MARITIME
RESEARCH NEWS 1

Vol. 19/ISSN 0784-6010 2004

Maritime Institute of Finland

List of Contents:

MARITIME INSTITUTE OF FINLAND

VTT Industrial Systems
P.O.Box 1705, FIN-02044VTT, Espoo, Finland
Phone +358-4561 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:
Saara Hänninen & Pentti Tuononen,
VTT Industrial Systems

Maritime news home page:
http://www.vtt.fi/tuo/institute/

MARITIME SAFETY – A RECURRING TOPIC

Kaj Riska
HUT Ship Laboratory

The topic of the annual seminar of the Maritime Institute of Finland held in late March was maritime safety. The lectures included a description of the latest activities by the Ministry of Transport and Communications given by Director Raimo Kurki. He outlined political activities, including the declaration of the Baltic as PSSA in IMO and the activities around the motorway of the Baltic. Most of the activities of the authorities stem from the increased marine traffic in the Baltic and increased safety consciousness – especially environmental safety – of people. Bo Fagerholm from the Finnish Maritime Administration described developments in the damage stability rules in IMO and Martti Heikkilä from the Accident Investigation Board discussed the accident investigations of the recent maritime disasters. The topics of the lectures given by the hosts included ice damage, ship grounding analysis, ship routeing, rules for small craft, and FSA analysis.

Maritime safety is a topic that encompasses almost all branches of marine technology – or to put this slightly differently, most of the research topics in marine technology are connected to maritime safety. This has led to an inflation of the use of the word “safety”. Earlier researchers investigated such issues as wave loads, ice loads, hull bending response in waves or shell structure response to ice loading. Now most of these topics are embedded in safety.

Safety is an issue for the entire transport chain or navigation route. Therefore safety is a concept that must be tackled as a whole. The method used for the safety research is risk analysis, which can be divided into research on the consequences of realised hazards and on the frequency of these hazards. The analysis of the whole transport chain should reveal the most critical places where the safety is most cost effectively improved and thus it points out where more technical research is needed. This systematic approach to safety is being recognised more and more widely – the topics of the seminar demonstrated this. The analysis of safety provides a good platform for research prioritisation common to both researchers and maritime authorities. The discussions in the seminar also showed that the environmental, material and human maritime safety is a common topic, shared by ship builders, suppliers, shipping companies and researchers alike.

A NEW DESIGN METHOD FROM VTT SELECTED FOR ARTICULATED TUG & BARGE COUPLING SYSTEM

Jukka Pajala
VTT Industrial Systems

To design of a new system of waterborne transport is always a challenge, especially if the new solution differs much from solutions presented previously. A tug and barge combination is not, as such, a new concept but the coupling system itself is under an extensive research and development process. At rough sea, the vessel's motions cause extensive loading to the coupling. The nature of the loading is cyclical, but the rather static load component is due to the pusher propulsion. In the case of a transversal hinge, a coupling system is under a load that is calculated by five components, two affecting longitudinally, two vertically and one transversally. The displacements of the vessels have an overwhelming influence on the magnitude of the dimensioning load; and likewise the location of the coupling devices onboard the pusher.

VTT has developed a method of calculating the forces acting on the coupling system of an articulated tug and barge (ATB) combination. The new method enables the coupling system to be modelled and dimensioned more accurately than at present. The method also speeds up the selection of the coupling unit. Transport costs are reduced because the coupling system can be made smaller and lighter than existing units.

By using the new design method the supplier of the coupling system can more easily and more reliably provide the ATB operator with the right kind of coupling solution. Different marine operating environments set different kinds of requirements for the coupling between a pusher tug and barge. The Pushpin™ coupling system developed by Acomarin Engineering Ltd Oy offers a number of advantages over its competitors.

In the ATB configuration, a pusher tug of say 1,000 tonnes is connected to the stern of a barge weighing perhaps 15,000 tonnes by a coupling system weighing 15 tonnes. The pusher tug becomes an almost fixed part of the barge for the duration of the voyage, and no tow-lines at all are used in this kind of transportation. The ATB configuration is economical because the combination can operate even in relatively heavy seas.

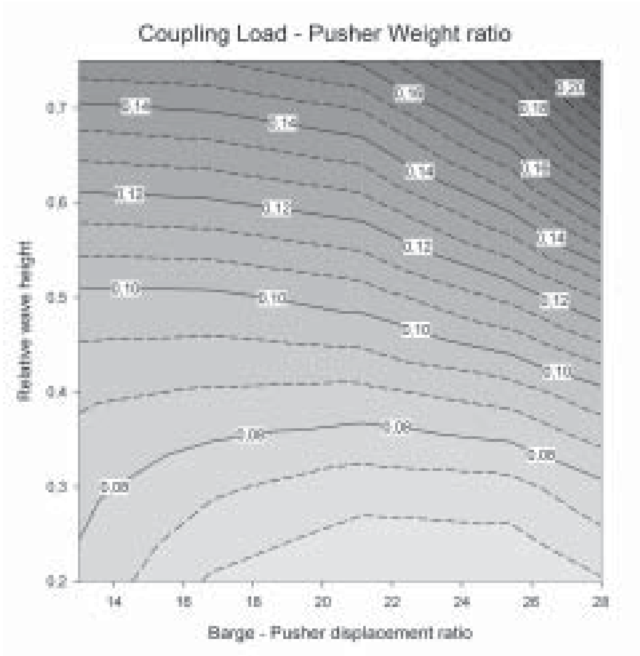


Figure 2. Model test series included a 3x3 test matrix for each coupling location. Regression surfaces were calculated by measured data points for design guidelines.

The new design method has been developed by VTT and by Acomarin Engineering Ltd Oy, a small Finnish company that concentrates on marketing and selling JAK 400 couplers and developing a wide range of new ATB coupling systems. VTT validated the functionality of the new method by means of ship model tests. This development work has been of internationally significance.

VTT and Acomarin Engineering Ltd Oy made over a hundred measurements on five-metre models of ATB combinations. The tests were performed on tugs and barges of different sizes. The behaviour of the ATB combinations in different sea conditions - and especially the forces acting on the coupling between the tug and barge - were examined in the tests.

"Our company is partly responsible for the safety of both the coupling systems that we supply and the cargo shipment in swells of up to five metres. The coupling system research that we do with VTT and the new design method enhance the credibility, reliability and competitiveness of our operations on the global marine transportation market," says Mika Laiho, Vice President of the predominantly export-oriented Acomarin Engineering Ltd Oy.

Figure 1. VTT carried out seaworthiness trial on five-metre models of ATB combinations.

UNCERTAINTIES IN RISK ASSESSMENT

Tony Rosqvist
VTT Industrial Systems

Uncertainties related to a risk assessment significantly affect confidence in the risk results and recommendations obtained. Uncertainties are dependent on the complexity and understanding of the causal and/or logical relationships of quantities and/or events of the real world, and their roles in the decision-making process depend on the adopted decision rules and criteria. Different risk assessment approaches account for the uncertainties in their own specific ways. Consequently, a risk assessment approach has to be selected that is compatible with the adopted decision/risk criteria. It seems that the following qualifications of uncertainties constitute rich enough a conceptual framework for a useful 'uncertainty analysis': parameter uncertainty [6], model uncertainty [3] and conceptual uncertainty [3], [4]. Properties of these uncertainties are depicted in Table 1. The differences appear in particular in the treatment of model uncertainty.

In the additive adjustment-factor approach by Zio and Apostolakis [3], the starting point for risk modelling is the specification of a single 'best' model, based on expert deliberation of the system's dynamic and structural properties. Any discrepancy between the risk model and reality is assumed to be adjustable by the 'adjustment-factor', which can be modelled as a random variable. The 'adjustment-factor' is argued to represent *model* uncertainty. Nielsen and Aven [5] point out that this factor may be unfeasible to quantify in practice. In the predictive Bayesian approach [5] and in the Bayesian statistical approach [1][2] all uncertainties are epistemic and related to the risk model's parameters in the form of probability distributions, depicting *parameter* uncertainty. It is, however, unclear, how model uncertainty is addressed during the deliberation of the risk model, and how the arguments, supporting the choice of a certain risk model, are communicated. In the Precautionary approach [4], model uncertainty is qualitatively assessed for each modelling assumption. Model uncertainty is here assessed in terms with neither optimistic nor conservative bias in respect to risk. Each modelling assumption made is associated with foreseen sources of bias. The net effect of all biases is a possible under- or over-estimation of the 'true' risk. Precautionary decision-making implies that the acceptance of a system is based on risk estimates biased in such a way that it is very unlikely that a false indication of compliance with the quantitative risk criterion would occur. The opposite outcome, i.e., rejecting the system when, in fact, it satisfies the acceptance limit, is possible. The precautionary approach thus requires that quantitative arguments be complemented by qualitative ones. Model uncertainty analysis is especially important in evaluating the risk toleration of a system when the modelled system represents a *generic* system concept rather than a real system. Does acceptance of the generic system automatically imply acceptance of the *population* of real systems represented by the generic system? From the point of view of precautionary risk decision-making the generic system should be defined as a reference system depicting the bottom-line. The actual system realisations should be at least as good as the reference system in terms of risk.This is particularly important in applying the Formal Safety Assessment methodology, which is a rational and systematic approach for assessing the risks associated with shipping activity and for assessing the cost and benefits of IMO's regulatory measures for reducing these risks.

References

1. Gelman A, Carlin JB, Stern HS, Rubin DB. Bayesian Data Analysis. Chapman & Hall, London, 1995.

2. Lindley D. The philosophy of statistics. The Statistician 2000; 49(3): 293 - 337.

3. Zio, E., Apostolakis, G. Two methods for the structured assessment of model uncertainty by experts in performance assessments of radioactive waste repositories, Reliability Engineering and System Safety 1996; 54(2-3): 225-241.

4. Rosqvist, T., Tuominen, R. Qualification of Formal Safety Assessment - An Exploratory Study. Safety Science 2004; 42(2): 99-120.

5. Nielsen T. Aven T. Models and model uncertainty in the context of risk analysis. Reliability Engineering and System Safety 2003; 79(3): 309-317.

6. United States Nuclear Regulatory Commission (USNRC). An Approach for Plant-specific, Risk-Informed Decisions on Plant-specific Changes to the Licensing Basis, Regulatory Guide 1.174, Washington, D.C., 1998

Type of uncertainty	Description	Technique of specification	Example
Parameter	The true value of the risk model parameter is not known with certainty.	Probability distribution based on elicitation of expert judgments or statistical estimation if empirical observations are available.	-the encounter rate λ of ships at a crossing of fairways is uncertain due to scarcity of data. The parameter λ is typically the 'rate' parameter in a (spatial) Poisson process. Uncertainty is depicted by probability distribution $p_\lambda(\lambda)$.
Model	The qualitative relationships of entities of physical or social phenomena are conceptually known, but practical limitations in describing complex relationships between variables and/or acquiring detailed information (e.g. by physical measurements) in specifying the risk model induce model uncertainty.	Hazard identification, Expert elaboration and consensus seeking on one or few different risk models, Stakeholder feedback	-the loss of stability of bulk cargo in a ship cargo hold under accelerating forces is a complex dynamic event forcing many assumptions to be made in the construction of the mathematical risk model -the magnitude of a 'Loss of Containment Accident' event is categorized and the realizations are modelled in a bounding way
Conceptual	The qualitative relationships of entities of physical or social phenomena are conceptually undefined / unknown. This reflects ignorance.	Basic research, conceptual development	-the impact of organizational changes to work motivation -the effect of global warming on the paths of sea currents

Table 1. Types of uncertainty in risk assessment.

VISCOUS-FLOW COMPUTATIONS OF A POLISH RESEARCH VESSEL AT FULL-SCALE SHIP REYNOLDS NUMBERS

Juha Schweighofer
HUT Ship Laboratory

Figure 1. Computed *wakes at the propeller plane. From the left to the right: Chien's low-Reynolds number k-e turbulence model, Chien's low-Reynolds number k-e turbulence model with Menter's modification for the turbulent viscosity, Menter's SST k-w turbulence model.*

The European-Union project, EFFORT (European Full Scale Flow Research and Technology), focuses on the validation of different CFD-codes for full-scale computations, *Verkuyl and Raven (2003)*. The most significant validation issues are the wake, the resistance, the thrust and the elevation of the free surface. More information about the project may be found at www.marin.nl (Joint Industry Projects).

In the last two issues of the Maritime Research News, the first full-scale results for simple computational cases were presented, indicating the suitability of the FINFLO-SHIP code for full-scale computations of ships. Over the last months, a more complex geometry has been computed. The computed case is an existing Polish research vessel equipped with a strong bulbous bow, a bulbous stern and a transom. It is a very challenging case as it has strongly curved lines and a transom, and the wave-making is remarkable, causing high demands on the grid generation and the robustness of the FINFLO-SHIP code. Using three different turbulence models, the double hull flow around the ship was computed at the full-scale ship Reynolds number corresponding to a speed of 12 knots. In Fig. 1, the computed wakes at the propeller plane are presented. The result obtained - with Menter's SST k-w turbulence model indicates the presence of the bilge vortex as a slight hook shape - is reproduced. Therefore, the appearance of the bilge vortex cannot be neglected at full scale, as is sometimes assumed. The other turbulence models belong to the group of the k-e turbulence models, which are incapable of reproducing a hook shape. The frictional resistance is quite similar for all three turbulence models. Nevertheless, the pressure resistance shows a clear dependence on the chosen turulence model. The frictional resistance shows also less dependence on the grid resolution than the pressure resistance. Therefore, in the evaluation of the total resistance of a ship, inaccuracies are more likely to be caused by the evaluated pressure resistance than by the frictional resistance. In Fig. 2, the computed wave pattern around the Polish research vessel is presented. The used turbulence model is Menter's SST k-w turbulence model. The frictional resistance coefficient is very close to the double-hull result. The pressure-resistance coefficient is remarkably increased, showing the significance of wave-making on the total resistance.

In the coming months, the obtained results will be validated against full-scale measurements carried out in the EFFORT project. Nevertheless, it can already be stated that the FINFLO-SHIP code can be applied to the computation of real ships with complex geometries.

References

Verkuyl, J.-B. and Raven, H.C. January 2003. Joint EFFORT for Validation of Full-Scale Viscous-Flow Predictions, *The Naval Architect.*

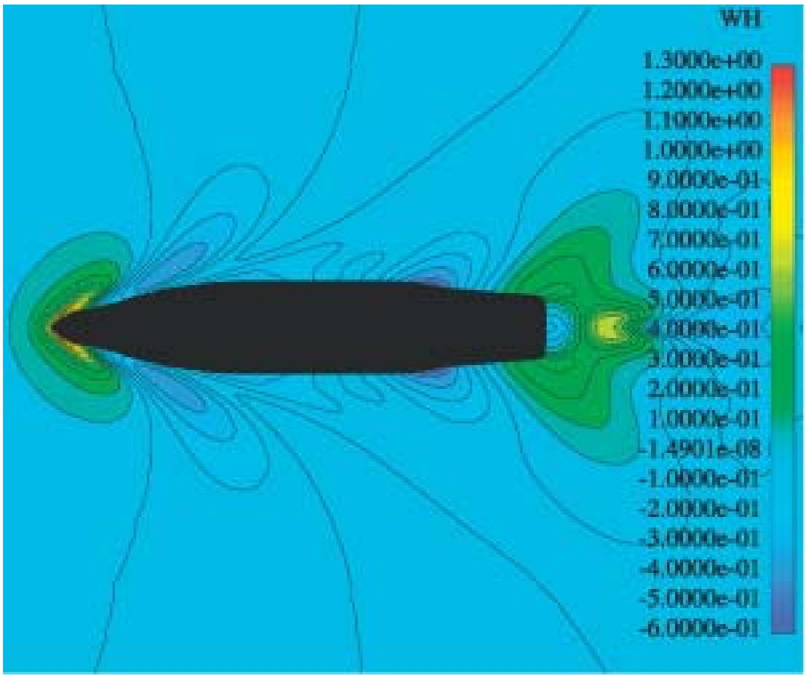


Figure 2. Wave pattern around a Polish research vessel at full scale evaluated with FINFLO-SHIP.

ICE TRIALS IN THE SAIMAA CANAL

Samuli Hänninen
HUT Ship Laboratory

Tapio Nyman
VTT Industrial Systems

IB ARPPE

*IB **Arppe** is a multipurpose vessel designed for icebreaking purposes in the Saimaa lake district. The ship was built in 1989 and it was docked for conversion in the autumn 2003. The propulsion machinery of the ship was converted to diesel electric, the main engine power was increased from 1.5 MW to 2.2 MW and the ship bow was modified to improve its icebreaking capability. The vessel is owned by Mopro Oy.*

MB VEKARA

*MB **Vekara** is a motor barge with a deadweight of 2700 tonnes. She was built in 1985 in Rauma, Finland. The vessel is designed to carry all kinds of bulk cargo, mainly timber in one continuous cargo space. The modification of the MB Vekara was carried out in a local repair shipyard in Savonlinna in 1999. Vessel's bow was modified to improve its ice-going capability. The principal dimensions of MB Vekara are: length 82.80 m, breadth 12.60 m, and draught 4.35 m. The engine power is 2 x 404 kW and maximum speed is 12 kn. The vessel is owned by Mopro Oy.*

INTRODUCTION

Finnish Maritime Administration commissioned the Maritime Institute to perform wintertime ship traffic trials in the Saimaa Canal. The idea was to obtain information on combined effects of the hot water running and ship traffic on ice formation in the canal. The flow rate of the discharged water was 5-10 m^3/s. This was a follow-up to a test carried out three years earlier. In the winter 2000-2001, hot water from a moveable thermal station was run into the canal at the rate of 4 m^3/s.

Ice trials took place between the 10th and 16th of February 2004, with the icebreaker Arppe and the motor barge Vekara. In the tests, IB Arppe assisted MB Vekara from Lappeenranta (Soskua lock) to Nuijamaa lake and back five times during the test week. During the two weeks period before the tests icebreaker Kummeli had made 36 trips along the route to create realistic conditions. Ice conditions along the route and ships' performances (propeller revolution, torque and speed) in ice were measured in the trials.

SAIMAA CANAL

The total length of the Saimaa Canal is 43 km and the total head from Lake Saimaa to the Gulf of Finland is 76 m. There are eight locks with heads varying from 5.5 m to 12.7 m. The maximum dimensions of vessels in the canal are: length 82.50 m, beam 12.60 m, draught 4.35 m, and height of mast above surface 24.5 m. Every year, the canal is closed for 2-3 months, centred around mid-winter. Means to extend the navigation period are being examined.

From the Saimaa area, paper industry products are exported to Central Europe through the canal. The total export through the Saimaa Canal has increased from 1.5 to 2.2 million tonnes since 1995. The maximum level ice thickness in the Saimaa lake district is typically between 50 cm and 70 cm. In the area ice does not actively move, i.e., the ships operate mainly in brash ice channels. The canal is quite

Figure 1. IB Arppe manoeuvring in Nuijamaa lake.

Figure 2. MB Vekara at Ice Trials in Saimaa Canal.

narrow and shallow. The average width is 60 m and depth about 6 m. With frequent ship traffic the volume of brash ice may became large compared to the total water volume in the canal. This may became a barrier for regular winter traffic in the Saimaa Canal. The idea was to slow down the ice growth by discharging condensation water from a nearby paper mill and so to make the canal easier for ships to operate during the winter months.

A TEST DAY IN SAIMAA CANAL

The first test voyage was done on the 10th of February 2004. One research group manned MB Vekara and the other group worked onboard IB Arppe. The weather was very bright during the day. Air temperature varied between –20 °C and –10 °C. The snow cover on the ice was about 20 cm thick. The water temperature and the mean brash ice thickness from Nuijamaa lake to Soskua lock are shown in Figure 3. The influence of the water discharge can be clearly seen. As the water temperature increased the ice thickness decreased, which also influenced the assisting speed. The level ice thickness was about 20 cm in Soskua lock and about 40 cm in Nuijamaa lake. As an example of the measured quantities, the assisting speed and power usage of IB Arppe from Nuijamaa lake to Soskua lock are shown in Figure 3. The same quantities were also measured from the MB Vekara. During this trial the ice was newly broken, but the upper part of the broken ice was already consolidated due to the temperature. The most difficult part of this route was the beginning. There were two tight turns and a shallow rectangular rock cutting. The channel ice thickness in the area was around 1.0 m in the centre of the channel, in the side walls the brash ice thickness was up to 2,5 m. The assisting speed was below 2 knots and the MB Vekara got twice stuck in ice. The propulsion power and the speed of IB Arppe varied a lot in close assistance. However, the propulsion power was kept through the voyage below 1200 kW and mainly below 500 kW. After the most difficult part, the speed was increased to 3-4 kn and the power needed was only about 400 kW. After 1.5 hours IB Arppe increased the power for a short while and took some distance from MB Vekara. Then the speed was kept 4-6 knots and the distance between the ships was about 200 m. At the end of the voyage the channel ice thickness was about 0.5 m

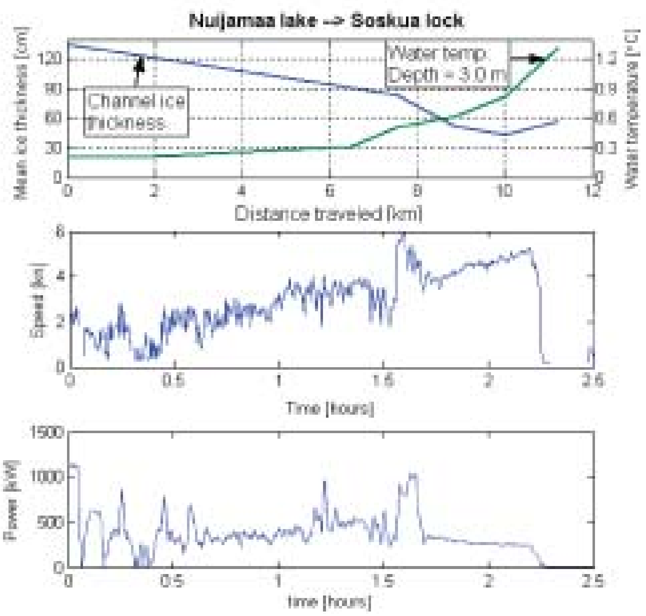


Figure 3. Example of measured channel ice thickness, water temperature and speed and power usage of IB Arppe from Nuijamaa lake to Soskua lock.

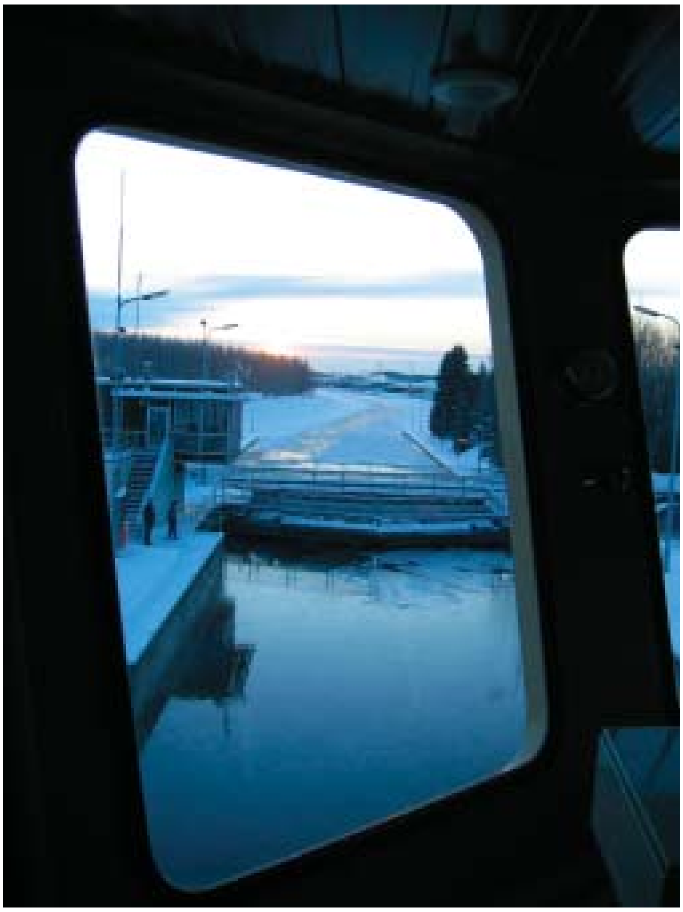


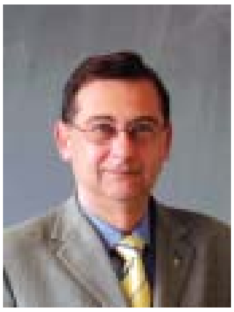
Figure 4. Mustola lock as seen from Arppe´s bridge.

IB Arppe did not have any difficulties managing in the Saimaa Canal ice conditions, but MB Vekara needed close assistance several times. The voyage from Soskua lock to Nuijamaa lake was made in consolidated brash ice and the channel width was the ship’s breadth. The voyage took 5 hours and the distance travelled was 11,5 km. The voyage back from Nuijamaa lake to Soskua lock was made in newly broken brash ice and the ice channel was made wider than the breadth of the ship. This voyage took only 2,5 hours. The mean assisting speeds were 1,25 knots (Soskua - Nuijamaa) and 2,5 knots (Nuijamaa - Soskua).

DISCUSSION

The conditions during the trials were quite ideal. Throughout the whole trial period there was frosty weather, especially in the first three days when the air temperatures were far below the long-term averages. The brash ice thicknesses in different sections of the canal correspond with the thicknesses of an average winter. The wide variation in the ice conditions in different parts of the canal, as well as the difference between the ice conditions of the outward and return journeys, enable the extrapolation of the performance of the ships towards the limit ice conditions. The aim of this survey was to define critical conditions for ship traffic during the winter and to model the thermal energy required in the canal. Analysis of the test results is not yet complete.

DYNAMICS OF SHIP HARD GROUNDING



Jerzy Matusiak
HUT Ship Laboratory

GENERAL

Ship grounding is a frequent event when navigating in the coastal waters.

As a result of collision or grounding ship hull may be damaged getting a dent or tearing along the hull plating. This damage can be represented by a penetration of an obstacle into initially undamaged hull surface. This penetration produces a certain force that, depending on its magnitude, affect the position and the motion of a ship. This motion in turn affects the contact force and the damage. Both, the ship dynamics and the local structural strength have to be taken into account in order to have a realistic estimate of a damage caused by grounding.

For a real ship structure the local structural strength is evaluated with an FE method (Fig. 1). Strength analysis yields the constitutive relations that relate the contact force to the penetration.

In order to verify the developed algorithms and to validate the entire procedure, grounding of a ship model was simulated, too. Computed forces and ship movements were compared to experimental results coming from ship model tank tests.

The presented method makes it possible to evaluate bottom damages caused by hard powered grounding. The effects of ship speed and bottom structure on the extent of damage and ship flooding can be evaluated for the accidents typical for ships operating in the coastal waters.

NUMERICAL SIMULATIONS

The general method of evaluating dynamic responses of a rigid ship was used when simulating ship motions due to grounding. This theoretical method [1] incorporates the non-linear time-domain seakeeping in the six-degrees-of-freedom and the elements of maneouvring.

A single force vector represents grounding. At each time step of the simulation, the minimum distance between the control points representing hull and rock tip is sought. This distance determines whether the contact occurs, it gives the location of contact and the penetration. If contact occurs and normal component of the relative velocity points inside hull, contact force is evaluated. Both the normal and the tangential component of the contact force are assumed to be simple functions of a penetration [2].

EXAMPLE RESULTS

A number of model test runs and full-scale grounding events were simulated. Initial velocity of ship and initial position of an underwater rigid obstacle in relation to ship were varied. Simulations were conducted for a Ro-Pax type vessel having two alternative bottom structures.

A clear effect of ship dynamics on the contact force and the motions is seen in Fig. 2 in terms of the pitch response. As a result of the grounding, initially ship's bow raises. At the final stage of the grounding the opposite occurs.

References

[1] Matusiak, Jerzy; Two-stage Approach to Determination of Large Amplitude Motions of a Rigid Ship in Waves. 15th Nordic Seminar on Computational Mechanics, Aalborg, Denmark, 18-19 October, 2002. Aalborg, Denmark 2002, Institute of Mechanical Engineering, Aalborg University, s. 1-10

[2] Kajaste-Rudnitski, J., Varsta, P and Matusiak, J. Dynamics of ship grounding. HUT, Ship laboratory. M-283, 2004.

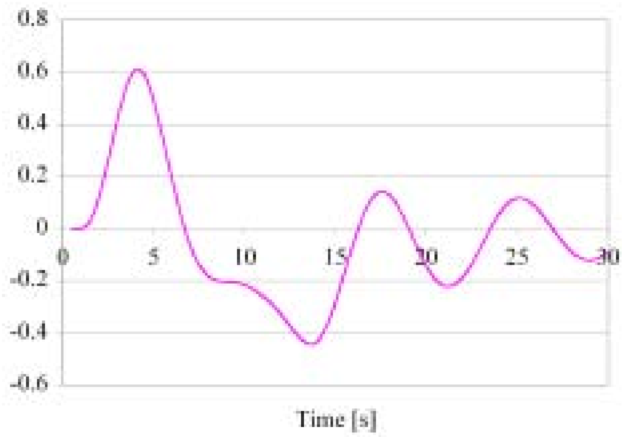


Figure 2. Pitch of the vessel caused by the unsymmetrical grounding.

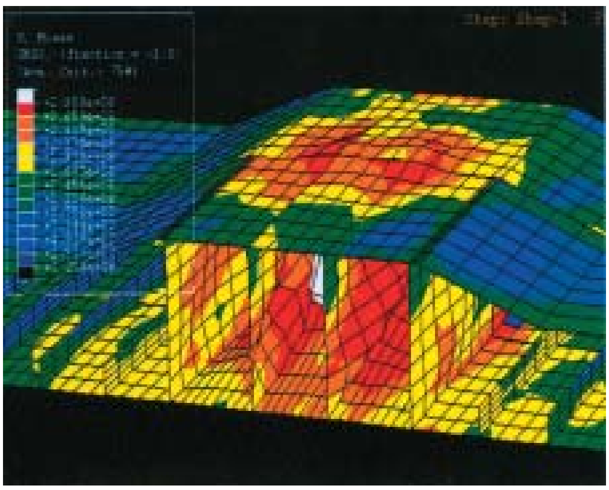


Figure1. Vertical penetration into the bottom structure of a Ro-Ro ship as evaluated by the FE method. Frames are not shown.

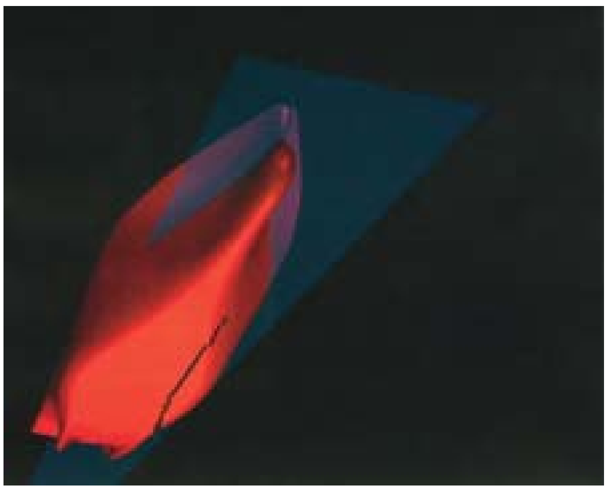


Figure 3. Trace of the bottom damage caused by a hard powered grounding.

PROPOSAL FOR NEW RULES FOR COMMERCIAL CRAFT UNDER 24 M LENGTH

Karl-Johan Furustam
VTT Industrial Systems

There has been a continuous demand for surveys according to the Nordic Boat Standard (NBS 1990) for small commercial craft. In most cases, the rules are used on a voluntary basis, although in same cases, supported by other legislation, they have a mandatory status. VTT Industrial Systems has reached an agreement with the Finnish Maritime Administration and the Environmental Central to develop a proposal for new rules for commercial craft under 24 m in length. The proposal is in many ways a significant change when compared to NBS.

WHY NEW RULES?

Due to development in small craft technology, the following deficiencies in NBS have become especially obvious:

- Some new types of craft are not covered in NBS, notably multi-hulls and RIB's.

- NBS is not sufficient for heavy-duty offshore service (for instance pilot boats).

- The rules are not particularly well suited to small boats.

- There is a "grey zone" between 15 m hull length and 24 m load line length that is uncovered, and which is increasingly important due to a general rise in craft size.

- The division into open and closed boats according to deck arrangement is too crude and, in some cases, leads to unsuitable arrangements.

Design category	A	B	C	D
Significant wave height	>4m	?4 m	?2 m	?0,5 m
Typical Beaufort wind force	up to 10	up to 8	up to 6	up to 4

Table 1. Design categories.

EXTENSION TO 24 M

The decision to extend the upper limit of craft size to 24 m load line length has a large impact on the rules. The goal has been to maintain the safety level of NBS up to 15 m length, and above that to adapt the level of safety to approximately that of the international conventions at 24 m load line length. As some of the craft concerned are in the regime of the High Speed Craft (HSC) code this was also taken into account. Figure 1 illustrates the "environment" where the new proposal fits in.

HORSES FOR COURSES

The variety of craft to be covered in the rules is very great. Therefore great emphasis has been put on mechanisms, which as accurately as possible, identify the relevant issues of a particular craft. Such concepts are *Design Categories*, *Type Notations* and *Additional Notations*. Also the *deck arrangement* with respect to preventing ingress of water plays an important role.

The design categories, which define maximum significant wave height and wind conditions, take into account the fact that commercial craft, depending on their mission, may operate in conditions ranging from sheltered waters to storm conditions offshore, see Table 1.

The requirements are also connected to the *type notation* of the craft, which indicates its primary mission. For the same reason so-called *additional notations* will be used to indicate when special equipment is taken into the assessment.

REFERENCE TO ISO-STANDARDS

During the last decade there has been a quite massive effort in developing ISO-standards for small craft. These have been developed mainly in support for the Recreational Craft Directive, but the scope is "Small Craft" up to 24 m hull length. Many of these standards are, in part or entirely, also very suitable for commercial craft. Reference is made to ISO standards when considered appropriate. In some cases, the methodology of the standards is used, but the requirements are adjusted to better suit the higher demands of commercial craft.

HTML-FORMAT

The rules are written in a hypertext format (HTML) and are mainly meant for use in electronic form. Of course, hard copies of the rules can also be printed. The result is very user friendly as the user quickly finds the topic he or she wants.

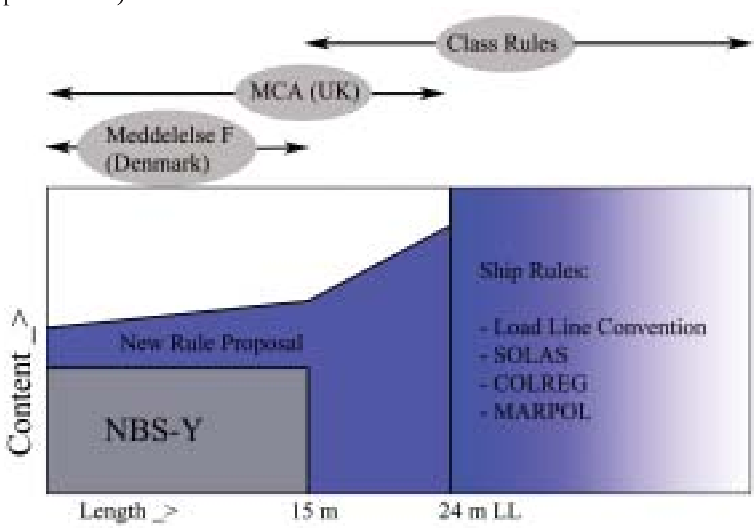


Figure 1. Sphere of application of the new rule proposal compared to other ship rules.

THE GOFREP MANDATORY SHIP REPORTING SYSTEM COMES INTO FORCE ON 1 JULY 2004 IN THE GULF OF FINLAND

Sanna Sonninen
VTT Industrial Systems

The Gulf of Finland mandatory Ship Reporting System (Gulf Of Finland REPorting, GOFREP) comes into effect on 1st July 2004. The operation covers the international waters of the Gulf of Finland in a joint effort between Finland, Estonia and Russia.

THE AIMS OF THE GOFREP

Shipping on the Gulf of Finland has increased significantly over the past few years. Especially east/westbound traffic has been growing constantly as new harbours are being established and old ones renewed in Russia. It has been forecast that oil transport through the Gulf of Finland will rise from the current 78 million tonnes to 150 million tonnes by the year 2010. Another heavy traffic route is that between Helsinki and Tallinn, where passenger vessels carry some six million passengers a year. As the volume of traffic grows, so does the risk of accidents. According to a risk analysis performed by VTT Industrial Systems on shipping in the Gulf of Finland, GOFREP will reduce the risk of two vessels colliding by 80%. The risk of oil spillage is reduced proportionately. However, even though GOFREP reduces the accident probability, no preventive measure can eliminate all risks. Ship crews will still be responsible for the navigation of ships after the system comes into operation.

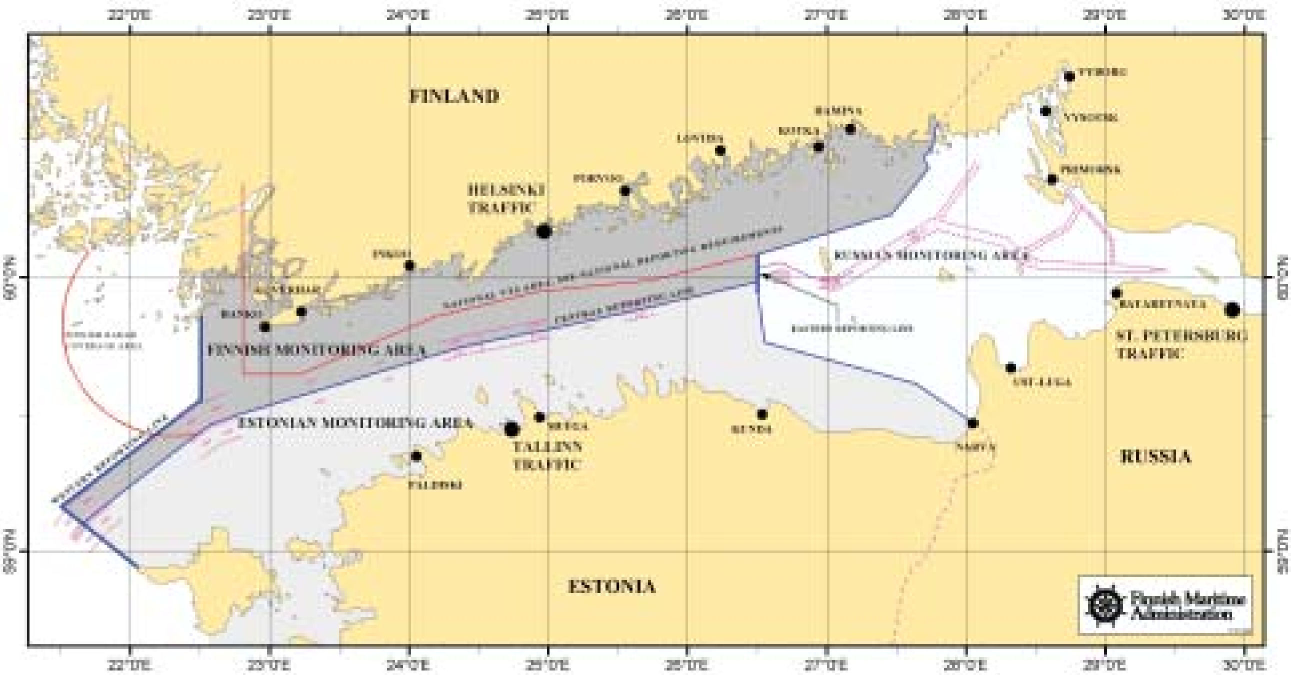
DESCRIPTION OF THE GOFREP ACTIVITY

The Gulf of Finland has been divided by mutual agreement into two monitoring sectors. Estonia (Tallinn Traffic) monitors the southern sector, and the northern sector is monitored by Helsinki Traffic in Finland. The eastern part of the Gulf of Finland, the Russian territorial waters, is monitored by Russia (St. Petersburg Traffic).

All ships of 300 GT and over must report to GOFREP (by AIS, fax, e-mail or VHF-radio). On arrival in the Gulf of Finland, ships will report to the centre in the monitoring sector in question. In exceptional circumstances, for example, in the case of loss of manoeuvrability, ships under 300 GT are also obliged to report. When the ship has reported in, the GOFREP operator begins monitoring the ship and enters the incoming data into the joint Finnish, Estonian and Russian database. This gives the authorities in all three countries the necessary information on ships and on hazardous cargoes in the Gulf of Finland. Ships will be monitored by radar, camera and the AIS system. More detailed information is given in the GOFREP Master's Guide, which will be issued in May 2004.

LEGAL GROUNDS

On 13th December 2002, the International Maritime Organisation IMO approved a joint application from Finland, Estonia and Russia for the establishment of a mandatory Ship Reporting System. By IMO decision MSC.139(76), Finland, Estonia and Russia require that all ships of 300 GT and over participate in GOFREP while sailing in international waters within the Gulf of Finland.



Map. Finnish Maritime Administration.

A VIGILANT EYE ON TECHNICAL DEVELOPMENT

Pentti Häkkinen
HUT Ship Laboratory

HUT Ship laboratory regularly invites guest lecturers from various organisations. The guest in March, Kirsi Tikka PhD belongs to those HUT graduates who have reached a high international post in the shipping and shipbuilding community. She started her career by specialising structural strength topics at Wärtsilä Turku Shipyards, and later moved to Berkeley, Ca. where obtained her doctorate. Positions at the Chevron Oil tanker company and professorship at Webb Institute qualified her for a high-ranking post at ABS.

Vice President - Engineering of ABS Europe, Kirsi Tikka described how ABS (American Bureau of Shipping) actively follows the technical development updating its rules and practices. She gave special attention to the structural strength and condition monitoring of crude oil tankers, bulk carriers, container vessels, and LNG carriers. New design and manufacturing methods are applied world-wide and the leading classification societies participate in this development. High-class technical service and rapid responses are the means by which to attract the attention of shipping companies.

IMO APPROVED THE DESIGNATION OF THE BALTIC SEA AS A NEW PSSA

Jorma Rytkönen
VTT Industrial Systems

International Maritime Organisation approved in the last meeting of MEPS 51 (Maritime Environment Protection Committee) three new Particularly Sensitive Sea Areas (PSSAs). The Baltic Sea area, with the exception of Russian waters, was also nominated here. When an area is approved as a PSSA, specific additional measures can be used to control the maritime activities in that area, such as routeing measures; mandatory ship reporting systems; and Vessel Traffic Services (VTS).

The proponents of the Baltic Sea PSSA stated in the meeting that they would submit detailed proposals for Associated Protective Measures (APMs) linked to the PSSAs to the Sub-Committee on Safety of Navigation (NAV) in 2005 for subsequent consideration by the MEPC.

The PSSA proposal for IMO was jointly prepared by the Baltic Sea States (excepting Russia). The proposal also contained information prepared by VTT: http://www.vtt.fi/tuo/projects/seastat/index.htm on seaborne traffic along the Baltic Sea. There was a special focus placed on oil transportation.

PSSA focus on the protection of the sensitive coastal and marine areas.

RECENT PUBLICATIONS

SCIENTIFIC PAPERS

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

Rosqvist, Tony; Tuominen, Risto. Qualification of formal safety assessment: an exploratory study. Safety science., vol. 42 (2004) 2, pp. 99 - 120. doi:10.1016/S0925-7535(03)00005-5.

LABORATORY REPORTS

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)

Klanac, Alan. Bending of Steel Sandwich Panels under Lateral Loading, Espoo, 2004. (HUT Ship Laboratory M-285)

Matusiak, Jerzy. Hydrodynamiikan sovellukset sotaaluksissa – ennuste vuoteen 2020. Espoo, 2004. (HUT Ship Laboratory M-286)

CONFERENCE PAPERS

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

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, 16 -19 June 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, 16 -19 June 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, 16 -19 June 2003, Trondheim, Norway, pp. 525-535.

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, 29 September -1 October 2003.

Nyman, Tapio. The improvement of winter navigation with risk-based approaches. Ice Day - Basics of Winter Navigation in the Baltic Sea, Oulu. University of Turku, Centre for Maritime Studies, 2004. 43 slides.

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.

Ruponen, Pekka; Matusiak, Jerzy. Calculation Method for the Steering Forces of a Pod in Hybrid. The 1st International Conference on Technological Advances in Podded Propulsion, Newcastle, UK, 14 - 16 April 2004, pp. 263-275.

Rytkönen, Jorma; Sonninen, Sanna. Maritime safety and the environment. Security on the Roads, Sea and in the Air. Press Tour in Finland, 17 - 23 February 2004, Helsinki. Finnfacts, Maritime Administration of Finland, 2004. 25 slides.

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

Rytkönen, Jorma. The Baltic Sea - a brief outline on the Helcom’s maritime activities. International Environmental Forum - Baltic Sea Day devoted to the 30-th anniversary of the Helsinki Convention, 22-23 March, 2004, St. Petersburg. 26 slides.

Rytkönen, Jorma. The Baltic Sea - a brief outline on the Helcom’s maritime activities. International Environmental Forum - Baltic Sea Day devoted to the 30-th anniversary of the Helsinki Convention, 23-24 March 2004, Malmö. Malmö, Nordic Minister Council, 2004. 26 slides.

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

Sonninen, Sanna. Research on vessel traffic information systems at VTT Industrial systems. Security on the Roads, Sea and in the Air, Press Tour in Finland, 17-23 February 2004, Helsinki. Finnfacts, Maritime Administration of Finland, 2004. 18 slides.

OTHER PUBLICATIONS

Matusiak, Jerzy. Hydrodynamics aspects of hybrid propulsors using the contra-rotating propeller concept. Marine News, February, 2004, pp. 12-14.

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

Remes, Heikki. Fatigue Strength Modelling of Laser Welded Joints. TUKEVA-tutkimus-ohjelman loppuseminaari, Espoo, Otaniemi, 27 November 2003.

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; Sonninen, Sanna. How could you improve the maritime safety? Note for the Finnish Parliament. (2004)

Rytkönen, Jorma; Sassi, Jukka. Onboard ballast water treatment -a tool for the future Navigator YearBook. (2004), pp. 47 - 48.