Urgently required!
Future Ship Powering Trials and Monitoring Now!

Vote for a revised, generally acceptable, lasting edition of ISO 15016, concerning not only trials, but also monitoring of the powering performance, meeting theoretical, contractual and legal standards and requirements

by Michael Schmiechen, Berlin

ABSTRACT

An executive summary of this short paper has been published under the same title in HANSA (150 (2013) 11, 55) and as 'Note on trials' (trl_note.pdf, trl_HANSA.pdf) in the Section 'News on ship powering trials' on my website.

In addition it is worth noting, that sometime during end of September, the deadline for the abstract, and end of October, the deadline for this paper, the Executive Committee of the ITTC decided to back out of the procession following the emperor in his new dresses. And further that work on the revision of ISO 15016 is under way.

THE PROBLEMS

The evaluation of ship powering trials is still treated as hydro-mechanical problem, although it is of 'conventional' nature – *not* to be mistaken for 'traditional' –, part of a whole range of intricately intertwined legal and contractual conventions.

At the focus of this short paper is the fact, that the structure, the implications and the relations of the conventions involved are usually *not* stated explicitly and are thus only vaguely known.

In particular, the underlying principles are *not* generally shared, although the same beliefs, convictions or 'principles', as they are fashionably called, – 'principles' being another name for 'prejudices' as Mark Twain aptly noted –, are essential pre-requisites of conventions. As their name says, conventions are *not* 'one man or one institute shows' as currently being performed by MARIN.

The present situation reminds of the time when railway gauges were purposely selected differently in different countries for 'protective' reasons, but which turned out to cause unnecessary costs and to delay progress for many decades, if not centuries as in case of the SI Units. In view of the urgent demands for a generally acceptable, lasting standard meeting theoretical, contractual and legal standards and requirements this 'strategy' is self-defeating.

RELIABLE PROOFS

Presently many colleagues realise, that very many methods have been developed to predict the powering performance of ships based on results of physical and/or numerical model tests, erroneously mistaken for propulsion theory, but that hardly any methods have been developed for the convincing, trustworthy proof of the pudding, of the results full scale, meeting today's requirements, their own in particular.

Theoreticians have 'simply' left the very difficult problems of trials and monitoring of the powering performance to 'practicians' (*for my taste this original, old fashioned term is more suitable than the recent 'practitioners'*) at ship yards and model basins. And, hard to believe, ship owners still accept, that the same 'people' providing the predictions are not only carrying out and analysing the trials 'as well', but are even setting up the standards to be met!

Further many colleagues at universities, model basins and the ITTC realise that they have consistently ignored developments of rational methods of performance analysis for decades for the sole reason, that these methods have *not* been phrased in the jargon of our great-grandfathers, *not* noticing that these methods cannot be phrased in that jargon, as the deficiencies of current methods show.

THE MODEL

Ship powering trials are based on two or even three very different, clearly to be distinguished and cleanly to be separated systems of conventions. Firstly those concerning the conduct of trials and of measurements, secondly those concerning the evaluation of the performance at the trials conditions, often ballast conditions, and thirdly, if requested (!), those concerning predictions (!) of the performances at conditions differing from the trials conditions, typically at the conditions contracted.

Conventions are agreements, are languages and their implications (to be) agreed upon. Traditional conventions are usually *not* explicit, often incoherent languages, while rational conventions are explicit *formal languages constructed ad hoc for the purposes at hand*. In terms of logics these are axiomatic systems, a terribly frightening name for extremely useful tools.

The most important parts of their grammar to be agreed upon are *not* the rather simple rules explicitly and implicitly to define concepts and the more or less simple rules to derive the consequences, but the principles underlying the introduction of basic concepts and conventions, the principles of objectivity in particular!

The concepts and their interpretations still taught worldwide did *not* fall from heaven, but have been inherited from our great-grandfathers and 'happen' *not* to be adequate for present day purposes, *not* to be applicable at full scale service conditions. *Concepts are defined and obtain their values only in the contexts of conventions, i. e. of suitable reference systems constructed ad hoc for the purposes at hand.*

THE GOAL

Of particular interest are still traditional trials as usually performed, *i. e.* without measurement of thrust, of hull speed through the water and of sea states. The fundamental task in the fair resolution of conflicts is to set up rational conventions so simple and 'self-evident', that they and their consequences are intelligible and thus acceptable for the all parties interested in the results.

As has been demonstrated unmistakably in a number of published cases, the evaluation *at the trials condition* does *not* require any theory of propulsion, but only some elementary mechanics, some common sense and, last but not least, an often to be missed extreme care in evaluating the valuable data acquired at considerable costs.

The most fundamental principle to be agreed upon is that the evaluation should *not* require any prior data, in particular no results of model tests, *as it must be for the objective assessment* of the powering performance *at the trials conditions*. 'Objective' implies *independent of the 'observer'*, of the person in charge of the evaluation and its prejudices and preoccupations.

This short paper just permits to mention the fundamental deficiencies of the standard ISO 15016: 2002-06 and of the STA methods, the latter developed and 'marketed' by MARIN, detailed explanations and references to be found in the few links quoted. As a consequence I am promoting the long overdue generally acceptable, lasting revision of ISO 15016, concerning not only trials, but also monitoring of powering performance as well, meeting theoretical, contractual and legal standards and requirements of all groups concerned.

ISO 15016: 2002-06

That the current version ISO 15016: 2002-06 of the pertinent international standard on the assessment of the powering performance of ships, based on the conceptions of our great-grandfathers, is outdated and error prone, has already been demonstrated and brought to the attention of all national groups long before it nevertheless has been adopted as standard.

The proposed draft alternative (trl_prp.pdf), filed as 'Informative' by the Japan Marine Standards Organisation (JMSA) under ISO/TC8/SC9/WG2/N28 dated 1998-06-23, has in fact already been rather detailed and theoretically solidly founded and has since been tested successfully, *i. e.* shown to serve the purpose! The early work is fully documented under 'Papers on Ship powering trials' on my website (pap_trl.htm).

THE STA- METHOD

"Reliable ship-speed assessment more relevant than ever" has thus been a 'late', perfectly correct title of a short note by Henk van den Boom of MARIN and co-authors in this journal (HANSA 150 (2013) 4, 58). But that note itself is more than surprising and 'incredible'.

The author, Head of MARIN Trials and Monitoring, Manager of the Ship Trials Analysis (STA) Group and Member 27th ITTC Specialists Committee (SC) on the Performance of Ships in Service (PSS), the re-established Specialists Committee on Powering Performance, is explicitly referring to the 'cooperation' of the MARIN promoted SAT-Group with the ITTC SC on PSS, and notably with HSVA and 'TUHH', in fact the Institute of Ship Design and Ship Safety of that Technical University.

In the note it is claimed, that the STA-Group has established an 'industry standard' and that the 'ITTC 21012 Guidelines' (ITTC 7.5-04-01-01.1 and 2), the second part based on that 'standard', has *not* only been approved by 'the ITTC', but forwarded to the IMO and that "finally the IMO Marine Environment Protection Committee (MEPC) has accepted these Guidelines as the only method to be used for speed-power analysis of vessels above 100 m length worldwide".

ITTC AND IMO

According to the rules of ITTC the 'Guidelines' may be approved or, more likely, *not* approved by the Full Conference at the 27th ITTC to be held at Copenhagen only in September 2014. How then could it possibly be "presented as a transparent, unambiguous and practical analysis method" to the IMO MEPC and accepted by the latter to be used 'worldwide'?

Further, according to the Final Report of the IMO MEPC 65-22, Annex 18, page 2, Amendments to Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI) (Resolution MEPC.214 (63)), Paragraph 4.3.8 is amended as follows:

> 4.3.8 The submitter should develop power curves based on the measured ship speed and the measured output of the main engine at sea trial. For the development of the power curves, the submitter should calibrate the measured ship speed, if necessary, by taking into account the effects of wind, tide, waves, shallow water and displacement in accordance with ITTC Recommended Procedure 7.5-04-01-01.2 Speed and Power Trials, part 2; 2012 revision 1, or ISO 15016:2002. …"

Thus the assertion by van den Boom and co-authors happens *not* to be true in two important respects: The 'ITTC 2012 Guidelines' have *not* yet been approved by 'the ITTC' and they have *not* been accepted by the IMO MEPC as the *only* method for the purpose at hand.

STANDARDS

In the note of van den Boom it is further stated, that to fulfil the new IMO rules to reduce CO_2 each new vessel *has to undergo unified strictly prescribed speed trials*. What trials else? But who is *prescribing how speed trials* are to be conducted and who is *prescribing how speed trials* are to be evaluated? Definitely *not* a single institute claiming to have produced an 'industry standard', a 'standard' that itself does *not* meet elementary standards, principles and requirements to be met by decent, lasting standards.

Even if the community has only an embryonic understanding of the purposes of standards, namely the fair resolution of conflicts among all parties involved, it cannot possibly accept the STA method, as none of the claims in the detailed exposition (www.hansa-online.de/STA-JIP.pdf) of the authors' proposal is substantiated. The goal of ITTC and its reputation have always been to meet the urgent requirements of researchers and clients based on the current state of research. The 'incredible' STA procedure confirms my repeated statement that the fundamental, intricate problems of evaluating powering trials and of setting up appropriate, acceptable standards for that purpose should *not* be left to naval architects and to practicians in model basins and ship yards.

THE EMPEROR'S NEW CLOTHES

Most surprising is the strictly traditional approach 'advocated' in the 'Guidelines', according to my experience definitely inadequate for many purposes of considerable interest, typically trials at ballast conditions. A detailed analysis of the STA procedure has been published as section 4.3.4 'The Emperor's New Clothes' in my draft paper on 'Future Ship Powering Trials and Monitoring Now!' (METEOR_25_pap.pdf).

At the end of Andersen's archetypal tale (Wikipedia) "a child in the crowd, too young to understand the desirability of keeping up the pretense, blurts out that the Emperor is wearing nothing at all and the cry is taken up by others. *The Emperor cringes, suspecting the assertion is true, but continues the procession.*" *Italics: MS.*

In my view it is *not* a viable alternative to 'continue the procession' and prevent innovation for further decades, as did the standard ISO 15016: 2002-06 before. To 'continue the procession' will seriously damage the reputation of the ITTC. The goal of ITTC, founded as the International Conference of Towing Tank Superintendents, the latter originally personally at the forefront of research, has never been to perpetuate the procedures originated more then hundred years ago and to protect related profitable businesses.

ITTC BACKED OUT!

Having brought the draft of this short paper with all these facts timely to the attention the Executive Committee of ITTC, finally before sending this paper to the editor in vain I have asked for a statement concerning the state of affairs and for advice 'what to say and what better *not* to say'. According to the rule of the game: 'No answer is an answer as well', I was thus 'forced' to come up with my own statement.

In order to protect myself from mistaking any vague clues and to be explicit and correct I carefully followed the inexplicable revision numbers in the Minutes of the MEPC Meeting, London, May 13-17, 2013: "Adopted amendments to resolution MEPC.214(63) 2012 Guidelines on survey and certification of the energy efficiency design index (EEDI), to add references to measuring sea conditions in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 Speed and Power Trials Part 1; 2012 revision 1 or ISO 15016:2002.", and in the Final Report of the MEPC quoted before: "ITTC Recommended Procedure 7.5-04-01-01.2 Speed and Power Trials, part 2; 2012 revision 1".

And to my surprise I 'discovered' that in the meantime on the website of the 27th ITTC the reference to the document

> 7.5-04 -01-01.2: Analysis of Speed/Power Trial Data
> Pages 1 to 25, Effective Date 2012, Revision 00 (!).
> (Updated / Edited by the Specialists Committee on Powering
> of Ships in Service of the 27th ITTC. *Not* approved!)

had been replaced, so far without notice, at least to my knowledge, by the reference to the older document, unsatisfactory itself,

> 7.5-04 -01-01.2: Analysis of Speed/Power Trial Data
> Page 1 to 11, Effective Date 2005, Revision 00
> Updated / Edited by the Specialists Committee on Powering
> Performance of the 24th ITTC. Approved by the 24th ITTC 2005.

My conclusion is that the Executive Committee 'finally' abandoned the STA procedure and backed the ITTC out of the procession following the emperor in his new clothes, thus making the way free for a rational, generally acceptable procedure.

RATIONAL APPROACH

A fundamental deficiency of all traditional methods, ISO 15016: 2002-06, ITTC 7.5-04-01-01.2 (2005) and STA-JIP, is that they all do *not* permit trustworthy to identify the current velocity and subsequently the hull speed through the water, particularly at ballast conditions. Any reference to the performance of the corresponding deeply submerged open water model propeller, as in most traditional methods, *e. g.*, ISO 15016:2002-06 and ITTC 7.5-04-01-01.2 (2005), and/or to the propulsive efficiency in model propulsion tests, as in the STA-JIP method, are unacceptable.

But this fundamental problem can be solved satisfactorily by extremely simple propeller (in behind condition!) and current conventions, the four parameters of which jointly to be identified from the data acquired by solving only one system of linear equations. Further conventions necessary to account for the wind and waves have to be introduced in the same fashion, as simple as possible, with only few parameters that can be identified reliably from the data acquired.

That the environmental influences can be identified only after the reliable identification of the hull speed through the water is self-evident practice of all experts. Only in the procedure marketed by MARIN the opposite is advocated, maybe due to the fact that it does not permit reliably to identify the current.

Decisions for one of 'equivalent' conventions, all resulting in residua within the confidence interval of the data available, are possible only by additional conventions, as has been shown in detail in the delicate evaluations of the ANONYMA trials at two different trim settings, *i. e.* at two different nominal propeller submergences.

MONITORING OF PERFORMANCE

In conclusion it is noted that traditional trials are quite ineffective! Waiting for steady conditions to be established and ignoring the wealth of information available during the long intermediate quasi-steady states is an incredible waste in view of the present state of measuring and computing techniques. And even more important, traditional trials are *not* useful for monitoring the powering performance under service conditions!

For the latter purpose quasi-steady trials have been advocated since the successful tests with the METEOR in the Greenland Sea in November 1988, subject of the international workshop '2nd INTERACTION Berlin `91' (int_rep.pdf). The corresponding method requiring *no* thrust measurements is under development only now, a basic exercise identifying some problems to

be solved has already been published (mod_trial.pdf). In this connection the method of Torben Munk, marketed by his company Propulsion Dynamics (www.propulsiondynamics.com) founded in 2002, is of interest.

If trials are (to be) performed at off contract conditions and the data at hand do *not* permit to extrapolate to the contract conditions, *i. e.* do *not* permit to identify the parameters of interest, predictions based on prior data and/or parameters have to be agreed and relied upon. The 'disadvantage' of the pertinent conventions is that the resulting predictions cannot be proved during the 'acceptance' trials, but they may be proved during the subsequent journeys using a conventional monitoring method to be developed and to be agreed upon, *i. e.* to be standardised. At this stage the question arises: Why not contract monitoring under service conditions following the 'acceptance' trials?

THE CONSEQUENCE

In view of the deficiencies of the two methods mentioned by the IMO MEPC in its Final Report 65-22 it is concluded, that the only reasonable consequence of the enduring unacceptable situation is *promptly* to develop and to agree on a revised, generally acceptable, lasting edition of ISO 15016 concerning not only trials, but monitoring of ship powering performance as well, meeting theoretical, contractual and legal standards and requirements.

In order to arrive at this standard all groups concerned have to be included, *not* only naval architects at model basins and ship yards, but ship owners as well as hydrodynamicists looking for trustworthy proofs of their numerical predictions and, last but not least, experts in standardisation.

Standards organisations, as *e. g.,* DIN and ISO, claim to pioneer innovations, but their rules to admit on their working groups only representatives of 'pressure groups', often retired colleagues, tend to perpetuate the current, deplorable state of practice trapped in the past, hardly accounting for the current state of research, as I have experienced even in case of the fundamental standard on 'Quantities' (din_raw_draft.pdf).

REFERENCES

All recent work of the author related to the subject of ship powering trials and monitoring is being published continuously on his website www.m-schmiechen.de, the most recent work and pertinent discussions under the title 'From METEOR1988 to ANONYMA 2013' in the Section 'News on ship powering trials' (news_trl.htm).

All files (xxxx.yyy) annotated on my website may also be directly accessed via links http://www.m-schmiechen.homepage.t-online.de/HomepageClassic01/xxxx.yyy, the present paper also under http://www.hansa-online.de/fileadmin/pdf/fachartikel/Schmiechen.pdf

AUTHOR

In 1997 apl. Professor Michael Schmiechen retired as Deputy Director, Head of Research and Development, from Versuchsanstalt für Wasserbau und Schiffbau (VWS), the Berlin Model Basin, and was released from duties, lecturing on Hydromechanical Systems at the Institut für Schiffs- und Meerestechnik (ISM), Technische Universität Berlin (TUB). Since then he continued to lecture at ISM until 2011 and to promote his ideas around the world.

CONTACTS

Prof. Dr.-Ing. M. Schmiechen
Bartningallee 16, D-10557 Berlin
m.schm@t-online.de
www.m-schmiechen.de

