Tasks and structure of the 29th ITTC technical committees and groups
(Conference changes implemented)

1. STRUCTURE OF TECHNICAL COMMITTEES

The structure of the technical committees includes five General Committees, eight Specialist Committees and one Group.

2. TERMS OF REFERENCE FOR THE GENERAL AND SPECIALIST TECHNICAL COMMITTEES AND GROUPS

2.1 General Committees

Each General Committee will be responsible for a general subject area. It will review the state-of-the-art, identify the need for research and development, and carry out longer term studies with broad impact.

Each General Committee will submit a report on the results of its work to the Full Conference. The conclusions and the recommendations of the General Committee report should be structured as follows:

1. General technical conclusions
2. Recommendations to the Full Conference, which require actions such as, e.g., adopting ITTC procedures.

In addition, each General Committee shall submit proposals for future work of the General Committee and identification of tasks, which may be appropriate for Specialist Committees. These proposals shall be submitted to the Advisory Council which will compile the proposals and present them to the Full Conference.

2.2 Specialist Committees

The ITTC Advisory Council will propose Specialist Committees. Each Specialist Committee will be responsible for studying a specific technical problem. The Specialist Committees will be appointed for a limited duration. It is expected that they will complete their tasks within maximum two ITTC periods (6 years). They shall interact closely with the appropriate General Committees. The tasks of a Specialist Committee can include establishing Procedures and/or Guidelines. Procedures and Guidelines shall contain only techniques which are applicable in commercial practice.

Each Specialist Committee will present a final report on the results of its work to the Full Conference and interim reports on progress if the duration of the committee spans more than one Conference. The conclusions and the recommendations of the Specialist Committee report should be structured as follows:

1. General technical conclusions
2. Recommendations to the Full Conference, which require actions such as, e.g., adopting ITTC procedures.

In addition, each Specialist Committee shall submit proposals for future work and identification of tasks, which may be appropriate for Specialist Committees. These proposals shall be submitted to the Advisory Council which will compile the proposals and present them to the Full Conference.

2.3 Groups

Groups may be established from time to time by the Executive Committee to carry out specific tasks for the Conference, which are generally not technical issues.

Each Group will present a final report on the results of its work to the Full Conference. The conclusions and the recommendations of the Group report should be structured as follows:

1. General conclusions
2. Recommendations to the Full Conference, which require actions such as, e.g., adopting ITTC procedures.

In addition, each Group shall submit proposals for future work and identification of tasks, which may be appropriate for General and Specialist Committees. These proposals shall be submitted to the Advisory Council which will compile the proposals and present them to the Full Conference.

3. MECHANISM FOR IDENTIFYING NEW SPECIALIST TECHNICAL COMMITTEES

As part of their Terms of Reference, the General Committees shall consider the need for new tasks and include appropriate proposals in their technical reports. If the Advisory Council identifies a need for a new Specialist Committee when it reviews the draft recommendations of the General Committees, the Council will prepare and agree on a statement of the technical aims and objectives for the work of the Specialist Committee.

Independent of the proposals of the General Committees, the Advisory Council will keep the requirement for Specialist Committees under continuous review.

When the Advisory Council has agreed on the need for a new Specialist Committee, the draft statement of technical aims and objectives will be presented to the Executive Committee for endorsement. If the Executive Committee approves the formation of a new Specialist Committee, it will present the proposal to the Full Conference for approval.

4. PROPOSED STRUCTURE OF THE TECHNICAL COMMITTEES AND GROUPS FOR 29TH ITTC

4.1 General Committees

- Resistance and Propulsion
- Manoeuvring
- Seakeeping
- Ocean Engineering
- Stability in Waves

4.2 Specialist Committees

- Ships in Operation at Sea
- Hydrodynamic Noise
- Hydrodynamic Modelling of Marine Renewable Energy Devices
- Ice
- Energy Saving Methods
- Modelling of Environmental Conditions
- Combined CFD/EFD Methods
- Manoeuvring in Waves

4.3 Groups

- Quality Systems Group

5. TASKS OF THE TECHNICAL COMMITTEES AND GROUPS OF THE 29TH ITTC

5.1 General Terms of Reference

1. All committees shall observe the Terms of Reference and general obligations. The committees are expected to perform all the tasks defined in this document. However, should a committee be unable to do this, it shall consult the Advisory Council with regard to reduction of the work.

2. All committees shall identify areas of mutual interest with other committees and the concerned committees shall establish active co-operation in these areas.

3. All general and specialist committees shall endeavour to identify benchmark data and submit these to the ITTC Secretary for inclusion in the benchmark data repository on the ITTC website. Each committee shall appoint a member responsible for this.

4. In their work, the committees shall follow the guidelines given in ITTC Recommended Procedure 1.0-03, General Guideline for the Activities of Technical Committees, Liaison with the Executive Committee and Advisory Council.

5. All general committees shall survey and review new techniques within CFD in their area and shall include the results thereof in their report.

6. All general committees shall monitor advances in the application of detailed flow measurements in the ITTC community to assess the need for detailed evaluation and implementation of best-practice, uncertainty analysis, and benchmark guidelines.

7. Committee reports to the Conference should be structured in line with the terms of reference of the committee and in accordance with Recommended Procedure 4.2.3-01-02, Guidelines for Preparation of Committee and Group Reports.

5.2 Requirements to new and revised Recommended Procedures and Guidelines

An important part of the work of the committees will be to establish Recommended Procedures and Guidelines to help the ITTC member organizations maintain their institutional credibility with regard to quality assurance of products and services such as predictions and evaluations, and quality assurance of designs. The committees will develop detailed plans in accordance with Conference Recommendations and their work should be directed towards the techniques and the understanding of physical and numerical modelling as a means of predicting full-scale behaviour. While maintaining an awareness of progress, fundamental theoretical studies and fundamental aspects of numerical fluid computation should be covered by other fora. Recommended Procedures and Guidelines shall contain only techniques which are applicable in commercial practice.

In the preparation of new or revision of existing Recommended Procedures and Guidelines, the committees shall observe the following:

1. Committees that have a task to review ITTC Recommended Procedures shall identify and report any proposed changes in their first annual report to the Advisory Council. The changes approved by the Advisory Council shall be implemented in the

second year and the draft revised procedure submitted to the Advisory Council for comment.

2. Committees that have a task to write new procedures or guidelines shall submit an outline of these with their first annual report to the Advisory Council. The outline shall be reviewed by the Advisory Council and comments made to the committees. The draft new procedures or guidelines shall be prepared during the second year and submitted to the Advisory Council for review.

3. New and revised draft procedures shall subsequently be updated, incorporating the comments made by the Advisory Council, and in February of the third year of the period be submitted to the Advisory Council for final review and approval. Following AC review, the committee will have three weeks to make the final adjustments to the procedure and resubmit them to the AC. After approval by the AC, the Quality Systems Group shall perform a formal check of the procedures.

4. Procedures and Guidelines must be in the format defined in the ITTC Recommended Procedure 4.2.3-01-03, Work Instruction for Formatting ITTC Recommended Procedures, and they will be included in the ITTC Quality Manual. Symbols and terminology must be in accordance with those used in the current version of the ITTC Symbols and Terminology List. If necessary, new symbols, complying with ISO 31, should be proposed in collaboration with the Quality Systems Group. Recommended Procedure 4.2.3-01-03 contains a template, which shall be used for new procedures and guidelines.

5. When a committee is given the task to write a new procedure or guideline or revise an existing procedure or guideline, the committee shall ensure that symbols and terminology as well as the contents of this procedure or guideline is consistent with any other procedure or guideline, which may deal with a related matter.

6. If relevant, procedures and guidelines shall specifically describe the deliverable to the customer for the described test.

7. All new and revised procedures shall, as far as feasible, include a procedure for uncertainty analysis. All new procedures for uncertainty analysis in experiments shall follow the ISO (1995) 'Guide to the Expression of Uncertainty in Measurements' (also known as ISO-GUM). It is not required to update existing procedures on uncertainty analysis to follow this standard. If a procedure for uncertainty analysis is for other reasons updated, it shall follow the ISO standard.

5.3 Terms of Reference for the General Committees

Resistance and Propulsion Committee

1. Update the state-of-the-art for predicting the performance of different ship concepts emphasizing developments since the 2017 ITTC Full Conference. The committee report should include sections on:
   a. The potential impact of new technological developments on the ITTC, including, for example superhydrophobic materials, new types of propulsors (e.g. hybrid propulsors), azimuthing thrusters, cycloidal propellers, propulsors with flexible blades and rim drives.
   b. New experimental techniques and extrapolation methods
   c. New benchmark data

d. The practical applications of computational methods to performance predictions and scaling
e. New developments of experimental and computational methods applicable to the prediction of cavitation.
f. The need for R&D for improving methods of model experiments, numerical modelling and full-scale measurements.

2. During the first year, review ITTC Recommended Procedures relevant to resistance, propulsion and performance prediction, including CFD procedures, and
   a. identify any requirements for changes in the light of current practice, and, if approved by the Advisory Council, update them,
   b. identify the need for new procedures and outline the purpose and contents of these.

3. Develop a new procedure for wave profile measurement and wave resistance analysis.

4. Develop a procedure for verification and validation of the detailed flow field data.

5. Cooperate and exchange information with the Specialist Committee on Energy Saving Methods on subjects of common interest.

6. Cooperate and exchange information with the Specialist Committee on Ships in Operation at Sea regarding consequences of EEDI, especially with respect to ITTC Recommended Procedures.

7. Investigate the need of change of standard hull and propeller roughness. Develop and propose new roughness correction methods for both hull and propeller.

8. Conduct the validation of the procedure 7.5-02-03-01.7, 1978 ITTC Performance Prediction Method for Unequally Loaded, Multiple Propeller Vessels.

9. Continue with the monitoring of existing full scale data for podded propulsion. If there is available data, refine the existing procedure.

10. Continue the benchmark campaign with regard to the examination of the possibilities of CFD methods regarding scaling of unconventional propeller open water data. Continue comparative CFD calculation project.

11. Continue with monitoring the use of and, if possible, develop guidelines for quasi-steady open water propeller and propulsion model tests.

12. Conduct a survey of cavitation erosion modeling and predicting methods and identify the need of change of ITTC procedures in this respect.

13. Identify the need of the elaboration of the procedure concerning the rim drives model testing and performance prediction. Elaborate the procedure when necessary.

14. Identify the influence of the new F_D definition on power prediction.

15. Investigate the need of changing the standard criterion for *Re* in model tests of propulsors as well as in the aspect of CFD validation.

16. Investigate the need of change of scaling methods with regard to propulsors (including pods).

17. Investigate and describe a propulsor performance in waves, and discuss the scale effects on its modelling.

Manoeuvring Committee

1. Update the state-of-the-art for predicting the manoeuvring behaviour of ships, emphasizing developments since the 2017 ITTC Conference. The committee report should include sections on:
   a. the potential impact of new technological developments on the ITTC
   b. new experiment techniques and extrapolation methods
   c. the practical applications of computational methods to manoeuvring predictions and scaling, including CFD methods
   d. the need for R&D for improving methods of model experiments, numerical modelling and full-scale measurements
   e. the effects of free surface, roll, sinkage, heel and trim in numerical simulation of manoeuvring.
   f. Include specifically, the prediction and testing of low speed manoeuvring to understand the impact of these types of manoeuvres in model testing.

2. During the first year, review ITTC Recommended Procedures relevant to manoeuvring, including CFD procedures, and
   a. identify any requirements for changes in the light of current practice and, if approved by the Advisory Council, update them,
   b. identify the need for new procedures and outline the purpose and contents of these.

3. Coordinate and exchange information with the Specialist Committee on Ice with regard to the possible updating of ITTC Recommended Procedure 7.5-02-04-02.3, Manoeuvring in Ice.

4. Update 7.5-02-06-03 2014 Validation of Manoeuvring Simulation Models, including verification, sensitivity analysis, results from the SIMMAN conferences and step by step validation of manoeuvring models.

5. Investigate the missing elements in the Procedure on Uncertainty Analysis for Manoeuvring Prediction Based on Captive Model Tests, such as the accuracy of carriage kinematics and the data filtering (noise).Update 7.5-02-06-04 if necessary according to the requirements of the ISO GUM.

6. Update 7.5-02-06-02 Captive model test procedure to provide a definitive, agreed, method for each of the testing approaches.

7. Assist with the organization of SIMMAN 2019. Use the output from this conference and others to develop a guideline for the setup, execution of benchmark tests and use of benchmark data for manoeuvring.

8. Investigate the uncertainties associated with manoeuvring tests in shallow water including aspects such as structural strength of moveable bottoms, extent of gaps around the edges and the degree to which a fixed floor is level.

9. Investigate the results from the previous ITTC questionnaire on captive model tests especially related to concerns over turbulence stimulation and full scale effects; update 7.5-02-06-02, if necessary, concerning this matter.

10. Liaise with Specialist Committees on Combined CFD/EFD Methods and Manoeuvring in Waves as required.

11. Develop guidelines for the model testing and sea trials of autonomous underwater vehicles (AUV's) (resistance, maneuvering, propulsion and control, computational methods for the low Reynold's Number flow around AUV's).

Seakeeping Committee

Note: The Seakeeping Committee is primarily concerned with the behaviour of ships underway in waves. The Ocean Engineering Committee covers moored and dynamically positioned ships. For the 29th ITTC, the modelling and simulation of waves, wind and current is the primary responsibility of the Specialist Committee on Modelling of Environmental Conditions, with the cooperation of the Ocean Engineering, the Seakeeping and the Stability in Waves Committees.

1. Update the state-of-the-art for predicting the behaviour of ships in waves, emphasizing developments since the 2017 ITTC Conference. The committee report should include sections on:
   a. the potential impact of new technological developments on the ITTC
   b. new experiment techniques and extrapolation methods
   c. new benchmark data
   d. the practical applications of numerical simulation to seakeeping predictions and correlation to full scale
   e. the need for R&D for improving methods of model experiments, numerical modelling and full-scale measurements.

2. Review ITTC Recommended Procedures relevant to seakeeping, including CFD procedures, and
   a. identify any requirements for changes in the light of current practice, and, if approved by the Advisory Council, update them,
   b. identify the need for new procedures and outline the purpose and contents of these.

3. Update ITTC Recommended Procedure 7.5-02-07-02.5, Verification and Validation of Linear and Weakly Non-linear Seakeeping Computer Codes to include the verification and validation of ship hydro-elasticity codes in response to any comments from the ISSC Loads and Response Committee.

4. Update7.5-02-07-02.1 Seakeeping Experiments. The procedure should be extended to include the measurement of added resistance in waves with emphasis placed on the uncertainty in the measurement. Review procedures 7.5-02-07-02.2 and the new procedure on the calculation of the weather factor f_w in the EEDI formula to ensure that they are consistent with the proposed update.

5. Update Recommended Procedure 7.5-02-07-02.8 "Calculation of the weather factor f_w for decrease of ship speed in waves" to bring it in line with the terminology in the EEDI guidelines and submit to MEPC 72 (Spring, 2018). The submission should state that the procedure is applicable mainly for large ships and that additional work is required for smaller ships, and state the limit between large and smaller ships.

6. Expand Recommended Procedure 7.5-02-07-02.8 "Calculation of the weather factor f_w for decrease of ship speed in

waves"to include the uncertainty associated with each method

7. Update 7.5-02-07-02.2 Prediction of Power Increase in Irregular Waves from Model Tests should be modified to make it more comprehensible for the wider community outside of the ITTC.

8. Update ITTC Recommended Procedure 7.5-02-07-02.3 Experiments on Rarely Occurring Events to include the measurement and analysis of impulsive loads, peaks in pressures and maximum accelerations.

9. Liaise with SIW Committee on the updates to the guideline 7.5-02-07-04.3 for the prediction of the occurrence and magnitude of parametric rolling.

10. Develop a procedure for undertaking inclining tests at full scale include estimates of the measurement uncertainty. Liaise with the Stability in Waves Committee, as required.

11. Develop a procedure for conditioning a model for seakeeping tests, e.g. CG position, GM, moments of inertia. Include in the procedure estimates for measurement uncertainty.

12. Survey and/or collect benchmark data for ship structural hydroelasticity in waves and for added resistance in waves tests

13. Continue the collaboration with ISSC committees, including Loads and Responses and Environment Committees.

14. Undertake a complete review of the procedures related high speed marine vehicles (HSMV) and update according to recent advances in testing techniques, in particular,

a. Update the seakeeping related HSMV procedures
   - 7.5-02-05-04 Seakeeping tests
   - 7.5-02-05-06 Structural loads
   - 7.5-02-05-07 Dynamic instability

b. Develop a new procedure for motion control of HSMV during seakeeping tests
c. Use as a basis the reports of the various committees to undertake a review the state-of–the-art in seakeeping of HSMV.

Ocean Engineering Committee

Note: The Ocean Engineering Committee covers moored and dynamically positioned ships and floating structures. For the 29th ITTC, the modelling and simulation of waves, wind and current is the primary responsibility of the Specialist Committee on Modelling of Environmental Conditions, with the cooperation of the Ocean Engineering, the Seakeeping and the Stability in Waves Committees.

1. Update the state-of-the-art for predicting the behaviour of bottom founded or stationary floating structures, including moored and dynamically positioned ships, emphasizing developments since the 2017 ITTC Conference. The committee report should include sections on:
   a. the potential impact of new technological developments on the ITTC
   b. new experimental techniques and extrapolation methods
   c. new benchmark data
   d. the practical applications of computational methods to prediction and scaling
   e. the need for R&D for improving methods of model experiments, numerical modelling and full-scale measurements.

2. Review ITTC Recommended Procedures relevant to ocean engineering, including CFD procedures, and

a. identify any requirements for changes in the light of current practice, and, if approved by the Advisory Council, update them,
b. identify the need for new procedures and outline the purpose and contents of these.

3. Review the state-of-the-art in offshore aquaculture systems (deeper water, further from shore, not in sheltered waters), including harsher conditions, larger volumes and scaling of whole structure vs scaling forces acting on nets.

4. Review the state-of-the-art in model tests of cable/pipe dynamics close to the sea surface (substantial wave and current forces) (e.g. electric cables, hoses offloading). Rationale:
   a. Different from mooring lines: closer to surface (subject to wave forces) and flexible
   b. Different from risers: S-shape risers usually at very deep water, no need to consider wave forces
   c. Need to know more on the external forces for fatigue damage assessment / design
   d. Investigate dynamic interactions between 2 floating platforms and connecting flow lines.

5. Review the state-of-the-art in hybrid testing - software-in-the-loop tests for modelling wind forces. Rationale:
   a. Dominant frequencies are higher than those in hybrid mooring tests (wind change faster, quicker dynamics to be represented)
   b. Reference cases/tests to verify system – cases available are too different to be compared.
   c. Liaise with the SC on Hydrodynamic Testing of Marine Renewable Energy Devices for effects on wind turbine testing.

6. Extend experimental wave run-up benchmark tests (four squared vertical cylinders) to measure wave run-ups and global forces on cylinders and to investigate scale effect.

7. Carry out CFD benchmark study on two-body interactions, focusing on the investigation of viscous effects on the gap surface elevation using the benchmark experimental results produced by the 28th ITTC OE committee.

8. Review the state-of-the-art for large diameter flexible risers used for deep water mining.

9. Re-write Model Construction Procedure with focus on model construction issues (materials, tolerances, production methods, quality control, acceptance testing, etc.).

Stability in Waves Committee

Note: The Stability in Waves Committee covers the stability of intact and damaged ships in waves. For the 29th ITTC, the modelling and simulation of waves, wind and current is the primary responsibility of the Specialist Committee on Modelling of Environmental Conditions, with the cooperation of the Ocean Engineering, the Seakeeping and the Stability in Waves Committees.

1. Update the state-of-the-art for evaluating the stability of ships in adverse weather conditions, emphasizing developments since the 2017 ITTC conference. The committee report should include sections on:
   a. the potential impact of new technological developments on the ITTC
   b. new experimental techniques
   c. new benchmark data

d. the practical applications of computational methods to prediction
e. the need for R&D for improving methods of model experiments, numerical modelling.
f. Include wind and current effects on stability assessments (intact and damaged ship, experimental and numerical methods)
g. Review the effect of flooding on non-watertight bulkheads due to fire fighting for example.

2. Review ITTC Recommended Procedures relevant to stability, including CFD procedures, and
   a. identify any requirements for changes in the light of current practice, and, if approved by the Advisory Council, update them,
   b. identify the need for new procedures and outline the purpose and contents of these.

3. Review the IMO 2nd Generation Intact Stability Criteria and standards with particular focus on the physics and background for each of the stability failure modes. It may be useful to develop a fault tree to better identify each of the stability failure modes.

4. Provide a recommendation on developing a procedure, or a set of procedures, for the direct assessment (computational methods) of the IMO 2nd Generation Intact Stability Criteria five modes of intact stability failure.
5. Review the state-of-the-art (both the experimental and the numerical studies) for free roll decay, forced rolling and excited rolling tests. Include methods of analysing time histories of data obtained from such tests and ways of deriving roll damping coefficients. Liaise with the Specialist Committee on Combined CFD/EFD Methods, as required.

6. Update Procedure 7.5-02-07-04.5 to "~~Numerical~~ Estimation of Roll Damping", giving detailed guidance on how to carry out real or numerical model tests (e.g. free roll decay, forced rolling and excited rolling tests).

7. Updating the guideline 7.5-02-07-04.3 for the prediction of the occurrence and magnitude of parametric rolling towards a procedure. Liaise with the Seakeeping Committee as required.

8. Update Procedure 7.5-02-07-04.4 Numerical Simulation of Capsize Behaviour of Damaged Ships in Irregular Beam Seas, to include the complete 6 DoF equations of motion for a damaged ship and numerical methods for flooding based on more accurate hydraulic models (than estimated discharge coefficients).

9. Develop/suggest a method for estimating time to capsizing and/or sinking and include this in the report.

10. Continue the identification of benchmark data for validation of stability in waves predictions.

5.4 Terms of Reference for Specialist Committees

Specialist Committee on Hydrodynamic Modelling of Marine Renewable Energy Devices

1. Report on full scale installations
   a. Type of device
   b. Problems in installation
   c. Success of energy extraction
   d. Survivability

2. Wave Energy Converters (WEC)
   a. Monitor and report on new concepts for WEC's
   b. Develop guidelines for physical and numerical modelling of WEC's
   c. Review and report on the progress made on the modelling of arrays
   d. Continue to monitor developments in PTO modelling both for physical and numerical prediction of power capture
   e. Investigate Survivability for WEC

3. Current Turbines
   a. Develop specifications for benchmark tests (EFD and CFD) for current turbines
   b. Investigate effects and reproduction at model scale of inflow turbulence and unsteadiness to the turbine
   c. Review and report on the progress made on the modelling of arrays elaborating on wake interactions and impact on performance

4. Offshore Wind Turbines
   a. Monitor and report on recent research related to model tests of bottom-fixed offshore wind turbines including modelling the influence of structure stiffness and soil stiffness.
   b. Report on other existing regulations related to model tests of offshore wind turbines (e.g. IEC, classification societies, DoE) and draw on these regulations if considered relevant.
   c. Continue monitoring the development in model testing methodology with respect to Froude/Reynolds scaling issues and incorporating the control system strategies.
   d. Develop a guideline for uncertainty analysis for model testing of offshore wind turbines.

Specialist Committee on Hydrodynamic Noise

1. Present ITTC procedures and our community's capabilities to predict emitted noise from ships to the IMO. Specifically, an informative submission shall be made to MEPC 72 (Spring, 2018) of Guideline 7.5-02-01-05 Model-scale propeller cavitation noise measurements.

2. Monitor progress on shipping noise measurement procedures for shallow water and regulations as developed by ISO, classification societies and regulatory agencies.

3. Monitor progress on model-scale noise measurements with emphasis on facility reverberation and scaling of vortex cavitation noise.

4. Monitor progress on computational prediction of propeller noise with emphasis on methods using the acoustic analogy such as coupling CFD with FWHE.

5. Identify a benchmarking case for model-scale noise measurements that has
   a. full-scale underwater radiated noise measurements available,
   b. that is a representative merchant vessel and
   c. of which geometry and measurement data can be shared with the ITTC community

6. Maintain and update ITTC guideline 7.5-02-01-05: Model-Scale Propeller Cavitation Noise Measurements and guideline 7.5-04-04-01: Underwater Noise from Ships, Full-Scale Measurements.

Specialist Committee on Ships in Operation at Sea

1. Address the following aspects of the analysis of speed/power sea trial results:
   (1) Shallow-water correction
   Formulate, validate and recommend a single method for correcting speed/power sea trial measurements for shallow water effects based on first principles, using full scale and model scale tests and CFD analyses of a suitable range of vessel designs and sizes, water depths and ship speeds. (This task is considered the highest priority for the specialist committee and shall be commenced immediately. If possible, the procedure 7.5-04-01-01.1 shall be updated to incorporate the new procedure. If this is not possible , the specialist committee shall liaise with the Advisory Council on which action to take).
   (2) Wave correction at full scale
   a. More extensive validation of the present wave correction methods and expand range of application, introduce other methods where necessary.
   b. Monitoring the development of CFD methods for added resistance due to waves

   (3) Wind correction
   a. Guidelines on the location and height of the anemometer and whether a dedicated anemometer is necessary
   b. Investigate limitations of averaging wind correction method and suggest improvements
   c. Establish guideline for CFD to get wind coefficient.
   d. Extend wind coefficient database for more ships.
   e. Initiate and conduct benchmark study for evaluation of CFD applicability to determine the wind resistance coefficients.

   (4) Current correction
   a. Further validation on the present current correction methods.
   b. To find the possibility of using long track on 2 double runs.

   (5) Comprehensive correction
   a. Further validation on Extended-Power-Method
   b. More investigation on existing methods for the speed/power sea trial analysis，including the Combined Correction Method presented by H. Yasukawa (Ship Technology Research, Vol.62, No.3, 2015, pp.173-185.)

   (6) Study and validate model-ship correlation factors at different drafts when possible

   (7) Provide a practical guideline for installation of measuring equipment on a propeller shaft with regard to the shaft material properties (e.g. G modulus), shaft geometry and alignment.

   (8) Other
   a. Water temperature and density influence on ship's performance
   b. Noise in the measured data during the ship performance assessment and identify the method for filtering it.
   c. Measurement error and influence on power
   d. The applicability of unmanned (flying, floating or underwater...) vehicles and devices.

2. Update the speed/power sea trial procedures 7.5-04-01-01.1 where appropriate.

3. Update guideline to determine model-ship correlation factors at different draft.

4. Explore 'ship in service' issues, to get feedback to towing tanks with respect to:
   a. Key performance indicators identifying and establishing performance baseline when appropriate.
   b. More accurate measurement of environmental data, including wind, waves, current, etc, and comparison with forecast data when available.
   c. Speed-Power related info monitoring, including fuel consumption, shaft torque, speed, draught, trim and rudder angle etc.
   d. Noon reporting: Specification of minimum data required.
   e. To find possibilities to analyse ship performance, including speed-power relation, decrease of ship speed, etc. on a single run.
   f. The applicability of unmanned (flying, floating or underwater...) vehicles and devices.

5. Monitor the new information and communication (ICT) technologies applied on board ships to collect and process data as well as ship control systems, and identify their influence on ship performance prediction.

Specialist Committee on Ice

1. Continue to maintain, review and update existing accepted procedures and guidelines in accordance with current practice.

2. Review manoeuvring experiments in ice, and revise "7.5-02-04-02.3 Manoeuvring Tests in Ice" in cooperation with the Manoeuvring Committee.

3. Conduct survey of uncertainty in ice model experiments, and revise "7.5-02-04-02.5 Experimental Uncertainty Analysis for Ship Resistance in Ice Tank Testing."

4. Review of current analytical and numerical determination methods for the global ice load upon offshore structures of various types and compare to physical modeling

5. Survey testing of platforms and monopiles in ice (such as wind turbine in frozen ocean) and consider establishing a new guideline or enhancing existing guidelines to cover such situation.

6. Update the Guideline 7.5-02-07-01.3 “Guidelines for Modelling of Complex Ice Environments” to cover additional complex conditions.

Specialist Committee on Modelling of Environmental Conditions

1. Complete tasks originally assigned to committee i.e. propose and develop guidelines for generation of waves, wind and current in model scale. Each guideline should address the following problems:

   Waves:

   - Non-linear effects – analysis, control
   - Interactions with current and wind
   - Distribution of extremes
   - Wave grouping (characterization and reproduction)
   - Short-crested wave modelling
   - Deterministic generation of extreme waves
   - Confinement
   - Wave frequency and low frequency reflections
   - Radiation and reflection from model, beach, etc.

- Measurement and analysis of long- and short-crested waves
- Non-stationary power spectrum (time and space)
- Wave breaking – influence on statistics and kinematics
- Geographical consistency of wave spectrum selection
- Investigate techniques for modelling those aspects of the extreme wave environment that are important in the determination of the dynamic instability of intact vessels. Coordinate and exchange information with the Stability in Waves Committee on this task.

Wind:

- Interaction with waves
- Gusting (including squalls)
- Turbulence
- Vertical profiles
- Horizontal variation
- Measurements
- Geographical consistency of wind conditions

Current:

- Interactions with waves
- Turbulence
- Vertical profiles (including current reversal)
- Horizontal variation
- Measurements

2. Continue work of modelling of extreme wave environment including design wave groups.

3. Continue work on breaking waves
   a. Breaking kinematics and typology
   b. Effects of breaking waves on spectral content
   c. Statistics of breaking occurrence and spectral shapes
   d. Extreme wave generation and statistics.

4. Investigate and review state-of-the-art of wind-wave interactions and the effects on wave breaking.

5. Investigate and review state-of-the-art of wave-current interactions and the effects the generation of extreme waves.

Specialist Committee on Energy Saving Methods

1. Continue a systematic survey of energy saving methods (excluding machinery), devices, applications and possible savings, including the influence on the EEDI formula. Identify the effect of energy saving methods on different sea trial and EEDI drafts. Consider a complementary metric to EEDI to represent power savings.

2. Continue identifying and update the physical mechanisms for the newly introduced energy saving methods.

3. Update a survey on frictional drag reduction methods, including air lubrication and surface treatment.

4. Update a survey on energy savings based on the use of wind energy.

5. Develop guidelines for:
   a. CFD methods,
   b. model tests,
   c. scaling,
   for energy saving devices, taking into account Tokyo 2015 CFD workshop results investigating the influence of ESD.
   Continue to identify the needs for new model test procedures (resistance and propulsion, extrapolation methods) to investigate the effect of energy saving methods.

6. Collect full scale data obtained through relevant benchmark tests on the effect of energy saving methods. Use the full scale data for validating the effect of ESM. Develop a guideline to conduct in-service performance evaluation for ESM.

7. Identify and recommend the tasks related to energy saving methods and devices that should be undertaken during the 30th ITTC by general committees.

Specialist Committee on Combined CFD and EFD Methods

Background
CFD offers new possibilities to improve the EFD based predictions, for example with new treatment of scale effects. On the other hand, we can still not in general rely purely on CFD for ship hydrodynamic predictions for commercial or legal purposes. By using the best combination of CFD and EFD, rather than viewing them as competing methods, we can deliver even better prediction.
New methods based on EFD/CFD combinations need to have the same confidence level as the existing Recommended Procedures give to the end client today.

Purpose
The purpose of the committee is to initiate and support the process of introducing combined EFD/CFD methods in ITTC's procedures, with a focus on the predictions confidence level.

(Members of this committee should preferably have experience with model test as well as CFD work and with an understanding of the commercial and legal aspects of ship predictions. Each member should be expert in one area with some exposure in the other)

Terms of reference
Combined methods

1. Review recent studies on claimed problems of the current model test prediction methods, for example scale effects. Assess their levels of impact.
2. Review benchmark studies, accuracy, achievements and challenges of full scale ship CFD.

3. Review work on EFD/CFD combinations for relevant applications.

4. Suggest ways to improve the current recommended procedures by using CFD in combination with model test. Especially focusing on scaling procedures, starting with but not limited to the calm water speed power prediction.

5. Suggest which other parts of the ITTC procedures that could benefit from combined methods in future work.

Confidence of predictions

6. Review past work and procedures, within and outside ITTC, on CFD uncertainty, validation & verification (V&V), applied to the marine and other business sectors.

7. Suggest practical procedures to ensure the quality of CFD/EFD combined predictions to the end user, especially when applied to speed power predictions. This includes the demonstration of V&V and uncertainty assessment of commercially or legally valid predictions.

Interactions

8. Liaise and cooperate actively with the ITTC TC of related technical areas. Suggest modifications of the relevant Recommended Procedures related to CFD/EFD combinations where applicable.

9. Liaise and cooperate actively with the "CFD Workshop" committee and other groups that deal with CFD benchmark and V&V. Consider their results and suggest further work.

10. Act as a research coordinator for other researchers who wish to contribute: Suggest research topics that lead towards the given committee goals, assembly and review ongoing work.

Presentation of result

11. Apart from the normal committee report, the work should also be presented in a format directed towards the typical receiver of ship predictions including both ship owners and authorities. This should include discussions on accuracy of respective method (CFD and EFD), reasonable requirements to uncertainty demonstration, and description of new combined methods.

Specialist Committee on Manoeuvring in Waves

For the 29th ITTC, the Specialist Committee on Manoeuvring in Waves has the responsibility for bringing together the two disciplines of calm water manoeuvring and classical seakeeping. The tasks to be addressed by the specialist committee include:

1. Define the overall framework for what manoeuvring in waves means.

2. Present the state of the art based on a comprehensive literature review, drawing knowledge from the SIMMAN workshops.

3. Create a guideline for benchmark tests on manoeuvring in waves, in cooperation with SIMMAN. Consideration should be given to the generation of data for the validation of numerical tools.

4. Investigate the methodology needed to combine experimental tests and numerical tools.

5. Investigate new manoeuvres to assess minimum power requirements (e.g. return to head waves).

6. Address the issues brought about from IMO-MEPC71 and following meetings concerning the minimum power requirements, including issues on manoeuvrability under adverse weather.

7. Validate the Level 2 – Simplified Assessment Method of the 2013 Interim Guidelines (MEPC.1/Circ.850).

8. Liaise with IMO and/or IACS to address manoeuvring in waves.

9. Liaise with the Manoeuvring Committee, the Seakeeping Committee and the Stability in Waves committee.

10. Establish a mathematical model for manoeuvring in waves

5.5 Terms of Reference for the Groups

Quality Systems Group

1. Update all ITTC Recommended Procedures and Guidelines to conform to the requirements of Recommended Procedure 4.2.3-01-03, Work Instruction for Formatting ITTC Recommended Procedures and Guidelines.

2. Support the Technical Committees in their work on Recommended Procedures. Supply the chairmen of the new committees with the MS Word versions of the relevant procedures.

3. Maintain the Manual of ITTC Recommended Procedures and Guidelines. Co-ordinate the modification and re-editing of the existing procedures according to the comments made by ITTC member organizations at the Conference and by the Technical Committees.

4. Observe the development or revision of ISO Standards regarding Quality Control.

5. Update the ITTC Symbols and Terminology List. Consolidate some inconsistencies in the use of symbols and add recognized symbols not contained in the S&T list to the list (such as RAW, *R*wave, rho ad rho0).

6. Update the ITTC Dictionary of Hydromechanics.

7. Revise and update the existing ITTC Recommended Procedures according to the comments of Advisory Council, Technical Committees and the Conference.

8. After the third AC Meeting, review and edit new ITTC Recommended Procedures with regard to formal Quality System requirements including format and compliance of the symbols with the ITTC Symbols and Terminology List.

9. Support the Technical Committees with guidance on development, revision and update of uncertainty analysis procedures.

10. Observe ISO standards for uncertainty analysis, in particular the uncertainty analysis terminology.

11. Review developments in metrology theory and uncertainty analysis and issue appropriate Procedures.

12. Continue to maintain the online Wiki keeping it up to date and in line with the adopted documents of the ITTC.

13. At the beginning of the period, organize an electronic repository of information and data on the benchmarks cases. ITTC member organizations should then be invited to participate in the adoption of the benchmark and contribute to the database.