: Supplier; Manufacturer  
Industry Expertise: Construction; Tanks and storage equipment; Offshore wind turbines – tower; Surface treatment and corrosion resistance

**Profile:**

VSb Industri- og Stålmontage A/S is an order producing company who can undertake all kinds of steel constructions.

**Welcon A/S**

Svindbækvej 1  
Thyregod  
7323 Give  
Phone: +45 75 73 44 41

**Contact Person:**

Jens Pedersen  
E-mail: jp@welcon.dk

**Competencies:**

Industry Sector: Offshore Wind

Industry Role: Supplier; Manufacturer  
Industry Expertise: Offshore wind turbines – tower; Construction

**Profile:**

Welcon A/S is a Danish company in the business of manufacturing mainly steel components and turn-key solutions.

During the last 40 years we have developed and maintained a very solid and competent know-how in the steel industry. This know-how, combined with targeted investments in production facilities and personnel, has resulted in our company being in the front line of the technological development in welding processes. This makes us a front-runner for supply of customer-tailored components and solutions.

**YIT A/S**

Vestkraftgade 1  
6700 Esbjerg  
Phone: +45 70 11 67 00  
E-mail: yit@yit.dk

**Contact Person:**

Nils Skeby  
E-mail: nils.skeby@yit.dk

**Competencies:**

Industry Sector: Oil and Gas; Service  
Industry Role: Service Provider; Supplier  
Industry Expertise: Communication; Instrumentation; Project planning; Manpower services and leasing; Repair and maintenance services; Contractors; Electrical and electronic equipment; Job/career placement; Ventilation

**Profile:**

YIT A/S supply integrated technical solutions and services for a wide range of applications. The company has more than 20 years of experience with work in the offshore industry.

**Aalborg Universitet Esbjerg**

Niels Bohrs Vej 8  
6700 Esbjerg  
Phone: +45 79 12 76 66  
Fax: +45 75 45 36 43  
E-mail: inst@aeu.auc.dk

**Advertisement**  
page 91

**Contact Person:**

Torben Rosenørn  
Direct Phone: +45 79 12 76 16  
E-mail: tur@aeu.auc.dk

**Competencies:**

Industry Sector: Oil and Gas; Offshore Wind; Safety and Environment  
Industry Role: Educational Institution; General Institution; Research Institution

**Profile:**

Aalborg University Esbjerg is one of Esbjergs fastest growing research and education institutions, meaning both the number of students and the wide offer of educations. With 700 students the University is not bigger than every one still knows each other.

Aalborg University Esbjerg formerly known as Esbjerg Teknikum merged with Aalborg University in 1995 and was named Aalborg University Esbjerg. At the same time we started to use the project-oriented form of teaching that now characterizes us.

# HYDROPOWER

THE POWER OF HYDRAULICS



Within the range of hydraulic equipment HYDROPOWER A/S offer the following services to the offshore field:

- Projecting/Construction
- Construction
- Trouble-shooting
- Service (World wide)
- Repair/Maintenance work (On-/Offshore)

We stock high-quality Hydraulic equipment of all distinguished marks and have up-to-date repair facilities including a test rig in our workshop in Esbjerg.

With over 30 years experience HYDROPOWER A/S stands for high-quality service and hydraulic expertise.

Certificates: ISO 9001, KMS-Diplom & Miljønetværk Ribe Amt.



## HYDROPOWER A/S

Lammefjordsvej 2 - 6715 Esbjerg N  
Tlf. +45 75 14 44 44 - Fax +45 74 14 45 45  
Info@hydropower.dk - www.hydropower.dk

## For Advertising in Offshore Center Danmark Yearbook 2007

Please contact:

Offshore Center Danmark  
Phone: 36973670  
info@offshorecenter.dk



Offshore Center Danmark

## Basic course in offshore oil/gas



Offshore Center Danmark offers 2 basic courses in offshore oil/gas. The courses are independent of each other and are adapted for employees with a need for knowledge about the most common terms in the offshore sector.

### Production

The Production course provides the participants with basic knowledge about offshore production of oil/gas. Topics include: what is oil and gas, geology, the oil adventure in the North Sea, how is oil/gas extracted, what is happening on the platform and distribution of oil/gas.

### Safety

The Safety provides an overview of the authorities, organizations and the legal frames within the offshore oil/gas area. The course also introduces the important area HSEQ (Health, Safety, Environment and Quality).

Both courses run over 2 days and are held twice a year in Esbjerg.

The courses are also offered as company specific courses where both the Production and Safety course are combined into one 2-day course. This can be held at the premises of your company and results in an economic benefit when your company has more 10 or more people attending the course.

Course programs and further info can be found at [www.offshorecenter.dk](http://www.offshorecenter.dk) under the menu Uddannelse (in Danish) or by contacting Offshore Center Danmark: +45 3697 3670 / [info@offshorecenter.dk](mailto:info@offshorecenter.dk).



Offshore Center Danmark



# www.OffshoreBase.dk

*Your link to the Danish Offshore Companies*

- Search for companies
- News
- Available positions
- Events
- Invitation for tenders
- Technology development projects
- Education
- Links

**OffshoreBase** is the new focal point for the Danish offshore companies and institutions! Here you will find potential Danish partners and suppliers whom match the exact qualifications, certifications, etc., which you are looking for.

But more than this, you may also find information about – What is written in the media? – Which conferences and seminars are being held? – Which courses may you attend in Denmark?

Within OffshoreBase.dk you will furthermore get an insight into the many technologically challenging development projects undertaken by the centre on behalf of its members.

**Visit [www.OffshoreBase.dk](http://www.OffshoreBase.dk)**



**Offshore Center Danmark**



# Solve the Needs of Today With the Solutions of Tomorrow



ABB has long term experience in servicing the offshore industry, our scope includes:

- Project Management
- Multidiscipline and Detailed Engineering
- Construction
- Documentation
- Service & Trouble-shooting
- Product & Solution Sales

**Read more about ABB's offshore solutions on [www.abb.dk](http://www.abb.dk)**



# Your reliable engineering partner---

Economical and conceptual studies / Risk and safety analysis /  
Design and engineering / Maintenance and inspection planning /  
Offshore topsides and structures / Pipelines / Oil refineries /  
Gas treatment and storage / Decommissioning

**Esbjerg**

Rambøll Oil & Gas  
Tel +45 7913 7100  
oil-gas@ramboll.dk  
www.ramboll.com  
/oil-gas

**Copenhagen**

Rambøll Oil & Gas  
Tel +45 4598 6000  
oil-gas@ramboll.dk  
www.ramboll.com  
/oil-gas

**Sandefjord**

Rambøll Future as  
Tel +47 3348 7800  
oil-gas@ramboll-future.no  
www.future.as

**Stavanger**

Rambøll Future as  
Tel +47 9942 8100  
oil-gas@ramboll-future.no  
www.future.as

**Qatar**

Rambøll Qatar A/S  
Tel + 974 4360 789  
ramboll@qatar.net.qa  
www.ramboll.com  
/oil-gas