
# Appendix 3

## Tasks and structure of the 28th ITTC technical committees and groups

### 1. STRUCTURE OF TECHNICAL COMMITTEES

The structure of the technical committees includes six General Committees, six 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 terms studies with broad impact.

An important part of the work of the General Committees will be to establish 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 General Committees will develop detailed plans in accordance with Conference Recommendations and their work should be directed towards the techniques and 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. Procedures and Guidelines shall contain only techniques which are applicable in commercial practice.

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 of 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 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 technical 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 of 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 a statement of the technical aims and objectives for the work of the Specialist Committee.

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

When the Advisory Council has agreed 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 28TH ITTC

### 4.1 General Committees

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

### 4.2 Specialist Committees

- Performance of Ships in Service
- Hydrodynamic Noise
- Hydrodynamic Modelling of Marine Renewable Energy Devices
- Ice
- Energy Saving Methods
- Modelling of Environmental Conditions

### 4.3 Groups

- Quality Systems Group

## 5. TASKS OF THE TECHNICAL COMMITTEES AND GROUPS OF THE 28TH 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 Committee with regard to reduction of the work.

2. Each technical committee shall consider any unfinished items from previous committees and report to the Advisory Council by 1st December 2014 in order to clarify whether these items should be included in the Terms of Reference.

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

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. 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 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.

6. 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.

7. Committees that have a task to review ITTC Recommended Procedures shall identify and report any changes proposed in their first annual report to the Advisory Council. The changes approved by the Advisory Council should be implemented in the second year and the draft revised procedure submitted to the Advisory Council for comment.

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

9. 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.

10. 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 procedure or guideline shall be prepared during the second year and submitted to the Advisory Council for review.

11. All new and revised procedures shall, as far as feasible, include a procedure for uncertainty analysis.

12. New and revised draft procedures shall subsequently be updated, incorporating the comments made by the Advisory Council, and in February of the third year be submitted to the Advisory Council for final review and approval. Thereafter, the Quality Systems Group shall perform a formal check of the procedures.

13. 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 Terms of Reference for the General Committees

### Resistance Committee

1. Update the state-of-the-art for predicting the resistance of different ship concepts emphasizing developments since the 2014 ITTC Full 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 resistance predictions and scaling
e. 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 and resistance specific 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 definitions of ship surface roughness and develop a guideline for its measurement, hereunder resolve differences between ISO 4287 and the widely used BMT roughness measurement system. Include effect of coatings and through-life changes.

4. Review trends and new developments on understanding the phenomenon of unsteady free surface flows, including their influence on added resistance and experimental techniques.

5. Develop a new procedure for measurement of wave pattern generated by the hull model , and wave resistance analysis, including its influence through uncertainty analysis for extrapolation.

6. Review roughness of models and appendages produced by rapid prototyping. Assess effects of this roughness on resistance.

7. Propose guidance for ITTC members to reduce/manage their uncertainty as a result of the worldwide resistance benchmark tests of previous ITTCs.

8. Review turbulence stimulation methods and devices from the point of view of their physics and update the relevant procedure 7.5-01-01-01 Ship models. Check occurrence of turbulence stimulation methods in other procedures and update as needed.

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

10. An ITTC benchmark study shall be initiated according to 7.5-01-03-04 Benchmark for PIV (2C) and SPIV (3C) setups. The benchmark study would involve PIV measurements performed on a flow of interest, with fully detailed uncertainty analysis. The results can then be compared with similar measurements done in different facilities or with high-quality CFD computations from various organizations.

**Propulsion Committee**

1. Update the state-of-the-art for predicting the propulsive performance of ships, emphasizing developments since the 2014 ITTC Conference. The committee report should include sections on:
   a. The potential impact of new technological developments on the ITTC including new types of propulsors (e.g. hybrid propulsors), azimuthing thrusters and propulsors with flexible blades
   b. New experimental techniques and extrapolation methods
   c. New benchmark data
   d. The practical applications of computational methods to the propulsion systems 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
   g. Monitoring the developments regarding high-speed marine vehicles.

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

3. Liaise with the Specialist Committee on Energy Saving Methods on subjects of common interest.

4. Liaise with the Specialist Committee on Performance of Ships in Service regarding consequences of EEDI, especially with respect to ITTC Recommended Procedure 7.5-02-03-01.4, 1978 ITTC Performance Prediction Method, with special emphasis on the proposed value of the propeller roughness (to high), $\Delta C_F$ and $C_A$, also for different draft conditions. Harmonize the formulae in ITTC Recommended Procedures 7.5-02-03-01.4 and 7.5-02-03-01.2.

5. Develop new roughness correction methods for both hull and propeller.

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

7. Review and update guideline 7.5-02-03-01.6, Hybrid Contra-Rotating Shaft Propulsors Model Test.

8. Review and update, if required, Recommended Procedure 7.5-02-05-03.2 Waterjet System Performance.

9. Develop an extension of the existing procedure 7.5-02-03-01.4, 1978 ITTC Performance Prediction Method for triple shaft vessels.

10. Examine methods of target wake simulation with the support of CFD (smart dummy).

11. Continue the given task 8 from the former period (Examine the possibilities of CFD methods regarding scaling of unconventional propeller open water data. Initiate a comparative CFD calculation project).

12. Monitor the use of and, if possible, develop guidelines for quasi-steady open water propeller and propulsion model tests.

**Manoeuvring Committee**

1. Update the state-of-the-art for predicting the manoeuvring behaviour of ships, emphasizing developments since the 2014 ITTC Conference. The committee report should include sections on:
   a. the potential impact of new technological developments on the ITTC
   b. developments in manoeuvring and especially course keeping in waves
   c. new experiment techniques and extrapolation methods
   d. the practical applications of computational methods to manoeuvring predictions and scaling, including CFD methods
   e. the need for R&D for improving methods of model experiments, numerical modelling and full-scale measurements
   f. the effects of free surface, roll, sinkage, heel and trim in numerical simulation of manoeuvring.

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. Liaise 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 ITTC Recommended Procedure 7.5-04-02-01, Full Scale Manoeuvring Trials Procedure. Include consideration of full scale to model scale correlation. In particular, examine the model scale to full scale correlation of steering control in manoeuvring.

5. Update ITTC Recommended Procedure 7.5-02-06-02, Captive Model Test Procedure, with particular attention to the use of PMM and hexapod.

6. Continue work in order to have a full set of benchmark data for each of the benchmark hulls (KVLCC2, KCS, 5415, HTC, SUBOFF and S175 – manoeuvring in waves).

7. Extend the uncertainty analysis for captive model tests from measurements towards a new procedure that provides the uncertainty analysis for the use of captive model tests in the

predictions of manoeuvring. Elaborate with an example.

8. Develop a procedure for verification and validation of ship manoeuvring simulation methods, including CFD.

9. Review testing methods for ships in ports and harbours, including ship mooring loads, safe speed limits for moving and its impact on moored vessels, manoeuvring concerns such as squat and bank effects.

10. Conduct a concise review and report on the specific aspects of the manoeuvring of vessels in restricted waters such as ports and harbours.

11. Organize a joint workshop on manoeuvring in waves with the Seakeeping and the Stability in Waves Committees and the Specialist Committee on Performance of Ships in Service, for example on the subject of minimum power requirements for safe manoeuvring in adverse sea conditions and model testing methods to investigate this.

**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 28th 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 2014 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 computational methods to seakeeping predictions and scaling, including CFD methods
   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. It is recommended that the developed section/procedure is reviewed by ISSC Loads and Response Committee.

4. Update ITTC Recommended Procedure 7.5-02-07-02.1, Seakeeping Experiments, to include tests specific to active stabilization systems, with particular attention to modeling the control system and prediction of full scale behaviour. If possible, update the corresponding procedure for high speed craft.

5. Review ITTC Recommended Procedures 7.5-02-05-06, Structural Loads, and 7.5-02-05-07, Dynamic Instability Tests, and propose updates, if any.

6. Develop a new procedure for the determination of speed reduction coefficient $f_w$. Liaise with the Specialist Committee on Performance of Ships in Service.

7. Develop a new procedure for model scale sloshing experiments.

8. Review the research considering the impact of seakeeping on propulsion and manoeuvring performance. Liaise with the Manoeuvring Committee.

9. Survey and/or collect benchmark data for seakeeping problems, such as motion, loads, sloshing, slamming, added resistance, full-scale measurements.

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

11. Support a joint workshop on manoeuvring in waves with the Manoeuvring and the Stability in Waves Committees and the Specialist Committee on Performance of Ships in Service, for example on the subject of minimum power requirements for safe manoeuvring in adverse sea conditions and model testing methods to investigate this.

**Ocean Engineering Committee**

*Note: The Ocean Engineering Committee covers moored and dynamically positioned ships and floating structures. For the 28th 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 2014 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. Complete the VIM guideline 7.5-02-07-03.11, which was initiated by the Ocean Engineering Committee of the 27th ITTC.

4. Continue work to further quantify the uncertainty sources in ocean engineering model tests. Prepare a list of uncertainty parameters with quantified values and conduct comprehensive uncertainty analyses for selected tests. Collaborate with the Seakeeping Committee and the Specialist Committee on Modelling of Environmental Conditions.

5. Investigate the modelling of wind for Ocean Engineering tests with attention to inflow conditions in cooperation with the Specialist Committee on Modelling of Environmental Conditions.

6. Develop a guideline for model tests of multi-bodies operating in close proximity.

7. Develop a procedure for the analysis of model tests in irregular waves.

8. Continue investigating thruster-thruster interaction, ventilation and their scaling for DP systems.

9. Conduct a concise review and report on specific aspects of moored structures and vessels in port such as the effects of passing ships and harbor resonance.

10. Continue wave run-up benchmark studies for cases of four columns (circular and square cross-sections) using the experimental data from Marintek.

11. Review the state-of-the-art in offshore mining, including model testing methods.

**Stability in Waves Committee**

*Note: The Stability in Waves Committee covers the stability of intact and damaged ships in waves. For the 28th 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 stability of ships in waves, emphasizing developments since the 2014 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 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. Update ITTC Recommended Procedure 7.5-02-07-04.1, Model Tests on Intact Stability, to include uncertainty analysis of measurements, including an example.

4. Consider whether the guideline for the prediction of the occurrence and magnitude of parametric rolling should be updated to a procedure.

5. Continue to investigate the criteria for modelling wave spectra in the determination of dynamic instability of intact vessels, i.e. wave steepness, non-linearity, frequency contents of the spectrum, statistical distribution of wave and crest height and spatial behaviour of the waves. Liaise with the Specialist Committee on Modelling of Environmental Conditions.

6. Include in the report an example of uncertainty analysis in measurements for damage stability model tests.

7. Review surface tracking methods for measuring flow between compartments of damaged ships.

8. Review the current approaches for quantifying time to loss and report in the impact for model testing.

9. Examine the model scale to full scale correlation of steering control and active motion control in extreme waves.

10. Support a joint workshop on manoeuvring in waves with the Manoeuvring and the Seakeeping Committees and the Specialist Committee on Performance of Ships in Service, for example on the subject of minimum power requirements for safe manoeuvring in adverse sea conditions and model testing methods to investigate this.
11. Continue cooperation with IMO SDC (formerly SLF) subcommittee.

## 5.3 Terms of Reference for Specialist Committees

**Specialist Committee on Hydrodynamic Modelling of Marine Renewable Energy Devices**

Work relating to wave energy converters (WEC):

1. Develop guidelines for uncertainty prediction for WECs.

2. Monitor and report on developments in power take-off (PTO) modelling both for physical and numerical prediction of power capture.

3. Review and report on the progress made on the modelling of WEC arrays.

4. Review and report on challenges associated with the performance of WECs in irregular wave spectra, particularly as it relates to physical modelling.

5. Check willingness of participants for the "round-robin" test campaign before starting work.

6. Review and report on integrated WEC simulation tools based on multi-body solvers which are in development.

Work relating to current turbines:

1. Develop specific uncertainty analysis guidelines / example for horizontal axis turbines

2. Report on development in physical and numerical techniques for prediction of performance of current turbines, with particular emphasis on unsteady flows, off-axis conditions, and other phenomena which offer particular challenges to current devices.

3. Report on the progress made on the modelling of arrays.

4. Report on progress in testing at full-scale and moderate scale in-sea test sites.

Work relating to offshore wind:

1. Wind Field Modelling including Froude/Reynolds scaling challenges for the turbine in cooperation with the Specialist Committee on Modelling of Environmental Conditions.

2. The impact of control strategies and other features on full-scale devices on global response to allow improved understanding of the impact of simplifications adopted in model tests.

3. Report on integrated tools for simulation of floating wind turbine including platform, mooring, turbine and control system.

4. Report on developments in full-scale demonstrators of floating wind turbines.

**Specialist Committee on Hydrodynamic Noise**

1. Continue development of the guidelines produced during the 27th ITTC and monitor how these guidelines are being implemented by the towing tank community.

2. Identify scale effects in prediction of hydrodynamically generated noises (flow noise, cavitation noise, etc.).

3. Examine the possibilities to predict full scale values (correlation and operational requirements) from model scale noise measurements.

4. Review uncertainties associated with model scale noise measure-

ments and full scale noise measurements, including variability between sister ships and influence of operational conditions during sea trials, such as manoeuvring and sea state.

5. Check the existing methodologies regarding full scale noise measurements in shallow and restricted water and provide, if possible, guidelines. Establish communication with ISO working groups active on this topic.

6. Update the overview of national and international regulations and standards regarding hydrodynamic noise.

7. Review the developments of predicting methods (theoretical and numerical) for underwater noise sources characterisation and for far field propagation.

8. Define and, if possible, conduct benchmarking tests of model test noise measurements, preferably for a ship for which full scale noise measurements are available.

**Specialist Committee on Performance on Ships in Service**

The purpose of the committee is to improve the performance predictions (especially for large ships) for service conditions covering the whole life-cycle of the ship, keeping in mind the EEDI and EEOI development within IMO.

1. Liaise with the Resistance, Propulsion and Seakeeping Committees as relevant, specifically with regard to estimating $f_w$, in the EEDI calculation and $C_A$ guideline.

2. Monitor and review the state of the art for EEDI and EEOI prediction and determination methods, including CFD based methods.

3. Monitor and review the state of the art with regard to minimum power requirements for safe and effective manoeuvring and requirements arising from the EEDI formula (sea margin).

4. Investigate the following aspects of the analysis of speed/power sea trial results:
   a. Temperature and density correction to take into account temperature/density gradient
   b. ISO proposed ‘iterative method' as an alternative for load variation method and current elimination.
   c. Statistical properties for the results of load variation tests
   d. New shallow water correction method to replace Lackenby
   e. Influence of headings and wind on sea trials
   f. Wave limits for the wave correction methods
   g. Application of CFD methods for wind loads
   h. Expansion of the wind coefficient database for more ship types
   i. More extensive validation of the wave correction methods (STA I , STA2, NMRI)
   j. Feedback of speed/power data for correlation purpose especially for the design and EEDI draft.

5. On the basis of the results of these investigations update the speed/power sea trial procedures 7.5-04-01-01.1 and -01.2.

6. Explore "Ship in Service" issues
   a. Investigate the monitoring and analysis of speed/power performance of ships in service
   b. Investigate feedback of speed power data to seakeeping committee to get reliable data for $f_w$ from full-scale measurements
   c. Investigate feedback of speed/power data for $f_w$
   d. Investigate the influence of ship hull surface degradation due to fouling and aging on the speed/power performance and consider the related EEOI issues originating from IMO requirements
   e. Establish a guideline for the use of $C_A$ for different draft conditions.

**Specialist Committee on Ice**

1. Finalize the updating of the guidelines commenced during the 27th ITTC, including:
   7.5-02-04-01and 7.5-02-04-02.1.

2. Revise the following procedures:
   - 7.5-02-04-02.3 Maneuvering Tests In Ice (liaise with the Manoeuvring Committee)
   - 7.5-02-04-02.2 Propulsion Test in Ice (liaise with the Propulsion Committee)
   - 7.5-04-03-01 Ship trials in ice
   - 7.5-02-04-02.5 Experimental Uncertainty Analysis for Ship Resistance in Ice Tank Testing

3. Review the following items with a view to developing procedures and guidelines in the future:
   - Station keeping in ice, for moored, DP and thruster-assisted moored structures and ships.
   - Offshore structures – fixed and floating
   - Scalability of ice with the goal of new guidelines on full-scale ice property testing
   - Brash Ice characterization and modelling.

4. Evaluate numerical and semi-empirical prediction for operation in ice.

**Specialist Committee on Modelling of Environmental Conditions**

This new committee will deal with the modelling of realistic environmental conditions in a reliable, reproducible way in a model basin. During the first period, the focus of the committee shall be in order of priority, waves, wind and current.

1. Review the report of Ocean Engineering Committee of the 24th ITTC (2005)

2. Propose and develop guidelines where appropriate.

Suggested topics may include:

Waves:

1. Non-linear effects – analysis, control

2. Interactions with current and wind
3. Distribution of extremes
4. Wave grouping (characterization and reproduction)
5. Short-crested wave modelling
6. Deterministic generation of extreme waves
7. Confinement
   a. Wave frequency and low frequency reflections
   b. Radiation and reflection from model, beach, etc.
8. Measurement and analysis of long- and short-crested waves
9. Non-stationary power spectrum (time and space)
10. Wave breaking – influence on statistics and kinematics
11. Geographical consistency of wave spectrum selection

Wind:

1. Interaction with waves
2. Gusting (including squalls)
3. Turbulence
4. Vertical profiles
5. Horizontal variation
6. Measurements
7. Geographical consistency of wind conditions

Current:

1. Interactions with waves
2. Turbulence
3. Vertical profiles (including current reversal)
4. Horizontal variation
5. Measurements

**Specialist Committee on Energy Saving Methods**

1. Conduct a systematic survey of energy saving methods, devices, applications and possible savings, including the influence on the EEDI formula.
2. Identify the physical mechanisms on energy saving on ships.
3. Conduct a survey on the frictional drag reduction methods, including air lubrication and surface treatment.
4. Conduct a survey on energy savings based on the use of wind energy.
5. Monitor the CFD methods, model tests and scaling procedures for energy saving devices.
6. Conduct a survey on existing full scale data on the effect of energy saving methods.
7. Identify the needs for new model test procedures (resistance and pro-

pulsion, extrapolation methods) to investigate the effect of energy saving methods.

### 5.4 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 SaT list to the list(such as RAW, Rwave, rho ad rho0).

6. To further develop a liaison with ISO with a view to reconcile the differences in definitions between ISO standards 15016, EEDI definitions and ITTC definitions as laid down in the procedures 7.5-04-01-01.1 and -01.2

7. Update the ITTC Dictionary of Hydromechanics.

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

9. 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.

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

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

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

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

14. To develop a procedure on the determination of a type A uncertainty estimate of a mean value from signal analysis, based on Brouwer et al. (2013). This analysis provides an uncertainty estimate in cases where instead of multiple repeat or reproduction measurements, only a single time series is available.

15. To develop a guideline with working title: “Guideline to Practical Implementation of Uncertainty Analysis”.

16. 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.

17. Survey the extent and breadth of uptake of uncertainty analysis techniques and procedures by the hydrodynamic testing community.

18. Include new sections in the Dictionary dedicated to Offshore Engineering, Planing Craft and Pods.