Quality Systems Group

Final Report and Recommendations to the 27th ITTC

Copenhagen

Monday, 1 September 2014

Membership and Meetings

Benedetti L., CNR-INSEAN (Secretary)
Derradji A., NRC
Ferrando M., University of Genova, (Chair)
Johnson B., US Naval Academy (senior)
Kobayashi E., Kobe Univ.
Morabito M. G., US Naval Academy
Park J. T. NSWC Carderock Div.
Pérez Rojas Luis, ETSIN
Sena Sales Jr J., LabOceano
van Rijsbergen M., MARIN
Woodward M. D., Newcastle Univ.

From March 4th 2013 **Morabito M. G.**, US Naval Academy replaced Johnson B.,

US Naval Academy. **Professor B. Johnson** will remain a corresponding member of the group.

From September 2013 **Park J. T.** Naval Surface Warfare Center Carderock Div. replaced Derradji A., NRC

Membership and Meetings

The Group held four meetings as follows:

Rio de Janeiro, September 3rd 2011 *during ITTC 26th*

Madrid, June 25th to 27th 2012

Annapolis, July 1st to 3rd 2013

Genoa, January 27th to 29th 2014.

PERFORMED TASKS according to ToR

Include a definition of the terms Verification and Validation in the ITTC documents
Maintain the Manual of ITTC Recommended Procedures and Guidelines
Support technical committees in their work on Recommended Procedures
Observe the development or revision of ISO Standards regarding Quality Control
Update the ITTC Symbols and Terminology List
Update the ITTC Dictionary of Hydromechanics

PERFORMED TASKS according to ToR

Cross-check the ITTC Symbols List and the Dictionary with other standards e.g. ISO
Revise and update the existing ITTC Recommended Procedures
Review and edit new ITTC Recommended Procedures with regard to formal Quality System requirements
Follow the implementation of the Benchmark data repository
Support the technical committees with guidance on development, revision and update of uncertainty analysis procedures
Observe ISO standards for uncertainty analysis
Maintain Wiki for the 27th ITTC as a trial period and create link to it from the ITTC website

Include a definition of the terms Verification and Validation in the ITTC documents

Verification is the process of determining that a model or simulation implementation accurately represents the developer's conceptual description and specification. (i.e., does the code accurately implement the theory that is proposed to model the problem at hand?)

Validation is the process of determining the degree to which a model or simulation is an accurate representation of the real world from the perspective of the intended uses of the model or simulation. (i.e., does the theory and the code that implements the theory accurately model the relevant physical problem of interest?)

Accreditation is the official determination that a model or simulation, is acceptable for use for a specific purpose. (i.e., is the theory and the code that implements it adequate for modeling the physics relevant to a specific platform? In other words, are the theory and code relevant to the type of vessel for which it is being accredited?)

Maintain the Manual of ITTC Recommended Procedures and Guidelines

The revision of the Manual of ITTC Recommended Procedures and Guidelines concerned 54 documents:

- **2** existing procedures were deleted
- **17** new Procedures/Guidelines have been evaluated, 16 have been approved and one postponed
- **35** existing procedures have been reviewed or updated, the revision of **3** of which has been postponed.

Support technical committees in their work on Recommended Procedures

Relevant instructions and files containing the procedures to be updated, together with the template to be used for drafting new procedures has been sent to the Chairmen of the ITTC Committees throughout the 3 years of activity.

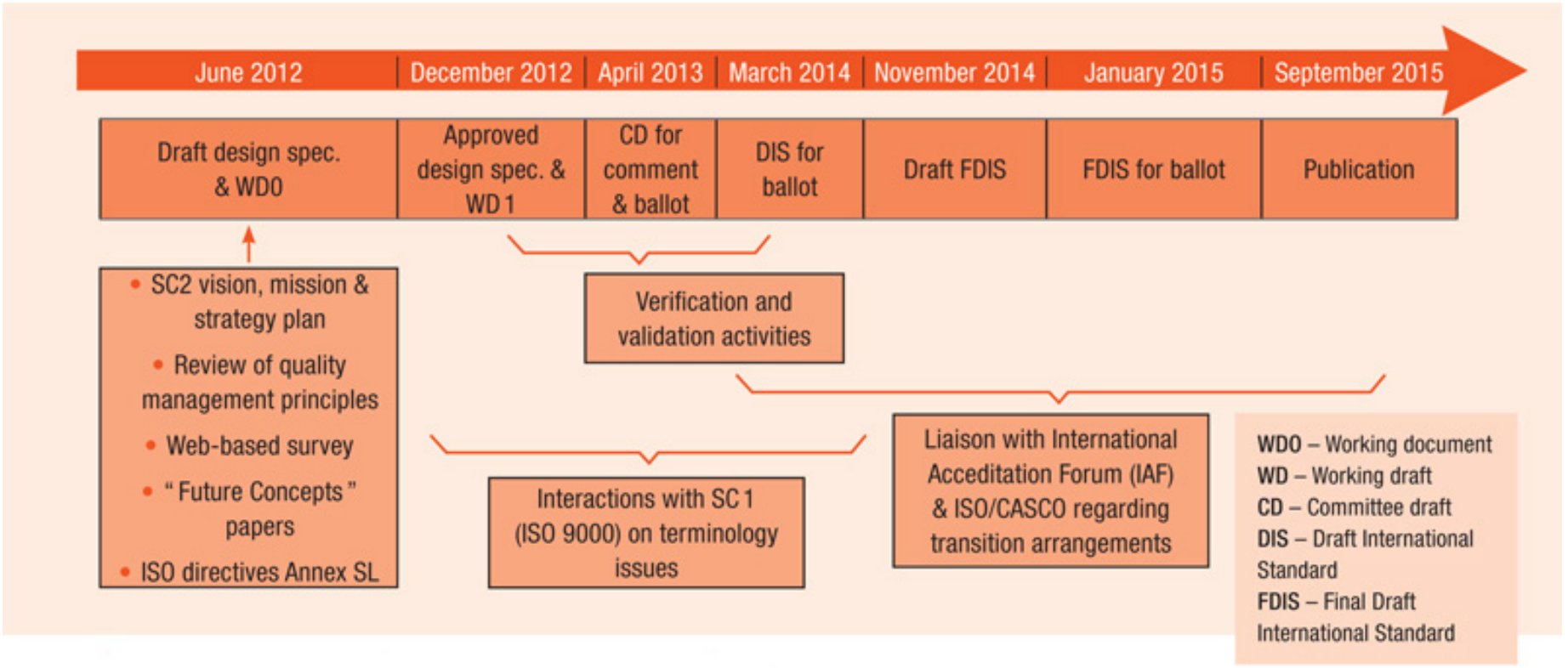
Observe the development or revision of ISO Standards regarding Quality Control

Outline

- New ISO 9000: changes and schedule
- One step more: ISO 17025.

New ISO 9000: Schedule

Observe the development or revision of ISO Standards regarding Quality Control



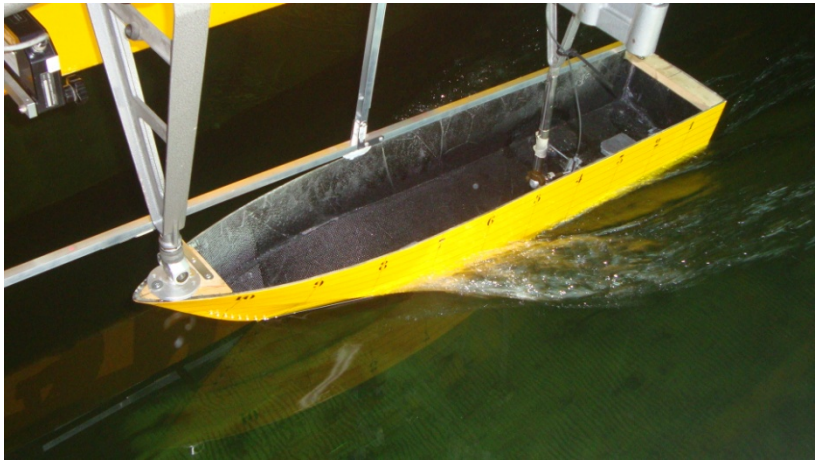
Observe the development or revision of ISO Standards regarding Quality Control

New ISO 9000: Differences

ISO 9001:2008	ISO 9001:2015
0. Introduction	0. Introduction
1. Scope	1. Scope
2. Normative Reference	2. Normative Reference
3. Terms and Definitions	3. Terms and Definitions
4. Quality Management System	4. Context of the organization
5. Management Responsibility	5. Leadership
	6. Planning
6. Resource Management	7. Support
7. Product Realisation	8. Operation
8. Measurement, Analysis and Improvement	9. Performance Evaluation
	10. Improvement

Observe the development or revision of ISO Standards regarding Quality Control

New ISO 9000: Technical procedures

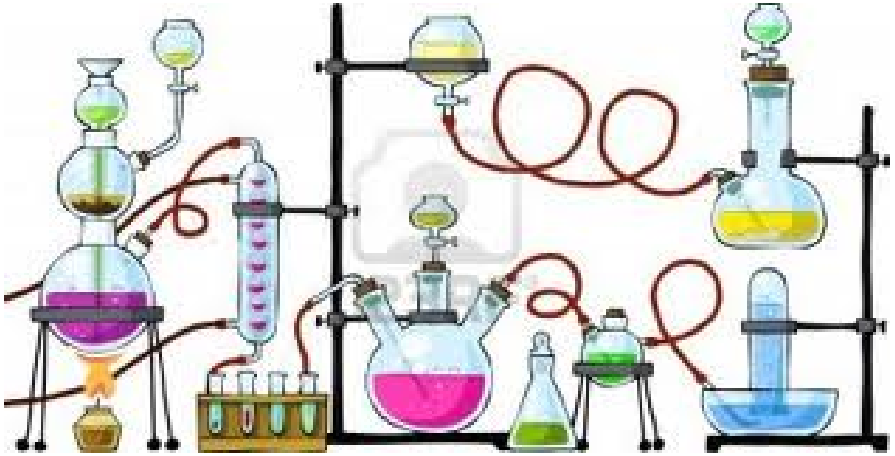


Observe the development or revision of ISO Standards regarding Quality Control

One step more ?

Observe the development or revision of ISO Standards regarding Quality Control

ISO 17025
ACCREDITED LABORATORY



Update the ITTC Symbols and Terminology List

After the last revision, the List is found to be up-to-date and does not require a major check.

Some minor maintenance has been performed to correct errors and resulting from the cross-check with the ISO Standards; in particular the changes regarded the following entries:

C_{APP} , L_{PP} , $c_{0.7}$, $Re_{0.7}$

Update the ITTC Dictionary of Hydromechanics

Some definitions have been added or revised:

Rake angle, Skew, Pod

Figures have been added, regarding the following entries:

Co-ordinate planes, Rake, Set back, Blade section

Cross-check the ITTC Symbols List and the Dictionary with other standards e.g. ISO

Cross-checked ISO Standards:

- ISO 3715-1:2002; Ships and marine technology – Propulsion plants for ships -- Part 1: Vocabulary for geometry of propellers,
- ISO 3715-2:2001; Ships and marine technology -- Propulsion plants for ships -- Part 2: Vocabulary for controllable-pitch propeller plants,
- ISO 7255:1985; Shipbuilding -- Active control units of ships – Vocabulary,
- ISO 7462:1985; Shipbuilding -- Principal ship dimensions -- Terminology and definitions for computer applications,
- ISO 8384:2000; Ships and marine technology -- Dredgers – Vocabulary,
- ISO/TR 13298:1998; Ships and marine technology – Voc. of general terms,
- ISO 19018:2004; Ships and marine technology -- Terms, abbreviations, graphical symbols and concepts on navigation.
- ISO/TR 13298, ISO 19018 and ISO 8384.

Modifications after cross-check

ISO 3715-1	ISO 3715-2	ISO 7462	ISO 7255
Leading edge, blade; Leading edge, foil section; Pitch, Pitch angle; Pitch, at a certain radius; Pitch, blade mean; Pitch, propeller mean; Propeller reference system, cylindrical; Propeller reference system, rectangular; Trailing edge, blade; Trailing edge, foil section.	Propeller; Pitch angle, range of; Pitch, design propeller; Pitch, maximum ahead; Pitch, maximum astern; Pitch, nominal; Blade position; Blade position, angle of; Propeller Windmilling.	Axis co-ordinate; Baseline; Section; all occurrences of Beam replaced with Breadth; Displacement Volume; Moulded.	Lateral thruster; Retractable lateral thruster; Rudder-propeller; Swivelling rudder-propeller; Retractable Rudder-propeller; Active rudder.

Cross-check the ITTC Symbols List and the Dictionary with other standards e.g. ISO

CONFLICTING DEFINITIONS
Definition of Body Axes given in ISO 3715-1
Definition of Skew given in ISO 3715-1
Definition of Propeller reference system, cylindrical given in ISO 3715-1
Definition of Baseline given in ISO 7462

Revise and update the existing ITTC Recommended Procedures

4.2.3-01-03	Work Instruction for formatting ITTC Recommended Procedures and Guidelines
7.5-01-03-01	Uncertainty Analysis, Instrument Calibration
7.5-02-01-01	Guide to the Expression of Uncertainty in Experimental Hydrodynamics

Review and edit new ITTC Recommended Procedures with regard to formal Quality System requirements 1/2

The QSG review process regarded 35 existing and 17 new procedures adding to a total of 52 documents

The great majority of the procedures required an enormous amount of editing with respect to format. This is probably due to the fact that procedure 4.2.3-01-03 was not sufficiently clear about the use of Styles. The new version of the document will help to obtain documents in line with the ITTC agreed format.

Review and edit new ITTC Recommended Procedures with regard to formal Quality System requirements 2/2

The document 0.0 Register has been updated accordingly.

A template in word format has been prepared to write new procedures in the next ITTC period. To write a new procedure, an author will open the new file with the following template:

ProcTemplate_2017.dotx

The file will be supplied to all TC Chairs.

Follow the implementation of the Benchmark data repository

The Benchmark Data Repository structure has been decided by the 26th ITTC.

The QSG tried to locate the benchmark data, in order to supply them to the web-site administrator for publication. The task proved to be extremely difficult since nobody seems to know who actually has the required data.

To this effect, a request was forwarded to the AC through the ITTC Secretary aimed go obtain information about the benchmark data location, but no news has been obtained.

The QSG proposes to the Conference to insert into the ToR of each of the Committees an item regarding the location of the benchmark data about relevant topics, and to provide the information to the next QSG.

Support the technical committees with guidance on development, revision and update of uncertainty analysis procedures

Liaison	Committee
Rojas	Resistance and Propulsion
Woodward	Manoeuvering - Stability in Waves
Sales	Seakeeping - Ocean Engineering
Rijsbergen	CFD - Detailed Flow Measurement and Noise
Benedetti	Perfomance of Ships in Service
Derradij	Marine Renewable Devices - Ice

Uncertainty Analysis

Outline

- New JCGM Documents: GUM and VIM
- Revisions to Uncertainty Analysis Procedures
- Survey on Uncertainty Analysis Usage
  - New Simplified Uncertainty Analysis Procedure
- New Procedure on Torsion-meters

JCGM Documents

- International vocabulary of metrology – Basic and general concepts and associated terms (VIM), JCGM 200:2008, Joint Committee for Guides in Metrology, Bureau International des Poids Mesures (BIPM)
- Guide to the Expression of uncertainty in measurement (GUM): GUM plus Seven (7) Supplements
  - JCGM 100:2008, GUM
  - JCGM 101:2008, Propagation of distributions using a Monte Carlo method

JCGM GUM Supplements (cont.)

- JCGM 102:2009, Extension to any number of output quantities
- JCGM 103:20xx, Modeling, to be published
- JCGM 104:2009, An introduction to the GUM and related documents
- JCGM 105:20xx, Evaluation of measurement data – Concepts and basic principles, to be published
- JCGM 106:2012, The role of uncertainty in conformity assessment
- JCGM 107:20xx, Applications of the least squares method, to be published

Revisions to UA Procedures

- ITTC 7.5-02-01-01, Guide to the Expression of Uncertainty in Experimental Hydrodynamics
- ITTC 7.5-01-03-01, Uncertainty Analysis Instrument Calibration
- Revision Summary
  - Corrections to equations
  - Clarification OIML Tolerance on Weights
  - Updated References
  - New Section on Direct Digital Calibration

New Procedures for 28th ITTC

- Survey on Usage of ITTC Uncertainty Analysis Procedures
  - New Procedure on Application of UA for Novices
  - Second Workshop on UA
- New Procedure on Signal Analysis with UA Estimates

New Procedure for Torsionmeters

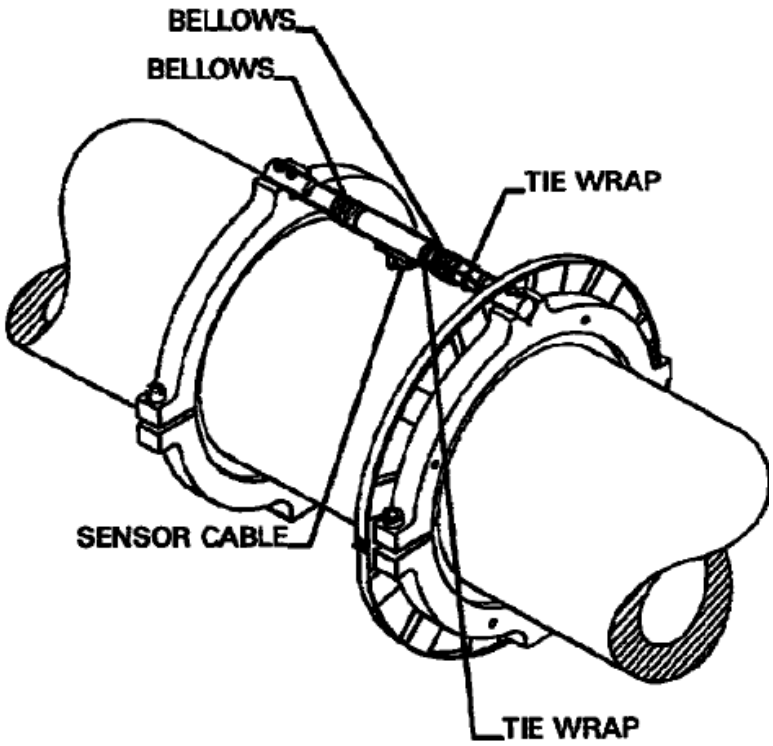
- Torsionmeter Equation

$$Q = \delta GJ\ /(RL)$$

  - δ Displacement
  - *G* Modulus of rigidity
  - *J* Polar moment of inertia
  - *R* Radial distance to displacement sensor
  - *L* Distance between rings

- Equation for *G*, dominant term in uncertainty

$$G = \rho V_s^2$$



Uncertainty in Shear Modulus

- Conventional Steel Properties
  - G = 8.0 x 10^{10} Pa
  - ρ = 7800 kg/m^3
  - V_s = 3200 m/s
- Uncertainty in G

$$u_G = \sqrt{(2\rho V_s u_{Vs})^2 + V_s^4 u_\rho^2}$$

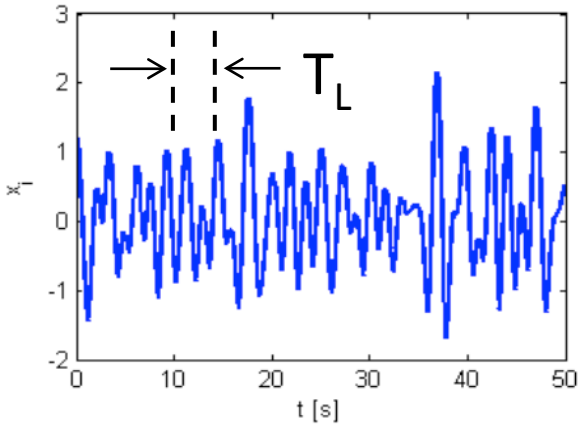
  - U_G = 2.3 x 10^8 Pa (0.29 %)

Uncertainty estimates for measurements in torque calculation

Symbol	Units	Value
C	mm	1.0
Di	mm	0.025
Do	mm	0.025
L	mm	0.10
R	mm	0.025
t	mm	0.025
Vs	m/s	3.2
ρ	kg/m^3	16

BASIC CONCEPTS IN UA: TIME SERIES ANALYSIS

- For a stationary time series, the uncertainty of the mean value is dependent on the correlation in the signal
- If there is no correlation (white noise) then $u_{mean} = s_X / \sqrt{N}$
- In practise however signals are often oscillatory and thus contain correlation
- For oscillatory time series two methods can be used to determine the uncertainty of the mean value (Brouwer et al., 2013)



  - Autocovariance method $u_{autocov} = \sqrt{\frac{1}{T}\int_0^T \left(1-\frac{\tau}{T}\right) C_{xx}(\tau)d\tau}$ for $T > T_L$
  - Segment method $u_{segment} = \frac{s}{N_s}$ for $T > N_s T_L$

A GOOD UNCERTAINTY ESTIMATE CONTAINS

1. Type B evaluation of zero-order replication level uncertainties
   - Including calibration with traceability to national standards
2. Same as above, but using Type A evaluations instead
3. Same as above and assessment of random uncertainties by
   a) Time series analysis
   b) Repeatability
   c) Reproducibility
4. Same as above and assessment of systematic modelling uncertainties
   - Model size
   - Inter-facility bias

Better estimate of uncertainty

Maintain Wiki for the 27th ITTC as a trial period and create link to it from the ITTC website

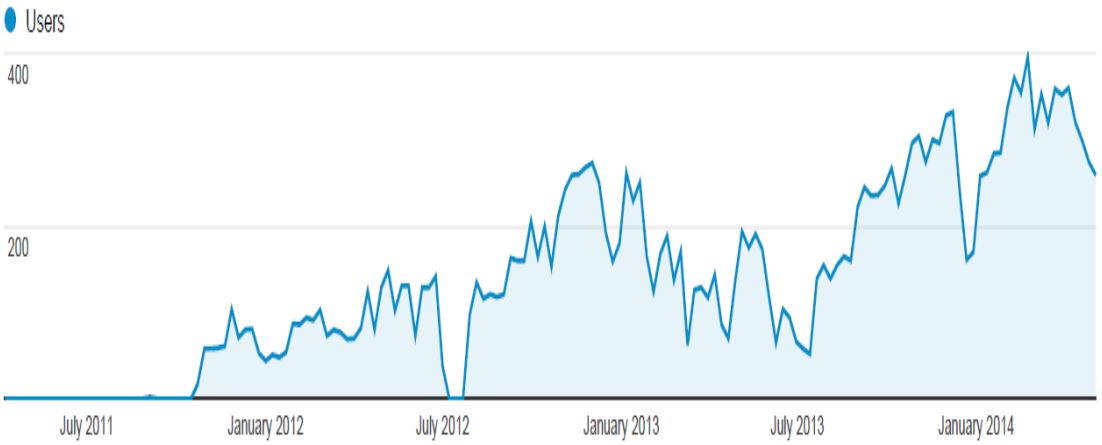
- Alignment with ITTC Dictionary of Hydromechanics edition 2011.
- Link to Wiki Dictionary on the ITTC website:

  www.ittc.info
- Direct access from:

  http://www.ittcwiki.org/doku.php

ITTC Wiki usage data between *September* 2011 (26th ITTC) and April 2014

SESSIONS
27.141
USERS
20.269
PAGE VIEWS
64.129
BOUNCE RATE
61.85%



Users Trend

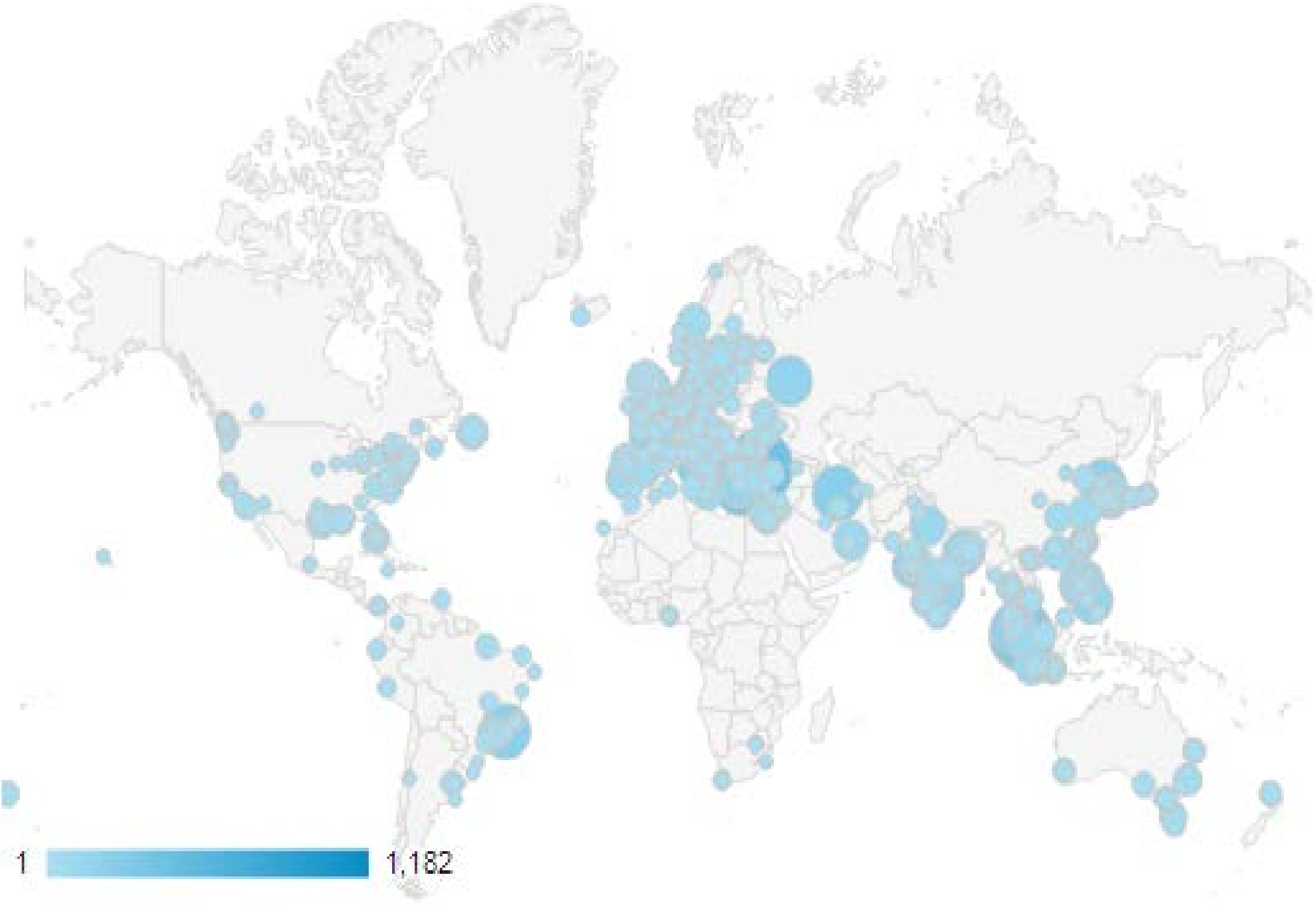
Analytics between 26th ITTC and April 2014

Maintain Wiki for the 27th ITTC as a trial period and create link to it from the ITTC website

One of the challenges is the renewal of the drawings, striving for a better resolution.

Overall usage data shows a constant increase with a significant number of returning visitors.

It is considered helpful that ITTC members creates link to the ITTC web pages on the websites of their own organizations.



Visits by City

27TH iTTc • CopenHagen

RECOMMENDATIONS TO THE CONFERENCE 1/2

The QSG recommends to the Full Conference to:

- adopt the revised procedure 4.2.3-01-03 Work Instruction for formatting ITTC Recommended Procedures and Guidelines;
- adopt the revised procedure 7.5-01-03-01 Uncertainty Analysis, Instrument Calibration;
- adopt the revised procedure 7.5-02-01-01 Guide to the Expression of Uncertainty in Experimental Hydrodynamics;
- adopt the revised Symbols and Terminology List;

RECOMMENDATIONS TO THE CONFERENCE 2/2

The QSG recommends to the Full Conference to:

- adopt the name of “ITTC Dictionary of Hydromechanics” in place of “Dictionary of Ship Hydrodynamics”;
- adopt the revised ITTC Dictionary of Hydromechanics Version 2014;
- enhance the liaison with ISO with a view to reconcile the differences in definitions between ISO standards and ITTC definitions as laid down in the abovementioned procedures
- allow the Wiki tool to implement updates to the Dictionary also between conferences.

RECOMMENDATIONS FOR FUTURE WORK 1/5

The following future work is recommended:

- Support the Technical Committees in their work on Recommended Procedures. Supply the chairmen of the new committees at the beginning of the period with the MS Word versions of the relevant procedures and the template for the production of new procedures,
- 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,
- Observe the development or revision of ISO Standards regarding Quality Control,
- Update the ITTC Symbols and Terminology List,

RECOMMENDATIONS FOR FUTURE WORK 2/5

The following future work is recommended:

- Update the ITTC Dictionary of Hydromechanics,
- Revise and update the existing ITTC Recommended Procedures according to the comments of Advisory Council, Technical Committees and the Conference,
- Before 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,
- Follow the implementation of the Bench-mark data repository,
- Support the Technical Committees with guidance on development, revision and update of uncertainty analysis procedures,

RECOMMENDATIONS FOR FUTURE WORK 3/5

The following future work is recommended:

- Observe ISO standards for uncertainty analysis, in particular the uncertainty analysis terminology,
- Review developments in metrology theory and uncertainty analysis and issue appropriate Procedures,
- Continue to maintain the online Wiki tool keeping it up to date and in line with the adopted documents of the ITTC,
- Include a new section of the Dictionary dedicated to Offshore Engineering, as preparation for an extension of ITTC procedures to this fast developing field,
- Include into the Dictionary a section dealing with planing craft,

RECOMMENDATIONS FOR FUTURE WORK 4/5

The following future work is recommended:

- Include into the Dictionary a section dealing with pods,
- Develop a guideline with number 7.5-02-01-02 and working title: “Guideline to Practical Implementation of Uncertainty Analysis”. This guideline should assist committee members (primarily beginners but also experienced in the field of UA) in making an adequate uncertainty analysis in both pre-test and post-test situations. It should provide an overview of all the steps to be taken in an uncertainty analysis and refers to existing procedures such as 7.5-02-01-01 on basic techniques and 7.5-01-03-01 on calibration,

RECOMMENDATIONS FOR FUTURE WORK 5/5

The following future work is recommended:

- 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,
- Surveying the extent and breadth of uptake of uncertainty analysis techniques and procedures by the hydrodynamic testing community,
- Develop a new procedure on torsionmeters for ship trials.