High-Speed Marine Vehicles Committee

Committee Chair: Prof. R. Compton
Session Chair: Mr. A. Hansen

I DISCUSSIONS

Discussion of the High-Speed Marine Vehicles Committee Final Report and Recommendation to the 21st ITTC

by Prof. Grant E. Hearn
University of Newcastle upon Tyne

It may be the case that the topic I am about to raise is not relevant to the High-Speed Marine Vehicle Committee, should be considered by the Seakeeping Committee, or at worse falls between the two! In research undertaken at Newcastle University on catamaran design we (Peter Wright and myself) have tried to address the problem of designing the hull form so that there is a lesser tendency for high speed catamarans to "corkscrew". If one looks in the SNAME publications one finds a very simple statement of what is necessary to reduce corkscrewing. One should endeavour to separate as far as is "reasonable" the natural pitch and natural roll periods. However, "reasonable" is not defined. One could argue that by controlling the responses of the catamaran at the design stage one was also addressing safety by ensuring the acceleration limits so carefully presented in Section 4.4 (under criteria for Passenger Safety), were not being exceeded. However, the representation of the simple verbal solution to resolving "corkscrewing" as a mathematical objective function in a genetic algorithm based optimisation procedure is not simple (see Fast'95 paper by Hearn, Wright & Hills). Could this aspect of catamaran design be included in the work of the Committee, even though "safety" might be the principal theme? They are clearly coupled (related) aspects.

May I also take this opportunity to thank you for your very clear and interesting report.

ITTC HSMV Committee should take more aspects into account than safety alone

by Geert K. Kapsenberg - Maritime Research Institute Netherlands (MARIN)

The choice of the 21th ITTC - High Speed Marine Vehicles Committee to concentrate on the one recommendation of the 20th ITTC HSMV Committee is an interesting one. Indeed safety is a factor of prime importance for HSMV. However, it appears that a lot of developments in HSMV did not receive the attention they deserve; indeed quite a lot has happened in recent years. Most striking feature is not only the quoted increase in numbers but more so the increase in size. This is specially the case for ferries.

A simple consequence of this increase in size is, that the innocent Froude numbers used to indicate the high speed character have become menacing figures in knots. It is today no problem in cruising the Mediterranean with a speed close to 40 kn and this speed will no doubt increase in the immediate future. Secondly the area of operation of these high speed monohulls are reported to include the English Channel next year.

The developments of the SES craft in recent years is ignored by the HSMV Committee. Much work has been done in Japan in course of the Techno Super Liner project, and also large research projects are being carried out in Europe. Both projects intend to develop large (about 150 m in length) and fast (50 - 55 kn) vessels; the Japanese one for containerized cargo transport and the European one as a passenger/car ferry. Several articles have been published on both projects in the referenced symposia; attention is being paid to the European project by the Seakeeping Committee

- Chapter 7.3 of their report.

The European project is split-up in several parts. One part considers only the hydrodynamic aspects. It involves an extensive experimental part (resistance, powering, PMM manoeuvring, seakeeping oscillations, wave force measurements and free running tests). Interesting aspect of the free running tests - head seas part - is, that they have been carried out with two models with different scale. In this way the method to compensate for the scale effects of the air cushion dynamics has been validated. For a typical result of this validation see Figure 1. Next to the experimental part a theoretical method for calm water powering and seakeeping has been developed.

A second part of the European project is the part that considers structural aspects. In the scope of this part segmented model tests with a free running SES model have been carried out. The results of these tests will be used for the validation of theoretical prediction tools and finally to define the design loads for large size SES craft as given by the rules of the classification societies. A second aspect of this project is research to measure slamming loads on the wetdeck. Drop tests with full scale sections of the wet deck have been carried out and also model tests are scheduled. Interesting aspect is that not so much the slamming pressures are considered relevant, but much more the stresses in the material invoked by the slam. This approach takes therefore hydroelasticity fully into account.

The choice of the present committee to limit its attention to safety aspects only should not be made a recommendation for the next committee. Their task should be made broader to follow all developments in the field of HSMV relevant for the ITTC membership. I would recommend that the next specialist committee or working group should work in a broader sense (government supported, IMO recognized) so that they really can make an impact on rules for safety for High Speed Craft. Attention to this field is certainly necessary and worthwhile; it is a good starting point that the ITTC wants to be 'active' instead of 're-active'.

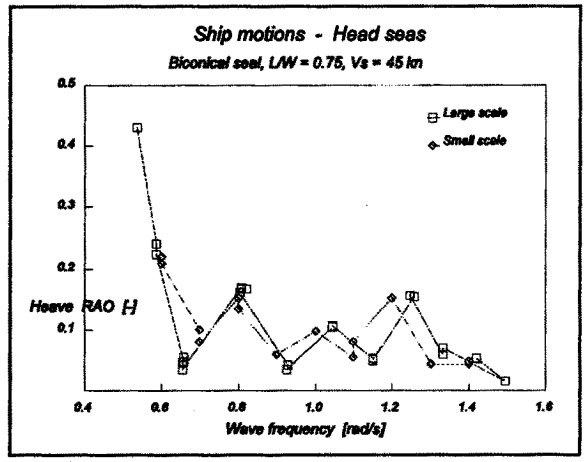

Figure 1. Heave response function of a large size SES tested at two different scale ratios in head seas, speed 45 kn.

Discussion to the High-Speed Marine Vehicles Committee

by L. Sebastiani
CETENA, Italy

First of all I would like to congratulate the Committee on the comprehensive report prepared.

Based on the experience and knowledge gained in-house also in relation to a cluster of European Union funded research projects on large SES vehicles I would like to submit to the attention of the Committee the following items relevant to specific topics of the Report.

Seakeeping Tests. Experimental techniques.

- Air pressure scaling has a significant effect on hydrodynamic coefficients.
- Diaphgram technique proved to be very effective in avoiding/reducing scaling effect.
- The fans system must be carefully designed and calibrated in order to avoid air-flow instability (in particular a "too" flat characteristic curve should be avoided).

Seakeeping Tests. Criteria for passenger safety.

- It should be preferred to use longitudinal/lateral force estimators as the proper criteria in place of linear accelerations and angles.

Dynamic Stability. SES

- PMM tests in conjunction with simulations confirmed the effectiveness of a well-designed dead rise angle in drastically

reducing heel angles at high-speed turning.

Craft Dynamics/Motions. SES

- A realistic prediction of SES motions in severe seas requires to accurately simulate the non-linear air-flow dynamics and its interaction with the flexible seals.
- Added resistance proved to be a major factor in reducing speed at sea.

Contribution to the Discussion on the Report of the High Speed Marine Vehicles Committee

by F. van Walree
MARIN, Wageningen

The Report describes the rapid growth in the fast vessel market in it's introduction. Furthermore, a review is given of the IMO Code of Safety for High Speed Craft. In the Conclusions of the Report, some shortcomings of the IMO Code are listed.

The Discussor would like to include the item of manoeuvrability and crash-stop criteria to the list of shortcomings. Especially for high speed craft operating on inland waterways with a high traffic density this is of importance. As an example may serve the introduction of hydrofoil ferry services on the rivers Rhine and Waal and on the inland lake Ijsselmeer in the Netherlands. While the rivers are mainly occupied with professionally operated cargo vessels, the lake may be heavily occupied with pleasure craft which are often operated less professionally. Especially for high speed ferry services at these waters there appears a collision risk. It would therefore be justified to develop criteria for manoeuvrability and crash-stop performance for high speed craft.

II REPLIES

HSMV Committee reply to written and oral discussions

The Committee thanks all contributors to the written and oral discussions of the Committee's report. Before answering these, it is necessary to point out the following errata in the report:

- the name of Professor L. Doctors (Australia) was inadvertently omitted from the list of committee members on the first page.
- Dr. Matusiak represented Finland not Poland as stated in the list of committee members.
- in page 518, in the last line of the right hand column, the word "not" should be inserted between the words "loads" and "included".
- the captions of Figures 9 and 10 should be exchanged.

The committee thanks Dr. Kapsenberg for his written contribution. We note his interest in the fact that our report dealt solely with HSMV safety and would refer him to the single recommendation to us from the 20th ITTC on the first page of our report.

We are aware of the extensive development in the HSMV world over the past three years and thank Dr. Kapsenberg for highlighting some of them, especially those related to SES. He mentions increases in both size and speed of proposed craft, which confirms the Committee's belief that concentration on safety - a very broad topic encompassing a number of disciplines - is vital. As Dr. Kapsenberg remarks, the ITTC must be pro-active, rather than reactive, in this important matter.

We therefore believe that investigations of HSMV safety should continue as the sole activity of one ITTC specialist committee, a view that is shared by the Advisory Council.

In reply to Mr. van Walree and his observations on the use of high speed vessels on inland waterways, we would mention that the IMO Code of Safe Practice for High Speed Vessels recognises the safe operation of these vessels and contains criteria related to their manoeuvrability. The need for good manoeuvring and crash stopping ability in fast vessels is emphasised by the fact that the law in many countries requries fast vessels, such as hydrofoils, operating on inland waterways, to give way to all other vessels, regardless of the situation.

However, not all high speed craft are treated equally in this respect because planing craft are still considered as "normal" vessels with the usual right of way.

The manoeuvrability of fast vessels is generally good and, due to their high power-to-weight ratio, their crash-stopping abilities are excellent.

Another important aspect to be considered when using high speed craft on inland waterways is the wash nuisance which they cause. The obligation placed on every vessel not to generate excessive wash is not yet supported by criteria on wash height or frequency. This may hamper the use of high speed vessels on inland waterways.

The Committee thanks Dr. Sebastiani for his contribution and the information it contains. It would be of interest to see the published results of the project to which he refers made available to the high speed craft community, and the Committee urges him to do so.

Regarding his comment concerning criteria for passenger safety, the criteria reviewed in our report also concern horizontal accelerations and these should be taken into account when evaluating Motion-Induced Interruptions (MII's). Shock-type responses are associated with transient vertical accelerations due to hull whipping. These are usually significantly greater than the horizontal accelerations experienced by a fast vessel and are therefore a dominant consideration in terms of passenger safety. Moreover, vertical accelerations are more unpleasant and dangerous than lateral accelerations for human beings, whether they are standing or sitting.

In the oral discussions, Mr. Comstock proposed a risk management approach to high speed craft safety in which an acceptable loss rate would be agreed on a statistical basis. Such a probabilistic approach was suggested as being more realistic than that of a deterministic nature, a suggestion agreed by the Committee.

Dr. Savitsky urged the Committee not to neglect the safety of recreational craft since, numerically, the loss of property and human life is very high for these vessels. He ascribed the forward movement of the longitudinal centre of pressure, combined with excessive trim tab movement, to directional instabilities in high speed planing craft, an observation noted by the Committee.

Dr. Bulgarelli appealed for more numerical analysis of the coupled response dynamics of high speed craft, as these often characterise instabilities at speed. He also made the important suggestion that the elasticity of a real high speed vessel would complicate the fluid-body dynamics even further.

Dr. Renilson asked the reason why a minimum model length of 2 metres was specified by the Committee for some of its model tests. In reply it was stressed that the real intent of the Committee's report was to recommend the use of large models, and not that a length of 2 metres was critical. Large models are important because of the small relative size of appendages and their importance in the testing of dynamic stability.

Finally Professor Hearn urged the Committee to recommend rigorous theoretical analysis of the complex motions experienced when dynamic instabilities occur. He also asked whether it was possible to modify the severest motions by design, and gave as an example the necessity to overcome the problems associated with catamaran roll and pitch periods being similar, thereby causing one motion to excite the other. The Committee replied by mentioning the present design trend in some catamarans towards greater length/overall breadth ratios and the ability to limit motions by setting operational limits, a significant feature of the IMO Code of Safe Practice for high speed vessels.