

**Computational Fluid Dynamics (CFD) models play a growing role in design and analyses of hull form, propeller and other systems in use on naval vessels. Jan-Bart Verkuyl reports on MARIN's role in a recent programme of CFD validation tests.**



Research Vessel "Alliance"

## MARIN takes to the seas for full-scale CFD validation tests

**J**uly this year saw MARIN's Trials & Monitoring group successfully perform full-scale flow measurements on board the NATO Research Vessel "Alliance" in the Mediterranean near the island of Elba. The measurements were part of a Euclid project, which aims to validate CFD models for predicting high Reynolds flows around ship hulls and the derivation of a database with measurement results for the validation of these codes, with both ship model results and full-scale results. Verification of accuracy and applicability of these CFD computer codes by means of model and full-scale flow measurements is a major task



LDV measurement grid.

in this project. The work undertaken by the Trials & Monitoring group was supported by the Ministers of Defence of France, Italy, The Netherlands and the UK. The work is conducted by a consortium of DCE Basin d'Essais des Carènes (France), INSEAN (Italy), MARIN (The Netherlands) and DERA Haslar (UK).

### Flow measurements at full scale

MARIN's main task within the project was to perform the flow measurements at full scale. The

aim was to obtain two components of the flow field in a plane close to the propeller (the axial velocity and the cross flow velocity components). For accurate flow measurement at full scale the Laser Doppler Velocity equipment at MARIN was upgraded and tested during a trial on board of Hr.Ms. 'Tydeman'. Furthermore in March this year LDV measurements were conducted on the Royal Netherlands frigate Hr.Ms. 'De Ruyter'. On board R.V. 'Alliance' LDV measurements were accompanied by boundary layer flow direction and speed measurements with custom pitot tubes. Both Hr. Ms 'De Ruyter' and R.V. 'Alliance' will be subjected to LDV measurements at model scale in the towing tank at INSEAN.

Bassin d'Essais des Carènes will perform detailed LDV measurements on the 'Alliance' and a generic submarine hull in the large cavitation tunnel (GTH) at 5 different planes (i.e. far upstream of the propeller, in the middle of the ship, upstream of the appendages, upstream of the propeller, downstream of the propeller). Meanwhile, INSEAN and DERA will conduct numerical flow analysis for these hull geometries with various CFD codes.

The measured full-scale flow data is an important dataset for the validation process which leads to proper viscous flow modelling.