

RECOMMENDATIONS OF THE EXECUTIVE
COMMITTEE AND THE TECHNICAL COMMITTEES

EXECUTIVE COMMITTEE

1. The following procedure round criteria for selecting ITTC Technical Committee Members should be followed in future: The Technical Committee shall plan in detail the recommended programme of work. The members, including the chairman, shall in all cases be selected for their personal contributions to, interest in, and ability to contribute to the field of the Technical Committee. The membership of each Technical Committee shall be reviewed by the Conference at intervals of not more than three years. No person may serve on more than one Technical Committee at any time.

The following procedures will be followed for selecting Technical Committee members:

1. The area Representatives in the Executive Committee will prepare a list of potential candidates, and a curriculum vitae for each, from their geographical areas for the different Technical Committees.
2. Liaison officers (Executive Committee Members) and Chairmen of the Technical Committees will advise the Executive Committee during the Conference about the chairmanship and the composition of the new committees. A Technical Committee member who has not performed on past committees should not be reconsidered for membership on a future Technical Committee except under

special circumstances.

3. A complete list of potential candidates and the recommendations of the Area Representatives in the Executive Committee and of the Liaison officers and Chairmen of the Technical Committees will be discussed at the Advisory Council meetings. Additions can be made.
4. Recommendations for the chairmanship and memberships of the Technical Committees to be made by the Executive Committee.
5. Recommendations of the Executive Committee will be considered by the full conference. Before any final lists of Technical Committee members are put before the conference, a clear statement of the support to be given to each candidate by his organization should be obtained. Where the proposed member is associated with an ITTC Member Organization, this statement of support should emanate from the Representatives of that Organization.

The Executive Committee has the responsibility of continually monitoring the Technical Committees have active participation of all Technical Committee members. The Technical Committee Chairman, and Technical Committee members in case of inactivity of a chairman, must inform the Executive Committee through their Area Representative of inactivity of a Technical Committee member for reason of resignation,

illness, lack of attendance at meetings, or general nonperformance. The Executive Committee then will replace, as appropriate, the nonperforming Technical Committee member in order that the Technical Committee will remain at full strength.

Written contributions to the programme of work of a Technical Committee may be submitted to its Chairman by any member of the Conference on his own behalf or on behalf of any other individual. Each Technical Committee may include a short abstract of any such contributions in its report, with an indication of the source from which the full text may be obtained. Conference proceedings and technical reports are not to be used as vehicles for disseminating technical papers.

2. The publication of the ITTC-Newsletter should be continued along the lines as followed during the period before the 16th ITTC. The members of the Information Committee should act as the Editorial Board for the Newsletter.
3. The Advisory Council should give further thoughts to:
 - geographical areas of the ITTC,
 - organization of the ITTC, in particular in connection with the tasks

and responsibilities of the Executive Committee and the Advisory Council,

- future scope of ITTC, and should come in the course of 1983 with proposals in this respect to ensure that actions can be taken in time by the Executive Committee to effectuate changes (if needed) during the 17th ITTC.

4. The "ITTC rules and organization" should be modified and updated after the work involved with recommendation 3 has been finished.
5. The Panel of High-Speed Marine Vehicles shall become a full Technical Committee of the ITTC from the end of the present Conference. The present Panel should therefore recast its recommendations to take this into account and in particular, should specifically make recommendations for the work of the new Committee.
6. Each technical committee should attempt to ensure that its recommendations for future work of the Committee do not significantly overlap the work of other technical committees. Where overlap can not be avoided, the new technical committees must ensure that their work is coordinated and joint meetings are encouraged.

RESISTANCE COMMITTEE

The following recommendations are placed in the sequence in which topics are treated in Section II of the report, not necessarily in order of importance. It will be noted that many of the recommendations are similar to those made to the 15th ITTC.

- 1) Work should continue on development and validation of methods to compute ship wave patterns and wave resistance.

Emphasis should be placed on numerical methods which exploit the use of high-speed digital computers to satisfy increasingly more exact formulations of hull and free-surface boundary conditions. Special attention should be paid to evaluating the numerical procedures employed: grid size, truncation errors, and convergence of solutions. In order to minimize the confusion often created in the past by numerical imprecisions

cision in the evaluation of theoretical solutions, by experimental uncertainty owing to nonstandard test conditions and by conceptual ambiguity in the definition of an experimental wave resistance, it is important that new computation methods be applied to the hull forms selected for the Resistance Committee's Cooperative Experimental Program.

2) Experimental and theoretical investigations should be continued to develop procedures for prediction of the flow over the stern and in the near wake of ships. Flow features of particular concern are: thick boundary-layer effects, viscid-inviscid interaction, turbulence and vortex generation, separation, and the influence of viscosity and turbulence on wavemaking. Special attention should be paid to carefully evaluating all aspects of the numerical procedures used in boundary-layer computation methods. Boundary-layer calculation methods should be applied to the test cases cited in the report, particularly those selected for the Resistance Committee's Cooperative Experimental Program, to facilitate comparative evaluations.

3) When new sets of measurements are made in boundary layer, stern and wake flows, a detailed documentation of the experiments and results, and an estimate of measurement uncertainties, should be made readily available. This would greatly facilitate the development and evaluation of new theories and computational methods. Experiments and calculations at model scale should be supplemented, insofar as possible, by parallel investigations at full scale Reynolds numbers to determine the validity of the underlying assumptions in the theories and obtain a measure of scale effects.

4) Since the data being collected within the Resistance Committee's Cooperative Experimental Program will become most valuable for evaluating ship flow and resistance calculations in the future, it is of great importance that the program be carried out according to the guidelines given by the Resistance Committee, and that the work be completed before the 17th ITTC in 1984.

5) Experimental and theoretical studies should be continued on the bow phenomena of wave breaking, flow transition, and bilge vortex formation to enable the corresponding contributions to resistance and even possible effects on propulsion to be assessed.

6) Research should be continued to attempt to determine correlations between geometric properties of the different varieties of irregular roughness occurring on ships and the roughness drag function. Careful measurements of hull roughness should be made in conjunction with obtaining ship performance data.

7) Systematic theoretical computations of potential flow about simple bodies in channels should be conducted to obtain more rational estimates of blockage. As a further elaboration, an irrotational wake model should be included to simulate the effect of viscosity. For high Froude numbers the effect of tank boundaries on wave resistance should be considered. The Resistance Committee should continue to monitor and assess work addressed in all the above recommendations, and in addition should consider evaluation of progress and programs associated with: the application of theory to hull design; shallow water effects on resistance; appendage resistance; and drag reduction techniques.

PROPELLER COMMITTEE

1. The state-of-the-art review of predicting the effective wake distribution should be continued. Theoretical prediction of the various propulsive coefficients, including the effect of roughness should be examined.
2. Methods of predicting the excitation caused by cavitating propellers should be surveyed and compared. Emphasis should be on methods for predicting cavity volume and volume oscillation of propeller blades.
3. Methods (theoretical and experimental) of predicting and means of reducing propeller noise should be reviewed.
4. The comparison of the methods for predicting pressure distributions on propeller blades presented at the 15th ITTC should be continued. Analysis of the lift distribution and the angle of attack should be included. If possible, comparisons should be made for a propeller on which pressure distributions have been measured.
5. Methods for the design of non-conventional propulsion devices, such as ducted propellers, contrarotating propellers, tandem-propellers, propellers fitted with stator or prerotation vanes and vertical axis propellers, should be evaluated.
6. The criteria used for propulsor and hull optimization should be reviewed. Emphasis should be on criteria for selecting propulsor number, type, rpm, diameter, blade area, load distribution, etc., to minimize the required shaft horsepower full scale.
7. Review of the performance of propellers in transitory modes of operation such as emergency stopping and when maneuvering should continue.
8. The performance of propulsors in waves with respect to propeller-induced excitation forces as well as propulsive coefficient should be investigated and prediction methods should be evaluated.
9. The mechanisms governing the creation of the propeller vortex system should be reviewed, especially with regard to contracting flow, nonconventional blade shapes and unsteadiness of the flow.

PERFORMANCE COMMITTEE

Recommendations to the Conference

1. Member institutions are recommended to continue the use and evaluation of the 1978 ITTC Performance Prediction Method for Single Screw Ships. In so doing the form factors should be calculated according to the Prohaska method as described in detail in Section 2.6 of the Report and predictions of shaft rate of rotation assessed on the basis of power identity.

2. It is recommended that propulsion model tests are carried out at more than one loading for at least one speed in the region of the trial speed.
3. When carrying out full scale trials the procedures outlined in the "1969 ITTC Guide for Measured Mile Trials" should be followed.

Recommendations for Future Work of the Committee

4. The applicability of the 1978 Performance Prediction Method to fine hull forms should be studied further and an investigation made into the reasons for the differences between C_p and C_N values obtained at different institutions.
5. The Committee should collect model and full scale data for ships for which very reliable trials and extensive corresponding model tests have been carried out with a view to the evaluation of possible improvements in prediction methods.
6. Phenomena involved in the prediction of the performance of twin screw ships should be evaluated in detail.
7. The Committee should inform the Conference of developments in the understanding of scale effects on

propeller characteristics including the roughness of the propeller, scale effects on components of the propulsive efficiency and separation and its scale effect. In particular, implications of recently proposed alternative approaches to scaling problems mentioned in Section 3.9 should be assessed.

8. Further work should be carried out on the resistance increase due to hull roughness. Particular effort should be made to improve the definition of surface geometry and to quantify the effects of roughness on local frictional resistance.
9. The review of recent alternative proposals for carrying out propulsion tests should be continued and methods of curve fitting test data closely related to the physical phenomena involved should be studied. Current work described in Section 9.3 which may lead towards the development of a new standard analysis method should be evaluated.
10. Work should continue in quantifying the factors influencing service margin.
11. The Committee should pay attention to performance in shallow and confined water.

SEAKEEPING COMMITTEE

RECOMMENDATIONS TO THE CONFERENCE

In the spectrum formulations for open ocean conditions and fetch limited situations recommended by the 15th ITTC in 1978, the use of average period T_1

should not be taken to preclude the use of other appropriate characteristic periods such as the modal period T_0 and the average apparent period based on zero up-crossings T_2 .

RECOMMENDATIONS FOR FUTURE WORK OF THE
COMMITTEE

1. Methods of generating waves in tanks and basins should be reviewed and evaluated. The development of standards for generating wave spectra in tanks and basins should be continued.
2. A comparison of present procedures used for the calculation of auto and cross spectral densities should be carried out, with particular attention to the use of Fast Fourier Transform (FFT).
3. Review and assesment of instrumentation for remote direct measurement of the motions of free-running models should be continued.
4. The availability of suitable multidirectional wave measurement systems for use at sea and in basins should be reviewed.
5. Procedures for experiments investigating rarely occurring events, such as wetness and slamming, should continue to be reviewed and guidelines established.
6. The Conference should be kept informed of new findings arising from the results of hindcast climatologies and other investigations into the definition of sea conditions, including directional spreading of waves.
7. Work should continue to review and evaluate retional linear and nonlinear methods of accurately estimating ship motions and associated seakeeping responses, especially wave induced loads and relative motions. In particular, more attention should be paid to the correlation of predicted results with experimental data.
8. Further investigations should be made into the effects of dynamic lift generated by the hull and appendages on the lateral motion hydrodynamic coefficients, particularly for high speeds.
9. Methods of predicting speed reduction in waves should continue to be surveyed. Attention should be paid to problems associated with propulsion factors and added resistance in waves for small wavelengths in case of involuntary speed reduction, and to limiting criteria values in the case of voluntary speed reduction.
10. Progress in the development of experimental techniques and analytical methods for the prediction of capsizing, and other conditions under which ship motions become unstable, should continue to be reported.
11. The Conference should be kept informed of developments in the fields of seakeeping test techniques, hydrodynamic forces which induce springing and whipping, tank wall interference, motion stabilization, ship motions in shallow water and full-scale ship trials.
12. The ITTC standard symbols for seakeeping should be reviewed and updated where necessary to meet present requirements.

MANOEUVRABILITY COMMITTEE

As a result of the work undertaken by the Manoeuvrability Committee for the 16th ITTC, the following recommendations are made:

- 1 The definition of the quantities and qualities which are considered

to describe ship steering and manoeuvring behaviour should be kept under review. In particular the activities of Regulatory Bodies formulating standards of manoeuvrability should be closely monitored. Further attempts to

develop definitive manoeuvres of relevance under normal operating conditions should be encouraged.

The study of hydrodynamic and other relevant aspects of automatic steering control of ships should be continued. Particularly as they apply to minimum energy course control and dynamic positioning systems. Second order wave effects require special attention.

- 3 A continued review should be made of theoretical and empirical methods for the determination of hydrodynamic and aerodynamic forces acting on manoeuvring ships. A co-operative effort should be made to correlate existing captive model and wind tunnel data with hull form parameters.
- 4 Investigations of the manoeuvrability of ships in extreme conditions of wind, waves and current should be encouraged, especially as they affect the ability of the ship to manoeuvre

in restricted waters. Attention should also be given to transient manoeuvring behaviour at low speed, as well as problems associated with disabled vessels.

- 5 Ship model correlation techniques applicable to manoeuvrability studies should be kept under review. It is recommended that ITTC Member Organizations use their facilities to conduct model tests and compare their results with the ESSO OSAKA deep and shallow water trials.
- 6 Experimental model and full-scale test techniques, as applied to manoeuvrability studies, should be kept under review. New techniques involving computer applications for on-line system identification, control and analysis should receive special attention. Problems concerned with offshore operations and special purpose craft should also be covered.

OCEAN ENGINEERING COMMITTEE

1. Further efforts should be made to obtain adequate descriptions of the full scale environment. With regard to waves, the wave group phenomena and description of multi-directionality should receive special attention. Emphasis should also be placed on the varying nature of the wind speed, because of the important effect that low frequency wind speed variations can have on the response of certain offshore systems.
2. Methods used for the modelling and generation of waves in a test facility should be studied further. In particular, attention should be paid to wave grouping, the set-down phenomenon and reflection build-up in tests of long duration. In view of the inability of most facilities to generate the high frequency part of a spectrum, it is desirable to develop a standard method for matching the actually generated spectrum with the desired one. Also the methods to generate and analyse multi-directional waves should be reviewed.
3. Attempts should be made to standardize the methods for data acquisition and analysis, for both regular and irregular wave tests.
4. Further consideration should be given to the development of standard experimental techniques for the testing of systems with low-frequency response.
5. New developments in theoretical methods

- for the prediction of linear and non-linear motions of offshore systems should be followed closely. Special attention should be paid to time-domain simulation techniques for the behaviour of moored systems.
6. Work leading to improvements in methods to determine wave and current forces on

cylinders of small diameter should be encouraged.

7. The problems associated with the determination of extreme values should be studied.
8. The standard ITTC list of symbols should be reviewed and supplemented to take account of ocean engineering requirements.

PERFORMANCE IN ICE-COVERED WATERS COMMITTEE

A. General Recommendations

1. The Symbols listed in Appendix A be used until they are approved by the Information Committee.
2. Continue the development of analytical prediction methods for the forces on and for the performance of vessels and structures in ice.
3. Continue and encourage the development of model ice.
4. Continue model and full scale testing in ice (including ice properties and conditions) and every opportunity be taken to make careful correlation analysis between model and full scale results.

B. Immediate Tasks for the Committee

1. Continue the testing of the ITTC ice Committee's standard model and that the comparison of test results and full scale predictions be reviewed and reported.
2. Investigate the fundamental effects of friction in ice-breaking. This is to be achieved by re-testing the standard model at other friction values which are to be determined by the new Committee.
3. Review the present techniques used in propulsion testing.
4. Model and full scale experiments, including ice impact force measurements, be initiated on ships and structures in all ice conditions.

CAVITATION COMMITTEE

1. Organizations should continue to make measurements of "effective" nuclei and "inactive" nuclei populations and to correlate these measurements with model/full scale cavitation comparisons.
2. Work on the relationship between viscous effects, nuclei "seeding", and turbulence stimulation on cavitation should be continued.
3. Continuation of comparative tests are recommended with the foil/headform combination for cavitation inception, the Sydney Express propeller for cavitation noise measurements, and the Soft Surface methods for cavitation erosion studies.
4. Further work on the subject of unsteady cavitation noise, hull pressure fluctuation

and erosion is recommended with specific attention given to the correlation of results from propellers in a wake and oscillating foils.

5. Work should be initiated to provide quantitative predictions of cavitation erosion and comparisons with full scale data.
6. It is recommended that the evaluation of the interaction effects between the ship and the cavitating propeller be continued and that model/prototype studies of cavitation scaling and wall effects for high speed propellers be pursued.
7. Organizations are encouraged to evaluate the influence of propeller manufacturing tolerance and small scale roughness on cavitation performance.

The recommendations listed above fall into three categories:

- (A) those directed to the member organizations,
- (B) those directed to individual research scientists, and
- (C) those to be considered by the next

Cavitation Committee, as shown in the following table.

Recommendation Number	Category		
	A	B	C
1	x		
2	x	x	
3	x	x	x
4	x	x	x
5	x	x	
6	x	x	
7	x		

This table shows that the immediate tasks recommended for the next Cavitation Committee are concerned with comparative tests on the foil-headform combination, with a parallel study of tunnel wall effects, and on the Sydney Express propeller noise and hull pressures comparative measurements. The remaining recommendations involve complex tasks and results should be made available to the Committee for its work. The Committee should review progress on all items.

INFORMATION COMMITTEE

1. The Information Committee should request all Technical Committees to prepare draft proposals for the revision and extension of their respective sections of the list of standard symbols. The Information Committee should then revise the list of symbols accordingly and arrange for publication.
2. The Information Committee should request all Technical Committees to draft proposals for the revision and extension of their respective sections of the ITTC Dictionary of Ship

Hydrodynamics. New sections are to be drafted where appropriate.

- The Information Committee should subsequently incorporate these drafts into a new edition of the dictionary.
3. The Information Committee should continue co-operation with other international organizations to achieve common agreements on symbols and terminology.
4. The Information Committee should keep the ITTC Catalogue of Facilities up to date.

5. A group discussion on new hydrodynamic test facilities and new instrumentation systems and techniques should be organized by the Information Committee and suitably documented by the organizing Committee for the next Conference.
6. The Catalogue of Computer Programs for the exchange of software should be maintained by the Information Committee.
7. The Information Committee should continue to monitor future developments in the field of data base management systems so that it can assist the Technical Committees in the exchange of data.
8. It is recommended that ITTC member organizations adopt the format described in Appendix 3 as a standard for the exchange of seakeeping data on computercompatible media between ITTC member organizations.
9. Standard formats for the exchange of other types of data on computercompatible media should be developed by the Technical Committees in cooperation with the Information Committee as specific requirements arise.
10. It is recommended that the Executive considers asking the Technical Committees to provide sufficiently detailed tables of contents of the subjects covered in their respective reports. The format for these should be specified by the Organizing Committee for each Conference.
11. The Information Committee should consider the adoption of a keyword system for the indexing of publications in the fields of interest to ITTC member organizations.
12. The Information Committee should continue to publish the ITTC Newsletter.

HIGH SPEED MARINE VEHICLES COMMITTEE

1. A High Speed Marine Vehicles Committee should be established and should continue to address all aspects of model testing, pertinent to high speed marine vehicles with particular attention being paid to cooperating with existing technical Committees.
2. Prepare a follow-up questionnaire to solicit comments, additions, corrections, etc. to the State of the Art Report.
3. Prepare a state of the art report on the testing of submerged hydrofoils.
4. Prepare a bibliography on all high speed marine vehicle types.
5. Undertake a review of symbols, coefficients, definitions, body coordinates, and equations of motion used in the field of high speed marine vehicles to provide a consistent listing for inclusion in the ITTC Dictionary of Ship Hydrodynamics and list of standard symbols.
6. Contact existing technical Committees to determine which of the 35 technical recommendations they will undertake.