

3.1 Publishable summary

Project Website: <http://www.fsb.hr/tulcs/>

Background and objectives

The increase in world trade has largely contributed to the explosion in sea traffic. As a result, the market demand is leading to Ultra Large Container Ships (ULCS), which have a capacity up to 14,000 TEU with length up to 400 m, without changes of the operational requirements (speed around 27 knots). The particular structural design of the container ships, leads to open midship sections, resulting in increased sensitivity to torsional and horizontal bending loads which is much more complex to model numerically. At the same time, due to their large dimensions, the ULCS become much “softer” and their structural natural frequencies become significantly lower so that the global hydroelastic structural responses (springing & whipping) can become a critical issue in the ship design and should be properly modelled by the simulation tools.

On the other hand, it appears that the existing simulation tools do not provide the definite answer to all these design issues and there is a clear need for their improvement.

The particular importance of whipping and the insufficient knowledge in its modelling is clearly reflected in the recent MAIB (Marine Accident Investigation Branch) report, following the loss of the MSC Napoli container ship:

“It is likely that the hull of MSC Napoli was subjected to additional load due to whipping.”

“... it is apparent that whipping effect is currently very difficult to reliably calculate or model.”

“In view of the potential increase in wave loading due to whipping effect, further research is required to ensure that the effect is adequately accounted for in ship design and structural analyses, and that sufficient allowance is made for the effect when determining design margins.”



Figure 1. MSC Napoli following the structural failure.

The final goal of the present project is to deliver clearly validated design tools and guidelines, capable of analysing all hydro-structure interaction problems relevant to ULCS.

Summary of the work performed up to now

During the first reporting period (first 20 months of the project) the project was successfully oriented toward the main objectives. The Project Consortium was consolidated with the important associated partner which is the world biggest shipyard Hyundai Heavy Industry (HHI) from Korea. This fact gave the additional practical value to the project showing the high interest on the subjects which are considered.

During the first phase, all the main tasks of the project were well identified, scope of work clearly defined and the main part of the developments started. In the second phase, which is of concern in

this report, the work was continued and the overall progress is in line with the objectives. However, due to the numerous technical difficulties some delay was encountered and the project extension of 6 months was requested and granted by EU. Thanks to that the project is continuing rather smoothly and there is no risk to not achieve the initial objectives.

In particular all the model test campaigns were successfully performed and the useful databases for validation of the numerical tools were produced. In that respect, it is important to mention that the test matrix for hydroelastic model of Rigoletto container vessel was significantly extended thanks to cooperation with another EU project “Extreme seas”. Main part of the analysis of the model test results is finished and the comparisons with numerical tools are in progress. In addition to the complex model tests campaign on Rigoletto, which was performed by CEHIPAR, an additional model test campaign, which was devoted to slamming impact problems, was also performed by ECM. This campaign showed to be very useful for validation of the slamming modules which are the critical part of the whole physical problem.

The full scale measurements on Rigoletto are continuing without major problems. The data collection is progressing smoothly and the exploitation plan which was agreed in between the partners is on-going. Fortunately for the project, and unfortunately for the ship crew, some heavy weather conditions were encountered during few voyages. These time traces are very useful for validation of the numerical procedures and tools.

On the numerical side, most of the developments were successfully finalized. That is true both for hydrodynamic, structural and hydro-structural tools. The first verifications were already performed and the different numerical tools can already be used independently as a stand-alone codes and the overall integration in the final TULCS tool is in progress.

The dissemination activities were also successful and the TULCS project is nowadays clearly identified within the shipbuilding community worldwide. The final project Workshop is planned in November this year and the major actors from the field already confirmed their participation.

Expected final results and their potential impact

The main final objective of the project is to increase the safety and security of sea transport by Container Ships. This will be done by proper analysis of all the aspects of ULCS particular structural design.

The end products of the project will be the dedicated numerical tools and Guidance for their use within the dedicated design methodology. Specific accent is put to the validation of the tools and that is why an important part of the project concerns the experimental and full scale measurements. The so called direct approach design methodology will be built around these tools in order to have more rational design procedure as compared to the classical Rule procedures of Classification Societies. This direct approach is necessary because the actual size of ULCS often exceed the size commonly covered by the Rules. At the end of the project a simplified procedures will also be investigated and amendment to the existing Rules based practice will be proposed.

Important accent will be put on dissemination of the project findings. This will be done through the dedicated publications and two International Workshops. Contact with IMO will be established and dedicated presentation proposed. At the same time the executive summary of the project will be put in the form of BV Information Note and will be distributed to the IACS members.

It is also important to note that, even if the project is specifically oriented to ULCS the results of the project might be used for other ship types too. Indeed, the methodologies and the tools are only slightly dependent on the ship type and can be applied, with small modifications, to any ship type and also to the floating off shore platforms.