MARITIME INSTITUTE OF FINLAND
ANNUAL REPORT 2003

VTT

TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY

ANNUAL REPORT 2003

General

The Maritime Institute of Finland is a joint venture of the Technical Research Centre of Finland (VTT) and Helsinki University of Technology (HUT). The aim is to co-ordinate and strengthen research efforts in the ship and ocean technology sectors. Publicly funded research and commissioned research are both covered. The Institute combines the scientific activities of a university and the applied research of a research centre. The research projects and programmes are developed and performed in areas that are considered to be essential for Finland's maritime industry. This results in close co-operation between the parties concerned.

The Institute is governed by a board consisting of three members from both organisations. In 2003 the chairmanship was held by Dr Harri Soininen from VTT. The activities are supervised by an advisory committee consisting of members drawn from the related industry and government bodies. The committee met once in 2003.

The volume of activities in 2003 was:
- commissioned research, EUR 2.5 million
- fully or partly publicly funded work (national and EU), EUR 1.6 million
- own research, EUR 0.5 million.

The personnel within the Institute totalled about 80 and consisted of researchers (57%), trainee research scientists (8%), technical support (24%) and office personnel (11%).

Joint functions

The facilities of the Institute comprise an open water towing tank, a combined manoeuvring, seakeeping and ice tank, a system simulator and a virtual design studio. A wind tunnel, a full navigation bridge simulator, an engine room simulator and structural testing facilities are also available. The model test facilities of the Institute are managed and supervised by the so-called 'model test group', comprised of the research personnel of both the University and VTT. Apart from the routine maintenance of the facilities, the group has started designing a new wave-maker for the towing tank. Also, the group procured new optical instrumentation capable of measuring model motion in 6 degrees of freedom. Ship model construction for both HUT and VTT is handled by the technicians of Helsinki University of Technology.

The annual Institute Seminar dealing with the current problems of ship hydrodynamics and solutions to them was held jointly by HUT and VTT on March 20 in Sjökulla, Espoo. The main topic of the seminar was the identification of the sources of uncertainties in ship power prediction.

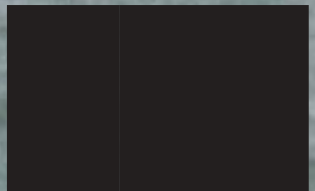
The Maritime Institute published two issues of Maritime Research News, in June and in December. These and previous issues are available also on the Internet at http://www.vtt.fi/tuo/institute/

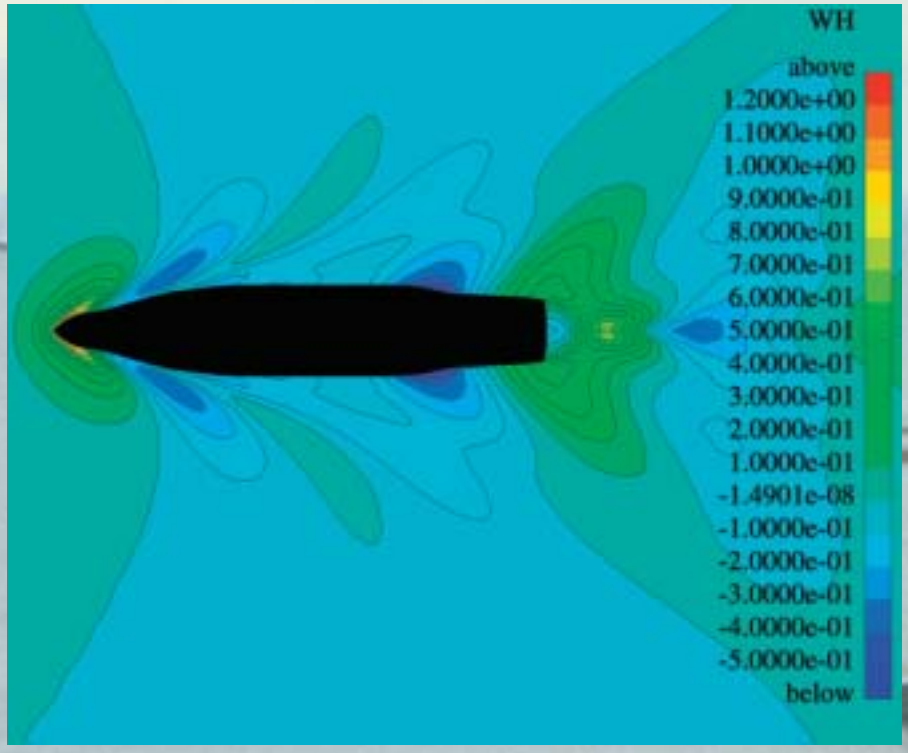
Selected research activities

The Ministry of Transport and Communications commissioned the Institute to work up a research strategy for maritime traffic in the Baltic Sea area. The work was carried out in the autumn, and it included a review of the research published after 1990, interviews with authorities, a workshop held November 25 in Otaniemi, and a strategy report.

Ice research concentrated on questions related to the Baltic winter navigation system. The severe winter in the Gulf of Finland in 2003 contributed to establishing an Ice Expert Working Group in HELCOM. The work of this group included a preliminary risk analysis of the winter navigation system in the Baltic. Also, several aspects of the Finnish-Swedish ice class rules were investigated, especially related to large vessels. A risk analysis of winter navigation in the Baltic Sea was started. Information concerning ice related incidents and damage in winter 2002–2003 was collected.

Due to the severe winter in 2003, new projects regarding winter navigation were started.





The computed wave pattern around an existing Polish research vessel. The RANS equations were solved using FINFLO-SHIP.
Re=3.39e+8.
Fn=0.268.
Lpp=54.135 m.

The HUT Ship Laboratory together with SNAME and IMarEST arranged the 9th ICMES international conference on ship machinery topics. The conference at the HUT campus and onboard MS Silja Serenade was a success. An active effort was also put into life-long professional learning. Three two-day seminars were arranged: one on electronic applications and another on HVAC systems in the marine engineering sector, and the third one on efficient network operations in shipbuilding.

Within the European Union FASTPOD project, VTT studied the application of electric drive podded propulsors to high-speed commercial vessels. A ropax and a cargo ship have been selected as candidates for speeds of 35–38 knots. For such high speeds, the hydrodynamic design of the propeller with its housing is critical due to the danger of cavitation on both propeller blades and the supporting strut. This study deals with the optimisation process of the propeller housing using the RANS solver FINFLO. A non-symmetric strut is designed in order to delay cavitation inception, keeping at the same time a low drag and low lateral forces on the strut. A remarkable reduction in low-pressure areas is observed on the strut surfaces for a tailor-made design as compared to a conventional symmetric strut. Several pod configurations are also analysed.

The HUT Ship Laboratory has participated in the European Union project EFFORT (European Full Scale Flow Research and Technology), where European CFD codes are being developed for full-scale computations of ships. Features such as the turbulent boundary layer, the free surface, the propeller-hull interaction, appendages and complex geometries are taken into account. A very thorough verification and validation of the computed results is made possible by model- and full-scale measurements conducted within this project. Already now, the respective CFD groups of the project have achieved remarkable results with respect to full-scale computations of ships. The results will be published shortly.

New definition principles for the required depth of the fairways were proposed by the Finnish Maritime Administration. In order to find out about possible risks related to the new practice, a risk analysis was carried out at VTT. A risk analysis was also performed when comparing the existing and new fairway proposal between Åland and Turku. The new proposal, entitled 'Kökar fairway', was analysed using the FSA procedure supported with simulator runs and statistical traffic analyses. An important part of the work was a cost and benefit analysis, which is a vital part of the FSA procedure.

The grounding risk of a 30000 GT ROPAX in hard grounding was studied in the two-year research project FSAKARI at the HUT Ship Laboratory. Calculation of the transient ship motion response in 6 degrees of freedom and the visualisation of the grounding process were included in the final phases of the work carried out. The research project TÖRMÄKE, which concentrates on the consequences of ship collision and the mitigation of collision damage with new structural design options, was started as a part of the national MERIKE project.

Ferry traffic between Åland and Turku.

Representatives of the Estonian and Russian maritime authorities at GOFREP trilateral operational exercise in Otaniemi, Finland.

The Finnish-Estonian-Russian development work to establish a joint Mandatory Ship Reporting System (GOFREP) for the Gulf of Finland was continued in 2003. Several trilateral meetings and operational exercises were held in good co-operation to develop the joint procedures and the technical framework needed to ensure the effective operation of the system. The official starting date of GOFREP will be 1 July 2004.

The ship machinery research and teaching activities at HUT continued to focus on the reliability and design of machinery systems. An investigation on propulsion plant reliability (an FMEA study) was completed and reported. Engine room layout was investigated with respect to operational safety and efficient space utilisation. Outlines for an interactive training tool were defined. Teaching material was produced for propulsion and auxiliary machinery in English and Finnish presentation sets and in a Finnish textbook on Ship Electric Net.

Exhaust gas boiler research was continued by developing a mathematical model for soot deposition on boiler surfaces. Although soot fouling problems are frequent, this extremely complicated phenomenon has been investigated hardly at all.

The new mechanical oil vibrating unit was assembled onboard the oil combating vessel LINJA. The design principle developed by the Finnish Environment Institute was originally tested in the laboratory and confirmed by several field trials by VTT. The novel device will be assembled onboard two fairway vessels in 2004 and two patrol boats of the Finnish Coast Guard.

VTT carried out a risk analysis to find an optimal sediment management method for the Port of Vuosaari. A TBT-contaminated settlement was found in the middle of the proposed new port area, and thus efforts were directed towards evaluating the best available dredging and reclamation practises.

Dredging in Port of Vuosaari.

THE MEMBERS OF THE ADVISORY COMMITTEE 2003

Chairman Mr Kari Airaksinen,
Director, Kværner Masa-Yards
Mr Henrik Bachér, Safety and Environmental Manager, Silja Line Shipping Ltd
Mr Rauli Hulkkonen, Technology Specialist, Finnish Technology Development Centre
Dr Heikki Kleemola,
Research Director, VTT
Mr Jorma Kämäräinen, Senior Maritime Inspector, Finnish Maritime Administration
Dr Seppo Laine, Professor, HUT
Mr Jukka Laiterä,
Managing Director, Deltamarin Ltd.
Mr Pekka Lopmeri,
Captain (Navy Eng.), Finnish Navy
Mr Eero Mäkinen, Director,
Kværner Masa-Yards
Mr Henrik Nordell, Director,
The Association of Finnish Metal Industries
Mr Erkki Strengell,
Director, Aker Finnyards Ltd

PUBLICATIONS 2003

SCIENTIFIC PAPERS

Bäckström, Mika. Multiaxial fatigue life assessment of welds based on nominal and hot spot stresses. Espoo, VTT Industrial Systems, 2003. 97 p. + app. 9 p. VTT Publications; 502. ISBN 951-38-6233-X; 951-38-6234-8.

Lensu, Mikko. The evolution of ridged ice fields. Espoo, 2003. (HUT Ship Laboratory M-280)

Matusiak, Jerzy. Momentum equation applied to the problem of a propeller in oblique flow. Ship Technology Research-Schiffstechnik, Vol. 50-2003, pp. 103-105.

Rosqvist, Tony. On the use of expert judgement in the qualification of risk assessment. VTT Industrial Systems, Espoo, 2003. 48 p. + app. 82 p. VTT Publications : 507. ISBN 951-38-6243-7; 951-38-6244-5

Schweighofer, Juha. Investigations of two-dimensional transom waves using inviscid and viscous free-surface boundary conditions at model- and full-scale ship Reynolds numbers. Espoo, 2003. (HUT Ship Laboratory M-281)

Working Group 41 of the PIANC/MARCOM (including Rytkönen, Jorma VTT). Guidelines for Management Wake Wash from High-Speed Vessels. Belgium, PIANC, International Navigation Association, 2003. 31 p. + app. 1 p. Report of the Working Group 41 of the Maritime Navigation Commission. ISBN 2-87223-142-0.

LABORATORY REPORTS

Häkkinen, Pentti. Laivan sähköverkko. Espoo: 2003. 96 p. (HUT Ship Laboratory M-279)

Kajaste, J; Varsta, P. Mechanics of ship grounding. Espoo, 2003. (HUT Ship Laboratory M-282)

Kujala, Pentti; Mäesalu Meelis. Tietotekniikka laivanrakennuksessa, työryhmän loppuraportti. Espoo: 2003. 30 p. (HUT Ship Laboratory M-276)

Remes, Heikki; Socha, Grzegorz. Laboratory fatigue tests of CO_2-laser, CO_2-laser hybrid and submerged ARC welded material of RAEX S275 laser. Volume 1 and 2. Espoo, 2003. (HUT Ship Laboratory M-277)

Remes, Heikki. Laboratory fatigue tests of CO_2-laser, CO_2-laser hybrid and submerged ARC welded butt joint of RAEX S275 laser and NVA. Volume 1 and 2. Espoo, 2003. (HUT Ship Laboratory M-278)

Rytkönen, Jorma; Bengston, Aaron; Peltoniemi, Hannu. Measurements of fast ferry waves in Helsinki-Tallinn run. Espoo, VTT Industrial Systems, 2003. 39 p. Research Report No. BTU034-031143.

Tamminen, Tero; Remes, Heikki. Fatigue Tests of Laser, Laser Hybrid and Arc Welded Butt and T-joints of RAEX S275 Laser, RAEX 420 MC Laser, RAEX 700 optim, GLA36TM and NVA Steels. Espoo, 2003. (HUT Ship Laboratory M-284)

CONFERENCE PAPERS

Häkkinen, Pentti; Domingo, Jeronimo. Factors Affecting Soot Fouling, Cleaning and Soot Fires in Diesel Engine Exhaust Gas Boilers. ICMES 2003 9th International Conference on Marine Engineering Systems Otaniemi, May 19-21, 2003. ICMES 2003, Electronical publication (only CD ROM).

Hänninen, Samuli. Design Ice Load Level in the Baltic Sea. The 17th International Conference on Port and Ocean Engineering under Arctic Conditions, POAC´03, June 16-19, 2003, Trondheim, Norway, pp.271-282.

Laitinen, Risto; Kujala Pentti; Remes, Heikki; Nielsen, S.E. CO_2-laser MAG Weldability of Laser Cutting LASER RAEX Steels, Hull Structural Steel Grade A and High Strength Formable Steel OPTIM RAEX 700 MC. 9th NOLAMP Conference, Trondheim, Norway, August, 2003. Trondheim, 2003, pp. 51-62.

Leiviskä, Topi. The Propulsion of an Ice Going Ship Ahead and Astern. The 27th International Conference on Port and Ocean Engineering under Arctic Conditions, POAC´03, June 16 -19, 2003, Trondheim, Norway, pp. 487-498.

Lensu, Mikko; Hänninen, Samuli. Short Term Monitoring of Ice Loads Experienced by Ships. The 27th International Conference on Port and Ocean Engineering under Arctic Conditions, POAC´03, June 16 -19, 2003, Trondheim, Norway, pp. 535-544.

Lensu, Mikko. Ridge Clusters and Ice Navigation. The 27th International Conference on Port and Ocean Engineering under Arctic Conditions, POAC´03, June 16 -19, 2003, Trondheim, Norway, pp. 525-535.

Matusiak, Jerzy. On the effects of wave amplitude, damping and initial conditions on the parametric roll resonance. Proceedings of the 8th International Conference on Stability of Ships and Ocean Vehicles, Madrid, Spain, September 2003, pp. 341-348.

Mikkola, Tommi. Development and Application of an Unstructured Finite Volume Solver for Free Surface Flows in 2D. 6th Numerical Towing Tank Symposium (NUTTS), Rome, Italy, September 29 - October 1, 2003.

Remes, Heikki; Kujala Pentti; Laitinen, Risto. Fatigue Characteristics of CO_2-laser MAG Welded Joints of Laser Cutting RAEX Steels. 9th NOLAMP Conference, Trondheim, Norway, August, 2003. Trondheim, 2003, pp. 37-48.

Remes, Heikki; Fatigue Strength of Laser and Hybrid Weldements in Shipbuilding Industry. Testing of Mechanical Properties of Materials and Construction Conference, Zakopane, Poland, December 2003, Institute of Fundamental Technological Research, pp. 145 - 159.

Romanoff, Jani; Kujala, Pentti. The Effect of Laser Weld's Dimensions on Transverse Shear Stiffness and Stress State of Steel Sandwich Panels, 6th International Conference on Sandwich Structures - ICSS6, Ft. Lauderdale, Florida, March 31 - April 2, 2003.

Rytkönen, Jorma; Sassi, Jukka; Mykkänen, Erkki. Recent oil recovery test trial with ice in Finland. 26th Arctic and Marine Oil Spill Program (AMOP), Technical Seminar, Victoria, June 10-12 2003. Vol. 2. Environment Canada (2003), pp. 577 - 594.

Sanchez-Caja, Antonio; Ory, Emmanuel; Salminen, Esa; Pylkkänen, Jaakko; Siikonen, Timo. Simulation of incompressible viscous flow around a tractor thruster in model and full scale. The 8th International Conference on Numerical Hydrodynamics, September 22 - 25, 2003, Busan, Korea.

Schweighofer, Juha. Viscous Flow Computations at Full-Scale Ship Reynolds Numbers Using the RANS Solver FINFLO. 6th Numerical Towing Tank Symposium, Rome, Italy, September 29 - October 1, 2003.

SEMINAR PRESENTATIONS

Hänninen, Saara. Vessel acquisition strategy for the Finnish Life Boat Society and the Estonian Life Saving Association [in Finnish]. “Etelä-Suomen rannikkoseudun Interreg IIIA -ohjelma ja liikenne” seminar. Helsinki, April 2, 2003. Finnish Maritime Administration, 2003. 20 p. [slides]

Jalonen, Risto. FSA-periaatteiden soveltaminen karilleajoriskiin [in Finnhis]. Seatech 2000+ Loppuraportti, March 25, 2003. MET Telakkaryhmä.

Rytkönen, Jorma. Methods to restrict the invasion of alien species. Seminar on the Environmental Impacts of the Maritime Industry, MS Silja Symphony, March 11-13, 2003. St. Petersburg Business Contact Centre Kymenlaakso Polytechnic Institute (2003).

Rytkönen, Jorma. Maritime transportation in the Eastern Gulf of Finland – oil transportation is growing fast [in Finnish]. “Suomenlahden tulevaisuus” seminar. February 20, 2003. Kotka, Kymenlaakso Environmental Protection District; Helsinki University adult educational centre, Kotka, 2003. 37 p. [slides]

Rytkönen, Jorma. Environmental Issues Concerning Maritime Transport. Economy and Transport in the Baltic Sea Area: Challenges and Research Needs [in Finnish]. “Oil transport in the Gulf of Finland” seminar. Helsinki, May 22, 2003. Advisory committee of Northern Research; Ministry of Transport and Communications; Ministry of Trade and Industry, 2003. 22 p. [slides]

Rytkönen, Jorma. Tanker Traffic and Traffic Control Systems [in Finnish]. “Oil transport in the Gulf of Finland” seminar. Kotka, April 9, 2003. Helsinki University Adult Educational Centre, 2003. 24 p. [slides]

Rytkönen, Jorma. R&D on maritime field in Finland. Bridging the European ITS business Co-operation with China, Liikenne- ja viestintäministeriö, 2003. 26 p. [slides]

Rytkönen, Jorma. Need for Traffic Control & Separation Scheme? HELCOM Expert Group Meeting. St. Petersburg, December 9 - 11 2003, Helsinki Commission, HELCOM, 2003. 14 p. [slides]

Sonninen, Sanna; Kunttu, Susanna; Hänninen, Saara; Maskuniitty, Matti; Tuominen, Risto. Electronical failures and hazardous situations caused by them [in Finnish]. MET Laiva-alan luentopäivät: Laivojen elektroniikka. March 27 - 28, 2003, Dipoli, Espoo. Meriteollisuusyhdistys ry (2003).

Sonninen, Sanna. GOFREP - Gulf of Finland Mandatory Ship Reporting System [in Finnish]. Ship officers’ seminar, University of Turku, Centre for Maritime Studies. November 20, 2003, Turku. 24 p. [slides]

OTHER PUBLICATIONS

Hänninen, Saara; Hentinen, Markku; Rytkönen, Jorma; Marttila, Kari. Vessel acquisition strategy for the Finnish Life Boat Society and the Estonian Life Saving Association [in Finnish]. Publications of Finnish Maritime Administration 3/2003. ISBN 951-49-0939-9.

Kujala, Pentti; Romanoff, Jani; Salminen, Antti; Varis, Juha; Vilpas, Martti. MET, Tekninen tiedotus; Teräksiset kerroslevyrakenteet, Helsinki, MET, 2003. 84 (MET-julkaisuja).

Mikkola, Tommi. Numerical Simulation of Free Surface Flows in 2D with Unstructured Finite Volume Based Pressure Correction Method. VIII Suomen Mekaniikkapäivät, Otaniemi, Espoo, June 12 -13, 2003, pp. 77-89.

Remes, Heikki. Fatigue Strength Modelling of Laser Welded Joints. TUKEVA Research Programme on Future Mechanical Engineering 2000-2003, Final Report, Tampere, 2003, pp. 156-167.

Rytkönen, Jorma. Safety of Maritime Traffic in the Gulf of Finland [in Finnish]. Tekniikka ja Kunta, vol. 27 (2003) 3, pp. 14 - 17.

Rytkönen, Jorma. Problems Induced by Winter in the Gulf of Finland Oil Transport [in Finnish]. Kymenlaakson luonto. Suomen luonnonsuojeluliiton Kymenlaakson piirin 9. vuosijulkaisu, vol. 9 (2003), pp. 32 - 33.

MARITIME INSTITUTE OF FINLAND

VTT Industrial Systems/Product Performance
P.O.Box 1705, FIN-02044VTT, Espoo, Finland
Phone +358-4561 Telefax +358-9-455-0619 Telex 122972 vttha fin

HUT Ship Laboratory
Otakaari 4, FIN-02150, Espoo, Finland
Phone +358-9-451-3501 Telefax +358-9-451-3419 Telex 125161 htkk fin

Editors: Saara Hänninen & Pentti Tuononen, VTT Industrial Systems
Institute home page: http://www.vtt.fi/tuo/institute/

TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY