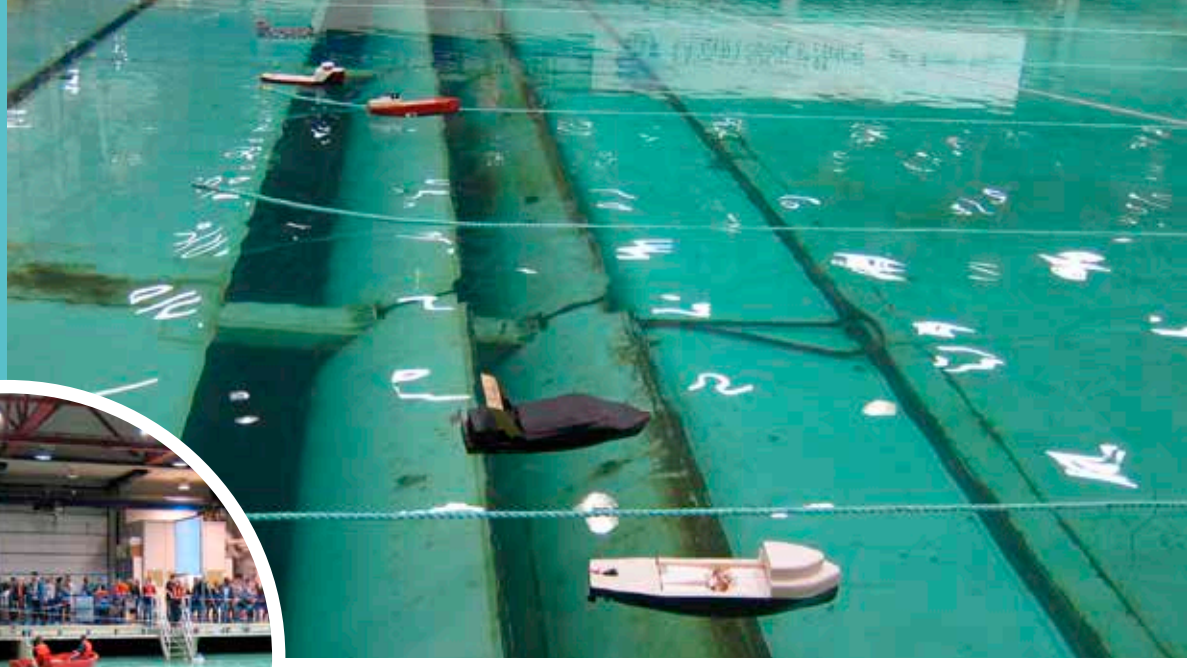
NTNU
Department of Marine Technology



DEPARTMENT OF

MARINE TECHNOLOGY

Annual Report 2014


SPJELKAVIK

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THE YEAR 2014 IN SUMMARY

The year 2014 was both interesting and prosperous for the Department of Marine Technology. Nearly 150 Master's Degree students graduated, the highest number ever. The latest number of newly admitted students was also high, and the proportion of female applicants was over 40% for the first time. Approximately 120 PhD students are currently studying, which implies that there will be very promising numbers of graduates in the future. The turnover of externally financed project activities, including EU projects, was increased compared to previous years. The administrative support including routine for project initiation and follow up was improved and contributed to a positive impact on the general work environment and efficiency.

By the end of the year, The Research Council of Norway announced that 3 of the new Centres for Research-based Innovation (SFI), in which we are heavily involved, were to be funded by the Research Council Board. The Centres include the following:

- SFI EXPOSED – Exposed Aquaculture Operations (SINTEF Fisheries and Aquaculture AS)
- SFI Smart Maritime - Norwegian Centre for Improved Energy Efficiency and Reduced Emissions from the Maritime Sector (MARINTEK AS)
- SFI MOVE – Marine Operations Centre (Ålesund University College)

These centres will begin their activities during 2015 and are expected to operate until 2023. In conjunction with SFF AMOS, these centres will further strengthen research activities within core areas including the maritime, offshore and aquaculture areas. These centres represent the most important key areas within the marine and maritime areas, so knowledge transfer between the centres is an important issue. Additionally, the management and operation of the new key research area "NTNU Ocean" are located in the department; metaphorically, this research area offers an ocean of opportunities.

CoE AMOS has progressed very well with the establishment of planned activities such as project initiation, international co-operation and high PhD engagement. Further, the financing of another 5-year gift professoriate has been achieved and is sponsored by the Statoil via the Statoil Academia Agreement.

Space available at the Marine Technology Centre is limited; however, the number of staff is increasing and many new PhD candidates and students are expected. In 2014, an office area rebuilding process was begun to allow for room for new employees and students. This rebuild will continue through the end of 2015. Further, the laboratories and much of the infrastructure requires upgrading and refurbishment, increasing the need for the realization of the Ocean Space Centre (OSC).

The strategic government plan for research and higher education (Langtidsplan for forskning), launched in October 2014, benefits two new infrastructure projects of great national importance including the Centre for Life Sciences at the University of Oslo and the Ocean Space Centre at Tyholt. The next phase of the Ocean Space Centre project will fully begin in 2015. Further, the government included "the Ocean" as one of the most important national future research areas in its "Langtidsplan for forskning".

During 2014, the Research Council conducted an *"Evaluation of basic and long term research within Engineering Science",* in which the department was examined. The outcome of this evaluation will be launched during first half of 2015. In this process, the research groups are evaluated versus their qualifications within the areas of "Scientific quality and productivity", "Relevance and impact" and "Strategy, organization and research cooperation".

During last part of 2014, as a response to an initiative from the Ministry of Education and Research (SAKS), NTNU developed a process discussing the option to merge with several other university colleges. It is expected that the NTNU board will convene and form conclusions regarding any mergers during January 2015.

The coming year will be challenging, with the beginning of new SFIs, followed by the OSC project. Furthermore, the enforcement of the staff and possible mergers between NTNU and several university colleges may also considerably impact the department. The University College in Ålesund is one of the possible merger candidates.

The in-house co-operation with MARINTEK has been successful in contributing to the success of the Centre of Marine Technology in the marine and maritime world. The co-operation with other parts of the SINTEF organization has also been important, especially co-operation with SINTEF Fisheries and Aquaculture. Furthermore, the laboratories such as the AUR-lab initiative are under constant development.

As in previous years, the co-operation and the day-to-day contact with students are inspiring and constructive. Among other things, the in-house co-operation with both MARINTEK and the students was fruitful in connection with the "Marine Technology Days" (Marintekniske Dager), an arrangement

that occurred at the same time as the student-organized "Industry Days" (Bedriftsdagene) at the Centre.

The department strives to steadily improve the working environment, and the social event working group has done a good job with many events including the summer and Christmas parties. The department did also very well in the Trondheim Marathon in September 2014. There are, of course, high expectations with respect to social activities in 2015.

Recruitment activities are highly prioritized in the Department, and several events have been arranged such as "Women's Day" (Jentedagen) to recruit more female students. Other events include the Ocean Space Race, the Talent Camp during Nor-Shipping in Oslo, participation at the Boat festival in Ålesund and the Researchers Night at NTNU, all to increase the interest of young people in physics, mathematics and technology. These activities have proven to be both necessary and highly successful, and they will be highly prioritized in 2015.

Prof. Harald Ellingsen
Head of the Department of Marine Technology

FACTS AND FIGURES

Staff
22 professors
8 professors emeriti
4 associate professors
2 assistant professors
15 adjunct professors
6 adjunct associate professors
7 researchers
13 postdoctoral fellows
94 PhD candidates*
14 graduated PhD candidates
149 graduated MSc students
102 MSc exchanges to universities abroad **
14 administrative staff
18 technical staff
1 apprentice

Revenues
Income: 129,5 MNOK
Costs: 125,5 MNOK
Year-end allocation: 4 MNOK

Publications
1 book
5 book chapters
93 refereed journal articles
116 refereed conference papers
12 international keynote and plenary lectures
45 media contributions
44 other presentations
2 patents

**Note: This number only includes PhD candidates who are financed by the Department of Marine Technology and/or CeSOS.*
***Note: Spring and autumn semester 2014 combined.*

ORGANIZATION

Head of Department
Prof. Harald Ellingsen

Assistant Head of Department
Prof. Svein Sævik

Head of Office
Astrid E. Hansen

Head of Marine Systems
Prof. Stein Ove Erikstad

Head of Marine Structures
Prof. Roger Skjetne

The Department of Marine Technology consists of two research groups: the Marine Systems research group and the Marine Structures research group.

The Marine Systems research group teaches and conducts research on major aspects of marine systems, such as machinery, ships and maritime transport systems; offshore oil and gas infrastructure and systems; other offshore energy production systems; and fisheries and aquaculture. The research group focuses on system design and operation as well as interaction and adaptation to the surroundings in a total lifecycle perspective. The prioritized research areas are as follows:

- Risk and safety management of marine systems
- Multi-level design of complex marine systems
- Design and verification of complex energy systems
- Sustainable development of shipping in Arctic waters

The Marine Structures research group educates and conducts research in the fields of marine structures, marine hydrodynamics, underwater technology, and marine control engineering. Key research application areas are the following:

- Oceanography
- Wave-induced motions and strongly nonlinear loads
- Structural load effects
- Abnormal loads and accidental load effects
- Slender marine structures
- Ship operations
- Propellers and propulsion
- Renewable energy propulsion
- Marine operations
- Aquaculture facilities
- Very large floating structures
- Deep-sea mineral mining
- Wind, current, and wave energy production
- Structural design
- Underwater robotics
- Ocean science

EDUCATIONAL PROGRAMMES

The department is responsible for the organization and implementation of the Marine Technology educational programme at the faculty. It is offered to students in three main options (number of students graduated in 2014 in parentheses):

- as a 5-year integrated Master programme (106)
- as a 2-year Master programme for students with a Norwegian Bachelor degree (12)
- as a 2-year international Master programme (21)
- other Master programmes with a specialization in Marine Technology (10)

The first 3 years of the integrated Master programme feature introductory courses in mathematics, statistics, physics, chemistry, mechanics, and thermodynamics in addition to courses that introduce the marine disciplines and their aspects, design, and operational problems to be encountered throughout the programme.

From the 6th semester onwards, students can choose among eight specializations:

- Marine structures
- Marine cybernetics
- Marine hydrodynamics
- Marine engineering
- Marine operation and maintenance engineering
- Marine systems design
- Marine resources and aquaculture
- Marine subsea engineering

The study specializations combine the disciplines of hydrodynamics, structural engineering and marine systems. An emphasis is placed on the students' ability to combine practical understanding with the use of mathematical models and computer-based methods of analysis. Emphasis is also placed on the development of the students' ability to view the big picture in technical problems related to design, analysis and operation of marine systems.

The 2-year Master of Science programmes in Marine Technology is offered to students with a Bachelor degree in Naval Architecture, Ocean Engineering or an equivalent upon admission. The structure of the programmes is built on the courses offered in the last two years of the 5-year programme.

In addition to Marine Technology, the department is involved in the following programmes:

- Engineering and ICT— 5-year integrated Master programme
- Maritime Engineering— 2-year international Master programme (Nordic Five Tech programme, in cooperation with the Technical University of Denmark, the Royal Institute of Technology and Chalmers University of Technology in Sweden, and Aalto University in Finland)
- Marine Coastal Development— 2-year international Master programme
- Subsea Technology— 2-year Master programme in cooperation with Bergen University College
- European Wind Energy Master— 2-year international Master programme in cooperation with Delft University of Technology, Technical University of Denmark, and Carl von Ossietzky Universität Oldenburg

Figure 1: (Kristin Lauritzsen, NTNU): Master students conducting experiments in the towing tank.

RECRUITMENT ACTIVITIES AND EVENTS

Project managers:
Assistant prof. Kristin Lauritzsen (Kristin.lauritzsen@ntnu.no)
Associate prof. Håvard Holm (Haavard.holm@ntnu.no)

Ocean Space Race: 6–7 March

Figure 2 (Pål Leraand, MARINTEK): pupils competing with their model boats at the Ocean Space Race 2014.

On Friday, 7 March, 2014, the Ocean Space Race (OSR) competition took place at the Marine Technology Centre. A total of 442 participants (405 pupils and 37 teachers from 20 different secondary schools of Norway) competed in the Ocean Basin Laboratory to create the fastest, most operative and most stabile ship models and wind turbines. Prior to this event, the participants worked for approximately half a year to design and build their ship and wind turbine models. The pupils also could listen to exciting lectures about ongoing research projects, student life and future job opportunities of the marine industry. OSR has been arranged by NTNU's department of marine technology in collaboration with MARINTEK and "Samarbeidsforum Marin" annually for seven years. The aim is to increase the interest of pupils at the secondary school level for studying mathematics and physics, and ocean space technology, in particular. A video was recorded by MARINTEK from OSR 2014: http://www.oceanspacerace.no/film-bilder/video-osr2015/

Educational Exhibitions in January in Tromsø, Frøya, Trondheim and Ålesund

Students from the recruitment team of NTNU's department of marine technology contributed at educational exhibitions in Tromsø, Frøya, Trondheim, and Ålesund. The stands at the educational exhibitions were organized by the central administration of NTNU. They offered information on the study programmes of NTNU to pupils at the secondary school level of Norway.

NTNU Jentedagen: 6–7 February

A total of 250 female pupils with the highest achievement in mathematics and physics at the secondary school level in Norway participated at NTNU's Jentedagen for two days. Presentations of the study programmes, social lunches and a dinner in the first evening were on the agenda. On the second day, the girls visited different stands that exhibited NTNU's broad activities related to mathematics and physics. NTNU's department of marine technology took part in organizing the stand at NTNU's Jentedagen.

Ocean Space Exploration Day: 29 April

Pupils and teachers at the primary school level of Norway that were offered the "Research in Practice" class were invited to have an inspiration day at NTNU. Five different classes from five different regions of the country were selected based on their reports from ongoing technological building projects. During this inspiration day, the pupils presented their projects and visited the laboratories of the Marine Technology Centre at Tyholt. Afterwards, they visited Trondhjem Biological Station and joined a fjord-rafting trip to and from a visit to the Research Vessel (RV) Gunnerus. On shore, they could investigate live samples of fish species and marine organisms placed in seawater basins. The fish and marine organisms had been caught that morning by the RV Gunnerus. This event was arranged by the NTNU department of marine technology, NTNU department of biology (Trondheim Biological Station), RV Gunnerus and "Samarbeids-

forum Marin". The NRK and "Adresseavisen" have published a couple of videos from the event:
http://tv.nrk.no/serie/distriktsnyheter-midtnytt/DKTL99042914/29-04-2014#t=3m54s

http://www.adressa.no/tv/?id=26462&autoplay=1

Figure 3 (Kristin Lauritzsen, NTNU): Live samples of fish that have just been caught by the RV Gunnerus for the pupils to investigate during Ocean Space Exploration Day.

NTNU Open Day: 29 April

Pupils at the secondary school level participated at NTNU's Open Day, which was filled with different activities at Realfagsbygget, NTNU's Gløshaugen campus. NTNU's department of marine technology organized a stand with different kinds of activities available for the pupils.

Textbook "Havromsteknologi" Published

A new textbook called "Havromsteknologi" was published for classes at the secondary school level in Norway with "Teknologi og forskningslære" as an educational programme. The book (ISBN 978-82-321-0441-3, Fagbokforlaget Vigmostad & Bjørke AS) is sold by bookstores in Norway. It is also available on the internet (http://www.ntnu.no/sf-marin/havromsteknologi/laringsmateriell) and may be freely distributed to school classes that show interest by contacting NTNU's department of marine technology via email: <haavard.holm@ntnu.no>. Leif Lundby is the editor of the book.

The production of the textbook has been financed by "Samarbeidsforum Marin" and "Stø Kurs". Currently, the book is being translated into English.

Figure 4: Holm, Håvard; Amdahl, Jørgen; Larsen, Carl Martin; Moan, Torgeir; Myrhaug, Dag; Pettersen, Bjørnar; Steen, Sverre; Sørensen, Asgeir Johan. Havromsteknologi. Akademika forlag 2014 (ISBN 978-82-321-0441-3), 483 pages.

Boat Festival of Ålesund: 8-13 July

NTNU's department of marine technology had a stand with recruitment activities for the general audience visiting the Boat Festival of Ålesund. Three students on the recruitment team organized the stand's activities, which were quite popular among the young people. NRK reported an all-time high participation at the festival: http://www.nrk.no/mr/rekordar-for-batfestivalen-1.11829507

"Tjuvstarten": 11 August

The Tjuvstarten arrangement was a half-day seminar for new female students in the marine technology study programme at the Marine Technology Centre. The aim of the seminar was to let new female students meet and get to know one another prior to meeting the rest of the students. A total of 51

girls joined the seminar, which provided information on the study life in general and at Tyholt, in particular. Finally, job opportunities in the marine industry were also highlighted.

Forskningsdagene 19–20 September and Researcher's Night 26 September in Trondheim

A stand with recruitment activities was arranged at the city centre of Trondheim during "Forskningstorget" on 19–20 September and during Researcher's Night, "Realfagsbygget", on 26 September, at NTNU's Gløshaugen campus. September 19–20 was dedicated to pupils of primary and secondary schools and the general audience. Pupils at the secondary school level from the middle part of Norway were featured in the evening of September 26.

Courses for Teachers in Secondary and Middle Schools

In cooperation with "skolelabben", NTNU now offers courses for secondary and middle school teachers in technology. In these courses, we offer projects with both a theoretical and a practical approach. All projects are targeted to be applied in the school courses and address certain topics that are part of the curriculum. Workshops have also been arranged for the science centres. The intention of these workshops is to enable the science centres to provide courses and support for schools locally. We have also had requests from institutions that educate teachers and are looking for possibilities to cooperate with them. This activity is a strategic action to set the focus on the marine sector in Norway and increase the interest for working in this sector.

Visitors to NTNU's Tyholt Campus

External visitors came to NTNU's Tyholt campus frequently throughout 2014. These visitors usually wanted to have a look at the unique laboratory facilities of the Marine Technology Centre and attend a presentation on the marine technology study programme of the department. The most frequent visitors were pupils and teachers from both primary and secondary schools in Norway. Occasionally, the visitors were marine industry professionals, politicians, representatives of volunteer associations, NTNU technical personnel and international students. During 2014, 15 different kinds of visits to the campus were organized.

Some visitors at the department of marine technology in 2014:

Visitor	Date
Norway's Minister of Petroleum and Energy Tord Lien	10 January
Norway's State Secretary from the Ministry of Trade, Industry and Fisheries Dilek Ayhan	22 May
Norway's Crown Prince Haakon Magnus of Norway and Germany's President Joachim Gauck	13 June
The Labour Party's team of experts for education and research («kunnskaps-utvalget»)	19 August
Brazil's Minister of Fisheries and Aquaculture Eduardo Lopes	20 August
Vietnam's Deputy Minister of Agriculture and Rural Development Vu Van Tam	20 August
Canada's Minister of Foreign Affairs John Baird	23 August
Norway's State Secretary from the Ministry of Foreign Affairs Morten Høglund	16 September

NTNU Bridgehead Frøya

NTNU Bridgehead Frøya (Brohode Frøya) is a regional developmental project that links educational institutions with industry and policy implemention systems within the field of aquaculture. The project objective is to mobilize higher education, strengthen recruitment to the marine sector industry, and increase the relevance of higher education as well as the secondary education level.

Since its establishment in 2012, the project has directly involved and influenced approximately 1000 people. Pupils from the secondary education level have been connected to students and researchers to inspire higher education in marine studies. Connecting students with the industry has led to projects and master theses that address current challenges. Students have also been given insight into the industry by attending events such as akvARENA, Boot Camp, and Aquavitalis, as well as gaining practical experience through summer jobs. NTNU Bridgehead Frøya cooperates with aquaculture themed "villages" in the NTNU subject Experts in Teamwork (EiT) and provides hands-on experience for EiT students with excursions and visits to relevant

companies. Aquaculture professionals have strengthened their theoretical skills by attending adapted classes in continuing education.

NTNU Bridgehead Frøya holds a large gathering known as the Bridgehead Conference, a biannual event in which pupils, students, researchers, and industry professionals meet to discuss current and future issues for aquaculture.

In 2014, NTNU Bridgehead Frøya produced a handbook and film to share its acquired knowledge on how to start and run a cooperative project.

Figure 5 (Jakob Berntsen, NTNU Brohode Frøya): Discussions at the Bridgehead Conference 2014.

Figure 6 (John Eilif Hermansen, NTNU): Experts in Teamwork visiting a salmon farm.

RESEARCH HIGHLIGHTS

A list of all of the department's research projects in 2014 is located in the appendices of this annual report. The following pages are selected research highlights from several of the department's projects in 2014.

Air-sea Interaction and Transport Mechanisms in the Ocean

Project manager: Prof. Dag Myrhaug (Dag.myrhaug@ntnu.no)

The ultimate aim of the project is to predict the air-sea interaction and the resulting wave-current flow from the free surface to the bottom of the sea. This includes the entire dynamics of the wind above the waves, the free surface, and the entire water column from the free surface to the bottom; these flows are mutually dependent. To obtain these goals, it is necessary to take the turbulence that exists in the ocean into account by providing good turbulence closure. We are working both with simplified one-dimensional models (Reynolds-averaged Navier-Stokes) and three-dimensional models (large eddy scale simulations), building all our models in-house.

Our present work includes combined wind-driven and tidal flows, seabed boundary layer flow, Stokes surface drift for random waves, sediment transport and wave-current interaction at the free surface of the ocean.

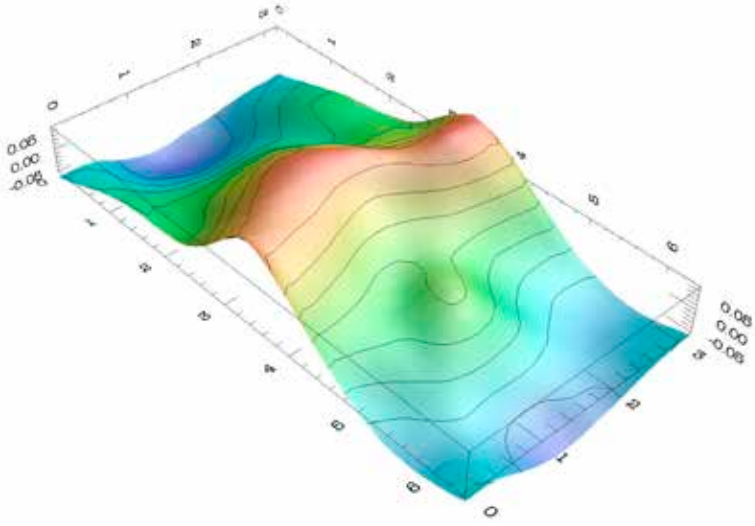


Figure 7: Free surface elevation resulting from a turbulent wave-current interaction. These waves were initially long-crested, but after 5 wave periods, they have become short-crested as a result of the turbulent wave-current interaction.

Highlights:

Holmedal, L. E. & Wang, H. (2015). Combined tidal and wind driven flows and residual currents, Ocean Modelling 89: 61–70.

Afzal, M. S., Holmedal, L. E. & Myrhaug, D. (2015). Three-dimensional streaming in the seabed boundary layer beneath propagating waves with an angle of attack on the current, accepted for publication, Journal of Geophysical Research.

Myrhaug, D., Wang, H. & Holmedal, L. E. (2014b). Stokes drift estimation for deep water waves based on short-term variation of wave conditions, Coastal Engineering 88: 27–32.

Myrhaug, D., Holmedal, L. E. & Ong, M. C. (2014a). Seapage effects on bedload sediment transport rate by random waves, Ocean Engineering 82: 123–127.

Arctic DP: Safe and Green Dynamic Positioning Operations of Offshore Vessels in an Arctic Environment

Project manager: Prof. Roger Skjetne (Roger.skjetne@ntnu.no)

The Research Council of Norway · DNV·GL · KONGSBERG · Statoil

The project "Arctic DP: safe and green dynamic positioning operations of offshore vessels in an arctic environment" was awarded by the Research Council of Norway in 2010 to the NTNU Faculty of Engineering Science and Technology and industry partners Kongsberg Maritime, Statoil, and Det Norske Veritas for the project period 2010-2014. Its vision is for the Norwegian industry to attain world-leading competence and knowledge of dynamic positioning (DP) system technology and operation developed for the safe and environmentally robust DP operations of offshore vessels in Arctic environments. The project is managed by Prof. Roger Skjetne, who, together with Prof. Lars Imsland and Prof. Sveinung Løset, is the key scientist.

The Arctic DP project conducts research on safe and efficient offshore operations in Arctic regions that include the dynamic positioning (DP) of offshore vessels in sea-ice.

The main focus has been on understanding the physics of DP vessel motions in Arctic sea-ice; the development of corresponding mathematical models and numerical simulators; and the use of control theory within the instrumentation and development of the feedback control, observer, and estimation algorithms. Scientific research has been performed in the following three main work packages (WPs):

- DP control system redesign
- Autonomous ice observation system
- Ice management ice load reduction

The project ended its main activities in 2014 and marked this by a special edition in the open access journal Modeling, Identification and Control (MIC), 2014, Vol. 35, No. 4 (Figure 8).

For a printed issue of the journal, please visit the journal: B&W or Color.

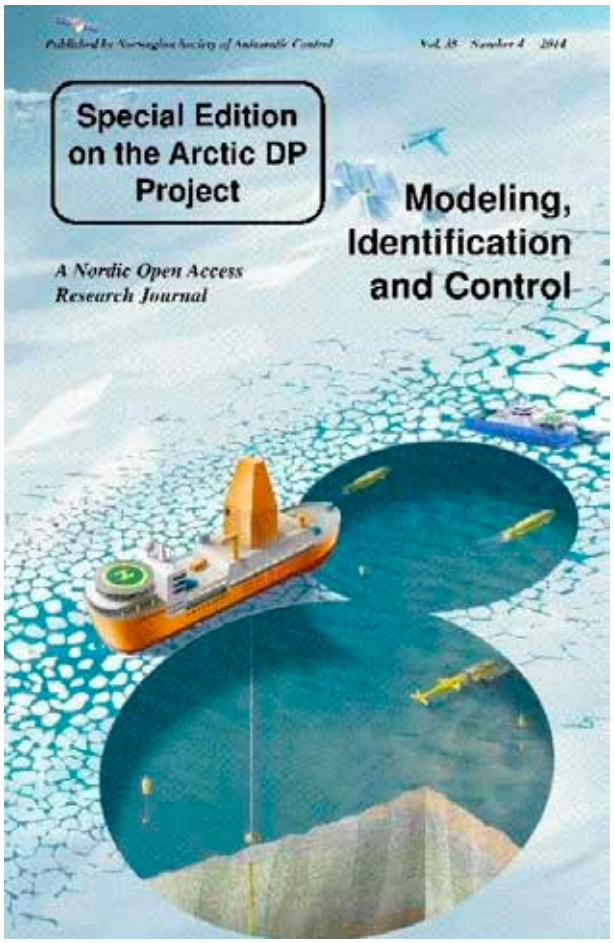


Figure 8: Special Edition on the Arctic DP Project of the open access journal Modeling, Identification and Control, 2014, Vol. 35, No. 4.

Design and Verification of Control Systems for Safe and Energy-efficient Vessels with Hybrid Power Plants (D2V)

Project manager:
Prof. Asgeir J. Sørensen
(Asgeir.sorensen@ntnu.no)

Dynamically positioned (DP) vessels with electric power plants in the range of 10-80 MW are used in the offshore industry in several safety-critical operations, including drilling, supply, offloading, construction, anchor handling, and production. DP vessels are being increasingly used, and they constitute a major part of the national and international maritime activities related to the exploration and exploitation of hydrocarbons and other advanced offshore operations. The development of knowledge and competence in the design and qualification of safe and environmentally robust power and energy management systems for safer and greener offshore vessels is critical for the Norwegian industry. Highlights for 2014 are the development of a simulator of a hybrid power plant, a dynamic positioning system as dynamic energy storage on diesel-electric ships, and the development of the optimization-based control of diesel-electric ships in dynamic positioning.

The D2V projects addresses:

- Design and verification of complex systems by system simulations
- Analysis of transient and stationary dynamics on fuel consumption and gas emissions
- Optimal and fault-tolerant control of hybrid power systems on ships and rigs
  - Diesel- and LNG-driven gensets
  - Energy storage using battery banks, flywheels, etc.
  - AC and DC systems

Figure 9: Hybrid power plant.

Follow-up JIP on Nonlinear FE-methods for Determination of Structural Capacity

Project manager: Prof. Jørgen Amdahl
(Jorgen.amdahl@ntnu.no)

DNV GL, in cooperation with industry partners, has developed guidelines to document the resistance of offshore structures by means of nonlinear FE methods. A recommended practice (DNV-RP-C208) was issued in 2013. The research project has been considered a success, but it was realized that there was a need to further develop the guidelines. A follow-up joint industry project (JIP) was therefore initiated in 2014. The project addresses the analysis of accidental actions in general, but the focus is especially on ship collisions and tensile fracture predictions, where the department is heavily involved. Ship collision is important because a significant increase in the design energies according to NORSOK N-003 is expected in 2015. One of the goals of the project is to establish a shell model library of different bow, side and stern configurations of offshore support vessels for an integrated FE analysis of collisions. As a part of this activity, DNVGL RP-C204 Design Against Accidental Loads is being further developed, notably on ship collisions and accidental fires.

HYDRALAB IV

Project manager: Alexandra Neyts
(Alexandra.neyts@ntnu.no)
Project web page: www.hydralab.eu

The FP7 Research Infrastructure project is a European network of unique experimental facilities for studying interactions between water and environmental elements, sediment, structures and ice. Thirty participants from 15 countries collaborate to stimulate transnational access to and improve services provided by existing research infrastructures. NTNU offers access and full-scale field research opportunities at the land-locked Bay of Hopavågen in mid-Norway. Researchers from the Department of Marine Technology were involved in an interdisciplinary study to correlate ecosystem field observations with physical model simulations. HYDRALAB IV was finalised in October 2014. Its successor, HYDRALAB+, has been retained for funding in Horizon2020 and is expected to start in 2015.

Figure 10 (Jussi Evertsen, NTNU): HYDRALAB IV field study at the Bay of Hopavågen.

Low Energy and Emission Design of Ships (LEEDS)

Project manager:
Prof. Bjørn Egil Asbjørnslett
(Bjorn.e.asbjornslett@ntnu.no)

The objective of the LEEDS project is to develop knowledge for concept design, system design and technology options for ship design for low energy consumption and greenhouse gas (GHG) emission. The baseline for energy usage and emission level is, to a large degree, set with the ship design. As such, to meet the challenges to reduce energy usage and emission

levels from shipping, a continuous line of new ship designs are required. The LEEDS project will contribute both new knowledge of low-energy and low-emission ship design and the education of personnel with the background and confidence to challenge ship and ship system design, and these people can become key personnel in the maritime industry for developing novel solutions for energy and emission reduction. One practical problem is the machinery system selection problem under uncertainty, and a two-stage optimization and decision support process is given in Figure 11.

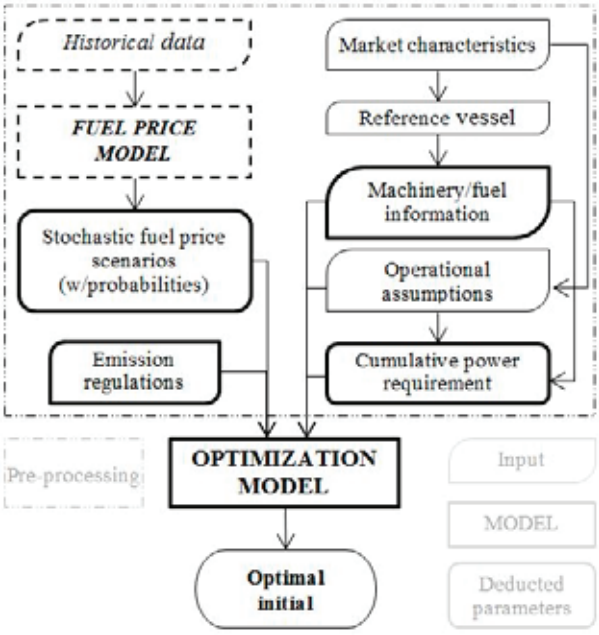


Figure 11: The decision support process for the machinery system selection process (Ø. Patricksson and S.O. Erikstad).

MARINA Platform

Project manager at NTNU: Prof. Torgeir Moan (Torgeir.moan@ntnu.no)
Project web page: http://www.marina-platform.info

COMMISSION OF THE EUROPEAN COMMUNITIES

The MARINA platform has been a Seventh Framework project in the EU in the period 2010-2014, with a total budget of 12.7 mill Euros, and is dedicated to bringing marine renewable energy applications closer to the market by creating a new infrastructure for both offshore wind and ocean energy converters. The MARINA platform has been coordinated by Acciona, and CeSOS, NTNU has been the scientific lead of the project, which involves 15 other industry, research institute and university partners.

Various concepts for generating electric power by combining wind and wave power have been developed with a focus on three concepts, including the STC and SFC concepts developed by CeSOS. The power yield and systems integrity of these concepts have been assessed by methods for integrated dynamic analysis, risk assessment, and experimental methods established in the project. The concepts are hence brought to a preliminary engineering design level with estimates of the power output and costs. The next stage of development, the new resultant multipurpose MRE platform designs, will be the construction of pilot scale platforms for testing at sea.

See MARINA's report summary:
http://cordis.europa.eu/result/rcn/55474_en.html

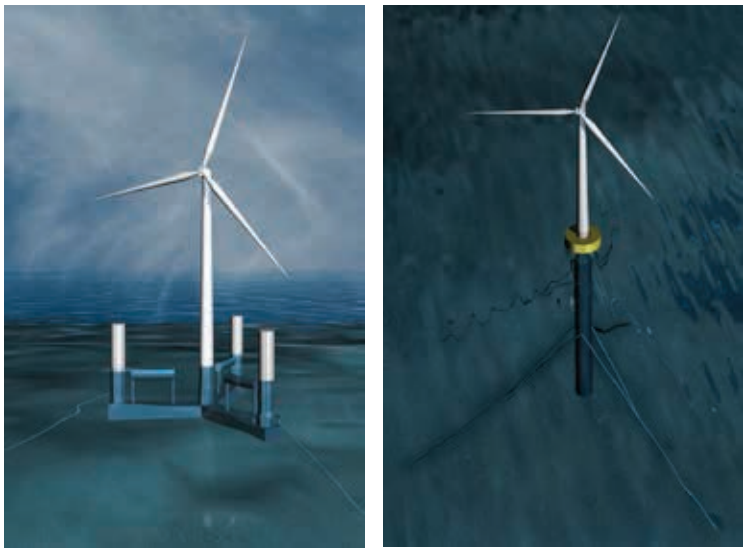


Figure 12: The SFC (to the left) and the STC concepts for converting wind and wave power into electric power, developed at CeSOS, NTNU.

SUSTAINFARMEX - Towards Sustainable Fish Farming at Exposed Marine Sites

Project manager:
Prof. Ingrid Bouwer Utne
(Ingrid.b.utne@ntnu.no)

Norwegian fish farmers express ambitions to adopt locations farther out on the coast. There are benefits related to less environmental impact, fewer area conflicts, and better production environment for the fish, but there are also challenges, e.g., because of higher significant wave heights and stronger currents. In the research project (KPN) SUSTAINFARMEX, SINTEF Fisheries and Aquaculture, NTNU and industry partners work together to solve challenges related to future fish farming in exposed sites. Research highlights are as follows:

- Development and analyses of statistics related to injuries, fatalities and the risk level in aquaculture
- Development of concepts for improved interactions between vessels, barge, fish, and cages
- Simulations and testing of different solutions related to the structural integrity of cages and the welfare of the fish in more exposed locations
- Development and testing of improved instrumentation and sensor systems

Figure 13 (SINTEF Fisheries and Aquaculture): Working conditions at a fish farm.

Virtual Prototyping of Marine Systems and Operations (ViProMa)

Project manager: Associate Prof. Eilif Pedersen
(Eilif.pedersen@ntnu.no)

The objective of this KPN project, awarded by the Research Council of Norway to NTNU, University College of Ålesund; SINTEF/MARINTEK and industry partners Rolls-Royce Marine; Vard Group; OSC; and DNV GL is to develop a common framework for the co-simulation and virtual prototyping of marine systems and operations for cases that are as realistic as possible. One PhD candidate and one post-doc are working on this project together with researchers at SINTEF and MARINTEK. The highlights of 2014 include the release of our first version of the co-simulation bus based on the de-facto standard functional mock-up interface (FMI) and the establishment of workshops where the project partners have been able to submit, set up and demonstrate co-simulation for the virtual prototyping of their own simulation models working together with models from other partners. Likewise, the simulation bus developed has been adopted by an Innovation project (IPN) called Virtual Sea Trial (VISTA), which has somewhat similar objectives but from more of a ship designer and end user perspective. This is a very complementary project that enables our project to obtain more user experience and gain more experience by including more relevant cases into the project. Activities that discuss in detail the requirements for component model interfacing and co-simulation setup are also underway. An open library of the major component models needed for a realistic co-simulation setup for the virtual prototyping of a vessel and its system is in its infancy.

Figure 14: Putting it all together using modelling and simulation.

RESEARCH CENTRES

Centre for Autonomous Marine Operations and Systems (AMOS)

Director: Prof. Asgeir J. Sørensen (Asgeir.sorensen@ntnu.no)
Web page: www.ntnu.edu/amos

The NTNU Departments of Marine Technology and Engineering Cybernetics, together with MARINTEK, SINTEF Fisheries and Aquaculture, SINTEF ICT, DNV GL and Statoil and leading international and national collaborators, were awarded a Centre of Excellence (CoE) by the Research Council of Norway in 2013.

AMOS creates fundamental knowledge and innovates through multidisciplinary theoretical, numerical, and experimental research within the knowledge fields of hydrodynamics, structural mechanics, guidance, navigation, and control. Cutting-edge inter-disciplinary research will provide the necessary bridge to realize high levels of autonomy for ships and ocean structures, unmanned vehicles, and marine operations and to address the challenges associated with greener and safer maritime transport, monitoring and surveillance of the coast and oceans, offshore renewable energy, and oil and gas exploration and production in deep and Arctic waters.

Centre for Ships and Ocean Structures (CeSOS)

Director: Prof. Torgeir Moan (Torgeir.moan@ntnu.no)
Web page: www.cesos.ntnu.no

The Centre for Ships and Ocean Structures (CeSOS) was established as a Centre of Excellence by the Research Council of Norway (RCN) in 2002 with support from RCN as well as NTNU, MARINTEK, DNV and Statoil. Key researchers involve professors from the Departments of Marine Technology, Engineering Cybernetics and Mathematics at NTNU.

The centre has been operating in close cooperation with sponsors and scientists from the Technical University of Denmark (DTU), Massachusetts Institute of Technology (MIT), INSEAN and other universities and research institutes. CeSOS focuses on the development of fundamental knowledge concerning the design and operation of future ships and ocean structures by integrating theoretical and experimental research in marine hydrodynamics, structural mechanics and automatic control.

The support from RCN formally ended after 10 years, as scheduled; however, CeSOS personnel still conduct high-quality research activities as key personnel in AMOS, a new Centre of Excellence. Furthermore, several PhD candidates are affiliated with AMOS. An overview of key personnel, scientific publications and PhD theses during the period of 2002-2012 are available on the CeSOS website: www.cesos.ntnu.no. Since 2013, research activities have primarily been reported through the Department of Marine Technology and AMOS.

Rolls-Royce University Technology Centre (UTC) "Performance in a Seaway"

Director: Prof. Sverre Steen (Sverre.steen@ntnu.no)
Web page: https://www.ntnu.edu/imt/rolls_royce

The University Technology Centre is a research collaboration with Rolls-Royce and focuses on propellers and propulsion research in waves and off-design conditions.

Current research focuses on the following:

- Renewable energy propulsion using wave foils; the PhD project completed by Eirik Bøckmann. The model test and simulation model for ships with wave foils and a proof-of-concept are being developed. The next developmental stage is of a commercially realizable system, in cooperation with Rolls-Royce.
- Scale effects of ducted propellers. The PhD project of Anirban Bhattacharyya, in co-operation with MARINTEK. The study is based on RANS CFD, at both model and full scale, and advanced model tests are conducted. The results explain the main sources of the scale effects on ducted propellers.
- Propulsion in waves. The effect of waves on the cavitation characteristics and propeller-engine interaction are examined. While cavitation is found surprisingly unaffected, the efficiency of an engine decreases as emissions increase. This is the PhD project of Bhushan Taskar.
- Hydrodynamics of merchant vessels with sails; the PhD research of Jarle A. Kramer.
- Validation of ship manoeuvring simulation models using both dedicated full-scale trials and data from ships in normal operation; the PhD work of Sergey Gavrilin and the post-doc studies of Afshin Abbasi-Hoseini.

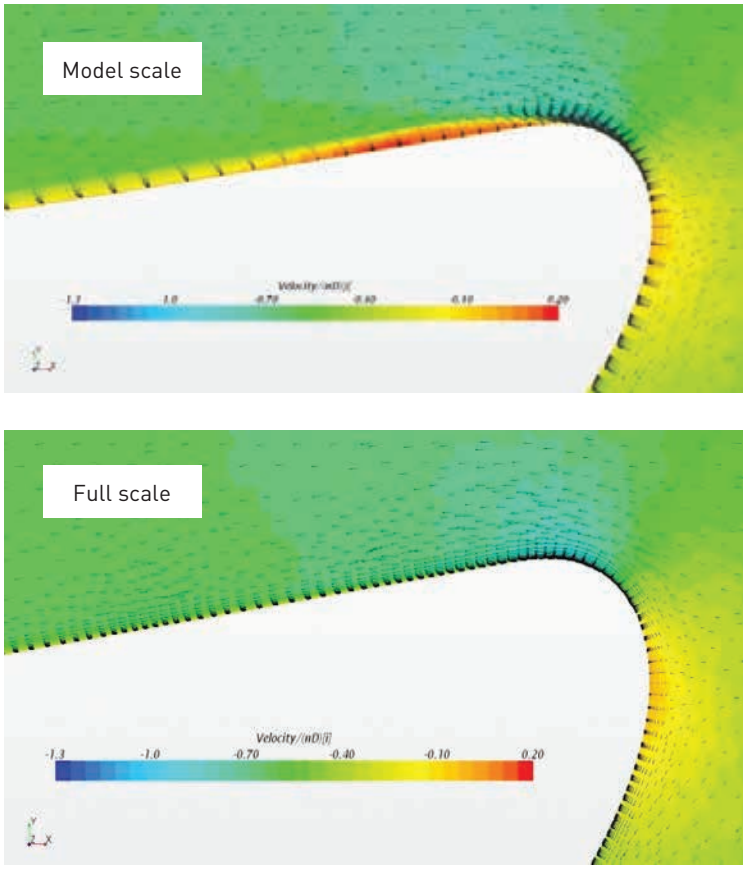


Figure 15: CFD simulation result of the flow around Duct 19A at both model and full scale. The separation zone on the outside is clearly shown at model scale; however, there is no flow separation at full scale.

Involvements to Three New SFI-Programs

By the end of the year, The Research Council of Norway announced 17 new Centres for Research-based Innovation (SFI), in which the department is heavily involved in the following three:

- SFI EXPOSED – Exposed Aquaculture Operations (SINTEF Fisheries and Aquaculture AS)
- SFI Smart Maritime - Norwegian Centre for Improved Energy Efficiency and Reduced Emissions from the Maritime Sector (MARINTEK AS)
- SFI MOVE – Marine Operations Centre (Ålesund University College)

According to the Research Council, "The purpose of the Centres for Research-based Innovation (SFI) is to build up and strengthen Norwegian research groups that work in close collaboration with partners from innovative industry and innovative public enterprises."

A short description of each of the three new centres is given below.

SFI "EXPOSED" – Exposed Aquaculture Operations

Host institution: SINTEF Fisheries and Aquaculture AS

The rationale for this research centre is a gradual move towards using more exposed coastal areas in aquaculture.

There is need for:
- more space and fewer areal conflicts
- improved production environment with stable conditions and greater dispersal of wastes
- locations further from wild salmonids in coastal waters.

The SFI shall:
- Develop new technologies and competence within aquaculture and other maritime industries. There is a growing national and international market.
- Enable safe and profitable operations at exposed fish farming sites. This will be a key to the sustainable growth of the industry.

The national research partners are:
- SINTEF (Fisheries and Aquaculture, MARINTEK & ICT)
- NTNU (Marine technology, Computer and Information Science & Engineering Cybernetics) with SFF AMOS
- Institute of Marine Research

SFI "Smart Maritime" - Norwegian Centre for improved energy efficiency and reduced emissions from the maritime sector

Host institution: MARINTEK AS

The vision of this SFI is to contribute to a "greening maritime transport, i.e., enable the Norwegian maritime cluster to be world leading in 2025 in environmentally friendly shipping". To achieve this, the SFI aims at establishing a Norwegian Centre for improved energy-efficiency and reduced emissions from the maritime sector.

Further the aim is to create innovations securing sustainability and competitiveness of the maritime transport sector by developing new knowledge, methods and technologies and educating students.

Research partners are:
- SINTEF (MARINTEK)
- NTNU (Department for Marine Technology, Industry Ecology Programme)

- Aalesund University College (Faculty of Maritime Technology and Operations)

SFI "MOVE" – Marine Operations Centre

Host institution: Ålesund University College

SFI MOVE shall develop knowledge, methods, tools, technology, prototypes and education for safe, robust and efficient installations and structures and maintenance of equipment in extreme waters. Technology and methods shall make possible new opportunities for Norwegian industry and other enterprises through operations in the Arctic and in deep waters, including the installation of windmills and deep-sea mining.

The vision of the SFI is to establish a "World-leading centre for marine operations with innovations and training by virtual prototyping".

Research partners are:

- Aalesund University College (Faculty of Maritime Technology and Operations)
- NTNU (Department for Marine Technology)
- SINTEF (MARINTEK and SINTEF Fishery and Aquaculture)

Other National Expertise Centres with the Involvement of the Department of Marine Technology

Sustainable Arctic Marine and Coastal Technology (SAMCoT): A Centre for Research-based Innovation for the development of robust technology necessary for sustainable exploration and exploitation of the valuable and vulnerable Arctic region. Lead partner: NTNU Department of Civil and Transport Engineering.

www.ntnu.edu/samcot

Norwegian Research Centre for Offshore Wind Technology (NOWITECH): A Centre for Environment-friendly Energy Research established to conduct concentrated, focused and long-term research to solve specific challenges in the field of energy and the environment. Lead partner: SINTEF Energy Research.

www.sintef.no/Projectweb/Nowitech/

OCEAN SPACE CENTRE

The Ocean Space Centre project made good progress in 2014. Much effort was used to establish understanding for the need of such a centre among decision-makers. Among others, a large number of central politicians representing many Norwegian political parties visited the Marine Technology Centre at Tyholt and were informed about the plans.

The most important achievement is the promotion of the Ocean Space Centre by Norway's Solberg government as one of two research and development infrastructure projects that will be prioritized in its Long-term Plan for Research and Higher Education, 2015 – 2024.

In 2014, the Ministry of Trade, Industry and Fisheries (NFD) began to establish a suitable organization to complete the next phase of the technical definition and development of the Ocean Space Centre. The project now answers to the Research and Innovation Department of NFD. Statsbygg, the key advisor to the Norwegian government for construction and property affairs, shall lead the pre-engineering of the Ocean Space Centre concept until the next quality assurance point (KS2), which is expected at the end of 2016. MARINTEK and NTNU will collaborate closely with Statsbygg.

The plan is to complete the Ocean Space Centre at Tyholt in Trondheim in 2022.

RESEARCH FACILITIES

	Facility	Description	Operational institution	Website
1	Ocean basin	LxWxD = 70m x 50m x 10m; waves from two directions, variable water depth, winds and currents	MARINTEK	https://www.ntnu.edu/imt/lab/ocean
2	Large towing tank (tank I+III)	LxWxD = 260m x 10m x 5m - 10m; waves in the direction of the tank, two carriages, max 10m/s	MARINTEK	https://www.ntnu.edu/imt/lab/towing
3	Cavitation laboratory	Circulating water tunnel with controlled pressure; measurement section of 1.2m in diameter, velocity up to 12m/s	NTNU and MARINTEK	https://www.ntnu.edu/imt/lab/cavitation
4	Circulating water tunnel	Used for flow visualization, PIV and LDV measurements in connection with student exercises and PhD research projects	NTNU and MARINTEK	https://www.ntnu.edu/imt/lab/cwt
5	Small towing tank	LxWxD = 25m x 2m x 1m; towing tank for educational purposes	NTNU and MARINTEK	https://www.ntnu.edu/imt/lab/towing
6	Marine cybernetics laboratory (MC-lab)	LxWxD = 35m x 3.5m x 1.6m; waves from one direction, advanced towing carriage and instrumentation for control system experiments	NTNU	https://www.ntnu.edu/imt/lab/cybernetics
7	Marine HIL simulation laboratory	Hardware-In-The-Loop (HIL) simulation lab for students and researchers to verify their HW/SW setups, signal communication, user interfaces, and test scenarios in real time for bugs and weaknesses prior to conducting actual time-limited experiments	NTNU	https://www.ntnu.edu/imt/lab/hil
8	Wave tank	LxWxD = 13m x 0.6m x 1m; for 2-D studies of wave kinematics	NTNU	-
9	Marine structures laboratory	Static and dynamic testing of structures and structural components	NTNU and MARINTEK	https://www.ntnu.edu/imt/lab/structures
10	Machinery laboratory	Equipment for testing of marine engines, fuel, and new concepts	NTNU and MARINTEK	https://www.ntnu.edu/imt/lab/machinery
11	Hybrid power laboratory	Combined power and simulation lab for testing novel marine power plants	NTNU	https://www.ntnu.edu/imt/lab/hybrid
12	Applied underwater robotics laboratory (AUR-lab)	Two remotely operated underwater vehicles (ROV), one autonomous underwater vehicle (AUV), research vessel Gunnerus and associated instrumentation systems	NTNU	https://www.ntnu.no/aur-lab
13	Unmanned aerial vehicles laboratory (UAV-lab)	Unmanned aerial vehicles and open-source guidance, navigation, control, and communication systems, payload sensors, simulators, test fields, crew, and support systems	NTNU	https://www.ntnu.edu/imt/lab/uav
14	Aquaculture engineering laboratory (ACE)	Large-scale laboratory facility designed to develop and test new aquaculture technologies	SINTEF Fisheries & Aquaculture, NTNU and more	http://aceaqua.no/en/
15	Flume tank	LxWxD = 2.5m x 0.61m x 0.61m; flume with a test section, velocity of 0.03-1.0m/s, laminar flow	SINTEF Fisheries & Aquaculture	http://www.sintef.no/home/Fisheries-and-Aquaculture/About-us/Laboratories/SINTEF-Fisheries-and-aquaculture-flume-tank/

Marine Cybernetics Laboratory (MC-Lab)

The Marine Cybernetics Laboratory is a fully instrumented marine hydrodynamic model basin that is used to conduct marine cybernetic and hydrodynamic experiments in PhD research, MSc projects and teaching. For quality assurance prior to experimental testing in the MC-Lab, the Marine HIL Simulation Lab (see list above for specifications) has been established as an extension of the MC-Lab.

In 2014, the MC-Lab was employed by several MSc students in their projects and by several PhD candidates in their research. Find out more about teaching activities in the lab on the website of the Marine Cybernetics Teaching Laboratory, currently under construction on https://www.ntnu.edu/imt/lab/cybernetics

In these days, the MC-Lab is being prepared for underwater robotics using small underwater vehicles. The goal is that the laboratory can serve as a rapid prototyping and qualification lab for research prior to larger experimental campaigns conducted via AUR-Lab (see list above for specifications).

Figure 16 (Andreas Reason Dahl, NTNU): New experimental platforms designed and constructed as part of MSc theses.

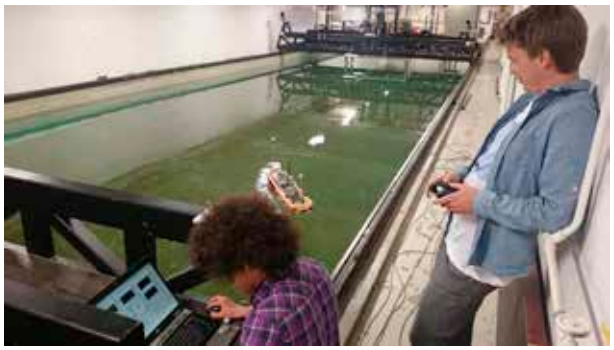


Figure 17 (Andreas Reason Dahl, NTNU): Marine Control Systems 2 project: students test their control design.

Figure 18 (Astrid H. Brodtkorb, NTNU): New methods for sea state estimation using the ship as a wave buoy is tested with Cybership 3.

AWARDS AND HONOURS

Master's student Magnus Arnhus received the Tryg award for the best Master's thesis in 2014 in health, environment and safety, together with two other Master's students. Prof. Jan Erik Vinnem was his supervisor.

Master's students Knut Gulsvik and Kun Xu won at the 2014 "Your Extreme Awards" by Kongsberg Group out of 83 proposals. Knut and his team won the main award, and Kun and his team won the student choice award. Kun is being supervised by prof. Torgeir Moan, adjunct associate prof. Zhen Gao and researcher Konstantinos Michailides.

Four Master's students won the international "Dr. James A. Lisnyk Award for Ship Design Excellence" in 2014: Tor Marius Angvik, Ada Næsset Hovind, Ole Harald Moe and Stian Høegh Sørum. Their main supervisors were prof. Sören Ehlers and assistant prof. Svein Aanond Aanondsen.

PhD candidate Erin E. Bachynski won the highly prestigious Chorafas foundation award in 2014. This year, the award was given to 31 junior scientists from top universities around the world.

PhD candidate Qin Zhang received the "2013 Chinese Government Award for Outstanding Self-financed Students Abroad" from the China Scholarship Council in January 2014. Her main supervisor is prof. Roger Skjetne.

The King of Norway dubbed Prof. Torbjørn Digernes knight first class of the Royal Norwegian Order of St. Olav. County Governor Jørn Krog handed over the decoration at Lerchendal estate in August 2014.

Prof. Odd M. Faltinsen was awarded the SOBENA International Award 2014 for his "fundamental contributions for marine and ocean engineering on an international level".

Figure 19: Front row from the left: Unni Steinsmo (CEO of SINTEF Group), Tore Ulstein (deputy CEO of Ulstein Group), Torbjørn Digernes (previous NTNU-rector), Professors Moan and Faltinsen, and Henrik Madsen (CEO of DNV GL).

Adjunct prof. Jørgen Juncher Jensen received the SNAME Davison medal for "outstanding scientific accomplishment in marine research" in 2014. Furthermore, Juncher was selected as the 37th Georg P. Weinblum Memorial Lecturer.

Two papers coauthored by adjunct prof. Claudio Lugni were selected in June 2014 for the Best Paper Awards at the 32nd International Conference on Offshore Mechanics and Arctic Engineering (OMAE'13) in Nantes:

Bouscasse, B.; Antuono, M.; Colagrossi, A.; Lugni, C. A classification of shallow water resonant sloshing in a rectangular tank, 32nd Int. Conference on Offshore Mechanics and Arctic Engineering (OMAE'13), Nantes, 2013.

Marino, E.; Nguyen, H.; Lugni, C.; Manuel, L.; Borri, C. Irregular nonlinear wave simulation and associated loads on offshore wind turbines, 32nd Int. Conference on Offshore Mechanics and Arctic Engineering (OMAE'13), Nantes, 2013.

Prof. Torgeir Moan was awarded an honorary doctorate degree (Dr.h.c.) at Aalto University in Finland in 2014.

Prof. Asgeir J. Sørensen received the Teacher of the Year 2014 Award from the Master's students of the Department of Marine Technology at NTNU.

Prof. Odd M. Faltinsen became a corresponding member at the Croatian Academy of Sciences and Arts in 2014.

Adjunct prof. Jørgen Juncher Jensen and adjunct associate prof. Ulrik Dam Nielsen became fellows of the International Community for Maritime and Ocean Professionals (SNAME) in 2014.

70-Year Anniversary Seminar and Celebration for Professors Faltinsen and Moan

For the 70-Year Anniversary Seminar and Celebration for Professors Faltinsen and Moan on 19–20 May 2014, the Marine Technology Centre was packed with 300 national and international guests and prestigious speakers. Additionally, the seminar was video streamed to 787 total viewers.

Please take a look at the programme, presentations given at the conference, media coverage and pictures taken at the seminar and celebratory dinner: https://www.ntnu.edu/imt/news2014

For more news from the department, visit: https://www.ntnu.edu/imt/news2015

APPENDICES

Staff

Academic staff

Aanondsen, Svein Aanond	Assistant Professor
Amdahl, Jørgen	Professor
Asbjørnslett, Bjørn Egil	Professor
Erikstad, Stein Ove	Professor
Digernes, Torbjørn	Professor
Greco, Marilena	Professor
Holm, Håvard	Associate Professor
Holmedal, Lars Erik	Researcher
Karlsen, Ludvig	Associate Professor
Larsen, Carl Martin	Professor
Lauritzsen, Kristin	Assistant Professor
Leira, Bernt Johan	Professor
Ludvigsen, Martin	Professor
Myrhaug, Dag	Professor
Pedersen, Eilif	Associate Professor
Pettersen, Bjørnar	Professor
Risberg, Per Anders	Associate Professor
Skjetne, Roger	Professor
Steen, Sverre	Professor
Sævik, Svein	Professor
Sørensen, Asgeir Johan	Professor
Utne, Ingrid Bouwer	Professor
Vinnem, Jan Erik	Professor
White, Maurice Furneaux	Professor
Ås, Sigmund Kyrre	Professor

Administrative staff

Bremvåg, Annika	Higher Executive Officer
Dahl, Ingelin	Higher Executive Officer
Ellingsen, Harald	Professor & Head of Dept.
Gripp, Jannike	Executive Officer
Hansen, Astrid Elisabeth	Head of Office
Karoliussen, Renate	Higher Executive Officer
Kristiansen, Lasse	Project Manager
Mahic, Sanda	Higher Executive Officer
Mørkve, Kristin Johansen	Senior Executive Officer
Neyts, Alexandra	Project Manager
Nordtiller, Marit	Higher Executive Officer
Solheim, Marit	Higher Executive Officer
Wold, Sigrid Bakken	Senior Executive Officer
Østhus, Oddny Kristine	Senior Executive Officer

Technical staff

Bach, Bjørn Tore	Head Engineer
Bratlie, Emil	Head Engineer
Dahl, Magnus	Apprentice
Fleischer, Eirik	Head Engineer
Gran, Frode	Head Engineer
Innset, Trond	Staff Engineer
Jalali, Mostafa	Staff Engineer
Kristiansen, Øystein	Staff Engineer
Lines, Johan Terje	Engineer
Minde, Kristian	Staff Engineer
Paulsen, Oddvar	Staff Engineer
Rosten, Terje	Head Engineer
Schjetne, Roar	Head Engineer
Selven, Mats Johan Strand	Engineer
Staven, Robert	Head Engineer
Vinje, Ole Erik	Engineer
Volden, Frode	Engineer
Wahl, Torgeir	Head Engineer
Aasen, Einar Magnus	Head Engineer

Scientific staff, temporary

Abbasi-Hoseini, Afshin	Postdoctoral Fellow
Andersen, Trond Michael	Adjunct Associate Professor
Balland, Océane	Adjunct Associate Professor
Berg, Tor Einar	Adjunct Professor
Bingingsbø, Arne Ulrik	Adjunct Professor
Brett, Per Olav	Adjunct Professor
Bøckmann, Eirik	Researcher
Ehlers, Sören	Professor
Eliassen, Lene	Postdoctoral Fellow
Fagerholt, Kjetil	Adjunct Professor
Faltinsen, Odd Magnus	Professor
Frandson, Adam	Researcher
Furnes, Gunnar	Adjunct Professor
Gao, Zhen	Adjunct Associate Professor

Hagen, Arnulf	Adjunct Professor
Hansen, Martin	Adjunct Associate Professor
Haver, Sverre	Adjunct Professor
Hutchison, Suzanne Ruth	Postdoctoral Fellow
Jensen, Jørgen Juncher	Adjunct Professor
Kim, Ekaterina	Postdoctoral Fellow
Krokstad, Jørgen	Adjunct Professor
Larsen, Kjell	Adjunct Professor
Lekkas, Anastasios	Postdoctoral Fellow
Lugni, Claudio	Adjunct Professor
Michailidis, Konstantinos	Researcher
Moan, Torgeir	Professor
Nematbakhsh, Ali	Postdoctoral Fellow
Nielsen, Ulrik Dam	Adjunct Associate Professor
Piehl, Henry Peter	Postdoctoral Fellow
Rakke, Jørgen Glomvik	Postdoctoral Fellow
Ren, Nianxin	Postdoctoral Fellow
Riska, Kaj A.	Adjunct Professor
Rustad, Anne Marthine	Adjunct Associate Professor
Sadjina, Severin Simon	Postdoctoral Fellow
Schjølberg, Ingrid	Adjunct Professor
Shi, Wei	Postdoctoral Fellow
Su, Biao	Postdoctoral Fellow
Søreide, Fredrik	Adjunct Professor
Todalshaug, Jørgen Hals	Researcher
Tymokha, Oleksandr	Researcher
Wallace, Stein William	Adjunct Professor
Wang, Hong	Postdoctoral Fellow
Ye, Xiaorong	Researcher

PhD candidates*

Name	Country
Abrahamsen-Prsic, Mia	Croatia
Afzal, Mohammad Saud	India
Alwan, Sabah Nouri Jasem	Australia
An, Song	China
Bachynski, Erin	USA
Bakkehaug, Rikard	Norway
Bardestani, Mohsen	Iran
Bergström, Martin	Finland
Bhattacharyya, Anirban	India
Borri, Daniele	Italy
Brandtsegg, Andreas Saur	Norway
Brodtkorb, Astrid H.	Norway
Canabes, José Particio Gallardo	Chile
Candeloro, Mauro	Italy
Chabaud, Valentin Bruno	France
Cheng, Zhengshun	China
Cho, Seongpil	South-Korea
Choi, Minjoo	South-Korea
Dahl, Andreas R.	Norway
Das, Jitapriya	India
De Almeida Fernandes, Daniel	Brazil
De Vaal, Jacobus Bernardus	South-Africa
Erceg, Boris	Croatia
Erceg, Sandro	Croatia
Fredriksen, Arnt G.	Norway
Fu, Ping	China
Gavrilin, Sergey	Russia
Ghamari, Isar	Iran
Ghane, Mahdi	Iran
Giske, Finn-Idar G.	Norway
Guachamin Acero, Wilson I.	Ecuador
Gunnu, Giriraja Sekhar	India
Hanssen, Finn-Christian W.	Norway
Hassel, Martin	Norway
Hatefi, Seyed Behzad	Iran
Hegde, Jeevith	India
Henry, Pierre-Yves	France
Heyn, Hans-Martin	Germany
Holen, Siri Marianne	Norway
Hoseini Dadmarzi, Fatemeh	Iran
Jafarzadeh, Sepideh	Iran
Jiang, Zhiyu	China
Jørgensen, Erlend K.	Norway
Jørgensen, Ulrik	Norway
Karpa, Oleh	Ukraine
Kjerstad, Øivind Kåre	Norway
Knudsen, Tore H.	Norway
Kramer, Jarle Andre	Norway
Kvittem, Marit	Norway
Li, Lin	China

Li, Quinyuan	China
Longva, Vegard	Norway
Luan, Chenyu	China
Ma, Shaojun	China
Malin, Maximilian	Austria
McGuinness, Edgar John	Ireland
Milakovic, Aleksandar-Sasa	Croatia
Miyazaki, Michel Rejani	Brazil
Muliawan, Made Jaya	Indonesia
Nam, Woongshik	South-Korea
Natskår, Asle	Norway
Norgren, Petter	Norway
Nornes, Stein M.	Norway
Ortega Malca, Arturo J.	Peru
Patricksson, Øyvind S.	Norway
Pedersen, Morten Dinhoff	Norway
Rasekhi Nejad, Amir	Iran
Rivera Medina, Ausberto	Peru
Rogne, Øyvind Ygre	Norway
Rokseth, Børge	Norway
Shen, Yugao	China
Siddiqui, Mohd A.	India
Singh, Dig Vijay	India
Skjong, Stian	Norway
Storheim, Martin	Norway
Stovner, Bård B.	Norway
Strand, Ida M.	Norway
Strandenes, Håkon	Norway
Tan, Xiang	China
Taskar, Bhushan	India
Thieme, Christoph A.	Germany
Thorat, Laxminarayan	India
Thorsen, Mats Jørgen	Norway
Tõns, Tõnis	Estonia
Tutturen, Svenn Are	Norway
Wan, Ling	China
Wang, Kai	China
Wang, Jingbo	China
Wu, Xiaopeng	China
Yu, Zhaolong	China
Yum, Kevin Kosup	South-Korea
Zhang, Qin	China
Zhao, Bo	China
Ødegård, Øyvind	Norway

**Note: This list only includes PhD candidates who are financed by the Department of Marine Technology and/or CeSOS.*

Nationality and gender distribution of PhD candidates

In 2014, the department of marine technology had 94 PhD candidates, of whom 11 were female. The geographical distribution of the origin of PhD candidates was as follows:

- Norway: 33 %
- other European countries: 16 %
- China: 18 %
- Other Asian countries: 23 %
- Other regions: 10 %

Professor emeritus

Berge, Stig
Endal, Anders
Kristiansen, Svein
Minsaas, Knut Johan
Rasmussen, Magnus
Sillerud, Bjørn Oskar
Valland, Harald
Westby, Ola

The Department's Economy

Distribution of financial contribution

The income of the department of marine technology is generated from two primary sources:

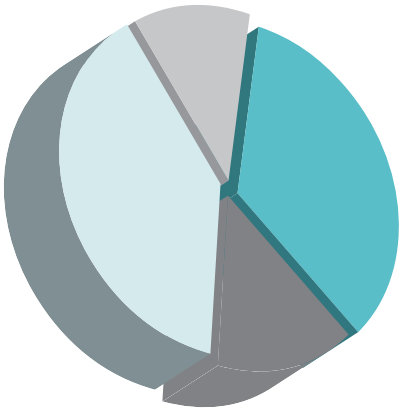
- funding from the government for normal operations and strategic restructuring
- external funding from private and public contributors for both commissioned and sponsored projects

The governmental funding is relatively stable. However, as it depends on both the quality and the quantity of research results, there are some variations in time. Income from commissioned and sponsored projects varies with the economic situation in the industry.

Distribution of cost categories

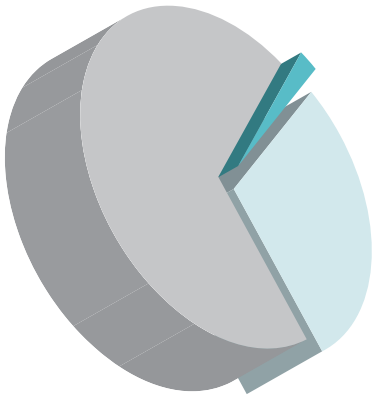
Zero-based budgeting is used, having the costs adjusted to the income level. Salary and social costs make up over 65% of the total costs.

Income 2014



- Funds normal operation MNOK 44,8
- Funds for strategic restructuring MNOK 15,3
- External funding MNOK 50,7
- Other income MNOK 18,7

Cost allocation 2014



- Investments MNOK 2,7
- Salary and social costs MNOK 86,0
- Other operating costs MNOK 36,8

Research Projects

European projects

Project	Programme
Breakthrough Solutions for the Sustainable Exploration and Extraction of Deep Sea Mineral Resources (Blue Mining)	7th Framework programme (European Union)
Hydralab IV: A network dealing with the complex interaction of water with environmental elements, sediment, structures and ice	7th Framework programme (European Union)
HyDynPro: Hydroelastic Effects and Dynamic Response of Propellers and Thrusters	Era-Net MARTEC Project HyDynPro
MARE-WINT: New MAterials and RELiability in offshore WINd Turbines technology	7th Framework programme (European Union: Marie Curie)
MARINA: A platform project to establish a set of equitable and transparent criteria for the evaluation of multi-purpose platforms for marine renewable energy	7th Framework programme (European Union: ENERGY)

National projects

Project	Programme/Company
Virtual Prototyping of Marine Systems and Operations (ViProMa)	NRC (KPN)
Low Energy and Emission Design of Ships (LEEDS)	NRC (KMB)
Maritime Logistics Fleet Size and Mix (MARFLIX)	NRC (KMB)
Handling Uncertainty in the Design of Ocean Engineering Systems (SIMOSYS)	NRC (KPN)

Holistic Risk-based Design for Sustainable Artic Sea Transport (RISKAT)	NRC (KPN)
Arctic Field Logistic and Transartic Shipping	Ministry of Foreign Affairs (MFA B2020)
Joint Centre of Excellence for Arctic Shipping and Operations	Lloyd Register Foundation
WaveSpring - Discovery Verification	NTNU Technology Transfer AS
Design and Verification of Control Systems for Safe and Energy-efficient Vessels with Hybrid Power Plants (D2V)	NRC (KMB)
Arctic DP: Safe and Green Dynamic Positioning Operations of Offshore Vessels in an Arctic Environment	NRC (KMB)
Ship Concepts for Harvesting Recovery and Storage of Energy (HRS-Ship)	NRC (BIP)
Air-sea Interaction and Transport Mechanisms in the Ocean	NRC (FRINATEK)
Full Scale Performance Prediction for Energy Efficient Ship Design (PropScale)	NRC (KPN)
Sea Trials and Model Test for Validation of Shiphandling Simulation Models (SimVal)	NRC (KPN)
Et Fullskalalaboratorium eller Testing av Fremtidens Marine Teknologi i Tett Samarbeid Mellom Næring og Akademia (F/F Gunnerus)	NRC (BIP)
Sustainable Design of Ships for the Future (SHIP-4C)	NRC (KMB)
SUSTAINFARMEX - Towards Sustainable Fish Farming at Exposed Marine Sites	NRC (KMB)
Next Generation Subsea Inspection, Maintenance and Repair (NextGenIMR)	NRC (KPN)
Safe, Environmental Friendly, and Cost Effective Operation of Vessels and Installations in the Arctic	NRC (BIA)
Dimensioning Sea Loads on Offshore Wind Turbines in Shallow to Intermediate Waters (DIMSELO)	NRC
National Ship Risk Model	NRC (SMARTRANS)
Forprosjekt Risiko Norske Skip	Norwegian Maritime Authority
Fergefri E39, Forskning Knyttet til Flytebruer og Flytende Nedsenkende Tunneler fra 2014	Norwegian Public Roads Administration
Kjedet Flytebru	NRC (BIA)
Energy Management in Practice Phase 2 (EMIP 2)	NRC (BIP)
Arctic Drilling Discrete Event Simulator (ADDES)	Statoil
Damage Assessment of Kristin FPU	Statoil
Collision Study Åsgard B Platform	Statoil Petroleum
Follow-up JIP on Nonlinear FE-methods for Determination of Structural Capacity	DNV GL

NRC: Research Council of Norway
KPN/KMB: Knowledge building project for the industry (Kompetanseprosjekter for næringslivet)
BIP: User-driven innovation project (Brukerstyrt innovasjonsprosjekt)
BIA: User-driven innovation platform (Brukerstyrt innovasjonsarena)
FRINATEK: Independent projects in mathematics, natural sciences and technology under the FRIPRO funding scheme
SMARTRANS: Næringslivets Transporter og ITS

NTNU Students Abroad

Spring semester 2014

Number of students	University	Country
7	University of California, Santa Barbara	USA
6	Instituto Superior Tecnico	Portugal
6	National University of Singapore	Singapore
5	Universidade Technica de Lisboa	Portugal
4	Universidade Federal do Rio de Janeiro (UFRJ)	Brazil
4	University of California, Berkeley	USA
3	Pontificia Universidade Catolica do Rio de Janeiro (PUK)	Brazil
3	Pusan National University	South Korea
3	University of New Orleans	USA
3	University of Strathclyde, Glasgow	UK
3	University of Western Australia	Australia
2	Delft University of Technology	Netherlands
2	Massachusetts Institute of Technology (MIT)	USA
2	Technische Universität Berlin	Germany
2	Texas A&M University	USA
2	University of British Columbia	Canada
1	Ecole Centrale de Nantes	France
1	Chalmers University of Technology	Sweden
1	Nanyang Technological University	Singapore
1	University of California, San Diego	USA
1	University of New South Wales	Australia

Autumn semester 2014

Number of students	University	Country
8	University of California, San Diego	USA
7	University of New South Wales	Australia
5	University of California, Santa Barbara	USA
3	National University of Singapore	Singapore
3	San Diego State University	USA
3	Universidade Federal do Rio de Janeiro (UFRJ)	Brazil
3	University of Strathclyde, Glasgow	UK
2	Pontificia Universidade Catolica do Rio de Janeiro (PUK)	Brazil
2	University of Michigan	USA
1	Instituto Superior Tecnico	Portugal
1	Technische Universität Berlin	Germany
1	University of California, Berkeley	USA
1	University of Texas at Austin	USA

Master Degrees

Candidate	Supervisor	Title
Akselsen, Cathrine	Erikstad, Stein Ove	Optimization of Onshore Base and Hub Location Supplying Oil and Gas Installations in the Barents Sea
Andersson, Christian	Sævik, Svein	Rigid Pipelay Curve Stability
Arnhus, Magnus	Vinnem, Jan Erik	Modeling of Technical, Human and Organizational Factors and Barriers in Marine Systems Failure Risk
Bahar, Md Habibullah	Amdahl, Jørgen	Analytical & Numerical Analysis of Ship/FPSO Side Structures Subjected to Extreme Loading with Emphasis of Ice Actions
Bense, Marvin Phillip	Moan, Torgeir	Comparison of Numerical Simulation and Model Test for Integrated Installation of GBS Wind Turbine
Bergstad, Andreas	Leira, Bernt Johan	Assessment of Hull Response due to Impact from Falling Object
Bertelsen, Torleif Ølund	Greco, Marilena	Installation of Large Subsea Structures
Bjerkholt, Runa Folvik	Sævik, Svein	Analysis of ROV Lift Operation
Bjørneset, Solveig	Sørensen, Asgeir Johan	Modelling and Control of Thruster Assisted Position Mooring System for a Semi-submersible
Bollestad, Geir Inge	Leira, Bernt Johan	Extreme Value Analysis of Riser Systems for large Water Depths
Brandt, Ulrikke	Sævik, Svein	Impact Analysis of Flexible Riser
Brauer, Simon Adrian	Moan, Torgeir	Damage Identification of an Offshore Wind Turbine Jacket Support Structure
Braun, Moritz	Moan, Torgeir	Fatigue Assessment of Threaded Riser Connections
Breivik, Tommy	Erikstad, Stein Ove	Electric Cable Ferry
Brodtkorb, Astrid Helene	Sørensen, Asgeir Johan	Dynamic Positioning in Extreme Sea States
Buberg, Thomas	Leira, Bernt Johan	Design and Analysis of Steel Catenary Riser Systems for Deep Waters
Bækkedal, Eivind	Amdahl, Jørgen	Alternative Methods of Realizing the Sea Spectrum for Time-domain Simulations of Marine Structures in Irregular Seas
Bøe, Vegard	Larsen, Carl Martin	Vibration Analysis of Superstructures on Supply Vessels
Chen, Jinchao	Larsen, Carl Martin	Non-linear Wave Loads on Offshore Wind Support Structure
Chen, Ying	Moan, Torgeir	Bucket Foundation in Clay for OWT Subjected to Combined Cyclic Loads
Cook, Timothy Wade	Moan, Torgeir	Buckling of Cylindrical Shells with a Granular Core Under Global Bending
Dahl, Sindre Misund	Myrhaug, Dag	Unsteady RANS Simulation of Flow around Rectangular Cylinders with Different Aspect Ratios at High Reynolds Number
Dashtizadeh, Leila	Leira, Bernt Johan	Estimation of the Long-Term Extreme Response of Drilling Riser by the Contour Line Method
Deac, Marius	Moan, Torgeir	Design and Analysis of a Large Wind Floater
Dekker, Marijn Johannes	Moan, Torgeir	The Modelling of Suction Caisson Foundations for Multi-Footed Structures
Drægebø, Elisabeth	Utne, Ingrid Bouwer	Reliability Analysis of Blowout Preventer Systems
Elger, David Emanuel	Holm, Håvard	Experimental Investigation of the Superposition Principle for a Free Surface Roll Damping Tank
Erstad, Camilla	Utne, Ingrid Bouwer	Tilstandsbasert Vedlikehold på Tørrgasstetninger
Eskild, Hege	Steen, Sverre	Development of a Method for Weather Routing of Ships

Fagnastøl, Øyvind Sæbø	Leira, Bernt Johan	Approaches for Assessment of Weld Fatigue and Verification of the Effective Notch Stress Approach
Fekene, Marius Kongsfjell	Erikstad, Stein Ove	Supply Chain Design under Uncertainty
Folgerø-Holm, Jon Andreas	Utne, Ingrid Bouwer	Long Term Scheduling of Major Renewals
Fu, Ping	Myrhaug, Dag	Scour Below Pipelines and Around Vertical Piles due to Random Waves Plus Current on Mild Slopes
Fæhn, Anna Kristine Hertzenberg	Leira, Bernt Johan	Dynamic Analysis and Verification of the Universal Buoyancy System
Førde, Daniel Andre S	Vinnem, Jan Erik	Modelling and Simulation of Ballast System on a Semi- Submersible Platform
Galaxy, Tri Buana	Utne, Ingrid Bouwer	Ship Energy Efficiency and CO_2 Abatement Cost Analysis
Gan, Xiao	Larsen, Carl Martin	Statistics of Bending Moment in the Splash Zone of a Tensioned Riser
Garnås, Sindre Joakim	Erikstad, Stein Ove	Benefits and Barriers Using Operations Research based Decision Support Software in Dry Bulk Chartering
Gedde, Steffen Tellugen	Erikstad, Stein Ove	Contractual and Economical Consequences of LNG Boil-Off Quality
Gottschal, Espen Joris	Skjetne, Roger	Dynamic Thrust Allocation
Grue, Ida Håøy	Steen, Sverre	Loads on the Gravity-net-cage from Waves and Currents
Grøv, Tom Are	Sævik, Svein	Fatigue of Flexible Risers Considering Alternative Constitutive Models
Gåsemyr, Øyvind Rønneberg	Pedersen, Eilif	Modeling of Hybrid Marine Electric Propulsion Systems
Hagen, Hilde Christine	Sørensen, Asgeir Johan	Feasibility Study on Active Wave Compensation of ROV
Hasfjord, Steffen	Steen, Sverre	Optimization of Propeller Pitch and Revolutions in Behind Condition
Hasund, Mattias Asbjørn	Leira, Bernt Johan	Dynamisk Analyse av Modul i Bølgesonen
Hauff, Kristian Stenvågnes	Utne, Ingrid Bouwer	Analysis of Loss of Position Incidents for Dynamically Operated Vessels
Haugen, Ine	Leira, Bernt Johan	Analysis of Hull Structure Response for a Sevan Arctic Mobile Drilling Unit in Arctic Areas Subjected to Ice Loading
He, Zhengmin	Amdahl, Jørgen	Analysis and Design of the SEVAN FPSO against Extreme Ice Actions
Heffermehl, Fredrik Stang	Asbjørnslett, Bjørn Egil	Arctic Drilling Discrete Event Simulation
Hegseth, John Marius	Larsen, Carl Martin	Assessment of Uncertainties in Estimated Wellhead Fatigue
Heian, Mats Johan	Erikstad, Stein Ove	Factors Influencing Machinery System Selection for Complex Operational Profiles
Heiervang, Mads Fredrik	Amdahl, Jørgen	Time Domain Analysis of Fish Farms Subjected to Extreme Environmental Conditions
Helland, Øystein	Amdahl, Jørgen	Review of IACS Unified Requirements for Design of Polar Ships against Ice Loads
Henriksen, Eirik Hexeberg	Sørensen, Asgeir Johan	ROV Control System for Positioning of Subsea Modules
Hermanrud, Lars	Larsen, Carl Martin	Dynamic Analysis of Workover Riser under Unexpected Conditions
Holgersen, Lars Kristian	Utne, Ingrid Bouwer	Performance Monitoring in Teekay Petrojarl
Hoque, Md Emdadul	Leira, Bernt Johan	Dynamic Response of Ship Hull due to Slamming
Hossain, Md. Jahangir	Leira, Bernt Johan	Effects of Pretension in Bolt for a Slewing Bearing

Huang, Yankang	Larsen, Carl Martin	Higher Order Frequency Component in VIV
Hustveit, Bjarte	Sørensen, Asgeir Johan	Kombinert Modelbasert og Sensorbasert Observer for Undervanns-fartøy
Hvidsten, Erik	Steen, Sverre	Development of a Numerical Simulation Model of the Forces on Ventilating Propellers
Hystad, Ida	Holm, Håvard	Numerical Modelling of Turbulent Boundary Layer
Håland, Sigve	Greco, Marilena	Lowering and Lifting Operations through Moonpools: Hydrodynamic Investigations
Jacobsen, Heidi	Amdahl, Jørgen	Structural Design Considerations for an Ice Resistant Semi Submersible Drilling Rig
Kajanus, Robert	Skjetne, Roger	Optimal Recursive Thrust Allocation Applied for ROV Minerva
K. Lundborg, Magne Erik	Vinnem, Jan Erik	Human Technical Factors in FPSO-Shuttle Tanker Interactions and Their Influence on the Collision Risk during Operations in the North Sea
Keane, Andre Christian	Erikstad, Stein Ove	Using Epoch Era Analysis in the Design of the Next Generation Off-shore Subsea Construction Vessels
Kinge, Helene Ruth Minet	Larsen, Carl Martin	Simulation of Riser Disconnection in Stochastic Waves
Klemetzen, Jonas Havnes	Leira, Bernt Johan	Load Charts Calculations for Offshore Pedestal Cranes by Motion Response Analysis
Knudsen, Tor Huse	Holm, Håvard	Wake Flow behind a Curved Cylinder
Knutsen, Mats Foss	Amdahl, Jørgen	Time Domain Analysis of Fish Farms Subjected to Extreme Environmental Conditions
Konstali, Ørjan	Amdahl, Jørgen	Analysis and Design of Ship Collision Barriers on a Submerged Floating Tunnel subjected to Large Ship Collisions
Kramer, Jarle Andre	Steen, Sverre	Hydrodynamic Performance of Sail-assisted Merchant Vessels
Kristiansen, Vegard	Erikstad, Stein Ove	Modulbasert Design av Fiskefartøy
Kristoffersen, Simen Svare	Erikstad, Stein Ove	System Based Design for Mobile Offshore Units
Krossholm, Andreas Kleven	Pedersen, Eilif	Ice Load Impact on the Power Train of Azimuth Propulsion Systems
Kvale, Jørgen Mathiesen	Berg, Tor Einar	Revised Simulation Model for a Very Large Crude Carrier (VLCC)
Lauritzsen, Martin	Sørensen, Asgeir Johan	Hardware-in-the-Loop Testing Systems for ROV Control Systems
Li, Hongtao	Myrhaug, Dag	Statistics of Surf Parameter and Wave Power for Individual Waves
Liu, Shijie	Sævik, Svein	Fatigue Study of Copper Conductors
Liu, Xiaoli	Sævik, Svein	Sammenligning av Moment og Spiralmodeller for Utmatningsanalyse av Fleksible Stigerør
Liu, Xueying	Sævik, Svein	Dynamic Response of Flexible Pipes Considering Different Damping Models
Lome, Ingrid Brandtsegg	Steen, Sverre	Validation of a Combined Wind and Wave Power Installation
Lyngra, Nora Helen Lund	Amdahl, Jørgen	Analysis of Ice-Induced Damages to a Cargo Carrier and Implications wrt. Rule Requirements
Lønne, Lars	Sørensen, Asgeir Johan	Development of an Irradiance Sensor Based on a Photon Counting Camera
Ma, Meilin	Amdahl, Jørgen	Damage Assessment of Sevan FPSO Subjected to Impacts From Shuttle Tankers

Magnussen, Eivind Tørset	Larsen, Carl Martin	Analysis of Low-Frequency Damping in Mooring Lines for Floating Production Units
Marin, Traian Ionut	Moan, Torgeir	Fatigue Analysis of the Column-Pontoon Connection in a Semi-Submersible Floating Wind Turbine
Marken, Vegard Brevik	Ehlers, Sören	A Bow-Tie-Based Analysis of the Risk of Delays Along the Northern Sea Route
Marley, Mathias Huuse	Skjetne, Roger	Modelling and Robust Control of Production Force of a Wave Energy Converter
Matland, Arild Eriksen	Amdahl, Jørgen	Simulation of Marine Lifting Operations with Focus on Structural Response Control
Midthaug, Asgeir Hovdelien	Amdahl, Jørgen	Nonlinear Wave Loads on Offshore Wind Turbines in Storm Condition
Moen, Fredrik Storflor	Larsen, Carl Martin	Hybrid Testing of Deep Water Moored Structures
Moheudden, Sharif Mohammad	Sævik, Svein	Snaking Behavior of Umbilicals
Moss, Andreas Rolland	Berg, Tor Einar	Simulation Model for an LNG Ferry
Nedrebø, Eirik Leikvoll	Myrhaug, Dag	Experimental Investigation of Marine Fouling on Piles in Currents
Nikolaisen, Svein Roald	Utne, Ingrid Bouwer	Life Cycle Cost Comparison Study
Nilsen, Øystein Grov	Karlsen, Ludvig	Flexibility in Ship Design
Nyhus, Ole Jonny	Ellingsen, Harald	Life Cycle Assessment of Farmed Salmon, Comparing a Closed with an Open Sea Cage System
Odland, Kristian Bergem	Hagen, Arnulf	Risk Management in Shipbuilding Projects
Olafsen, Helle Kristine H	Sørensen, Asgeir Johan	Control of Thruster Assisted Position Mooring System on Floating Production Storage and Offloading
Olsen, Thomas Brækkan	Pedersen, Eilif	Utslipp til Luft og NOx - Reduksjon på Grunn av NEA på Marine Dieselmotorer
Orsten, Andreas	Skjetne, Roger	Automatic Reliability-based Control of Iceberg Towing in Open Waters
Palmer, Christian	Utne, Ingrid Bouwer	Asset Integrity
Paulshus, Øivind	Steen, Sverre	Critical Assessment of Non-linear Wave Loads in the Design of Offshore Wind Turbines
Rahman, Ahnaf	Leira, Bernt Johan	Dynamic Analysis of Floating Bridges with Transverse Pontoons
Rasmussen, Simen Kleven	Amdahl, Jørgen	Assessment of Structural Damage due to Cryogenic Spill for FLNG Plants
Ringheim, Paul Anders Haug	Erikstad, Stein Ove	Improving Ship Operational Efficiency by Statistical Analysis of Voyage Data
Rode, Henrik Mikael	Asbjørnslett, Bjørn Egil	Arctic Drilling Discrete Event Simulation
Rohde, Anders	Valland, Harald	Thermodynamical Analysis Tool in MATLAB
Rokseth, Børge	Pedersen, Eilif	A Bond Graph Approach for Modelling Systems of Rigid Bodies in Spatial Motion
Rosnes, Aleksander	Utne, Ingrid Bouwer	Risikobasert Inspeksjon (RBI)
Shi, Yunzhu	Sævik, Svein	Comparison of the Stress Distribution in the Metallic Layers of Flexible Pipes Using Two Alternative Bflex Formulations
Simonsen, Eirik	Pedersen, Eilif	Active Magnetic Radial Bearings Applied To Rotor Dynamics
Skarbø, Runa A.	Ehlers, Sören	Emission Reduction Technology and Cost Efficiency for Ships Operating on the Northern Sea Route
Skjong, Stian	Pedersen, Eilif	Modeling, Simulation and Control of Hydraulic Winch System

Slagstad, Martin	Amdahl, Jørgen	Accidental Impact Resistance of Non-disconnectable Bouy Type FPSO
Slettevold, Yngvild	Steen, Sverre	Determination of Minimum Propulsion Power to Maintain the Manoeuvrability of Ships in Adverse Conditions
Spence, Silas	Pettersen, Bjørnar	Numerical Investigation of Free Surface Flows
Staalesen, Odd Eivind Solø	Sævik, Svein	Investigation on the Performance of the Universal Buoyancy System
Stavnem, Ole Alexander	Steen, Sverre	Modelling of Loads and Responses of a Permaskirt on a Flexible Net Cage Fish Farm
Stendebakken, Oda Ingeborg	Vinnem, Jan Erik	A Reliability Study of a Deepwater Vertical Xmas Tree with Attention to XT Retrieval Rate
Stettner, Oliver	Moan, Torgeir	Numerical Simulation for Installation of Jacket Foundation of Offshore Wind Turbines
Straume, Jonas Gullaksen	Amdahl, Jørgen	Dynamic Buckling of Marine Structures
Sunde, Christian Heimdal	Schjølberg, Ingrid	3D Visualization of Autonomous Underwater Robots
Sørgård, Ellen Helene	Fagerholt, Kjetil	Emission Control Areas: Effect on the Fleet Renewal Problem
Thieme, Christoph	Utne, Ingrid Bouwer	Development of a Risk Management Process for NTNU's REMUS 100 AUV
Thomassen, Øystein Sunde	Steen, Sverre	Sensitivity Analysis of Large Rotor Diameter on Offshore Wind Turbines with Suction Foundation
Tran, Nam Dinh	Skjetne, Roger	Line-Of-Sight-based Maneuvering Control Design, Implementation, and Experimental Testing for the Model Ship C/S Enterprise I.
Trøen, Tine Louise	Steen, Sverre	Fatigue Loads on Large Diameter Monopile Foundations of Offshore Wind Turbines
Tufte, Espen Dalsøren	Valland, Harald	Impacts of Low Load Operation of Modern Four-Stroke Diesel Engines in Generator Configuration
Tuset, Georg Duvsete	Vinnem, Jan Erik	Operational Barrier Elements in Critical Drilling Operations
Tutturen, Svenn Are	Skjetne, Roger	Topics in Dynamic Positioning
Tvare, Øyvind	Moan, Torgeir	Fatigue Analysis of Column-Pontoon Connection in a Semi-submersible Floating Wind Turbine
Ulstein, Mads	Ehlers, Sören	A Simulation-based Decision Support Tool for Arctic Field Logistics
Vandervaeren, Nathan	Sørensen, Asgeir Johan	Distributed Control of a Drifting Formation of Autonomous Underwater Vehicles
Verheugt, Bas	Moan, Torgeir	Efficient Response Simulation Strategies for Jacket-based Offshore Wind Turbines
Vik, Bjørn Eliassen	Pedersen, Eilif	Development and Verification of a Gesilinger Flexible Coupling Bond Graph Model
Vindenes, Arne	Leira, Bernt Johan	Parametric Studies of Dynamic Response for a Workover Riser
Wang, Lidong	Sævik, Svein	Comparing Alternative Flexible Pipe Fatigue Stress Models with Focus on the Bflex Helix Models
Wang, Qiang	Moan, Torgeir	Design and Dynamic Analysis of a Steel Pontoon-type Semi-submersible Floater Supporting the DTU 10MW Reference Turbine
Wattum, Sverre	Utne, Ingrid Bouwer	Reliability Centered Maintenance on the Norwegian Continental Shelf
Xing, Zheng	Moan, Torgeir	Response and Structural Analysis of a Flap-type Wave Energy Converter in a Combined Wind and Wave Concept
Yao, Tianzuo	Haver, Sverre Kristian	Uncertainties In Predicted Extreme Wave Induced Platform Response

Zhao, Jing	Sævik, Svein	Collapse Capacity of Corroded Pipelines
Zhou, Chongyao	Sævik, Svein	Transverse Tensile Armour Buckling of Flexible Pipes
Zhou, Chunqi	Amdahl, Jørgen	Ultimate Strength and Post-Ultimate Behavior of Hybrid Platform Deck Girders
Øyri, Torstein	Leira, Bernt Johan	Contour Methods for Deepwater Riser Systems

All Master theses can be found at http://brage.bibsys.no/xmlui/handle/11250/227458

PhD Degrees

Date	Name	Sex	Title	Land	Main supervisor
24/01/14	Song An	M	Theoretical and Experimental Studies of Wave Diffraction and Radiation Loads on a Horizontally Submerged Perforated Plate	China	Odd M. Faltinsen
27/02/14	Øyvind Y. Rogne	M	Numerical and Experimental Investigation of a Hinged 5-body Wave Energy Converter	Norway	Torgeir Moan
07/03/14	Lijuan Dai	F	Safe and Efficient Operation and Maintenance of Offshore Wind Farms	China	Ingrid B. Utne
13/03/14	Erin E. Bachynski	F	Design and Dynamic Analysis of Tension Leg Platform Wind Turbines	USA	Torgeir Moan
06/05/14	Jingbo Wang	M	Water Entry of Freefall Wedged – Wedge Motions and Cavity Dynamics	China	Odd M. Faltinsen
09/05/14	Ekaterina Kim	F	Experimental and Numerical Studies Related to the Coupled Behavior of Ice Mass and Steel Structures during Accidental Collisions	Russia	Jørgen Amdahl
13/05/14	Xiang Tan	F	Numerical Investigation of Ship`s Continuous- Mode Icebreaking in Level Ice	China	Torgeir Moan
25/06/14	Made J. Muliawan	M	Design and Analysis of Combined Floating Wave and Wind Power Facilities, with Emphasis on Extreme Load Effects of the Mooring System	Indonesia	Torgeir Moan
07/10/14	Zhiyu Jiang	M	Long-term Response Analysis of Wind Turbines with an Emphasis on Fault and Shutdown Conditions	China	Torgeir Moan
16/10/14	Fredrik Dukan	M	ROV Motion Control Systems	Norway	Asgeir J. Sørensen
07/11/14	Nils I. Grimsmo	M	Dynamic Simulations of Hydraulic Cylinder for Heave Compensation of Deep Water Drilling Risers	Norway	Carl M. Larsen
20/11/14	Marit I. Kvittem	F	Modelling and Response Analysis for Fatigue Design of a Semisubmersible Wind Turbine	Norway	Torgeir Moan
24/11/14	Muhammad Juned Akhtar	M	The Effects of Human Fatigue on Risk at Sea	Norway	Ingrid B. Utne
10/12/14	Nur Syahroni	M	Fatigue Assessment of Welded Joints Taking into Account Effects of Residual Stress	Indonesia	Stig Berge

All PhD theses can be found at http://brage.bibsys.no/xmlui/handle/11250/227458

Publications

Book

Holm, Håvard; Amdahl, Jørgen; Larsen, Carl Martin; Moan, Torgeir; Myrhaug, Dag; Pettersen, Bjørnar; Steen, Sverre; Sørensen, Asgeir Johan. Havromsteknologi. Akademika forlag 2014 (ISBN 978-82-321-0441-3) 483 p.

Book chapters

Berge, Stig. Test Methods. I: *Handbook on Design and Operation of Flexible Pipes*. Trondheim: Norsk Marinteknisk Forskningsinstitutt AS 2014 ISBN 978-82-7174-265-2. p. 349-357

Berge, Stig; Eriksen, Morten. Flexible Pipe Properties and Materials. I: *Handbook on Design and Operation of Flexible Pipes*. Trondheim: Norsk Marinteknisk Forskningsinstitutt AS 2014 ISBN 978-82-7174-265-2. p. 71-100

Larsen, Carl Martin; Sævik, Svein; Qvist, Jacob. Design Analysis. I: *Handbook on Design and Operation of Flexible Pipes*. Trondheim: Norsk Marinteknisk Forskningsinstitutt AS 2014 ISBN 978-82-7174-265-2. p. 155-276

Leira, Bernt Johan. Reliability Methods. I: *Handbook on Design and Operation of Flexible Pipes*. Trondheim: Norsk Marinteknisk Forskningsinstitutt AS 2014 ISBN 978-82-7174-265-2. p. 293-317

Leira, Bernt Johan. Risk Analysis Methodology. I: *Handbook on Design and Operation of Flexible Pipes*. Trondheim: Norsk Marinteknisk Forskningsinstitutt AS 2014 ISBN 978-82-7174-265-2. p. 277-292

Journal articles

Abrahamsen-Prsic, Mia; Ong, Muk Chen; Pettersen, Bjørnar; Myrhaug, Dag. Large Eddy Simulations of flow around a smooth circular cylinder in a uniform current in the subcritical flow regime. *Ocean Engineering* 2014 ;Volume 77. p. 61-73

Akhtar, Juned; Utne, Ingrid Bouwer. Human fatigue's effect on the risk of maritime groundings - A Bayesian Network modeling approach. *Safety Science* 2014 ;Volume 62. p. 427-440

Akhtar, Juned; Utne, Ingrid Bouwer. Reducing the probability of ship grounding: Which measure to undertake?. *WMU Journal of Maritime Affairs (JoMA)* 2014 ;Volume 13.(1) p. 27-42

Akhtar, Muhammad Juned. Fatigue at sea - A manning problem. *Journal of Maritime Research* 2014 ;Volume 11.(3) p. 27-42

Antuono, Matteo; Bardazzi, Andrea; Lugni, Claudio; Brocchini, Maurizio. A shallow-water sloshing model for wave breaking in rectangular tanks. *Journal of Fluid Mechanics* 2014 ;Volume 746. p. 437-465

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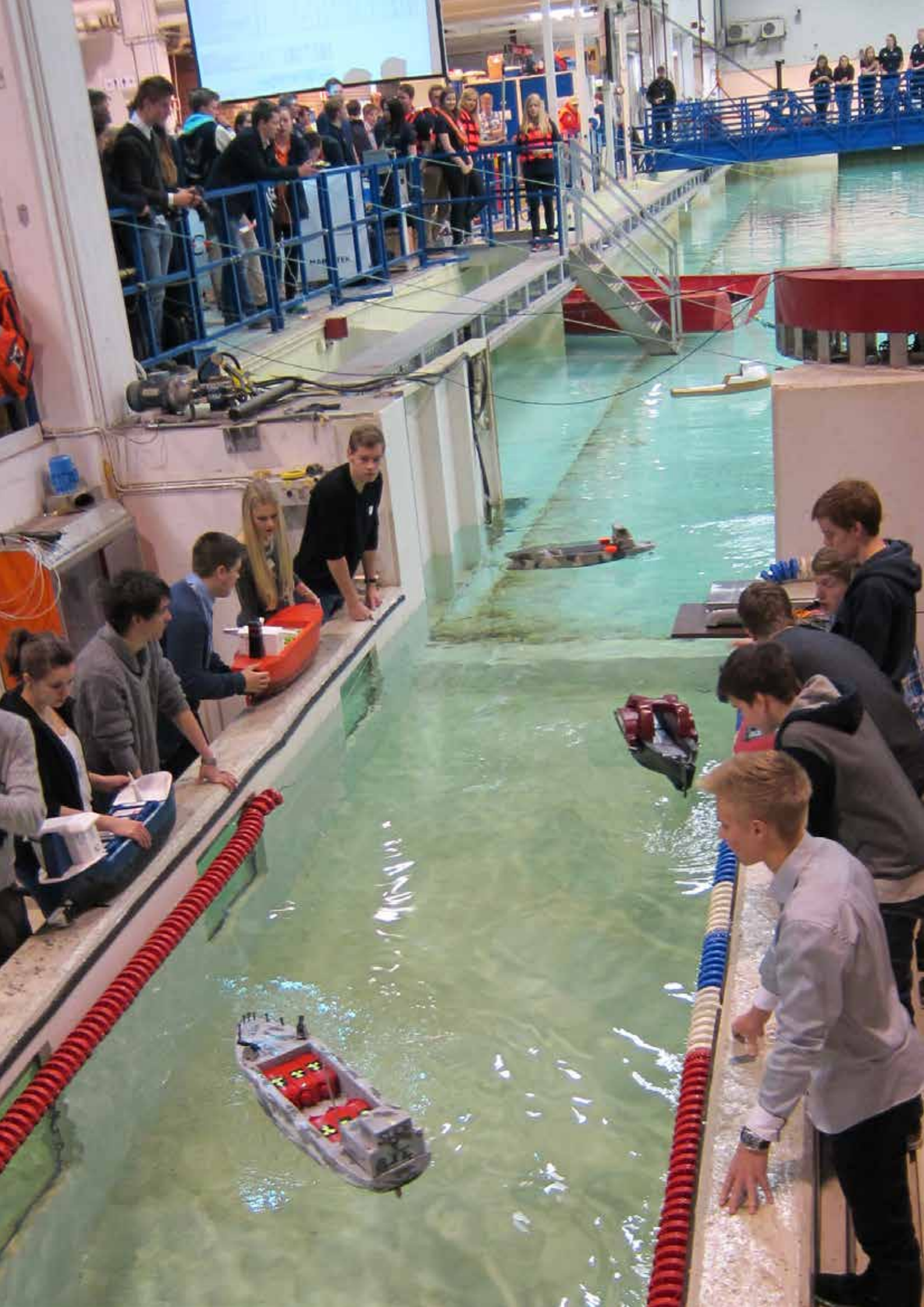

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