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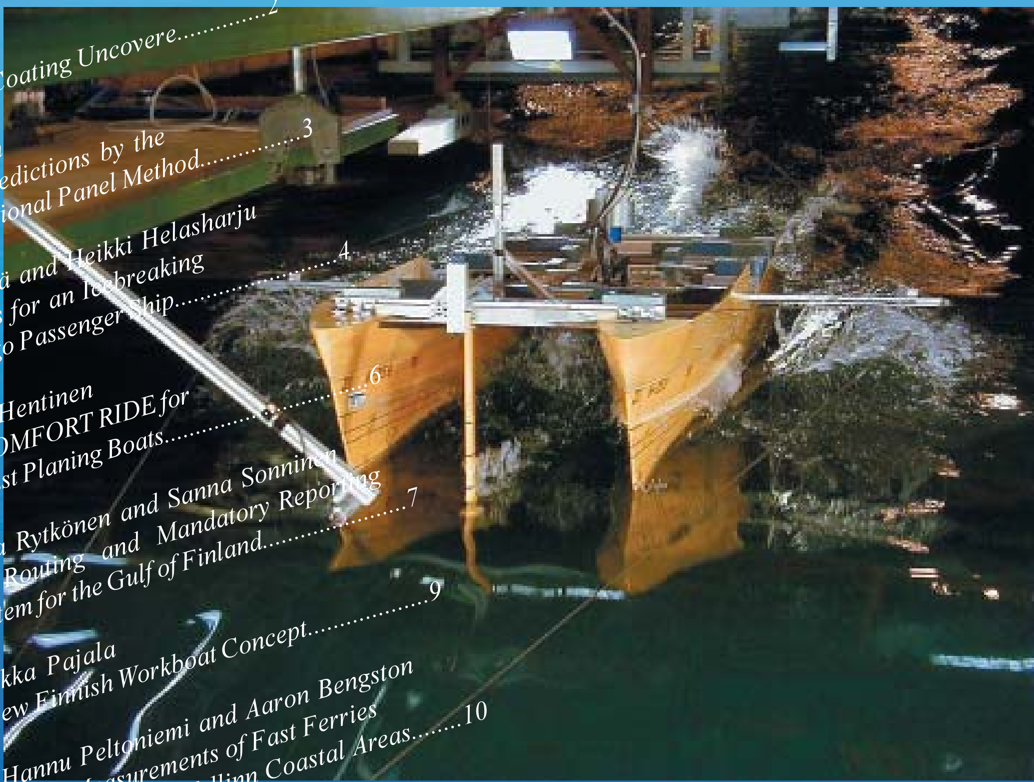

Maritime Institute of Finland

VTT

TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY

EDITOR'S CORNER

Kaj Riska
Professor, HUT Ship Laboratory

EU IS OPENING ITS DOORS!

The European Union's present Fifth Framework Programme covering Research in is now coming to a close. The last calls for research proposals have been closed and only some other funding instruments for researcher mobility are still open up to next winter. In addition, the first Thematic Networks (TNs) funded in the present framework programme are being wrapped up. Among these are the two TNs in shipbuilding technology, CEPS and PRODIS, as well as one in ship safety, SAFER EURORO. CEPS concentrated on the shipbuilding process (design and production) while PRODIS concentrated on new products. It is now time to take stock of what has been achieved and how to continue in the new environment created by the new Sixth Framework Programme.

The original motivation of the Thematic Networks was to assess the present state of R&D in Europe in the maritime field and, based on this assessment, suggest new research that would be fruitful for all partners involved. The coordination of the CEPS and PRODIS networks was done by the R&D organisation of the Association of European Shipbuilders, COREDES. This is in line with the emphasis in the Fifth Framework Programme on the end users in the research results. The major outcome of the networks was the mobilization of European research teams, which is proven by the large amount of proposals submitted. I am sure that everybody benefitted from the extensive interaction in Europe in building research consortia.

The major themes in the submitted projects were related to ship safety, ship propulsion, and ship structures and materials. When the projects submitted are looked at closer, it can be noticed that only a few are related to environmental issues. Some projects focus on emissions and some on the Life Cycle Analysis (LCA), but very few of them focused on environmental impact, especially from the perspective of nature. No projects related to enhanced performance in special conditions like in ice-covered waters were submitted. This situation is naturally related partly to the immediate interest of end users but also to the capabilities of research organisations.

The plans for the next framework programme, the Sixth Framework Programme, are quite different from those of the present one. The new programme has set the target on focusing on research in areas that are important from the perspective of European society. Many of the priority thematic areas are related to the well-being of individuals (health, food safety) and the electronic environment of individuals (information society, knowledge-based society). In addition, some research themes aimed at key industrial areas are included (aeronautics, nanotechnologies). Another theme dominant in the Sixth Framework Programme is the encouragement of researchers to network and seek new means of co-operation and interaction. Here, one of the stimuli is that, according to statistics, in the Fifth Framework Programme only about 10 % of the actual research was carried out by end users. Thus, the focus on supporting those who do the research. In addition, emphasis is on the best available knowledge, be it within the EU or across the Atlantic or across the Asian continent.

The new environment created by the Sixth Framework Programme contains challenges for those of us in the universities. It is not clear how our research themes fit the new EU priorities. We have to cover certain aspects of ship technology in education and these are not easily adapted to a new environment. It is clear that more emphasis must be placed on environmental issues – and not only on ship emissions but also on the impact on the environment of our design objects; ships, offshore structures, ship routes, etc. Another important topic will be new production processes. It is not enough that we inject new vocabulary in our research, we must change emphasis. This requires, among other things, seeking new partners for the environmental, production process and IT issues. This strong guidance from Brussels should be turned into a strength in a similar way as the present emphasis in the Fifth Framework Programme on forming consortia within Europe was.

SECRETS OF BLACK COATING UNCOVERED

Pentti Häkkinen
Professor, HUT Ship Laboratory

Soot accumulation on steam boiler surfaces reduces the efficiency of heat transfer and creates the risk of fire. Large diesel engines in ships and power plants are generally equipped with exhaust gas boilers for economical steam production. When high molecular mass is used as fuel, the exhaust gas contains ash and hydrocarbons in a wide spectrum. These 0.1-10 ìm particulates deposit as layers on the boiler tubes.

HUT Ship laboratory is currently completing a KELTO research project that deals with all aspects of marine heat recovery boiler fouling.

In principle, simple exhaust gas boilers have undergone many changes during recent decades. The gas inlet temperature level is generally lower, while the outlet temperature cannot be reduced due to sulphur acid corrosion attack. Boilers are located inside narrow engine casings and their outside dimensions are therefore minimised. Feed water flows inside tubes and the heat transfer surface is extended with fins and ribs. The desire to reduce manufacturing costs has brought about designs where the ribs are densely located, gas flow velocity is high and pressure loss on the gas side is also high.

Accumulated soot is usually removed by blasting steam through nozzles at regular intervals and washing the boiler with abundant water once or twice a year. The dense internal boiler structure and the soot properties in heavy fuel oil operation hamper cleaning efficiency, which has resulted in reduced steam generation and frequent soot fires.

Guidelines have been issued for boiler design and operation with the goals of less fouling, more efficient cleaning and avoiding fires. All these problems have, however, continued, which was then the origin of the KELTO project. The project should start with the investigation of *ash* and *char* generation and continue with studies on the fouling process. Ash and char are the main components of soot, with ash denoting the metallic inorganic material in fuel and char the residual coal, generated during incomplete combustion. The theoretical part was complemented with an extensive measurement program in a test plant and ten ships. The test plant included a 1500 kW diesel engine fed with three heavy fuel oil grades and a special design ribbed tube boiler. Fouling and cleaning was recorded with several parallel methods in varying combinations; for example, all available soot removal methods were tried out.

The KELTO project was financed by domestic industry, five shipowners, the Finnish Maritime Administration and the National Technology Agency (TEKES). VTT Energy acted in close co-operation.

The results include many findings that cancel out previous knowledge and guidelines. The phenomena in soot fouling and ignition are very complicated and leave room for further detailed research. Nevertheless, the results can be widely utilised in designing more economic and safer heat recovery plants in diesel engine driven ships and power plants. Besides the complete result report, a condensed version of the instructions will be printed in Finnish.

Figure # shows the view of the test boiler from inside through an inspection hatch. Gas flow direction is from top to bottom. Soot hangs like icicles that withstand the surrounding gas flow but are loose and fall away when touched.

SEAKEEPING PREDICTIONS BY THE THREE-DIMENSIONAL PANEL METHOD

Timo Kukkanen
VTT Manufacturing Technology

An accurate estimate of the wave-induced loads and motions of ships is important in predicting the performance of a ship in seaways. Though ship wave loads have been investigated a long time, there is still quite a lot of research to be done until the design wave loads can be accurately estimated for different ship types.

A research project was conducted by VTT to investigate numerical methods for computing ship motions and loading in regular waves more accurately. The work was carried out in a research project funded by the Technology Development Centre (TEKES), Kvaerner Masa-Yards and VTT. The work was carried out in co-operation between VTT and Prof. Iwashita from Hiroshima University and Prof. Ohkusu from Kyushu University. The aim of the present study was to get insight on the present state-of-the-art numerical method applied to practical seakeeping problems in ship design. The seakeeping program was developed by Prof. Iwashita from Hiroshima University. The program is based on a three-dimensional Green function method for ships with forward speed.

Seakeeping predictions were calculated for the passenger car ferry Silja Serenade (Figure 1). Ship motions were calculated in regular waves and the transfer functions were used to predict the characteristic values in irregular waves. Calculated responses were compared to the model test results, which were provided by Kvaerner Masa-Yards. Good results were obtained for vertical motions and accelerations (Figure 2). Uncertainties exist in the predictions of roll motions. Simple approximation was included in the calculation to take into account the non-linear and viscous roll damping effects.

The main emphasis was on estimating the important ship motions and accelerations that will influence the seakeeping performance of a ship. More detailed hydrodynamic quantities were not investigated in the present study. One advantage of the program is that the method predicts hydrodynamic pressure distribution around the hull, which can then be used as input in a structural analysis by the FEM (Figure 3). The research project also includes the development of link programs that generate the panel grid from a NAPA program and link files for post-processing responses in irregular wave calculations.

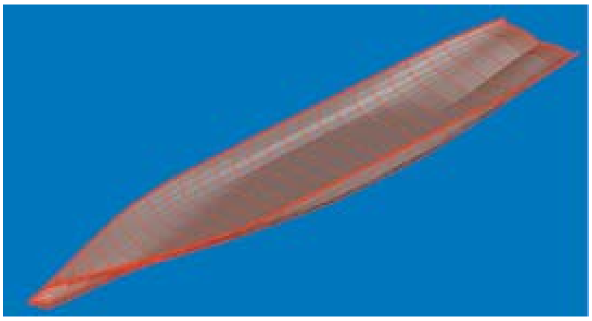

Figure 1. View of the panel mesh used in the calculations.

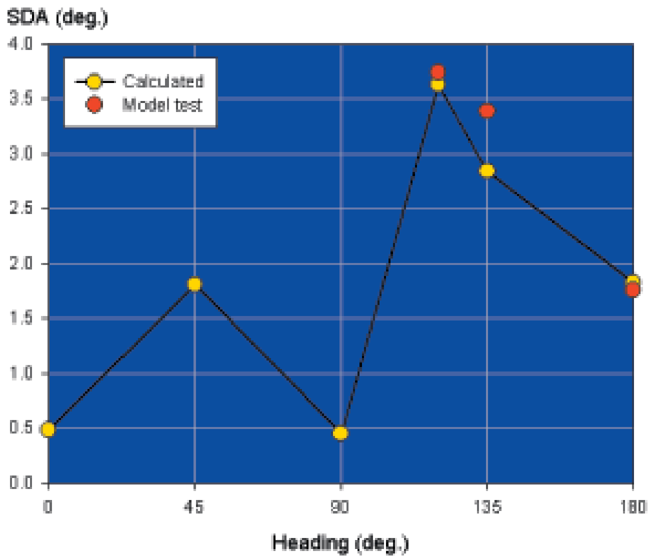

Figure 2. Comparison of calculated and measured significant double amplitudes (SDA) of pitch in irregular waves, H_s = 4.5 m and T_p = 9 s. Ship speed of 19 knots.

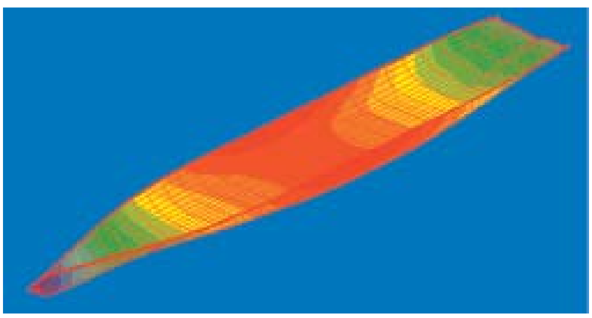

Figure 3. Unsteady pressure distribution around the hull. Snapshot of a one time instant from the regular wave l/L » 2 with a speed of 0 knots.

MODEL TESTS FOR AN ICEBREAKING ARCHIPELAGO PASSENGER SHIP

Topi Leiviskä and Kaj Riska,
HUT Ship Laboratory
Heikki Helasharju,
VTT Manufacturing Technology

Figure 1. Model in self- propulsion at 14 kn

BACKGROUND

The Finnish engineering company ILS Consulting Naval Architects and Marine Engineers is well known for their substantial contribution to the creation of the Finnish fleet of multipurpose icebreaker-supply ships. The designers faced a similar kind of challenge in a recent project for Waxholmsbolaget of Sweden. Waxholmsbolaget currently operates the island routes of Stockholm with some twenty vessels, but the requirements for the new project ship were set high with respect to guaranteed year-round operation. Thus, the hull form design needed to combine high ice-going and manoeuvring capabilities with a fairly high service speed with respect to the ship length in open-water operations and friendliness to the environment i.e., as small wash waves as possible. In early 2001, ILS commissioned both parties of the Maritime Institute of Finland to performed model tests for the ferry project. VTT was in charge of the open-water model tests and HUT handled the ice model tests.

SHIP DESCRIPTION

The ferry's main dimensions are about 44 m x 10.2 m x 2.9 m (LWL x BWL x TDWL). Except for a small cargo hold, she is only intended for passenger traffic. The ferry propulsion system will be based on two pusher-type azimuthing propulsion units. In project stage model tests, the units were pusher-type podded propulsors, but diesel-electric machinery with mechanical azimuthing thrusters were also considered at the project stage.

Figure 2. Customers studying the ferry hull after successful model testing. From right to left: Project Manager Henry Westerberg (Waxholmsbolaget), Chief designer Harri Eronen (ILS) and Managing Director Jyrki Lehtonen (ILS).

MODEL TESTS IN TOWING TANK

The test program in the towing tank consisted of a normal series of resistance and self-propulsion tests. The intended operational environment in the Stockholm archipelago forced the designers to also take special care with respect to the wave formation of the hull, which was studied by particular measurements of the waves generated by the hull during all resistance and self-propulsion tests. Aft wave formation was considered by introducing two alternative transom designs in the bare hull resistance tests. The results showed that wave formation was not dependant on the presence or absence of the pod propulsion units nor were the wave heights affected by running propellers; i.e., the rather moderate dynamic trim was not affected by the propulsor action even at top speeds.

Overall, the hull design proved to be very successful with respect to flow patterns, hull resistance and wave formation. The wave formation of the project ship has been favourably compared to the model test results of a vessel that is known to have acceptable wave formation when full-scale.

ICE MODEL TESTS

BACKGROUND

The ice model tests of the Waxholm passenger ship were conducted at the Ship Laboratory of the Helsinki University of Technology in April 2001. The vessel is designed to operate year-round on her route of carrying passengers in the Stockholm

Figure 3. Breaking out of a channel ahead.

archipelago. She is designed to travel in level ice and her own old channels as well as those of the Finland-Sweden car ferries. The most difficult ice conditions she will encounter lie in the quay areas where the brash ice layer gets relatively thick during winter. Therefore, the focus in the ice model tests was on operational tests: turning in thick brash ice and in channels, crossing the channel and turning out of the channel.

ICE CONDITIONS AND TESTS

The ship was designed to break 50 cm thick level ice although the normal ice thickness in Stockholm's inner archipelago is 20-30 cm and in the outer archipelago 10-20 cm. The brash ice channels made by the vessel itself are approximately 20 m wide and the channels of the car ferries are more than 30 m wide. The channel thickness in the middle of the channel is about 35 cm in the inner archipelago and 45 cm in the outer archipelago.

The level ice tests were conducted in two level ice sheets, the first of which was conducted in Masa-Yards Arctic Technology, where the level ice performance ahead and astern was tested. In the second level ice sheet, operational tests were also performed, such as turning on the spot, turning circle tests ahead and astern and breaking out of a newly broken channel.

Channel tests were performed in three different channels, two of which were very thick, almost corresponding to the thickness of the channels in the Gulf of Bothnia. The reason for such heavy channels was that they were also to correspond to the most difficult quay areas the ship has to operate in. The third channel was closer to the channels in the vessel's route. The tests in the channels were performance tests ahead and astern, turning in the channel and out of the channel ahead and astern, crossing the channel with some additional channel clearing tests with the Azipod units turned sideways.

ICE MODEL TEST RESULTS

The level ice performance tests were conducted using the ice thickness corresponding to the thickness of 32 cm in full scale. The performance in level ice ahead was found to be better than originally anticipated and the performance astern corresponded to the design. The Azipod units make the vessel very manoeuvrable. The turning-on-the-spot test showed that she could easily turn 180° in 32 cm thick level ice. The turning circle tests again proved the superiority of azimuthing propulsion over the conventional system. The turning radius was a little more than one ship length ahead and a little less than one ship length astern when the Azipod were turned 50°.

The channel performance of the vessel was good. She could easily advance in the heavy channels and in the light channel, she could maintain a speed of 8 m/s. The performance of the vessel when breaking out of an old channel proved to be better astern than ahead in a heavy channel probably because the Azipod units break up the side ridges better. In the light channel, the breaking out took less time when travelling ahead.

One of the operational tests was the channel-widening test. The idea is that the vessel can make a heavy channel lighter for the older and less powerful vessels by turning the Azipod units almost 90° sideways so that the propeller slipstream widens the channel while the propellers still thrust the vessel a little ahead. The tests showed that a relatively heavy channel had almost no ice mid channel after the clearing tests.

The ice-going capability as well as the operational performance proved to be to be sufficient for all the possible ice conditions that the Stockholm archipelago could present. In addition, the capability of making the old channels lighter for the older and less powerful archipelago vessels of the same ship owner, Waxholmsbolaget, is good.

Figure 4. The clearing-the-channel test.

MORE COMFORT RIDE FOR VERY FAST PLANING BOATS

Markku Hentinen,
VTT Manufacturing technology

Fast, planing boats have many good characteristics in smooth water, but wavy seas are problematic. Due to slamming pressures, high vertical accelerations combined with large motion amplitudes are encountered. These restrict the operation of the boat as well as driving comfort. Operational limits affect the usability of workboats, while driving comfort is more pronounced for recreational boats.

During earlier projects and full-scale measurements at VTT, it has been found that the present design methods are inaccurate when the boat jumps from one wave crest to another. For example, the results for a very fast RIB of the Finnish coastguard showed that the equations for vertical accelerations do not characterise the effect of the boat speed in the proper way. It has thus been difficult to evaluate the main dimensions and hull shapes from the driving comfort and usability point of view. Other parameters, the effect of which can be shown as numeric values, have dominated design decisions. Boat designers and manufacturers, which are small and medium-sized enterprises, have not had the resources to develop these methods.The assessment of seakeeping qualities has been almost purely empirical, at least in the early design stages.

A CHALLENGING GOAL

To improve the situation, a project called ”Reduction of slamming loads and vertical accelerations of fast planing boats – COMFORT RIDE” was put together at VTT. Marine Alutech Oy, Palkkiyhtymä Oy, Wihuri Oy Power Products, Kesko Oy Marine, the Finnish Maritime Administration, the Headquarters of Frontier guard and the Headquarters of the Navy participated in the project. Work was started in spring 1999 and the project was subsidised by the National Technology Agency (TEKES).

The goal of the work was to improve present methods and extend their scope of application for calculating the vertical accelerations of very fast, planing boats. The result should be simple directions and equations for seakeeping comparisons in the early design stage. In this way, the driving comfort could be taken as a new, measurable design parameter.

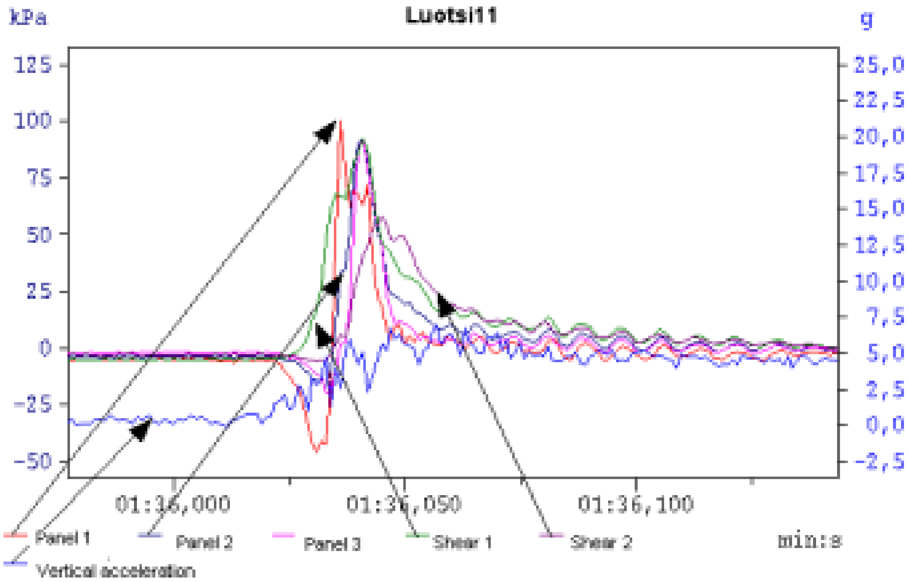

Figure 2. Slamming-pressure during a typical slamming event as calculated from the strains in panels and stringers. Vertical acceleration near the measured panel is also presented.

FULL-SCALE MEASUREMENTS IN DEMANDING CONDITIONS

Literature was extensively read in order to find test results and formulae for vertical accelerations. Very little relevant data was found though. The existing methods - or at least the published ones - are made for larger craft (Loa > 20 m), which are proportionally slower than the scope of the COMFORT RIDE project. The possibilities of developing new theoretical models for direct calculations (wave surface, hull motion and pressure loading) were also limited in this project. Thus, there was a clear need for new full-scale measurements to get more empirical data.

In addition to reanalysing some older measurements, vertical accelerations were measured on four different planing boats. The dimensions of the boats extended from light, wide hull forms to heavier, narrow hulls. The measurements were carried out at open sea at significant wave heights of 0.8-1.3 m and at boat speeds of 25-45 knots (Fig. 1). High G-forces put great strains on both boats, the measuring devices and the people involved, luckily; no serious damage occurred. An example of the measured data is shown in Fig. 2.

Figure 1. Full-scale measurements were carried out in the Gulf of Finland.

The results from every boat measured showed that the vertical accelerations are not proportional to the square of the speed, although this is the assumption in the majority of existing calculation methods. Instead, linear or even smaller influences were discovered. The effect of the trim angle and wave height was pronounced. The scatter in the results was quite large because of the limited measuring time and number of encountered waves, although about 200 impacts were encountered during each measuring leg. Choosing a suitable statistical method is critical when estimating extreme values.

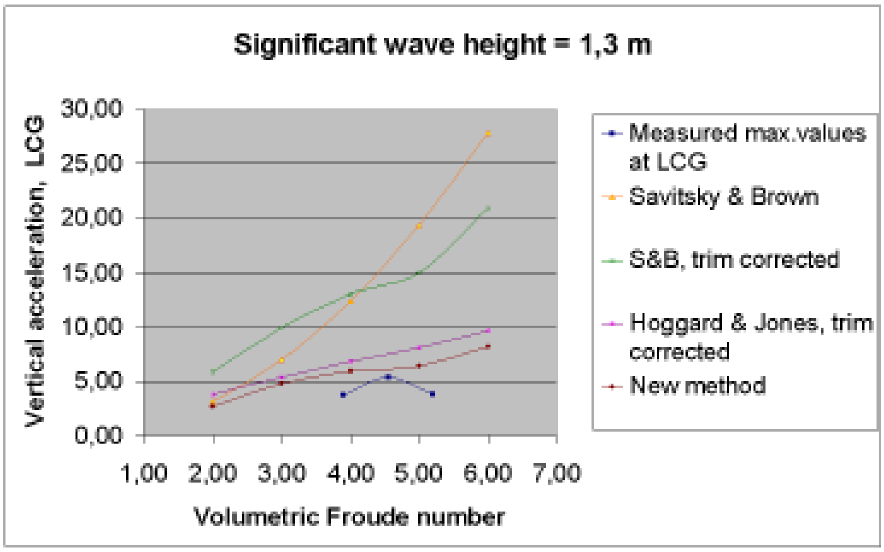

Figure 3. An example of measured and calculated values for vertical acceleration

AN IMPROVED FORMULA FOR VERTICAL ACCELERATIONS

A new calculation formula was fit to the measured data. This formula is based on the simple method of Savitsky and Brown, but the speed of the boat is taken into account in a completely different way (Fig. 3). The formula gives results that are clearly closer to the measured values than earlier methods, especially at very high speeds. The formula can be applied to seakeeping comparisons of fast planing boats in the early design stage. This creates new possibilities for improving usability and driving comfort when the boat is meant for travelling in a seaway at high speed.

During the project, the proper method of measurement of vertical accelerations as well as the relevant criteria become a new field of required research. The motions of fast, planing boats are, in this sense, between high-frequency vibrations and the motions causing seasickness. There is a clear need to prepare suitable criteria for judging driving comfort or usability in this area.

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SHIP ROUTING AND MANDATORY REPORTING SYSTEM FOR THE GULF OF FINLAND

Jorma Rytkönen and Sanna Sonninen
VTT Manufacturing Technology

BACKGROUND

There has been a considerable amount of growth in maritime traffic in the Gulf of Finland (GOF) since 1990. In particular, oil and passenger transportation has increased, and container traffic is also showing heavy growth figures; for instance, the amount of oil cargo has doubled since 1995 and exceeds 40 million tons annually. The largest oil terminal for the GOF is the Port of Muuga, which together with the other ports in Tallinn (e.g., Miduranda), will soon equal 20 million tons. The Finnish Kilpilahti oil terminal has 10 – 14 million tons annually; St. Petersburg Sea Port already exceeds 8 million tons. After the new Russian Primorsk oil terminal is complete in December of this year, a new oil tanker flow of 12 million tons of crude will be added in the first stage. The government of the Russian Federation, however, has already given a new order to start up the second phase of the Primorsk oil terminal (order dated 2 November 2001), which will raise the proposed first stage annual oil flow by 6 million tons up to an annual level of 18 million tons.

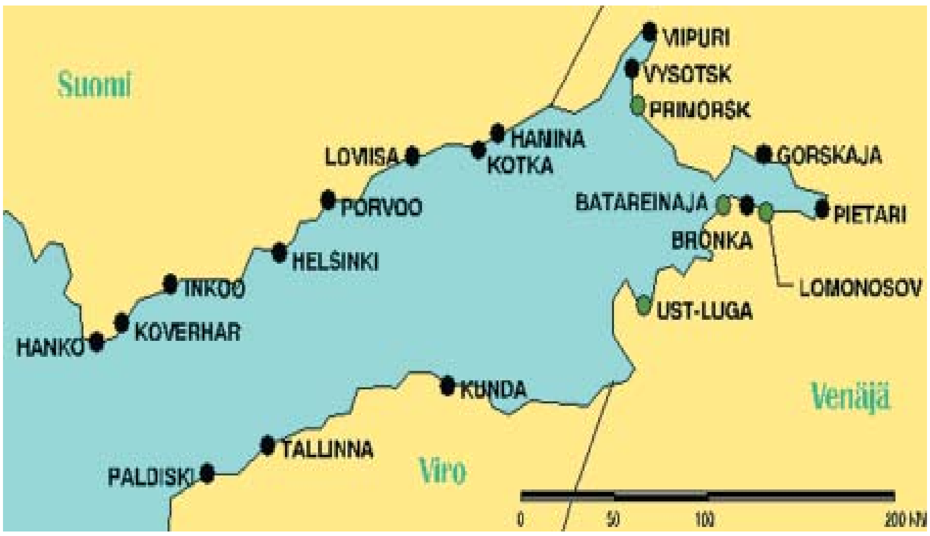

Figure 1. The main ports of the Gulf of Finland. The black dots correspond to existing ports; the grey dots, the ports under construction or still in the planning stage.

After the past accidents of MT Erika near the French coastline, followed by a chemical tanker accident, and later the ship collision in March 2001 (Baltic Carrier's oil spill), a strong debate has been carried out in the EU to figure out tools to improve maritime safety and to protect the environment against oil spills. The EU's traffic ministers, for example, discussed safety matters 28 March in Brussels, in particular, the stricter control of classification societies, ship structural matters and port state control. The European Maritime Safety Agency is currently being established, and on a HELCOM level, safety issues were discussed in a special ministerial meeting in September 2001.

THE SHIP ROUTING AND MANDATORY REPORTING SYSTEM

After preliminary work by VTT to establish a ship routing and mandatory reporting system for the Gulf of Finland (GOF) was completed in February 2001 (cf. Maritime Research News 2/2000), design work has continued as a joint technical working group between Russia, Estonia and Finland.

Work was completed by the end of November and the proposals will be presented to the international working group in November 2001. After the international working group has evaluated and studied the proposal, the proposal is to be left with IMO in February 2002 for further measures. The new routing and mandatory reporting system should be implemented in 2004, after which all ships of 300 gross tonnage or over traveling through the reporting area (See Figure 1) to ports in the GOF or between them must report to the authorities. The contracting states will agree on the information requested. Eastbound vessel traffic will report to Tallinn VTS Centrum and westbound to the Helsinki Traffic Center. The reporting format basically contains the same data that can be gotten later from AIS, which will be an acceptable means of giving the report. The system will cover the international waters of the GOF eastward from longitude 022°30' E.

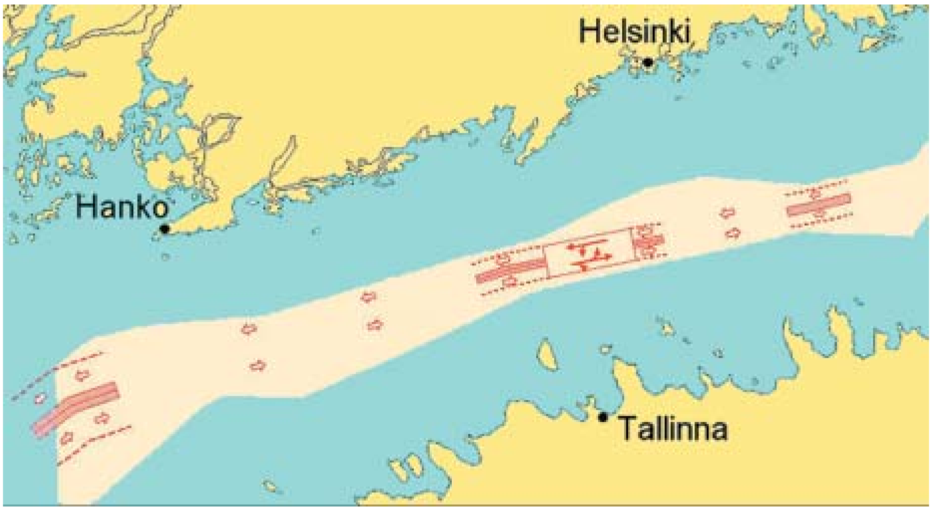

Figure 2. The mandatory routing system proposed for the Gulf of Finland starting in 2004. The routing system is part of the VTMIS system of the Gulf of Finland.

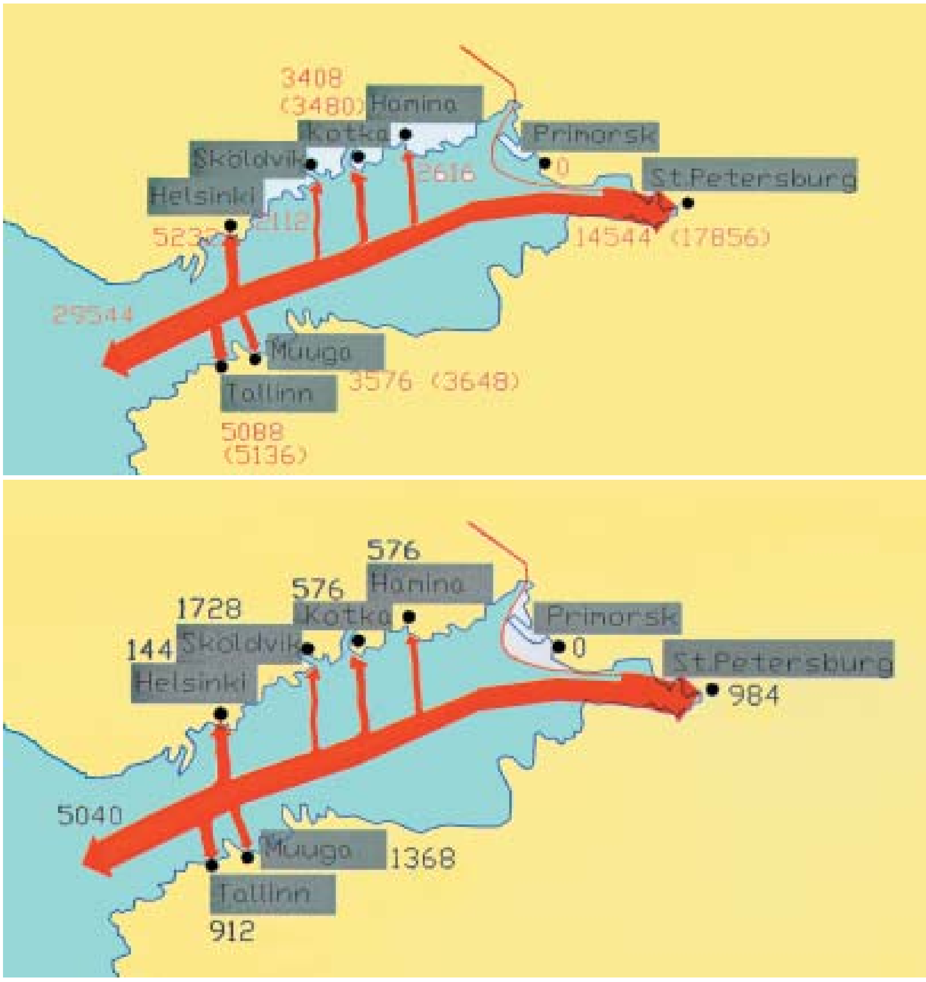

Figure 3. The total number of ships (upper) and oil tanker calls (lower) in the GOF in 2000 (VTT).

FUTURE CHALLENGES

The proposal to be submitted to IMO also contains risk analysis based on Formal Safety Assessment (FSA)-methodology. This risk analysis was started by VTT and the Finnish Environment Institute in September. The task of VTT is to evaluate the reduction of risk achieved with the proposed routing and reporting system using the FSA method. During severe ice conditions, the routing system (traffic separation schemes) may be declared not valid. Such a decision will be jointly made by the authorities of Estonia, Finland and the Russian Federation. In addition, the risks related to such circumstances, and to winter navigation in general, will be studied. HUT's Ship Laboratory will carry out the winter traffic analyses. The Finnish Environment Institute will map the environmentally sensitive areas for this study.

During wintertime, ice restrictions regulate the traffic to ports in the GOF and ships are assisted by icebreakers. The mandatory ship reporting system will be in force at all times and during severe ice conditions co-operate and complement the national icebreaker services by transmitting essential information and the icebreaker's orders to the vessels.

NEW FINNISH WORKBOAT CONCEPT

Jukka Pajala
VTT Manufacturing Technology

INTRODUCTION

The Finnish Maritime Administration (FMA) produces nautical charts for coastal areas as well as for thousands of lakes, which necessitates extensive hydrographic survey work.

FMA has planned on purchasing a new survey vessel, which will carry a modern multibeam sonar system. The ship will be particularly well suited for shallow channels in inland waterways, although it will also be capable of dealing with sea areas. The length of the ship will be 22 metres; breadth, 7.0 metres; and displacement when fully loaded, 48.5 tonnes. VTT was commissioned by ILS Oy to test the hull form of the concept in the towing tanks of the Maritime Research Institute of Finland in the autumn of 2001.

Although most workboats in Finland are monohull, the catamaran concept has also been used in some cases, and is becoming more common. A catamaran consists of two narrow hulls and thus differs from a monohull ship in many ways. Some of its advantages are its high deck area to waterplane ratio and the low environmental impact of wash waves. New challenges have been found in wet deck design and wave responses.

MODEL TEST RESULTS

Resistance tests were carried out for one catamaran version and sea keeping tests for two. The goal of the model tests was to investigate the resistance and sea keeping performance of the vessel, including the wet deck arrangement.

The resistance model tests were carried out at 6-20 knots, F_n=0,2-0,7. According to the test results, the particular speeds were:

Figure 4. Vessel will carry a modern multibeam sonar.

6 knots. Residual resistance equals frictional resistance.

13 knots. A peak in residual resistance. Maximum sinkage for centre of gravity.

15 knots. The aft starts to rise. Maximum trim.

20 knots. The centre of gravity rises to zero speed level.

The hull form that had sharp bow lines and a rather full stern with a tunnel cut out for the propeller created a low bow wave and a peculiar double-spray wave astern. This phenomenon was possibly caused by the lifting surface of the stern bottom, which is in two separate parts. The hull worked well at higher speeds and it clearly has a potential for speed.

When thinking about propulsion energy consumption for a certain distance, the ship's speed plays an important role. A simply defined unit transportation work for different ship speeds is shown in Figure 2, which has been calculated from the measured effective power with a propulsion efficiency assumption of 0.6.

$$\frac{E}{wdist} = \frac{PE}{V * \Delta * \eta_D}$$

The spray rails, according to VTT's proposal, were symmetrically placed round the demi-hulls. They stayed dry in calm conditions but begun to turn the water flow sideways when the relative wave height increased.

The sea keeping tests were carried out for two model versions, A and B. The latter had a raised freeboard and a raised wet deck at bow. The tests were performed in head seas for several speeds and in beam seas for a speed of zero. The irregular, long-crested waves were generated by using the ITTC wave spectrum. The significant wave height range was 0.5-1.1 metres.

The bow of version A became submerged in head seas when the significant wave height was one meter. This did not happen with model version B, though. The higher freeboard, as it was arranged in model version B, is necessary for avoiding water on deck in its intended area of use: Finnish lakes and sheltered coastal waters. In head waves, a higher vessel speed reduces the pitching and deck wetness, but vertical acceleration values increase. The longitudinal centre of flotation is aft from the centre of gravity, which increases pitching. No notable slamming was observed during these tests.

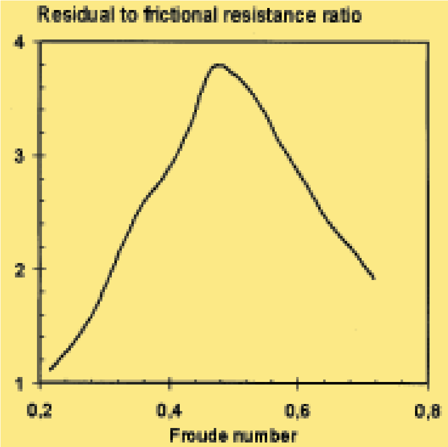

Figure 1. The wave formation is at its highest in the middle of the speed range.

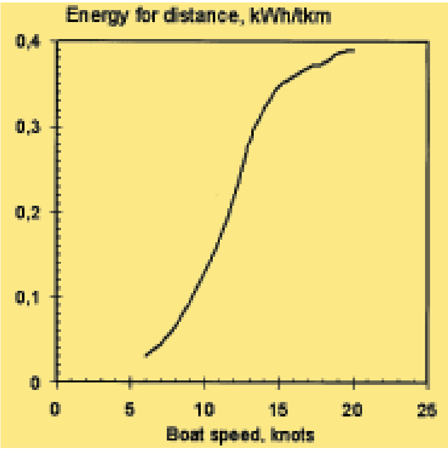

Figure 2. The graph shows how much energy/ tonne is needed for 1 km of transportation.

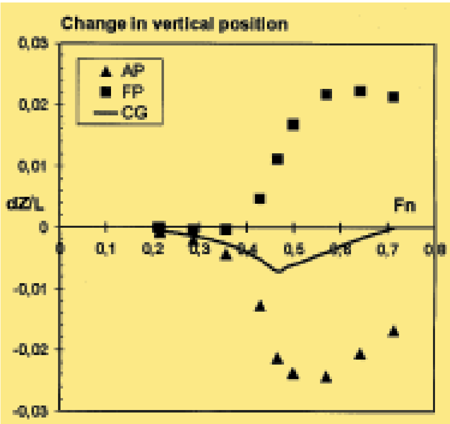

Figure 3. The vessel rises and the trim decreases at speeds of more than 15 knots.

WAVE MEASUREMENTS OF FAST FERRIES AT HELSINKI AND TALLINN COASTAL AREAS

Hannu Peltoniemi and Aaron Bengston
VTT Manufacturing Technology

VTT Manufacturing Technology conducted field experiments in an effort to quantify the wakes produced by various fast ferries, which operate on routes between Helsinki and Tallinn. The objective of the study is to develop methods and tools, which can be used to evaluate the effects of the fast-ship induced waves on the environment, and establish guidelines to minimize possible environmental damage.

Initial field experiments were conducted in Helsinki on the 30, 31 of August 2001 off the west coast of Pihlajasaari, and on the 4 of September 2001 at the tip of Harmaja's breakwater. Measurements in Tallinn Bay were made over the period of two days, the 6 and 7 of September 2001. Three nearshore locations were chosen for the trials, Katariina Kai, Viimsi, and the southeastern end of Naissaar. The sites all differ in terms of bathymetry, local sea bed geology and distance relative to the shipping lane. In addition, simultaneous ship wave measurements were conducted by Tarmo Kõuts of the Estonian Maritime Administration.

Data was recorded from three different instruments, a capacitance-type wave gauge, an acoustic Doppler velocity meter (ADV), and a pressure sensor. The ADV measures flow velocities in the three cardinal directions, at a single location in the water column. For these experiments that location was approximately 1 meter above the sea bed. All instruments were attached to a 3 meter tripod as illustrated in Figure 1. Cables were run from the tripod to the data acquisition and power supplies which were either land based for the Helsinki experiments, or ship board during the Tallinn experiments. Figure 2 is an example of a time series from the capacitance-type wave gauge.

The total number of measured ship passes were 13 in Helsinki, and 22 in Tallinn. During the Helsinki measurements, ship tracks and speeds were recorded by the Helsinki VTS. This additional data will be used to evaluate the dependence of the measured wake on ship velocity, distance, and ship type.

The results of this study will be used in PIANC's (International Navigation Association) working group 41 for environmental impacts of wake wash.

Acknowledgement to the Finnish Maritime Administration and Estonian Maritime Administration for providing assistance during these experiments.

Figure 1. Tallink AutoExpress high speed catamaran and the experimental set-up at Pihlajasaari, Helsinki.

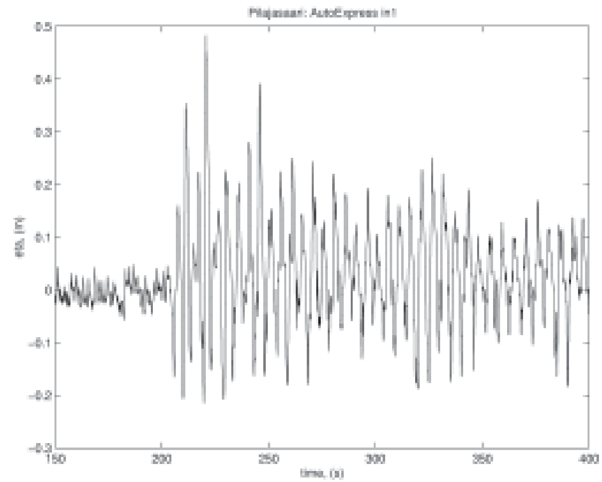

Figure 2. Wave gage time series illustrating the difference between the wind-wave climate and the ship induced waves.

PIANC's 15th Environmental Committee meeting took place in September 22-25.

The meeting, arranged this time by the Environment Canada, was divided into two sessions: first in Toronto, and the second one in the Niagara Falls. The main issues of the meeting were the progress reports of the working groups, establisment of new working groups, networking and the programme of the next PIANC´s Biennal in Sydney, September 2002. PIANC will highlight the EU´s Water Framework Directive in an international seminar in 06.02.2002. Please, read more: www.pianc-aipcn.org.

FINNISH - TAIWANESE WORKSHOP ON MARINE TECHNOLOGY

Jerzy Matusiak
Professor, HUT Ship Laboratory

The 2nd Finnish - Taiwanese Workshop on Marine Technology was held in Otaniemi on 20 August 2001. Our Taiwanese guests, representing the National Taiwan University as well as United Ship Design and Development Centre (USDDC), gave three lectures.

Professor Fong-Chen Chiu talked about the prediction of non-linear motions and wave loads of high-speed vessels in oblique waves.

Mr. Chung-Yun Lu spoke on a free surface RANS that was developed at USDDC. Apart from computing viscous flow and wave making, this CFD tool also evaluates running sinkage and trim. In addition, it is possible to simulate the self-propulsion of a ship. The method is used daily in ship design practice at USDDC.

Professor Chen-Far Hung of the National Taiwan University had a presentation on the identification of dynamic characteristics of marine structures. The presented procedure uses structural response data in the form of displacements, accelerations or velocities and results in natural frequencies, modes and other relevant modal parameters. The method can cope with noisy signals and closely spaced modes.

The eight presentations given by the staff and post-graduate students of the Helsinki University of Technology covered a broad range of the type of research done in ship technology at the Ship Laboratory.

Juhani Sukselainen in Memoriam

Professor Juhani Sukselainen passed away unexpectedly on 7 September 2001 at the age of 62. Being interested in technology and in marine technology in particular, he started to study Naval Architecture at the Helsinki University of Technology (TKK) in 1957. From 1964 to 1966, he worked as a research scientist at the Hamburg Ship Model Basin (HSVA).

After returning to Finland, Juhani Sukselainen started his post-graduate studies at the Helsinki University of Technology. Apart from working on his post-graduate studies, he dedicated much of his time to the designing and construction of the ship model test facilities at the Helsinki University of Technologylocated in Otaniemi, Finland. In 1968, he successfully defended his dissertation on ship manoeuvring. This dissertation can be regarded as one of the cornerstones of ship safety research conducted in Finland.

In 1975, the Ship Laboratory was founded at the Technical Research Centre of Finland (VTT) with Professor Juhani Sukselainen as the Director. Under his guidance, the Ship Laboratory grew rapidly. Professor Sukselainen gathered a team of young, capable researchers, who developed both the experimental and theoretical tools to serve the maritime industry under his leadership. The services provided by the VTT Ship Laboratory were of great help both for the domestic and for foreign customers in solving a large range of problems related to ship and offshore technology.

In the late 1980's, the crisis occurring in the Finnish shipbuilding industry had endangered research in the field. Professor Sukselainen was one of the key persons in establishing the Maritime Institute of Finland as a result of that crisis. His wisdom and calm judgement were qualities needed at those times. Apart from being the director of the laboratory, and thus leading the research activities, Professor Sukselainen was an active researcher himself. His broad knowledge of ship technology combined with his in-depth expertise in navigational matters resulted in important developments related to ship safety. Thanks to his dedication in this area, ship safety research in the Institute has been given a high priority, which has resulted in high quality results. He was one of the initiators of the shiphandling simulator constructed in Otaniemi. He has also activated research, which resulted in the development and implementation of modern navigational means such as digital charts and the Vessel Traffic System in Finland. From 1995 onwards, he was able to devote all of his professional interest to ship safety research as a Research Professor with the successor of the VTT Ship Laboratory, the research area of Maritime and Mechanical Engineering.

Professor Juhani Sukselainen was a pioneer of European ship research in Finland. Long before Finland joined the European Union, he actively participated in the preparation, execution and evaluation of many European research projects. He was an active member of many international organizations such as the European Co-operation in Maritime Research (ECMAR), International Towing Tank Conference –(ITTC), International Navigational Association –(PIANC), etc.

Professor Sukselainen's interest in international activities was reflected in his skill in many languages, which was complemented by a broad interest of many areas outside of technology. His colleagues will fondly remember the many deep discussions they had with him on a multitude of subjects.

Jerzy Matusiak
Harri Soininen

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MARITIME INSTITUTE OF FINLAND

VTT Manufacturing Technology /
Maritime and Mechanical Engineering
P.O.Box 1705, FIN-02044 VTT, Espoo, Finland
Phone 358-9-4561 Telefax +358-9-455-0619
HUT Ship Laboratory
Otakaari 4 , FIN- 02150, Espoo, Finland
Phone 358-9-451-3501 Telefax +358-9-451-3419

Editors: Sakari Rintala & Pentti Tuononen, VTT Manufacturing Technology
Maritime News home page: http://www.vtt.fi/manu/val3/institut/mrnews.htm

TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY