

NORTH⁵⁷

The maritime research newsletter from Lighthouse | No 9, 2010

Challenge of the ice



Report from the second Lighthouse CARGO SHIP theme day

LIGHTHOUSE

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CARGO SHIP

Future research for greater s

THE DECEMBER 10TH LIGHTHOUSE CARGO SHIP THEME DAY

Lighthouse Cargo Ship Theme day on December 10, 2009, focused on arctic engineering, and a strengthened cooperation between SP in Borås, Chalmers and Lighthouse.

After the opening by Jonas Ringsberg, professor and head of the theme area Cargo Ship, Anders Marby, director of Lighthouse, gave a brief summary of the development of the Lighthouse Maritime Competence Center.

Today, 100 researchers, teachers and PhD-students are connected to Lighthouse. 45 projects are currently under way, and 24 PhD-students are working on their doctorates. The main goal for Lighthouse is to increase cooperation with other universities as well as the maritime industry.

Winter navigation

Pentti Kujala, professor at Helsinki University of Technology, TKK/MeriKotka,

spoke about Winter Navigation - that practical needs define the challenges for future arctic research.

Winter navigation and ship-ice interaction are two of five main research topics of TKK, together with risk analysis of ship safety. Fifteen doctoral students and a vast international cooperation are included. An important asset for the Marine research center in Kotka is the world's largest ice tank: 40x40 meters, with a production capacity of 70 mm thick model ice.

"The main concern is to find out how to estimate the movement of ice and the effects of compression ice on the hull", said Pentti Kujala.

Risk based design and reducing oil spill

The big increase in oil transport in the Gulf of Finland, from 50 million tons in 2000, to close to 200 million tons in 2010, has put a demand on research regarding traffic flow, risk modeling, classification of risks, risks of winter navigation, as well as improving cooperation around the Baltic sea. From October to March the risk factor increases, and there are approximately ten groundings and five to eight minor collisions a year, according to ten years of statistics. Simulations have shown a risk for a yearly oil-spill of nearly 30 tons.

"The main challenges for ice-related risk-based design are: hazard definition, frequency and consequences of the hazards, safety measures/risk control options and cost-benefit analysis. In the Baltic Sea we have a lot of experience, but in the Russian Arctic and Canadian Arctic we don't. So these studies are important since the traffic is increasing", said Pentti Kujala.

"Parts of this are performed in the EU project SAFEWIN, Safety of Winter Navigation In dynamic ice, which will run till 2012, and includes eight major

A clear rise in activity in ice covered water.

- This means more research after a long period of steady state progress.
- There are still a number of fundamental topics related to ice-ship and ice-structure interaction to be fully investigated.
- Some interesting topics for future research:
 - Application of risk based design for ice going ships.
 - Ice failure process along the ship hull and its effect on ship-maneuvering characteristics in various ice conditions.
 - POD-propulsion and ice interaction.
 - Ice management in highly moving ice field.

safety in ice covered water

Cargo Ship is led by Professor Jonas Ringsberg. Cargo Ship comprises sections of the Ship Design division at the Department of Shipping and Marine Technology at Chalmers University of Technology. Cargo Ship also collaborates closely with the Department of Applied Mechanics and the Department of Mathematical Sciences at Chalmers.

topics. But we have little knowledge of risks. There are no models for this - so I'm glad the research activities have increased".

Drilling in the Arctic

Göran Liljeström, Naval Architect working at Stena Technical division, spoke about the challenge to develop oil and gas in the Arctic region. The potential is 150-300 billion barrels of oil and huge gas and gas liquid deposits in the Canadian high Arctic.

To be able to participate in the exploitation, Stena has ordered the first vessel in the world to be built to new IACS Polar Ice Class PC5 for delivery at the end of 2011. The hull will be reinforced for seasonal operation in the Arctic and winterized with increased boiler capacity, de-icing arrangements, and two additional moon pools for ROVs.

"Ice-management and transit in ice are crucial, but the biggest challenge is to find a system to keep the drilling ship at its position. Still, the transit operation will be more demanding than the drilling, and at least two icebreakers are highly recommended as a support", said Göran Liljeström.

Modeling in transit and performance in ice has been performed, but a full data processing with models is to be completed before 2012, when Stena expect to start its operations.

Research activities at KTH

Anders Rosén, PhD in technology, from the Royal Institute of Technology in Stockholm, (KTH) was happy to visit Chalmers and Lighthouse to present projects from KTH.

After a series of reorganization, a Center for Naval Architecture started 2006. During 2010 the faculty and research will expand and a new master of science program in naval architecture will be in place.

KTH are working in several research areas, for example: high-speed craft in collaboration with several Swedish and international partners, wave measurement, dynamic stability and parametric rolling, criteria development, decision support and routing are other fields of research. Structural design and structural monitoring, added resistance due to wind and waves are also ongoing projects where Wallenius Marine, Seaware and Swedish Transport Agency are partners.

The Cargo Ship project portfolio

CS1 Cargo operations studio (COS)

(Development project of a simulator)

Contact person: Mr Tomas Olsson-Neptun

CS2 Structural integrity analysis of critical elements of RoPax ships

Head supervisor: Professor Jonas Ringsberg

PhD student: Lic Eng Ulf Karlsson PhD 2008

CS3 Hasard/Marine structures

Head supervisor: Professor Jonas Ringsberg

PhD student: Mr Per Hogström

CS4 Ship routing and fatigue analysis of container ships

Head supervisor: Professor Jonas Ringsberg

PhD student: Mr Zhiyuan Li

CS5 Optimisation of ship routing with respect to fatigue and fuel consumption

Supervisors: Professor Jonas Ringsberg and Professor Igor Rychlik

PhD student: Lic Eng Wengang Mao

CS6 Lightweight design using composite structures

Head supervisor: Professor Jonas Ringsberg

PhD student: Mr Måns Håkansson

CS7 Methods for large amplitude ship motions in waves

Head supervisor: Associate Professor Carl-Erik Janson

PhD student: Mr Martin Kjellberg

CS8 Ship manoeuvring in waves

Head supervisor: Associate Professor Carl-Erik Janson

PhD student: Ms Heng Ran

CS9 Hasard/Seakeeping

Head supervisor: Associate Professor Carl-Erik Janson

PhD student: Lic Eng Martin Schreuder

CS10 Requirement management in ship design

Head supervisor: Professor Olle Rutgersson

PhD student: Lic Eng Ingar Malmgren

CS11 Fatigue and ageing of composite lightweight structures

Head supervisor: Professor Jonas Ringsberg

PhD student: Mr Luis Sanchez

New project!

CS11 EU-project BESST

Project Manager at Chalmers: Professor Jonas Ringsberg

PhD students: Mr Måns Håkansson and Mr Luis Sanchez

New project!

Finished

Running

Business Ship

Business Ship takes up the research into the shipping industry's conditions that has long been the centre of attention at the School of Business, Economics and Law at the University of Gothenburg. Today there is continuing active research within four areas connected to the shipping business: law, logistics, world trade and financial analysis of the firm.

Eco Ship

Eco Ship deals with research and education with focus on sustainable resource use and minimization of environmental impact from shipping and maritime activities. This encompasses optimization of ship design and propulsion, energy efficiency and energy management but also studies of the relation between ship operation, technology and design and the emissions to air and water. An important research area is development and use of environmental systems analysis to evaluate technology and operation of technical systems. Another area is studies of the impact of different regulatory tools, international conventions and organisational measures.

Ergo Ship

Research under Ergo Ship falls within the Human Factors discipline, bringing together technology, humans and organisational issues. A total of twelve, senior researchers, PhD-students and research assistants, study work environment issues, human-technology interaction and technology design to increase safety, effectiveness and efficiency in the shipping domain. This competence area is cross-disciplinary by definition and applications are to be found even outside the shipping area. Research is performed in close cooperation with industry in about ten projects, three of which are EU-projects.

Safe Ship

Safety is a key issue and involves all aspects of the shipping industry. In Safe Ship, a systematic approach is used in order to create a holistic view of safety. Safety in this context is divided into the following areas: regulation and control, organisation, training, ship and equipment design and operations. Each area addresses different activities and functions in the safety criteria chain and can be organized as pro-active measures, accident response, and post-accident response. Examples of important research areas are risk-based design, infrastructure for safe navigation, crisis management, and increased survival and evacuation of damaged ships.

"There have been incidents where ships have operated in quite mild conditions and suddenly started to roll from nothing to thirty, forty, fifty degrees, and it comes from nothing", said Anders Rosén.

The education program in Naval Design is a three year Bachelor program, followed by a Master program. The students, between 20-25 per year, generally come to Naval Architecture in the Bachelor thesis course. The Masters program attracts 15-20 students. A framework, CDIO, was created to fill the gap between scientific and practical engineering demands in the engineering education.

The Hazard Project

Per Hogström, PhD student at the division of Ship Design at Chalmers presented his work in the Hazard project, a holistic approach to determine the survival time of a ship damaged by collision. Future work will be to look into material behavior and survival of ships on ice.

Breaking the waves

Martin Kjellberg, also PhD student at the division of Ship Design at Chalmers, presented his work on methods for large amplitude ship motions in waves. Possible applications of the methods are: safety of ship, crew and cargo, as well as evacuation safety, sea-keeping performance criteria, ship motion and acceleration.

International research

Erland Johnson, research manager at SP Technical Research Institute of Sweden in Borås, gave an overview of the work at SP and the increasing cooperation between SP, Chalmers and Lighthouse.

SP is an international research and innovation institute with about 950 employees and a turnover close to one billion crowns. The main goal is to increase competitiveness and sustainability of the industry.

A new platform within Shipping and Off-shore, new constructions at sea, will start in 2010.

"We want to support work on lightweight design, structural integrity, arctic shipping and off-shore & wind energy", said Erland Johnson. SP and Chalmers work together in several projects and there are fields where SP, Chalmers and Lighthouse collaboration will be of good mutual use.

A link between SP and Chalmers was established in 2009 by an adjunct professorship (Erland Johnson) with an agreement that will run for at least 3 + 3 years.

Claes Hindenfelt / Metra Reportage

Read about coming events and current projects at www.lighthouse.nu

Lighthouse

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