ICE Committees and ice related work at ITTC
a short review

Harri Soininen, VTT

The early years

- The first time the heading ice emerges on the ITTC proceeding is Ottawa 1975, 14th ITTC – a group discussion: ”Testing in Ice”
- A ”Panel of Testing in Ice” was established for the 15th ITTC and it gave its first report at the Hague 1978
- Ice work within ITTC has always been the matter of just few interested parties – the community is small

Areas of consideration (15th ITTC, the Hague 1978)

Laboratory tests

- Model material
  - similarity
  - preparation
  - properties
- Modeling environment
  - level ice
  - ridged ice
  - ice under pressure
  - broken channel ice
  - floe conditions

Areas of consideration (15th ITTC, the Hague 1978)

Laboratory tests

- Testing procedures
  - Towing
  - Self-propelled
  - Manoeuvring
- Analysis
  - Presentation
  - Format
    - » recommended standardized resistance equation
    - » units and symbols
  - Method and non-dimensional parameters

Areas of consideration (15th ITTC the Hague 1978)

Full scale tests

- Ice
  - Properties
  - Conditions
- Testing procedure
  - Continuous mode
  - Non-continuous mode
  - Manoeuvring

Areas of consideration (15th ITTC the Hague 1978)

Full scale tests

- Ship performance measurements
  - Trial
  - Voyage
- Analysis
  - Presentation
  - Format
    - » Recommended standardized resistance equation
    - » Units and symbols

Model-full scale correlation

Work after the Hague, 15th ITTC

- 16th ITTC, Leningrad
  - Friction
  - Model ice properties, elasticity/strength
  - Comparison of tests performed for an LNG-carrier at four basins (30% difference in speed predictions)
  - Preparations for comparative tests with a R-class icebreaker model
  - Word offshore emerging
  - List of symbols
  - Theoretical work
- 17th ITTC, Gothenburg
  - R-class comparative tests results –Power vs speed 20-30% differencies
  - Friction
  - Ridges
  - Propulsion tests

Work after Gothenburg, 17th ITTC

- 18th ITTC, Kobe
  - More tests of R-class icebreaker
  - Friction
  - Offshore
- 19th ITTC, Madrid
  - Friction
  - Model ice properties
  - Propulsion tests in ice
  - Offshore structures, comparative tests with a cylindrical structure initiated
  - R-class model some re-analysis
- 20th ITTC, San Fransisco
  - Analysis of cylinder tests
  - Recommended methods for ice properties tests for level ice
  - Ice load calculation methods
  - Model propulsion tests in ice

Work after San Fransisco, 20th ITTC

- 21st ITTC, Trondheim
  - Recommended procedures for tests in ice
    - Parameters to be measured in various test types
  - Recommendations for ship trials in ice
  - Comparative cylinder tests, some reanalysis
  - Propeller/ice interaction tests
- 22nd ITTC Seul&Shanghai
  - Model ice properties measurements
  - Questionnaires: deformed ice tests, offshore structure tests
- 23rd ITTC, Venice
  - 3 procedures reviewed: ice model tests in general , resistance testing in level ice, model ice measurements,
  - Uncertainty analysis in ice model testing
  - A short discussion on iceberg impact tests
- 24th ITTC, Edinburgh
  - Umcertainty analysis in ice model testing
  - Numerical methods, questionnaire
  - Remote sensing of sea ice

Greatest achievments

- **R-class comparative tests**
- **Cylindrical offshore structure comparative tests**
- **The three procedures (especially methods for measuring model ice properties)**

Committee memberships

- The ice community is has alwasys been quite small
- At its maximum 13 institutes responded to some questionnaire regarding methods applied in offshore structure testing
- The Committee membership has often been a kind of a hobby of some interested individuals.
- In the 70´ies and 80´ies some strong individuals within the field dominated the work.
- The 23 rd ITTC saw a collapse in the committee mebership, just four persons, five persons at 24th and 25th

Work still to be performed

- Scale effect is not quite undestood - the model tests are performed with a friction factor 0.05 between the hull and ice, in full scale the factor is 0.10-0.15
- The tests in broken ice are not standardised (speed in broken ice is an important information in practice) –modelling of broken ice mass in fairways is not well covered.
- Modelling ridge mass and accordingly tests in ridges are not very well covered
- The dynamics of level ice breaking in thin ice should be better understood –the achievable speed in thin ice is in practice an important information
- More understanding of effects of model ice properties to the ice failure modes against offshore structures

Conclusion

- The greatest achievments:
  - R-class comparative test
  - Cylindrical offshore structure comparative tests
  - The three procedures (especially methods for measuring model ice properties)
- A lot to do still:
  - Friction
  - Propulsion tests
  - Tests in deformed ice

- Navigation in ice infested waters and offsore activities in polar regions are a growing trend (global warming may accelerate this development) - for the ice community to be scinetifically credible work should be done within ITTC