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1.2.3 Prof. P. Rigo (Belgium)

First, I highly congratulate the committee members for their excellent report. I particularly appreciate the "*Application Software Review*" section and the comprehensive discussion on the "Optimisation Trends".

Optimisation and cost assessment are the two topics that I would like briefly discuss today.

1.2.3.1 Optimisation

I found in the report some discrepancies concerning the interests to perform optimisation at the early design stages.

In Table 2, optimisation is rated as "*very important*" at the Conceptual Design stage, only "*Important*" at the Initial design stage and surprisingly (at least for me) "*no important*" at the "Preliminary design ". In addition, p460, we read: "*Due to time limitation, any large scale optimisation work is not carried out on the early design stage...*". In 2003, this is no more true. Large 3D structures can be optimised within few days at the early design stages with tools like LBR5 (Rigo, 2003).

Hopefully, later in section 6.1.2, we read "*Methods were further developed for large-scale optimisations in ...*".

My experience in optimisation of large scale structures like 4 holds of a medium size gas carrier for Chantiers de l'Atlantique (ALSTOM, France) shows that:

- Large scale structure (3D model) can today be optimised at the Preliminary design stage.
- Optimisation of such large 3D structures can be perform within a tight schedule (one week).
- Conceptual design stage and Initial Design Stage are the most relevant periods for such analysis.
- A lot of money can be saved performing such optimisation (5 to 10% of the hull cost),
- To be relevant optimisation must be performed of cost and not only on weight.

This last sentence introduces the second topic on the *construction cost.*

1.2.3.2 Cost Assessment

Figure 5 "Time Flow of Initial design" and Section 2.2.2.3 (pages 459 and 460) include only statements on weight assessment. In 2003, data (databases), IT tools, etc. are available to perform at the early design stages (based on a conceptual design) a reliable assessment of the cost.

I would like to know why the committee does not include "cost assessment" in that level.

To support this discussion, Figure 1 shows the tanks of a medium size gas carrier that we optimised at the preliminary design stage within a couple of days. The goal was to define the tank optimum scantlings corresponding to the minimum construction cost. The structural mesh model is shown on Figure 2.

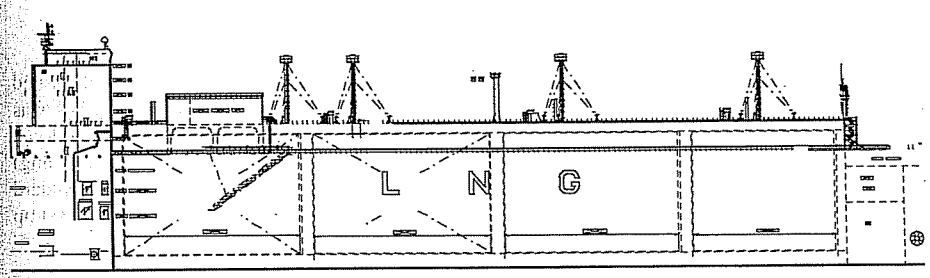

Figure 1: General view of a medium capacity gas carrier (ALSTOM, France)

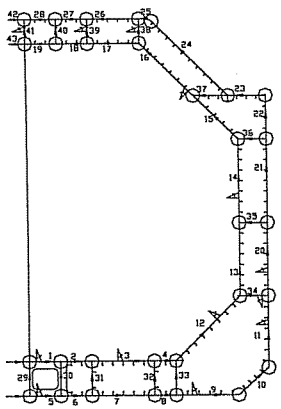

Figure 2: Mesh Model of a Medium Capacity Gas Carrier

Tracks to reduce the construction cost of the medium capacity LNG ship were found:

- To reduce the number of web-frames (N_w):
  ($N_w - 2$) or ($N_w - 3$) web-frames instead of N_w web-frames
- To increase the stiffener spacing (Δ_L):
  1.09 Δ_L, 1.15 Δ_L or 1.28 Δ_L instead of Δ_L

Such changes induce a cost saving of about 8.50% (material and labour costs).

REFERENCE

Rigo P., (2003), "How to minimise production costs at the preliminary design stage - scantling optimization", IMDC'2003, Eighth International Marine Design Conference, Greece, Edited by A. Papanikolaou (NTUA, Athens), Vol.2, May 2003, pp. 437-448.

1.2.4 Mr. Stefano Ferraris (Italy)

First of all, I would like to congratulate the Committee members for their comprehensive report and the Committee Chairman, Mr. Pradillon, for his smart presentation.

Extending "Specialised Marine Structures" chapter to maintenance and repair is very relevant, but we missed the expertise especially for offshore.

The Committee for ISSC 2006 would take these comments into account.

2.2.2 *Reply to Mr. Y. Kawamura*

Mr Kawamura highlighted the importance of exchange standards and especially the relevance of STEP and XML. These topics have been covered in the reports of this Committee and especially for ISSC 1997 and ISSC 2000.

The questionnaire survey results used for this report demonstrated that even if STEP is now mature, it is used on a seldom basis. The reason for that is coming perhaps from the relatively limited industrial implementation of STEP in the major CAD systems, especially regarding the exchange between them.

XML is an alternative to STEP that often uses STEP-based schemas. Some successful XML exchanges already exist such as the TRIBON (Tribon Systems) to NAUTICUS (DNV) interface.

Mr Kawamura also underlined the critical aspect of confidentiality regarding data exchange. The Committee agrees that confidentiality is a major concern and must be addressed by the software vendors. Data encoding or VPN may be possible answers.

2.2.3 *Reply to Prof. P. Rigo*

Prof. Rigo was surprised by the apparent inconsistency in the way the use of optimisation techniques is introduced. The table in Chapter 2 is reflecting the present state of the art and many yards are not regarding optimisation techniques as day-to-day tools to be used in the concept and preliminary design stages. Obviously, optimisation techniques are of a great interest for these two stages and this is the reason why we included Chapter 6 that is dedicated to this issue. The Committee also acknowledges that some yards already use these techniques in the early design stages.

The Committee wants also to supplement Prof. Rigo's comments - who presented interesting results on scantling optimisation – by stating that shape and topological optimisation techniques are coming, and have been successfully used in some cases (for example within the EC funded project DISCO).

Optimisation techniques may be used also to improve onboard safety or environmental impact.

Prof. Rigo highlights the interest of optimisation techniques regarding the cost assessment. This is very relevant and this idea may be pushed further. For instance, cost module may be directly included within CAD systems to let the designer know the cost of a design alternative and the possible ways to improve it. This supposes a significant effort to feedback relevant production data inside the module database for each individual shipyard.

2.2.4 *Reply to Mr. S. Ferraris and Dr. G. Parmentier*

The Committee wants to thank Mr. Ferraris for his contribution. This supplements very conveniently the navy section of the report. The Committee wants also to let the reader know that several other Navy Class initiatives are on going or just finished. For instance, Bureau Veritas has the same project with French Navy that the one described by Mr Ferraris with RINA, Italian Navy and Fincantieri involved in.

Due to a very strict schedule for ISSC reports, they must be ready late in the year preceding the Congress. This is the reason why some very recent references may not be included in the reports. The next report of this committee may include such references. As mentioned by Mr Ferraris, it appears also clear that new Specialist Committee V.5 - Naval Ship Design - will probably deal with this subject.

2.2.5 *Reply to Mr G. Tam*

Model testing is obviously a very important sector of the ship and offshore structures design. Regarding the Committee mandate, at least three issues may be addressed:

- Stating when and how model testing may be used within the design process,
- Describing the possible electronic data exchanges between trials results and calculations,
- Comparing the results extracted from model testing and simulation.

Such a topic is very relevant and may be addressed in the next report.

2.2.6 *Reply to Prof. R. Eatock Taylor*

As stated by Prof. Eatock Taylor, societal concerns are indeed increasing the pressure on engineers. Sustainability becomes a key word for modern products and both regulations and public opinion stress not only the shipyards but also owners, Classification Societies, ports, repair yards and all other involved actors to take it into account.

The Committee has to recognise that a fully integrated sustainability-oriented design chain of tools is not to be available in a close future. But it is predictable that a systematic use of new techniques such as reliability methods or risk-based analyses, an integration of environmental or working condition criteria in the design process are milestones on the road to this goal.

These techniques are improving and their utilisation is quitting the limited area of academic or research users. Further improvements may be expected in the next years and the Committee should have interesting advances to report in this area in 2006.

2.2.7 *Reply to Dr. P.G. Bergan*

The Committee fully supports the comments made by Dr. Bergan who mainly highlights the interest and relevance of the PDM technology. The Committee regarded this subject as covered by the previous reports and decided, for ISSC 2003, to just make a point in order to check if either this stable and efficient technology is being used or not. If the PDM technology mainly helps in representing the data in a conceptual way, it is also mandatory, for a comprehensive PDM approach, to deal with data exchange using compatible PDMs that may communicate from software tools to others. The questionnaire gave us a good figure for that with a rather low use of STEP in the design process. But we are convinced that this technology will progress in the future.

2.2.8 *Final words*

The Committee wants to thank all discussers for their inputs and comments and especially Dr Vivalda, the Official Discusser of Technical Committee IV.2. The Committee also hopes that the Report and the Discussions provide the reader with a useful reference.

Information Technology is quickly changing and shipbuilding, and more generally marine, industry is quickly adopting new standards and methods. Very challenging and interesting simulation-based techniques are entering the ship design offices. We expect a very exciting report for ISSC 2006!

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VOLUME 3

DISCUSSION ON THE REPORT OF TECHNICAL COMMITTEE IV.2

DESIGN METHODS

MANDATE

Concern for the synthesis of the overall design process for marine structures, and its integration with production, maintenance and repair. Particular attention shall be given to the roles and requirements of computer-based design and production, and to the utilization of information technology.

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