



**MARINTEK**

## R&D: essential for dealing with future challenges

In 2009 the world economy faced its worst financial crisis since the 1930s. Most industries, including the maritime sector, were severely affected.

The world is facing great challenges caused by climate change and shortages of natural resources such as food and energy. The oceans of the world are increasingly important as a means of facing these global challenges. More than half of the earth is covered by oceans at depths of more than 3000 metres. Surprisingly, mankind probably knows more about outer space than “ocean space”.

The sustainable utilisation and extraction of resources from oceans requires the development of new technologies in a wide range of disciplines. We need to meet global challenges by adopting a holistic approach. Innovation and the development of new technologies will be important aspects of the solutions we adopt. Research and development are crucial to providing the knowledge we need to be able to meet the global challenges.

As a knowledge-based nation, Norway competes in international markets with products that are extremely R&D-intensive. Knowledge is our competitive edge. More than 40% of the wealth generated and more than 70% of Norwegian export value come from ocean-related activities. Today, Norway is a global leader in marine technology, and it needs to remain so.




For more than 70 years, MARINTEK has been supporting the efforts of the Norwegian maritime industry to conquer the global markets by supplying R&D and expert knowledge. The history of MARINTEK started with the Ship Model Tank back in 1939, and on September 1, 2009 we celebrated its 70th anniversary. The Ocean Basin was inaugurated in 1981. Both the Ship Model Tank and the Ocean Basin have been instrumental for decades in generating the expert knowledge in the vital aspects of marine technology needed by industry.

The maritime industry and the authorities have collaborated for several decades in developing a world-class R&D-infrastructure for technology development and innovation in Trondheim. Several white papers have expressed willingness of the Norwegian government to continue the development of our marine technology R&D-community into a leading European centre of expertise. A pilot study carried out on behalf of the Ministry of Trade and Industry in 2009 produced a specification for an Ocean Space Centre – a nexus of marine technology knowledge that will carry us into the future to meet and deal with global food, energy and climate challenges.

  
Oddvar Eide  
President



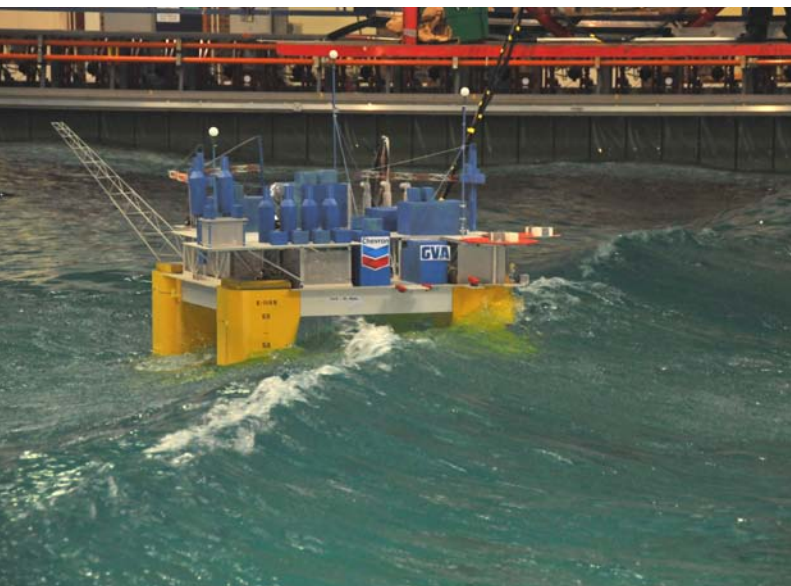




More than 80% of the world's energy consumption is based on fossil fuels, and this situation is likely to continue for some time. Offshore oil and gas resources play an important role in this picture, though they are becoming more and more difficult to access in harsher environments and deeper waters. A large proportion of our undiscovered oil and gas resources is believed to be in the Arctic, a region in which cold, darkness, great distances, unpopulated areas and a vulnerable nature offer significant challenges. The deepest offshore field today lies at a water depth of 2600 m in the Gulf of Mexico. More than 50% of the surface of the earth is covered by ocean with depths of more than 3000 m. All this means that we need "more technology per barrel produced" than we used to. Knowledge is a key factor in this development.

Marine technology is a vital component of our ability to meet global food, energy and climate challenges. Renewable ocean energy is one potential way of dealing with these.

MARINTEK is involved in activities that will help industry to produce leading-edge knowledge and technologies that will enable us to conquer the challenges presented by advanced offshore activities and renewable ocean energy generation.



*Semi model in the Ocean Basin, 100-year storm.*

## Ultra deep water and harsh environment

New oil fields are very often characterized by ultra deep waters whose depths may exceed 1000 metres and by a harsh environment with steep, high waves combined with strong currents and wind, or both. These conditions present severe challenges to offshore installations. MARINTEK is heavily involved in the analysis and verification of design loads and responses for such installations. Our activities include model testing as well as the development and use of advanced numerical analysis tools. Examples of such projects are:

- Model test verification of a new FPSO for installation west of Shetland (BP's Schie-



*FPSO model in the Ocean Basin, 100-year storm.*

hallion field), representing an area with particularly strong wind-driven seas and with strong currents and swell. The primary objectives of the tests were to verify the motion characteristics of the FPSO system, assess extreme wave interactions with the hull, calibrate the results of the analytical studies of the mooring, and calibrate the global mooring fatigue analytical model.

- Model test verification of a large new production semi-submersible platform to be installed in the Gulf of Mexico (the Jack-St. Malo field operated by Chevron), at a depth more than 2000 m and with hurricanes and strong loop currents challenging the design. The objectives of the model tests were to evaluate global motion response (wave frequency and low frequency), verify extreme motions applied in design with particular focus on Steel Catenary Riser (SCR) design, verify the deck clearance or air-gap and run-up in extreme hurricanes, and measure and estimate slamming loads.
- A four-year international Joint Industry Project (JIP) with the aim of improving the design against the impact of energetic and extreme waves on ships and platforms. Focus areas have been on knowledge and numerical tools for design against wave impact on stationary ships and floating structures in severe storms. The wave impact problem is theoretically very challenging. A combination of model tests and numerical tools has therefore been needed for analysis of the problems. On the basis of the findings of the analyses, lessons learned and recommendations for such developments are included in final guidance reports.

## Management of ageing and life extension

A large number of Norwegian offshore installations are older than, or approaching,

their designed operating life limits. Although continued operation is favourable from both economic and social perspectives, it is not acceptable if it compromises Health, Safety and Environmental (HSE) standards.

Ageing can be defined as a process in which the characteristics of SSCs (Structures, Systems, and Components) gradually change and degrade with time or use. Ageing is not only related to a degradation of the technical condition of SSCs, but also to non-physical aspects from obsolescence issues, lack of knowledge, non-compliance with standards, to human and organisational problems.

While the petroleum sector can inspect and assess the current condition of facilities, there are very few, if any, operators who are capable of processing this information and predicting



*Ageing Management should be addressed from the design phase and not when the design life is due to expire.*

with any credibility the remaining useful life of SSCs and their facilities as a whole. This makes assurance of integrity and safe operation in the future a somewhat unquantifiable opinion. Instances from several industries demonstrate that failure to address ageing phenomena in a structured and disciplined way may lead to severe consequences. In 1980, for example, fatigue fracture in a structural member caused one of the five pillars of the Alexander Kielland semi-submersible platform to tear off, resulting in 123 fatalities. The Texas City Refinery explosion in 2005 killed 15 persons and injured many more.

These are examples of challenges which can be related to ageing and it is necessary to establish sound ageing management programmes in order to ensure that critical SSCs are not forgotten.

MARINTEK is currently cooperating with the petroleum industry to develop tools for

ageing management. Key elements required to address these challenges include the establishment of a wide range of essential processes and the development of dedicated models and methods.

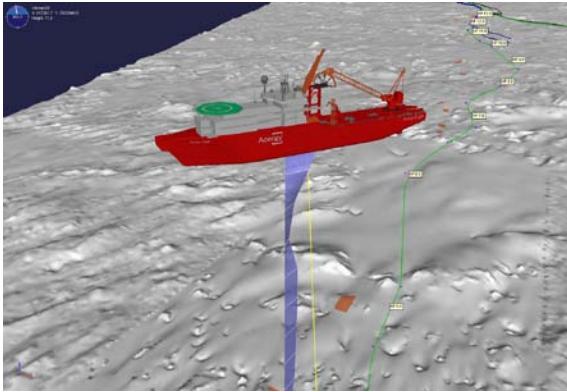
## **On-board monitoring, analysis and decision support during offshore pipelaying operations**

Offshore oil and gas production is moving into deeper waters, with subsea completion of the offshore end of the installation complex. Making subsea installations safer and more cost-effective offers an important challenge to the offshore construction industry. High efficiency in marine operations is crucial in this respect. Planning safe and efficient installation procedures in a realistic environment is a decisive aspect of being able to meet high safety standards and prevent damage and loss of equipment during installation operations.

In the course of the past few years, MARINTEK has developed the SIMLA. Installation software package, an online simulator that provides valuable decision-making support during the installation operations. The project is being co-funded by the Research Council of Norway (DEMO2000), leading industrial companies and MARINTEK.

*The MEG pipeline installation campaign at Ormen Lange in 2009 was performed by Acergy Falcon.*





Online 3D visualization of the Ormen Lange umbilical installation campaign in August 2009.

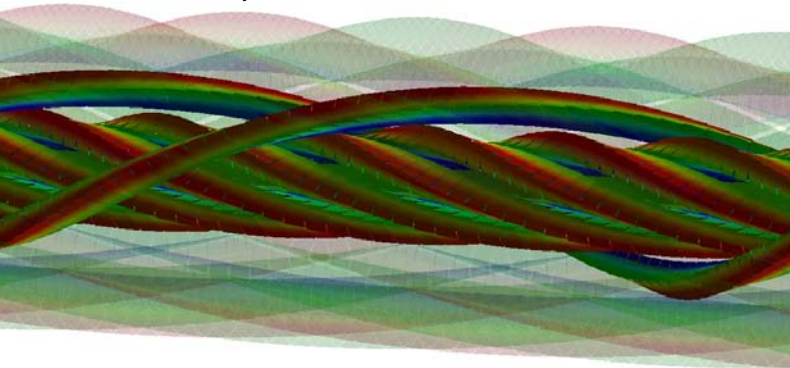
SIMLA.Installation offers on-board data acquisition and storage of key parameters during installation, real-time online 3D finite element analysis to support optimization of the pipelaying operation and support of decision-making processes related to specific events or emerging situations.

SIMLA.Installation has now been tested in real-time operations with successful results on the Ormen Lange Southern Field Development project. Transferring key information monitored on the pipelaying vessel to onshore computers allowed the complete offshore campaign to be followed onshore.

## Better understanding of local effects in umbilicals

Umbilicals are important components of offshore petroleum production installations, as they provide the link between the topside facility and the subsea control system. The

Section of 3D umbilical model displaying the different helical layers.

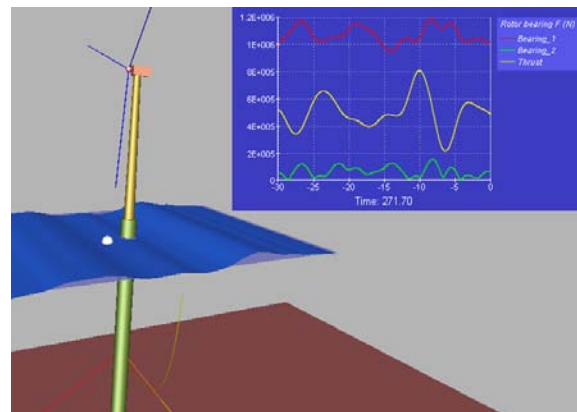


umbilical comprises a wide range of components; electric control lines, power cables and hydraulic and chemical fluid lines. The functional requirements of umbilicals differ from one installation to another, so there is a need for a wide range of designs. Offshore activities are moving to deeper waters, offering ever greater challenges to the design and qualification of umbilicals.

With the objective of obtaining a more complete understanding of the mechanisms inside these complex structures, a joint industry project on Stress and Fatigue Analysis of Umbilicals was launched in 2006. As part of this project, MARINTEK has developed and implemented a 3-dimensional finite element model tailored for prediction of the behaviour of complex umbilical cross-sections. Laboratory testing of two full-scale umbilicals has also been performed in order to validate the model, with successful results.

In 2009 a second phase of the project was launched. Additional full-scale testing is currently under planning, as is further development of the underlying mechanical models and software tools.

## Renewable ocean energy – offshore wind technology



Snapshot of SIMO simulation, with time traces of rotor bearing forces.

Energy consumption and energy prices are both on the rise. Concerns about global climate change have led governments all over the world to focus on new and sustainable energy sources. Renewable ocean energy,



*Hywind is the very first full scale floating wind turbine installed offshore. A scale model of the turbine was tested in the MARINTEK Ocean Basin for proof of concept.  
Photo: Trude Refsahl / Statoil*

and particularly offshore wind, is a promising energy source that is attracting ever more attention. The potential for wind farms in deep waters is huge, provided that costs can be kept to a competitive level. However, a significant amount of technology development is needed to meet this challenge.

As part of an R&D project co-funded by the Research Council of Norway, MARINTEK has developed a tool for analysing the design of floating wind turbines, based on MARINTEK's well-proven software for simulation of complex offshore marine operations (SIMO). The tool has already been successfully employed in the IEA's Annex 23 Benchmarking test programme. Ongoing activities are concentrating on implementation of the wind turbine module in the finite element analysis tool RIFLEX. MARINTEK has also been working on the logistics operations and maintenance aspects of offshore turbines, as these are critical issues for the safety and efficiency of these machines.

MARINTEK is one of the major R&D institutions involved in the Norwegian Research Centre for Offshore Wind Technology (NOWITECH), which was launched in 2009. The project will run for eight years. NOWITECH is part of the Centre for Environment-friendly Energy Research (CEER) scheme, which is co-funded by the Research Council of Norway, leading industries and research organisations.

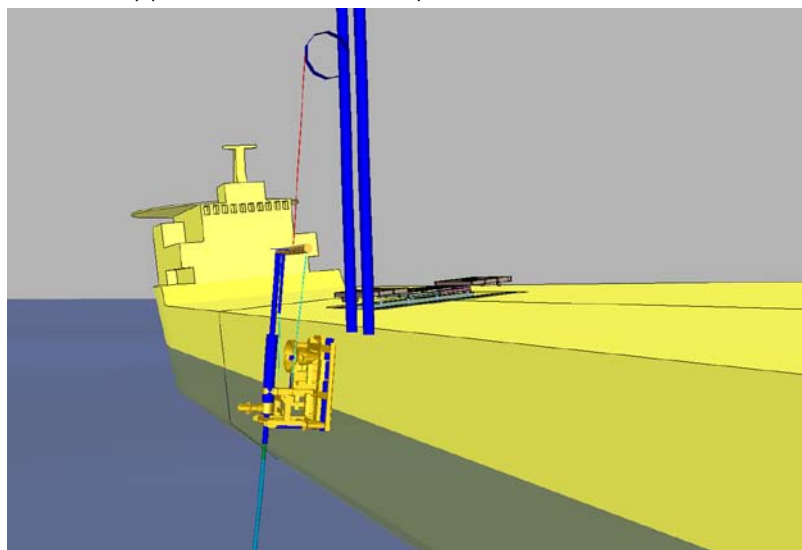
## Marine operations

Marine operations are critical for success in most offshore activities related to offshore oil and gas or renewable ocean energy. Feasible installation methods and related specialized equipment have been qualified by means of MARINTEK's software for dynamic analysis of marine operations (SIMO), an advanced tool for simulation of a wide range of marine operations, such as:

- Installation of deep-water petroleum production equipment in harsh environments. Accurate estimates of expected dynamic forces can improve the efficiency of such operations.
- Qualification of units and equipment for off-loading or load transfer in the open sea, and determination of weather windows.
- Analysis of the dynamics and safety-related aspects of equipment for evacuation of personnel in emergency situations.
- Safe and cost-effective installation methods for wind turbines and tidal current turbines.

The development of an advanced user interface has simplified access to our simulation tool, enhancing the quality assurance of the analytical processes involved.

*Installation of pipes with end termination template.*





The Norwegian fleet is the fifth largest in the world, and Norwegian shipowners stand for quality shipping. Our maritime and service industries are world leaders as is the classification society Den Norske Veritas. Norwegian shipyards are in the high-technology business of building specialized tonnage for demanding customers. Our maritime equipment industries are world leaders in their segments. The key factor is knowledge.

MARINTEK supports the world maritime industry with research-based knowledge and test and development facilities for improving its competitive edge in the global market. We are working on projects aimed at supporting this sector in a wide range of disciplines.



Continuous improvement in operational activities is vital to all businesses and industries, in which performance measurement and condition indexing are critical issues.

Shipping is a major contributor to emissions of greenhouse gases. What will be the future energy source in shipping? If LNG becomes the “bunker of the future” in coastal shipping, it will definitely have a great impact on the environmental footprint of this sector. Fleet and route optimization and “smart ICT” are likely to have an important impact on emissions in general.

Today, there is growing interest in the Arctic. Minimizing the environmental footprint of ship operations and offshore activities in Arctic waters is a key issue for our time.

There is a continuous activity in improving technologies. MARINTEK takes part in series of projects for developing new knowledge as well as new concept designs.

## Ship performance management

MARINTEK lies at the leading edge of expertise in technical performance measurement and condition indexing.

Measurement is a foundation of knowledge generation and of understanding about the performance, degradation and ageing of systems. Such knowledge has been utilized in targeted analyses and troubleshooting in collaboration with industrial customers for many years.

Performance Management uses measurement as an integral part of the management loop that is the basis for a continuous and structured improvement process. The link between measurement and management is self-evident; you can manage only what you can control and you can control only what you can measure.

MARINTEK works in close cooperation with industry on performance measurement as a way of improving sustainability in its operations in ever more competitive markets.

In the TOCC (Technical Operations Competence Centre) and RISE (Reducing Impact from Shipping on the Environment) projects, methods and infrastructure have been developed that permit shore-based analysis of ships' measurement data as a basis for performance assessment, benchmarking and decision support. The results are being transferred to the commercial "TOP Monitoring" service that is marketed by DNV Petroleum Services.

In the Shipping KPI project, leading industrial partners are collaborating in the development of a standard for performance

*Shipping KPI - towards transparent shipping.*



measurement of ship operations by means of a set of indicators. These indicators are collated to create benchmarks for the industry as a whole. Benchmarking is important and should be seen in the context of the IMO SEEMP (Ship Environmental Efficiency Management Plan) initiative to establish a regime through which all vessels should measure their environmental performance and document their continued attempts to implement improvements.

## Efficient and sustainable maritime transport

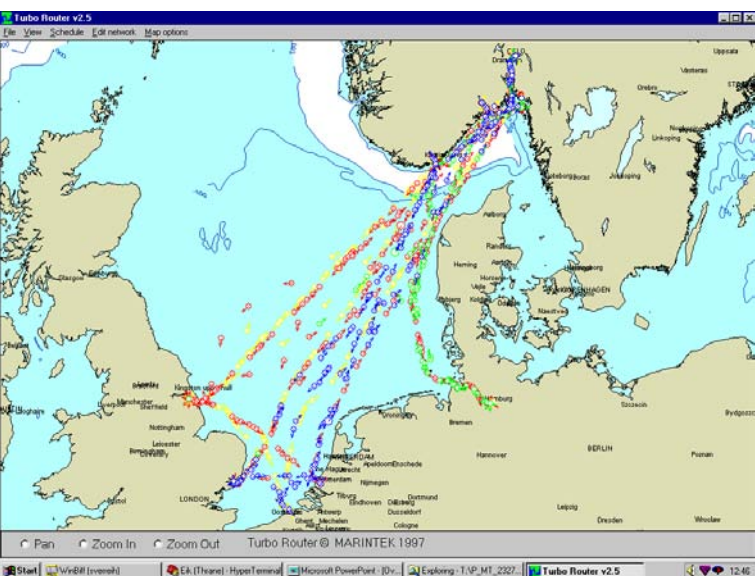


*View from ship bridge to port of Pireaus: Although binoculars and magnetic compasses are in use, modern ship operations is more and more dependent on information technology.*

*Photo: Rødseth/MARINTEK*

Efficiency in ship operations has a significant potential for reducing greenhouse gas emissions as well as costs. Fleet and route optimization and information management are key issues in this respect.

For some years, MARINTEK has been working with analyzing and optimizing maritime transport systems. A central part of this work is MARINTEK's TurboRouter software package, which is used for fleet scheduling and optimization purposes by a number of shipping and freight companies for operational, tactical and strategic decision-making support. A new version of TurboRouter that was launched in 2009 was specifically aimed at making it more accessible to non-expert users.



Map with optimized routes in MARINTEK's state of the art scheduling application, TurboRouter®.

MARINTEK's activities in 2009 in the area of information management have also been closely related to the development of the e-Navigation initiative in IMO as well as a more widely ranging e-Maritime concept, currently being investigated by the European Commission DG MOVE (Directorate General for Mobility and Transport).

Through a series of EU research projects, MARINTEK has contributed to the development of both of these concepts. Concrete results include data models for electronic port clearance of ships (ISO 28005), lightweight Ethernet protocols for integrated bridge systems (IEC 61162-450) and standard messages for transport execution plans, transport execution status and transport operation status reports (through UBL – Unified Business Language).

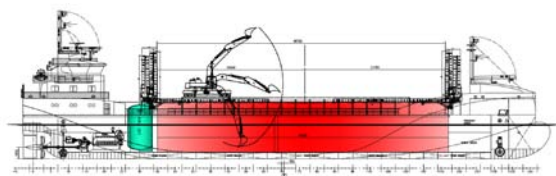
## NyFrakt – A new bulk vessel concept for coastal shipping

NyFrakt is an R&D project initiated and managed by MARINTEK, with funding from industrial partners and the Research Council of Norway. The aim of the project is to develop a new bulk vessel concept for operation on the coast of Norway. A 90 m l.o.a. bulk vessel for

transport of stone products is being developed as a pilot project.

The vessel has been designed by Rolls-Royce Marine, while the hatch and excavator arrangements have been the responsibility of TTS. Hull performance is being tested in collaboration with MARINTEK, partly in the form of model tests. The propulsion system is a single gas engine with mechanical drive of a controllable pitch propeller.

The new design offers a better than 20% improvement in energy efficiency compared to the most efficient designs of similar size available on the market. The main engine, which is the first dedicated gas engine that has been developed specifically for maritime applications, satisfies the requirements of the forthcoming IMO tier III for NOx emissions. In addition to improved energy efficiency, the reduction in greenhouse gases (GHG) will be in the range of 20-25%, including methane emis-

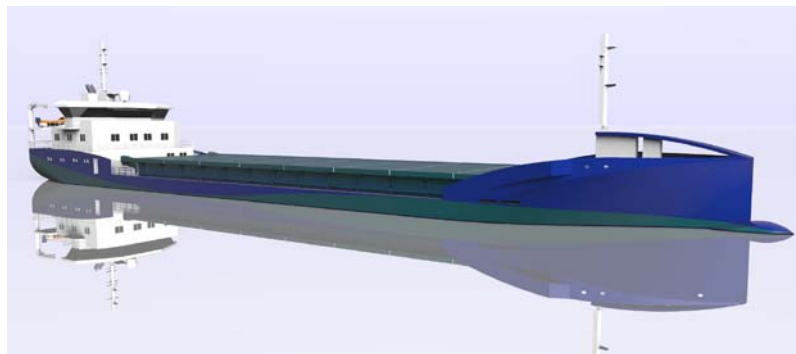


Propulsion and LNG arrangements. Hatch and excavator system design by TTS. Illustration: Rolls-Royce Marine.

sions, which will give a total reduction in GHG emissions for this type of operation in the region of 40%.

The NyFrakt project clearly indicates that in the future, LNG will be the preferred fuel for short sea shipping, from both the environmental and economic points of view.

Bulk vessel for transport of stone products, designed by Rolls-Royce Marine.





*Ice breaker assistance in Arctic waters.  
Photo: Aleksey Marchenko, UniS.*

## Vessel operation in the Arctic

Global warming may influence traffic patterns in international shipping. The shortest route between Asian manufacturing centres and their European markets is the Northern Sea Route across the Arctic Ocean. Less sea ice will prolong the season for commercial shipping in these areas.

We can also expect a considerable increase in internal shipping activities in the Arctic region. The Arctic is rich in natural bio-marine resources and minerals. A significant proportion of the world's undiscovered oil and gas resources is also believed to lie in these areas. Utilization of these resources will significantly increase the need for shipping operations, which in turn will increase the environmental impact of shipping transport.

A vulnerable environment will definitely require specific actions and measures to be taken in the fields of ship design, propulsion fuels and contingency planning in order to minimize risks to personnel, environment and infrastructure.

For some years, MARINTEK has been studying how to minimize the environmental footprint of vessel operations and offshore activities in Arctic waters. Together with industry we are developing a new design for the next generation of Arctic intervention and construction vessels.

More and more attention is being paid to seaworthiness and contingency planning as

a result of industrial and commercial development in the Arctic. MARINTEK is leading a major project on the specification of user requirements and measures to meet needs for traffic control and surveillance, risk management, safety control and contingency planning in Arctic waters.

In another project we are developing an integrated approach to ensuring seaworthiness in collaboration with the Norwegian Coastal Administration.

## Wave-loads on ships

Better knowledge of extreme hull girder load effects and early warnings of possible vibration-related fatigue problems are essential to the ship design process. Numerical tools can to some extent be used to predict extreme load effects, but model tests are still needed



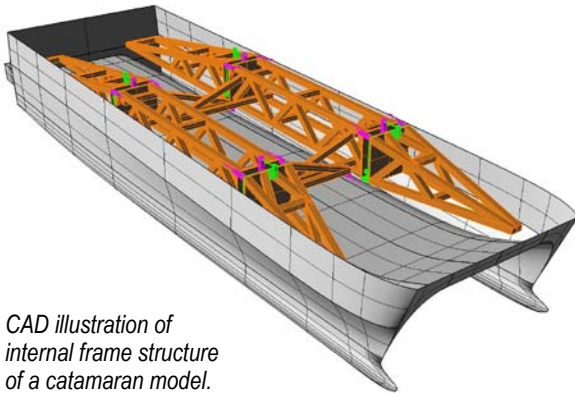
*Towed flexible model of an ore carrier.*

to ensure that the theoretical predictions are validated and properly calibrated.

“Whipping” is the transient vibration response excited by wave-impact loads, such as those that arise from bottom or bow-flare

*High speed catamaran model with waterjet propulsion.*

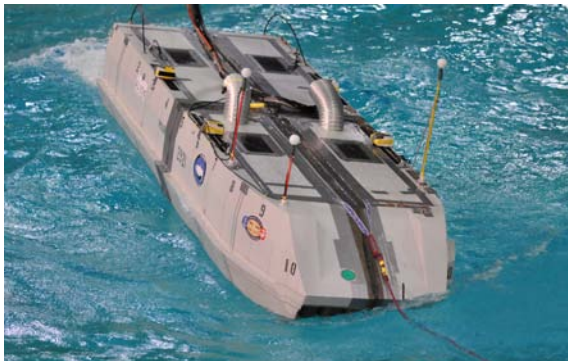




*CAD illustration of internal frame structure of a catamaran model.*

slamming. “Springing” is associated with resonant vibrations; i.e. when there are excitation forces whose frequency coincides with the natural frequency of one of the hull-girder vibration modes.

For ships with open cross-sections, e.g. large container ships, moving at relatively high speed, these effects can be a problem. The springing vibrations are usually excited by nonlinear wave forces, which are sensitive to bow geometry, and today’s numerical tools cannot properly capture these effects. Accurate model tests of carefully designed flexible models are therefore of vital importance.



*Flexible model of air cushion catamaran (SES) tested in the Ocean Basin.*

In the course of the years, MARINTEK has developed a practical design for these flexible models, which are made up of stiff segments connected through flexible “hinges”. All relevant forces and moments are measured at these connections.

In 2009 MARINTEK performed a series of tests on flexible models that ranged from high-speed catamarans via container ships

to large ore carriers. In the case of the large monohulls, the owners are concerned about potential fatigue problems caused by wave-induced vibrations.

## The Moonpool project

Offshore construction and intervention vessels are built with a moonpool. However, our knowledge of moonpool dynamics is still limited and new designs are therefore usually developed in the form of modifications of old designs that have been found to function well under normal operating conditions.

In order to improve the development of moonpool design, MARINTEK, STX Norway Offshore Design and DOF Management have launched a multi-year project aimed at developing methods and guidelines for designing moonpools. The project is being co-funded by the Research Council of Norway. The first year of the project focused on summarising and evaluating existing knowledge, and on describing the physics of water responses in typical moonpool geometries using CFD (Computational Fluid Dynamics) methods. Validating CFD calculations (OpenFOAM) with the aid of data from model tests was a priority task that aimed to ensure that reliable results were obtained by the calculations. The next phase of the project will apply the new knowledge and methods to more complex designs in order to gain experience for further development.

The ultimate target of the project is to enable designers to evaluate moonpool operability in the early design phase of a vessel. Vessel performance in both operation and transit will be considered.

*Moonpool water responses are critical for operability of offshore vessels.*



## Activities

MARINTEK performs research and development projects for industry and public-sector bodies involved in marine activities. The company operates in an international market, developing new technologies in the fields of floating petroleum production, subsea pipelines for oil and gas transportation, renewable energy from the oceans, vessel development, the shipbuilding and maritime equipment industries, shipping and logistics.

The headquarters of the company are in Trondheim, and it has subsidiaries in Houston, Texas: MARINTEK (USA), Inc., and in Rio de Janeiro: MARINTEK do Brasil Ltda. These companies have been set up as an element of our strategy of focusing on the international market, in collaboration with other Norwegian companies that wish to export Norwegian petroleum technology.

An important aspect of our work is the operation of the marine technology laboratories at Tyholt in Trondheim, the most important units of which are the Ocean Basin Laboratory, the Ship Model Tank and the Structural Design Laboratory. These laboratories are also utilised by NTNU's Department of Marine Technology in a fruitful collaboration with our own groups. Most of our research scientists are recruited from there.

## Markets and technology

MARINTEK had a good backlog of orders as we entered 2009, and both our laboratories and our long-term research work have enjoyed a high level of activity. This is in spite of the fact that the problems of the global economy have also affected our customer group, particularly in the maritime technology sector.

In the Ocean Laboratory, large, complex model tests on floater systems for operation in very deep waters and/or under extreme conditions have been performed. The work has included verification and concept-development tests for fields in the Gulf of Mexico, west of the Shetlands, in the Norwegian Sea and offshore Vietnam. There has also been a significant rise in activities related to offshore wind-power, including studies of industrial concepts for the installation of fixed wind turbines.

Testing of risers and cables for offshore installations continues to be a significant market. We have studied vortex-induced loads on riser towers during tow-out and installation in the Ocean Basin. Full-scale studies of the mechanical behaviour and strength of risers in cables have been carried out in order to verify the analytical tools

developed by MARINTEK for this type of structure. Test have also been performed in our H<sub>2</sub>S laboratory in order to identify the demands made on risers in fields in which the presence of CO<sub>2</sub> and H<sub>2</sub>S make an extremely corrosive environment.

The development of methods and tools for the design, installation and operation of offshore pipelines has been an important area of activity at MARINTEK for many years. Our efforts passed a new milestone in 2009, with the successful completion of two field tests that demonstrated and verified an on-board system for monitoring, analysis and decision support for pipe-laying operations on the Ormen Lange field.

In the area of operation and maintenance, we envisage a growing market in servicing Norwegian subsea installations. MARINTEK is also a participant in the Centre for Research-based Innovation in Integrated Operations in the Petroleum Industry. The Centre is a leading supplier of strategies and methods for raising standards of overall integration of onshore and offshore organisations for the performance of various types of operations, particularly those concerning operation and maintenance, integrated planning and logistics, and operations in crisis situations.

A large number of tests of a wide range of models have been performed in the Ship Model Tank and the Ocean Laboratory with the aim of studying the speed, seaworthiness, manoeuvrability and safety of various types of vessel. The work has included tests of advanced segmented models for the study of hydroelastic properties. Most tests have also included numerical analyses carried out with the aid of computational fluid dynamics (CFD) methods.

In maritime ICT, most of our work has concerned vessel operation, arctic operations and port operation, focusing particularly on communications technology and information processing. MARINTEK also participates in the work of the International Maritime Organisation (IMO) on improving transport and internationalisation through the ISO and the IEC, and in IMO's e-Navigation strategy and the efforts of the EU's Transport Directorate to develop more comprehensive e-Maritime and e-Freight strategies.

Our work on small-scale LNG distribution has continued to study the possibility of using LNG as bunkers for shipping. A pilot project has been launched in collaboration with the maritime industry, with the aim of developing a new bulk carrier concept capable of operating on the Norwegian coast and using LNG as its main propulsion fuel.

## Profit and loss accounts and balance sheet

The parent company's result is somewhat higher than the Board had anticipated. With a gross turnover of MNOK 303.3 and net operating income of MNOK 244.2, we made an operating profit of MNOK 18.4. A positive financial result of MNOK 1.0 left a profit after financial items of MNOK 19.4. The result after tax came to MNOK 13.4, which the Board proposes to transfer to the company's other equity capital.

Of a total capital of MNOK 296.4, our equity capital comes to MNOK 151.4, equivalent to an equity capital ratio of 51.0%. Our working capital is MNOK 123.5, which is a rise of MNOK 18.8 over the previous year's figure. Highly liquid assets come to MNOK 81.9, an increase of MNOK 31.4 for previous year.

The National Budget for 2009 earmarked MNOK 20 for new investments in the marine technology laboratories at Tyholt.

The company's order reserve stands at MNOK 121.7, compared with MNOK 100.9 at the same point in time last year.

## Prospects for the future

The international financial crisis has left large marks on the global economy. It is assumed that this will continue to present MARINTEK with significant challenges during the next few years. In our client segments, which are largely composed of the shipping and petroleum industries, we note that investments in major projects have been postponed, and that it has become more difficult to finance new innovative concepts.

MARINTEK is involved in major long-term R&D programmes in all the fields of R&D that are defined in our strategic plan, an aspect of our work that provides us with a constant level of activity throughout the year. MARINTEK also participates in one of the research centres for environmentally friendly energy that were established in 2009 by the Research Council of Norway to carry out research on offshore-based wind-power.

In collaboration with Norwegian maritime industry, MARINTEK has been given the task of developing an integrated strategy, called Maritime21, for maritime research and innovation. This has the ambition of making Norway the most attractive global base for a knowledge-based and environmentally robust maritime industry. The project was initiated by the Ministry of Trade and Industry in Spring 2009, in agreement with the maritime sector. In the process of drawing up a complete policy document that will describe a vision that looks ahead to 2020, a

number of workshops have been held and leading members of the maritime industry interviewed.

In the course of the past few years, MARINTEK and NTNU's Department of Marine Technology have been making highly goal-oriented efforts to profile themselves vis-à-vis the Norwegian authorities in the policy-making processes that deal with Norwegian industrial development and the need for more innovation in areas in which Norway enjoys such special advantages and good conditions as should enable it to maintain its position as a leading player at global level.

MARINTEK received special mention during the Storting's debate on the 2005 Research White Paper, which the government followed up in 2007 with the launch of its marine strategy, "Steady Course", via direct funding of research infrastructure to the amount of MNOK 45 over two years. This in turn was followed up by its support for our visionary "Ocean Space Centre" project, during the launch of the government's Innovation White Paper, "A Creative, Sustainable Norway" in December 2008. The Marine Technology Centre also came to the fore in the government's 2009 white paper on research, "A Climate for Research" and in its 2009 maritime strategy document, "Steady Course – Two Years On".

The pilot study for the visionary project was carried out in 2009, and is due to be submitted to the Ministry of Trade and Industry in Spring 2010. The aim of the pilot study was to develop the relevant material that would enable us to continue working towards the establishment of the Ocean Space Centre.

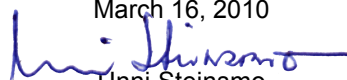
All of the above makes it clear that MARINTEK and the marine technology milieu in Trondheim occupy a prime position among the authorities' measures to promote sustainable industrial sectors in this country. This is an extremely positive signal for our efforts to contribute to increased creation of value in our priority market areas. Our task must be to think ahead and to be an important instrument for long-term wealth creation in Norway.

## Thanks to our employees

The Board extends its thanks to our employees and management for their excellent work in 2009. We also thank both the NTNU staff who are involved in MARINTEK's activities and our clients for their positive collaboration.

Trondheim, December 31, 2009

March 16, 2010



Unni Steinsmo  
Chair

## Income statement 2009

## Balance sheet 2009

Extract of MARINTEK concern's accounts (KNOK). Current exchange rate: 1 USD = NOK 6.28 - 1 EUR = NOK 8.73

### Operating revenues and expenses

<b>Revenues</b>	309 572
- Direct project expenses	54 431
<b>Net operating revenues</b>	<u>255 141</u>
Salaries, soc. sec. and other sec. costs	169 819
Other operating expenses	65 269
<b>Net operating expenses</b>	<u>235 088</u>
<b>Operating result</b>	<u>20 053</u>
Financial result	1 006
<b>Annual result before taxes</b>	<u>21 059</u>

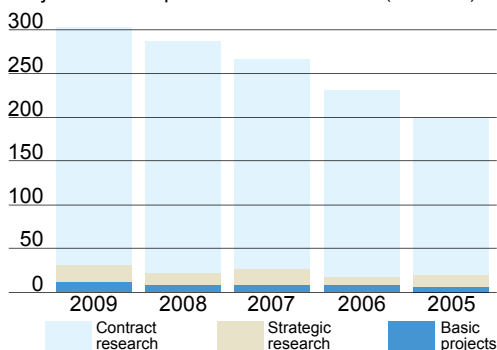
<b>Assets</b>	297 158
<b>Fixed assets</b>	<u>40 669</u>
Fixed operating assets	37 379
Financial long-term assets	290
<b>Current assets</b>	<u>256 489</u>
Other current assets	160 678
Cash, bank accounts	95 812
<b>Equity and liabilities</b>	<u>297 158</u>
<b>Equity</b>	153 592
Paid-up equity	11 600
Earned equity	141 992
<b>Liabilities</b>	<u>143 566</u>
<b>Long term liabilities</b>	<u>15 959</u>
<b>Current liabilities</b>	<u>127 607</u>

### Key figures (MARINTEK concern main financial figures)

KNOK	2009	2008	2007	2006	2005
<b>Result</b>					
Gross operating revenue	309 572	292 337	270 682	232 113	199 282
Net operating revenue	255 141	245 614	227 956	194 049	164 844
Operating result	20 053	3 632	15 006	12 278	7 352
Annual result	21 059	9 072	18 321	12 270	7 795
<b>Balance</b>					
Operating assets	40 669	46 214	38 367	35 757	27 994
Liquid assets	256 489	223 049	218 837	169 075	173 186
Total assets	297 158	269 263	257 204	204 832	201 180
Equity capital	153 592	139 508	131 446	115 578	103 483
Liabilities	143 566	129 755	125 758	89 254	97 697
Total equity and liabilities	297 158	269 263	257 204	204 832	201 180
<b>Profitability</b>					
Operating margin %	7.9	1.5	6.6	6.3	4.5
Total profitability %	3.5	0.7	3.2	3.0	1.9
Profitability on equity %	7.2	3.3	7.4	5.6	3.9
<b>Liquidity</b>					
Cash flow from operations (KNOK)	29 022	-16 885	25 670	4 810	4 185
Degree of liquidity	1.8	1.7	1.7	1.9	1.8
<b>Solidity</b>					
Equity capital %	51.7	51.8	51	56.4	51.4

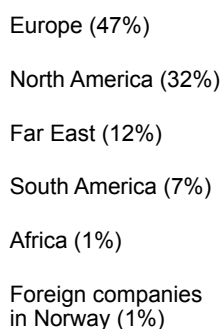
### Turnover

Project-related specification of turnover (mill. NOK)



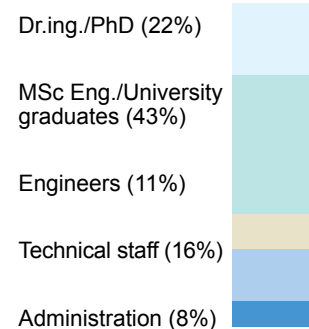
### Foreign trade

28% of total turnover



### Personnel

Total staff: 202



Auditors: Deloitte

## Ownership

MARINTEK's shareholders:

SINTEF	6.5 MNOK	56%
Norwegian Shipowners' Assoc.	3.0 MNOK	26%
Det Norske Veritas	1.0 MNOK	9%
Found. of Shipbuilders' Fund for Research and Education	0.5 MNOK	4%
Norwegian Maritime Directorate	0.5 MNOK	4%
Fed. of Norw. Coastal Shipping	0.1 MNOK	1%
<hr/>		
Total share capital	11.6 MNOK	100%

## Board of directors

President (CEO) Unni Steinsmo, Chair of the Board  
Technical director Jan-Kristian Haukeland  
Consultant Yngvil E. Åsheim  
Senior vice president Jon Rysst  
Acting director general Sigurd Gude  
Professor Bjørnar Pettersen  
Principal research engineer Karl Erik Kaasen  
Research manager Hans Jørgen Rambech  
Research scientist Janne Kristin Gjølsteen

## Management

President Oddvar Eide  
Executive vice president Birger Åldstedt  
QHSE - Karl Andreas Haugen  
Personnel - Anne Jørgensen  
Marketing - Egil Rensvik

### *Research directors:*

- Egil Giertsen, Structural engineering
- Ørnulf Jan Rødseth, eMaritime
- Andrew Gibson, Maintenance technology
- Eivind Dale, Strategy and logistics
- Per Magne Einang, Energy systems and environment
- Kourosh Koushan, Ship technology
- Frode Meling, Marine operations and simulation
- Halvor Lie, acting, Offshore hydrodynamics

*Laboratory manager, Ship & ocean lab., Audun Øydvin*

### *Subsidiary management:*

- President Terje Nedrelid, MARINTEK (USA), Inc.
- President Svein Karlsen, MARINTEK do Brasil Ltda.

## MARINTEK - a certified institute

MARINTEK has chosen to certify the whole company to the ISO-9001:2008 standard. We have mapped out all of our work processes, including laboratory activities, theoretical studies and analytical work. This is intended to ensure that our customers enjoy quality in all the work that we do for them.

## MARINTEK (USA), Inc.

MARINTEK is dependent on being close to its key customers, some of whom operate in the offshore industry. Houston, Texas, is still one of the most important global centres in offshore structure design. These centres are active vis-à-vis deep-water field developers in Brazil and West Africa as well as field developments in the Gulf of Mexico. MARINTEK operates a subsidiary in Houston involved in studies aimed at taking up the challenges of ultra-deep water.

## MARINTEK do Brasil Ltda.

Following several years of cooperation with Petrobras and other Brazilian companies, MARINTEK opened an office in Rio de Janeiro in April 2007. The office promotes areas of expertise for the whole SINTEF Group towards Brazil's oil and gas industry. In addition to be a service provider to this industry, MARINTEK do Brasil Ltda has the intention to be part of the research community in Brazil. We have therefore, in cooperation with SINTEF, signed cooperation agreements with a number of the major universities.

## Cooperation with NTNU and with other units of SINTEF

NTNU's Department of Marine Technology and MARINTEK are coordinating their strategic programmes so as to ensure that the strategic research is integrated. These efforts are coordinated both vis-à-vis industrial partners and the Research Council of Norway, and turn the combination of MARINTEK and NTNU into one of the strongest civil R&D-centres within marine technology in the western world. As part of this strategy, MARINTEK participates in the financing of the Centre for Ship and Ocean Structures (CeSOS), a world class centre of excellence partly funded by the Research Council of Norway.

We have established a Gemini Centre in the field of structural mechanics, and this model is profited by the SINTEF Group and NTNU when the two institutions wish to emphasise their cooperative efforts.

MARINTEK cooperates widely with other units of SINTEF, and we participate in SINTEF Group research on pipelines for offshore applications and offshore integrated operations. In 2009 we cooperated successfully with SINTEF departments for being prequalified for final submission of applications for several Centres for Research-based Innovation (SFI) to the Research Council of Norway.



# MARINTEK



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