Where the majority of CRS research projects are devoted to very specific hydrodynamic topics, such as seakeeping, propulsion and manoeuvring phenomena, there has always been room for ship concept development studies in CRS. Projects on Segregated Ballast Tankers, Fast Ship concepts, covering various types of multi-hull vessels and Hydrostatic Balanced Tankers, are just a few examples.

Design development always

High Speed RoPax.

Jari Sirvio,
Kvaerner Masa Yards &
Bert Koops
A.Koops@marin.nl

The most recent activity in this field is the MONOFAST project, which started in 2002. The MONOFAST project has its main focus on the design development of two large, high-speed, mono-hull ship concepts, capable of operating on long haul European routes and Trans Atlantic crossings.

Initially, market studies covering the transport infrastructure and transport modes in Europe and on the Trans Atlantic route were carried out. The high-speed maritime logistics analysis shows that high-speed ships are most attractive economically when the speed is in balance with the number of departures.

Scenario simulations

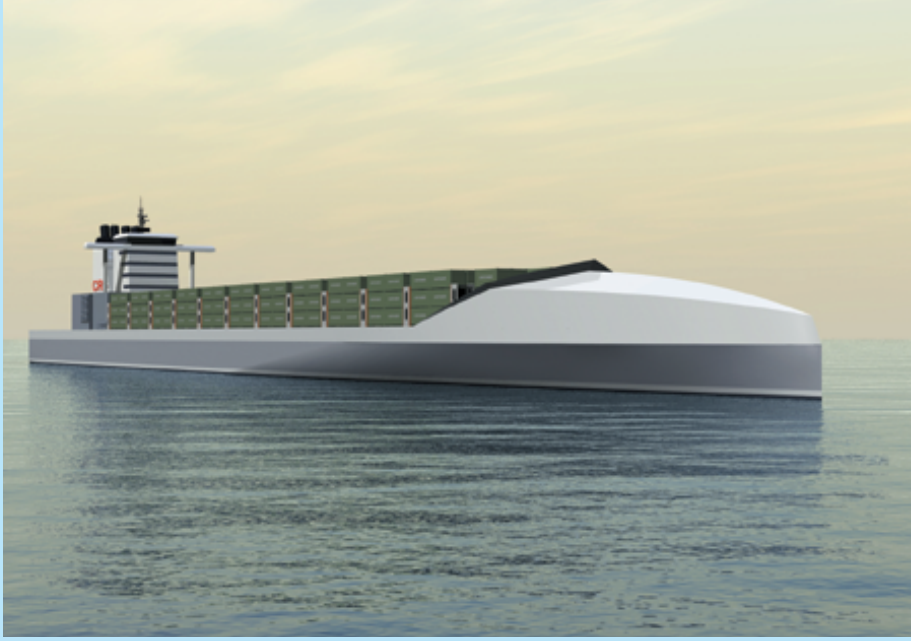
The main objective of the study was to perform a propulsion and seakeeping assessment, determine the reliability of the service offered, predict the hull girder loads and establish the operational limits for these new concepts. Five scenarios have been covered in the present project which is for a Trans Atlantic Container (TAC) ship. All scenarios are simulated on the eastbound, as well as westbound crossing on the route Southampton to New York.

Conceptual design studies

Two ship concept designs, a High-Speed Ro-Ro Passenger Ship (Ropax) and a Trans Atlantic Container ship were developed. The concept development work included a general arrangement plan, the machinery arrangement and an artist impression of both designs. These two concepts are the basis for further development which will include the evaluation of structures, hull form and propulsion arrangements.

Traditional and innovative approaches

The weight of the carrier is a key factor to attain the required operational speed and payload as about 50% of the ship's light weight can be attributed to the hull structure. Developments in welding and high strength materials have opened possibilities to change the structural concept. The application of high tensile steel sandwich-type, panels looks promising. In order to establish the validity of these estimates a hull structure of the TAC was designed twice, a conventional design, using the traditional approach and an innovative design using high tensile steel sandwich panels.



Trans Atlantic Container ship.

high on CRS agenda

Hull form development

Hull form development work started with a parametric study with full-scale resistance predictions for variations in length, breadth and draught, using a specific range of main parameter values. This study resulted in a clear choice of main dimensions for both ship types, for a given payload and design speed. CFD optimisation work was carried out in order to minimise the total drag for both high-speed vessel hulls. For this process the hulls have been parameterised with local and global coefficients. The main variations of the hull comprised the bulbous bow, the transom design and immersion, the mid-ship section coefficients and the longitudinal centre of buoyancy. The total drag of each hull has been calculated with a Navier-Stokes solver, with free surface representation. Final computations were made for three different bulbous bow forms, with one optimised transom.

Propulsion studies

A variety of propulsive arrangements have been studied, such as conventional propellers, pod units, single propeller, contra-rotating propellers, water jets and combinations of different propulsion systems. Wake measurements in the first series of model tests were carried out and the results used for propeller design calculations. These were made for a twin-screw and a POD arrangement, applying Navier-Stokes solvers. Model tests are being planned now to verify the resistance and propulsion predictions. Cavitation tests and hull pressure measurements are also envisaged to study the behaviour for these high power, high-speed ships. This project will be completed in 2005.

Ship Operations

In the field of ship operations, the Design for Service (DES) project conducted in the eighties and nineties resulted in the development of a voyage simulation tool. More recent activities in this area comprised pilot studies looking into possible CRS projects for Operator Guidance tools and Design for Service and Simulation Based Design approaches. These projects were built on knowledge obtained from long-term, full-scale measurement campaigns and developments of various hydrodynamic tools in CRS. So far these initiatives have had cursory support and this is primarily due to the limited representation of merchant ship owners in the present membership of CRS. But the organisation has embarked on an ambitious marketing campaign in an effort to attract more ship owners and CRS is very optimistic that more owners will be members very soon. Once CRS has some more ship owners onboard it very much looks forward to extending ship concept research.

MARIN

04-002189

Trans Atlantic Container ship model tests at a speed of 39 knots.