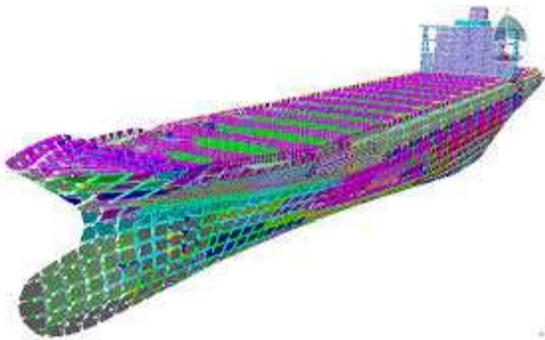
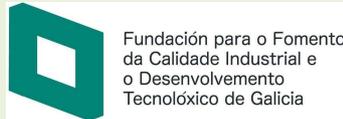


Executive Summary



Virtual Reality in shipbuilding industry



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“The use of simulation-based design and virtual reality technologies leads to higher efficiency in terms of work strategy planning, and offers, as a result, significant productivity gains. It gives computer-supported answers to the major questions: when and where to produce what and with which resources depending on the availability and restrictions of resources and materials”

During the last decade, shipyards, research centers and universities started to use this powerful tool to analyze shipbuilding operations. The group **SimCoMar** (Simulation Cooperation in Maritime Industries) is an example of an initiative to accelerate the development of simulation in the industry, helping North American and European shipyards. The Flensburger Nordseewerke Emden shipyard, the universities TUHH (*Technische Universität Hamburg-Hamburg*), DUT (*Delft University of Technology*), ANAST (*University of Liege*), and the Center of Maritime Technology (CMT) in Germany are participating at this initiative. Besides SimCoMar, other partnerships have been established between shipyards and universities such as the University of Seoul South Korea, Japan's Kinki, Michigan University, and Federal University of Brazil (LABSEN laboratory).

In recent years, the Dutch and German shipbuilding industry is seeking to reduce delivery times, production costs and increase product quality, using the process simulation. Some German yards are well advanced in the use of simulation and integration solutions to environmental planning processes, such as Meyer Werft and Flensburger.

On the other hand, implementation of new methods of 3D design using virtual reality is not exclusively limited to the manufacturing area, as in other areas such as navigation, staff training or academic purposes is having a big impact.

In that sense, this technology has been widely used for navigation training, evaluation hydraulic construction, battlefield environment simulation, etc. In the past few years, this technology has been introduced into ship navigation simulation. Through this method, Marine environment scene special place can be rebuilt and ship motion can be described in detail. The whole Ship Navigation Virtual Reality System (SNVRS) includes three parts:

- 1) The environment forecast module.
- 2) The ship maneuver forecast module.
- 3) The scene virtual reality module.

The environment forecast module is used to forecast the environment factors in the navigation area. For example, wind, fog, current, wave and rain can be calculated by this module. After that, the ship maneuver forecast module used these environment factors to calculate the ship movement and motion in this area based on the maneuver equation. The final step is to realize the virtual reality of the ship navigation. The whole scene, including environment, ship and wharf building, will be shown in three-dimension vision in ship virtual reality module.



Many companies are looking at virtual reality to train company personnel. With virtual reality, companies can save money and time and also train people in areas they could not consider before. As technology has progressed in the past two decades, researchers have been developing many ways to immerse a person into the virtual world.

Bearing in mind this state of the art, a Technology Surveillance study in the field of Virtual reality equipment in 3D designs, fabrication/assembly methods, worker training, safety and salvage methods for shipbuilding industry has identified **137 inventions** protected by patents and patent applications, and **47 scientific documents** published in the last decade. The analysis of this information has yielded trends with respect to evolution, research lines, top players, generating regions and markets of interest.

Looking at the development of patent applications, it is inferred that the continuous improvement in the development of new virtual reality equipment has motivated a new growth stage in the area. The main research lines are focus on technologies related to simulators for teaching or training purpose.

A geographical analysis highlights in the first instance the leadership of the Asiatic region, wherein **China, Republic of Korea** and **Japan** are leaders in new developments, bearing in mind both the perspective of generation (47%) and publication (58%). That means that this continent represents a key market in the technological area of interest.

It is followed by Russian market, which collects around 12%, and USA with 4%. In a more relegated position, Europe accounts for a 3% share of documents, wherein Germany, Norway and Spain are the most active countries.

Finally, **UNIVERSITY OF DALIAN** appears as a technological leader both in patent applications and scientific documents. Its protections related to the study area are mainly focused on Simulation systems for use in maritime search and rescue field and high quality navigation simulator for navigation teaching and training.

HYUNDAI HEAVY IND CO LTD, the **AGENCY FOR DEFENSE AND DEVELOPMENT (KOREA)** and **QINGDAO PORT GROUP CO. LTD** are other organizations that could be considered as key players in the area.

As the technologies of virtual reality evolve, the applications of virtual reality become literally unlimited. It is assumed that virtual reality will reshape the interface between people and information technology by offering new ways for the communication of information, the visualization of processes, and the creative expression of ideas.

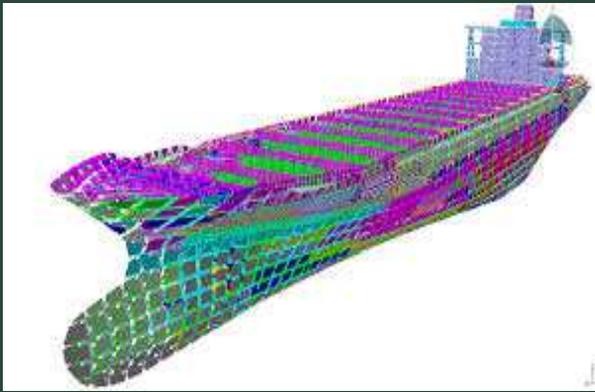


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