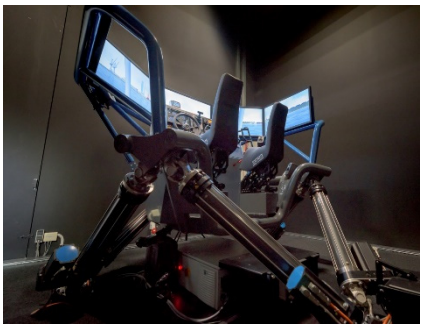
FSSS / Fast Small Ship Simulator

Bouncing over the waves at a speed of 43 knots, the director of the Defence Materiel Organisation (DMO) Vice Admiral Arie Jan de Waard, together with MARIN director Bas Buchner, made the first test voyage on the moving 'Fast Small Ship Simulator'. The FSSS is built by MARIN and partners Cruden and TreeC under a DMO project as catalyst for the development of a prototype. Vice Admiral De Waard experienced the test as very realistic: 'You feel as if you are involved in a complex operation at sea. Virtual reality like this is going to play a large role in education and training.'

Services:

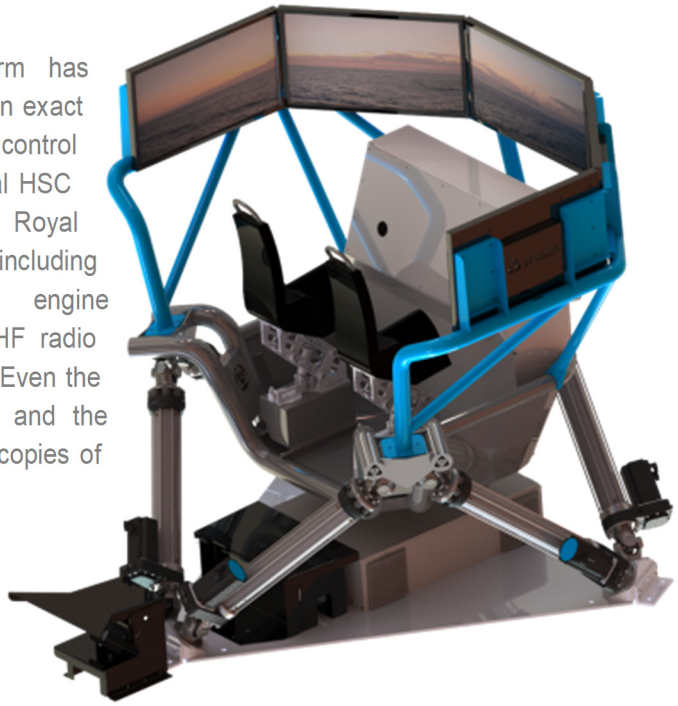
- Crew training & assessment on seakeeping operations both for Naval and Civil Ops
- Impact forces dealing with slamming, broaching & surfing
- Experience impacts on a 6DOF motion base
- Mission rehearsal on anti-drugs, anti-terror and boarding operations



Unique combination

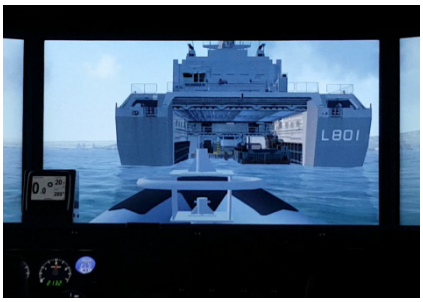
For the FSSS a unique combination is made of a motion base typically used for racing car simulations (Cruden), DOLPHIN real-time simulation of ship dynamics (MARIN), and an advanced visualisation environment (TreeC). The main goal of the FSSS project is to provide a safe and accurate environment for training of drivers and navigators of high-speed craft (HSC) both for naval and civil operations.

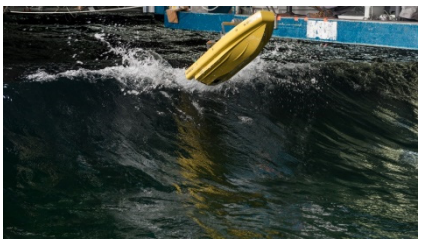
The motion platform has been outfitted with an exact representation of the control console of the actual HSC used by the Royal Netherlands Navy, including steering wheel, engine controls, ECDIS, VHF radio and a GPS system. Even the seats of the driver and the navigator are exact copies of the actual seats.



Related products:

- DOLPHIN simulator
- XMF 6DOF ship model
- Crew Training using the MARIN MSCN facility





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Slamming, broaching & surfing

To facilitate simulation of fast HSCs, MARIN extended its DOLPHIN simulation framework with a new approach to simulate complex phenomena such as slamming, capsizing, surf-riding and broaching. The main challenge was to develop a method capable of simulating such complex motion dynamics while at the same time providing predictions in real-time, including the effect of control inputs by the operator.

A force module was developed based on added mass planing theory (or 'momentum theory') as was pioneered by Von Karman and Wagner. Experience from recent research into the modelling of the impact of free falling lifeboats into the water surface also contributed. In this approach the ship is split into a number of 2D transverse sections and the impact force of each of the sections is determined based on the impact velocity and wetted shape of each section at each time instant.

The method is based on first principles and proves to be very adequate in dealing with both planing in calm water and impact forces on fast vessels in waves.

Verification & validation

Validation of the numerical model was done by means of model tests. A selection of 17 tests were conducted dealing with various environmental situations, such as head waves, beam waves and stern quartering waves. In fact, the model tests were used to tune the numerical model to complete the quantitative validation process.

During the development phase of this project, instructors of the Royal Netherlands Navy were invited to give their feedback on the behaviour of the model in combination with the motion system. During various workshops, the instructors have been testing every aspect of the simulator, including steady trim in calm water, steering and throttle response, turning circle diameters, the roll angle during turning and the motion behaviour in waves from every direction.

Finally, a qualitative validation was conducted after installing the unit at the naval base in Den Helder.