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From METEOR 1988 to ANONYMA 2013 *and further* Trustworthy ship powering trials and monitoring *now!*

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ABSTRACT

Since 1980 I have developed a rational, conventional (!) theory of ship hull-propeller interactions and applications concerning steady and quasi-steady trials on model and full scale. The basic motivation has been to overcome the many 'incredible' inherent deficiencies of the traditional model procedure, the worst of all, that it cannot be applied on full scale.

Quasi-steady testing, promoted since the beginning of the development and demonstrated to be feasible in the METEOR tests of 1988, permits extremely time and thus cost effective trials under any service conditions without anybody noticing, that such tests are being performed, requiring no extra instrumentations and calibrations.

The analysis can be greatly improved, if it is *not* based on obscure averages, but on the quasi-instantaneous values preferably of quasi-steady tests as described in the following, providing for variability and *not* suppressing all relevant information as is done in traditional steady speed tests.

The detailed analysis of the powering performance requires no prior data, from inconsistent model tests in particular, as it must be! And according to my latest finding it requires no thrust measurements. The purpose of full scale trials is trustworthy to prove predictions based on physical and/or numerical experiments.

The whole development has been documented in a large number of reports and publications, the latter since 1990 readily accessible on my website. Thus this paper is limited to explaining in 'plain' terms the motivation of my work since 1980 and the essential steps of acceptable solutions I have produced so far, illustrated by prominent results, but purposely devoid of any formal derivations, which are to be found in every detail in the references.

Though its topic is the future of trials, this paper is also a contribution of a witness to the history of a constitutive, though neglected branch of the theory of ships.

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INTRODUCTION

Scope of paper and presentation

In the given limits I cannot possibly write and talk about any details in this contribution to the 30th ATTC. The details, documented and discussed in every detail, are readily accessible in worked examples together with many extended explanatory notes on my website.

I shall rather try in plain terms to explain the origin and the development of my ideas, theories and procedures. I shall talk about 'philosophy', i. e. 'meta-physics', meta-principles and meta-models, as well as basic principles and models concerning the subject stated in the title.

The repeated 'advices' to forget about the 'philosophy' indicate, that neither the problem, nor its solution has been understood: They ignore the fact, that the solution has *not* been possible in the traditional, inadequate framework, which is at the root of the problems to be solved! Further, I have never heard of a 'solid' building, the foundations of which have been taken away.

Symbols and terminology

For the purpose of my work it has been necessary to develop my own, rule driven symbols based on a sufficiently rich terminology, documented in the tabular version of my axiomatic model, the file to be found on my website via the link 'Rule driven symbols developed' in the 'News flash' under 'Very happy end of a very long story', the 'last', the fifth revision of the evaluation of my 'model' trial of 1986.

The symbols of the ITTC SaT (Symbols and Terminology) List, are *not* sufficient for the purpose at hand, as I already explicitly stated in Version 1993 of the ITTC SaT List. That meanwhile 'historical' document, which I personally edited and produced as Member of the SaT Group, is still available on my website.

My figures are either self-explanatory or explained in the 'surrounding' text. The few symbols in the figures are *not* of 'importance' for the purpose of this paper. The hull advance ratios J_{HX} are based on hull speeds 'relative to X', and instead of the 'nonsensical' torque ratios $10 K_Q$ the power ratios $K_P = 2 \pi K_Q$ are being used.

Usage of inverted commas

Instead of starting with a list of symbols, to be treated in due course, I start with the usage of inverted commas for paragraphs, which are *not* quotations proper, and further in line with the usage recommended in the 'Current English Usage' (Wood, 1970):

"(iv) Inverted commas may also denote, that a word is used in irony or sarcasm, [or] in a sense which is *not* its generally accepted one; ... however, they should be employed only, if it is felt necessary to apologise for the use of such words. ..."

and with italics found in the literature:

"Our author's italics warn us to look for special importance."

John T. Williams: Pooh and the philosophers (1996/152).

"This and several other words in the passage were italicised ... in order, apparently, to help the reader appreciate Swift's irony."

Jonathan Swift: Gulliver's Travels. Notes (2003/279).

STORIES TOLD

Tales, parables, fables, satires

"The humour of the 'Disc-World' is based on metaphors taken literally and the consequences pondered."

Terry Pratchett in an interview (2002).

Grandfathers are expected to tell 'stories'. And that I shall do, taking advantage of the fact, that tales, parables, fables, jokes, satires, persiflages have evolved as the most

efficient ways to communicate and highlight intricate situations and strategies of 'survival'. Usually the name of a tale etc is sufficient to invoke the whole context for the initiated, *i. e.* educated and/or trained.

Most famous are emperor Sun Tsu's, ('Sunzi'), collection of stratagems, about 500 BC, the animal fables of Aesop, of the 6th century BC, and the Arab collection 'Kalila and Dimna', collected about 750 AD for the same educational purpose as Sunzi's stratagems.

Repeated claims, that stories, symbolical or allegorical narratives, ranging from parables, metaphors, satires, ironies to sarcasm, do *not* 'apply' in ship theory, ignore the wisdom of our forefathers and the 'power' of vivid conceptions, of Goethe's 'Anschauung'.

The race of tortoise and hare

In talking about forty years of my intense research on trials and monitoring off the beaten track at VWS, the Berlin Model Basin, and in the twenty years since my retirement, my stories and anecdotes are *not* plucked out of the air. They are based on my long experience and, most important, on the continuous reflections and corrections of my mistakes. And they also serve the educational purpose mentioned; they concern the future, the future of my young colleagues, who could be my grand-children.

Most appropriate for the present presentation is the fable about the race of the tortoise and the hare:

'While the tortoise slowly approached the common goal, carefully watching the way and considering every single step, the hare raced ahead and, waiting for the tortoise to arrive, fell asleep and lost the race.'

Aesop: Fables. About 6th Century BC. Perry Index no. 226.

Anniversaries 'celebrated'

Two anniversaries in 2013 have been incentives to wind up my work on ship powering trials and monitoring and to publish my recent results:

the 25th anniversary of my tests with the German research vessel METEOR in the Greenland Sea, November 1988, has triggered the publication of three volumes of a 'Festschrift' in 2013, 2014 and 2015, respectively, and two related brochures, and

the 15th anniversary of my proposal for a rational procedure to identify the prevailing currents and to evaluate steady trials of 1998, 'filed' by JISC/JMSA under ISO/TC8/SC9/WG2/N28 dated 1998-06-23: 'Prof. Schmichen's comments to ISO/TC8/SC9/WG2/N20, Informative'.

Limits of peer reviews

According to my repeated personal experience I do *not* 'believe' in peer reviews of papers and research proposals. 'Peers' are tacitly defined as people talking in terms of the current professional jargon.

For reasons to be explained I am purposely talking in a different jargon,

"[but I] always remember, that it is impossible to speak in such a way, that you cannot be misunderstood: ... If greater precision is needed, it is needed because the problem to be solved demands it."

Karl Popper: Unended Quest. 1974.

Concerning the theory and practice of trials peer reviews have retarded progress already for decades. At this stage a very queer experience is worth noting. A paper of mine had been accepted for presentation at a conference. But when I saw the review, I 'dared' to 'inform' the reviewer, that he evidently had *not* understood, what I intended to say. 'Consequently' my presentation was cancelled (and I cancelled my attendance), paper and correspondence to be found on my website.

Two, more serious experiences with peer reviews will follow in due course further down.

Journey to the Houyhnhnms

The 'organisation' of research today is still very much the same as at Jonathan Swift's time, described in his persiflage, in 'Gulliver's travels', *not* contained in picture book versions for children, but in the original of 1726, published anonymously and "for fear of prosecution cleaned from the worst offending passages" (Wikipedia).

The sarcasm of the following story (2003/217) is evidently pin-pointing the situation of anybody exercising lateral thinking.

'On his fourth and last journey, the journey to the rational horses, Gulliver has been asked, from which part of the country he came and how he was taught to simulate a rational creature. His claim, that he came with other sailors over the sea in a ship built of wooden logs, was found *not* at all plausible by the Houyhnhnms, *not* only in view of the obscure building of ships, but more so in view of the fact, that there were no countries beyond the sea.'

PROBLEMS, SOLUTIONS

Problems: resolution of conflicts

Traditionally educated and/or numerically trained, *not* to say indoctrinated colleagues still have a problem to admit, that trials and monitoring are basically *not* physical, *not* hydro-mechanical problems, *but* conceptual (and, *not* to be forgotten, their own psychological) problems, arising in resolving conflicts between the parties concerned, typically ship owners and ship builders.

And how these can be reached *rationally*, I have described, demonstrated and published easily accessible on my website many times during the past decades.

At my age I am of course *not* so naïve, to believe, that everybody is 'interested' in the rational resolution of conflicts, quite to the contrary! But like the little child in Hans

Christian Andersen's tale of 'The Emperor's New Clothes' I have raised my voice, whenever I felt 'necessary'.

Solutions: Formal languages

Conflicts can rationally be resolved by formal models and their coherent interpretations, 'subscribed' by the parties concerned. Formal models are dedicated, appropriate, rule driven languages, unmistakably to talk about and to solve the intricate problems at hand. Thus formal languages are inherently perfect systems of conventions, in terms of logics they are axiomatic systems.

Since David Hilbert's fundamental concept of 'implicit', I prefer 'coherent' definitions (1899) 'independent' interpretations of concepts, e. g., of hull resistance and propeller advance speed, are no longer considered to be acceptable, they do *not* meet current standards of rationality. Whenever I introduced a concept I have been asked, *not* only by naval architects, 'how do you define this concept' and/or measure its values. *Answer:* In the context of the language adopted!

That interpretations of the concepts introduced are meaningful only in the context of the language developed is still widely unknown with a very serious consequence. 'Independent' interpretations are creating an infinite regress of research, an irresponsible waste of research resources.

This reminds me of the old lady, who 'knew' our Earth to be based on turtles, 'all the way down'. But whom are cosmologists and naval architects laughing at? It is standard scientific practice to 'support' established theories, which are no longer adequate and/or acceptable, as long as possible by additional 'turtles'. The most famous example is the *Almagest* dating back to Claudius Ptolemy (ca. 100 to 170 AD).

Kuhn's paradigm of disruptive changes of paradigms of 1962 vividly describes, what happens when these fragile foundations can 'no longer' be repaired and new, 'stronger' turtles need to be introduced to 'support' the 'worlds'. More than hundred years earlier Ernst Mach has already expressed similar ideas concerning the evolution of science. Currently many cosmologists believe the universe to be based on the turtles 'dark energy' and 'dark matter'.

Structure of grammar

Coherent systems of conventions consist of basic concepts implicitly, coherently 'defined' by basic propositions, the axioms, and of rules formally to define further concepts and to deduce further propositions, the 'theorems', the consequences, which 'have to be' accepted by each of the parties having agreed upon the basics and the rules of the game.

The structure of the grammar sketched, *not* only of formal languages, is so simple, that it could and should (!) be taught to children at school. It shows that any language consists of two 'corresponding' calculi. The fundamentally different definitions and deductions are often confused due to the use of the same equal sign in the 'equations'.

Consequently (!) the usual lists of symbols are degenerate languages, lacking the essential 'halves', and are thus *not* useful to serve scientific purposes. The calculi of conventions are substituted by tacitly shared instinctive beliefs. This practice is closely related to the children's game of 'silent post service'.

Calculus of ...	... concepts	... propositions
Rules of ...	... introduction	... introduction
Basic ...	... concepts: 'elements'	... propositions: axioms
Rules of ...	... definition	... deduction
Derived ...	... concepts: 'compounds'	... propositions: theorems

Here is *not* the place to discuss the fact, that human beings are *not* rational beings and are *not* necessarily 'honest', but try to change the rules during the game in order to evade unfavorable consequences of the conventions, they (hopefully explicitly) agreed upon before they started the game.

Representation 'spaces'

Axiomatic models with only very few basic concepts and basic propositions are already unfolding extremely rich, intricate conceptual 'spaces'.

To explore them without getting lost, requires at least 'paper and pencil', preferably corresponding, intuitive computational environments. Since decades I have used and promoted Mathcad, being a particularly adequate, efficient and powerful tool for the purposes at hand.

Such models are used to represent systems under investigation, their parameters being the 'coordinates' to be identified.

By definition the values of the parameters of a given system in different representation 'spaces' are in general different. Thus the usual simple minded requests for comparative evaluations, e. g., of trials data, are *not* addressing the 'real' problems under discussion. Except in trivial cases the parameters cannot be compared directly. The same holds in case of simple minded requests for comparative designs, e. g. of ducted propulsors.

Evidently everybody, who studies my proposals 'needs' to re-program my routines in his own environment, a 'necessity' *not* subject of this paper and presentation.

Developments so far

Since 1980 I have developed systems of the type outlined among others:

as 'late' as 1998 for the evaluation of traditional steady speed trials without any reference to ship theory, to model test results and to any other prior information, triggered by the 'incredible' standardisation of the error prone ISO 15016,

and, based on that work, for the evaluation of quasi-steady trials permitting to identify all parameters of powering performance on model scale and on full scale at any service condition in the same way, revisions of the 'model' trial of 1986 still in progress, routine applications on model and full scale still to be developed.

Terminology and symbols

In order *not* to get lost I have developed a rule driven (!) language adequate for the purpose at hand and in accordance with the rational conventions, *not* with the traditional conventions!

"Presence of synonymy, intuitive appeal, agreement with customary modes of speech, far from being *the* philosophical virtue, indicate, that *not* much progress has been made and that the business of investigating, what is commonly accepted, has *not* even started."

Paul Feyerabend: How to be a good empiricist (1999).

While for ready communication I am using the traditional names for many concepts, it is important to note, that their 'conceptions' and their operational interpretations are more or less different from the traditional. Accordingly it is mandatory (!), *not* my hobby as has been suspected, to use symbols differing from the traditional symbols, in order to avoid very costly (!) confusions.

Mush-rooming bureaucracy

But this is evidently only half the story. The results of tests are trustworthy, 'if and only if' the conventions agreed upon, demonstrably (!) meet certain requirements, specifically those of coherency and of transparency. Everything else is blind confidence, that can be and is (!) manipulated and misused.

Thus, if naval architects and ship builders and ship owners do *not* want to be 'cheated', they should primarily *not* care to meet the mush-rooming bureaucratic conventions proposed and even standardised, but to prove their coherency and their transparency.

Even if the requirements are understood 'in principle', it is *not* easy to meet them in practice, certainly *not* by traditionally educated naval architects. Right after describing mistakes definitely to be avoided, I myself repeatedly fell victim to exactly those mistakes.

In remarks on Reports for the 28th ITTC I have noted, that the ITTC is in great danger to fall victim to mush-rooming bureaucracy; see my letter to the Chairman of the Advisory Council in my '3rd, virtual INTER-ACTION.

Naïve 'philosophy' aversion

My mentioning and taking advantage of formal systems of conventions since 1980 has shied naval architects away, instead of inspiring them, immediately to try the

power tool themselves and solve problems impossible to be solved before.

'Philosophy' aversion, openly expressed even by professors, misses the fact, that it is based on a 'philosophy' itself, but on a particularly poor one, *not* meeting the current requirements and standards, widely established in other fields of research.

Thus, when I started to reconstruct ship theory for the difficult problems of trials, I did *not* ask naval architects, but rather 'architects' of theories. The simple reason is, that there is no chance to pull yourself out of the 'morass of ignorance' (Popper), as the Anglo-Saxons try by their bootstraps and as the Germans try by their braids, following the 'story' of Baron von Münchhausen, incidentally *not* of German, but of English origin.

I.1 A Puzzled Philosopher Abroad

Only after I 'finished' the draft of the present paper I found the time to close a gap in my knowledge and to start reading the first volume of Karl Popper's 'Postscript' to his 'Logic of Scientific Discovery'. And already in the first Section of the first Chapter of Part I (1982/12-18) I realised how deeply my approach is influenced by Popper's 'realism'.

Further details are *not* of interest in the present context, but an amusing 'story' from the Preface of 1956 (p.7) is 'well' in place here:

"You will all know the story of the soldier, who found, that the whole battalion (except himself, of course), was out of step. I constantly find myself in this entertaining position. And I am very lucky, for, as a rule, a few other members of the battalion are quite ready to fall into step. ...

Some of the things, which put me out of step and which I like to criticise are: (1) *Fashions*: ... (3) *The authority of specialists*: ..."

INTERPRETATIONS

Fundamental errors

Concepts introduced are clearly to be distinguished from their interpretations in terms of results of hydro-mechanical experiments, physical and/or numerical in accordance with the underlying models. In most of the cases I happened to be involved in, my work has been limited to the core problems. Neither test conditions and performance, nor the 'use' of the results have (yet) been subject of my scrutiny.

Admittedly the use of the result is the main concern of users. But what is the use of 'useless' data, unreliable, doubtful data, suffering from severe fundamental errors? These I find much more 'disturbing' than the ill-defined random errors 'carefully' evaluated using the elementary theory of samples, without properly checking its applicability.

Task of empiricists

The 'only' task of empiricists is to identify the values of the 'physical' parameters, coherently defined by an axiomatic ship theory, *that deserves the name*. The emotional reactions to this statement do *not* change the situation, but support my argument.

Identification is essentially a matter of professionally designed and conducted experiments, physical and/or computational, and their professional evaluation.

Once and again I have 'found out', *not* being told so, but by 'accident' or by 'inquisition', that colleagues, having tried to apply the approaches I proposed, publicly claimed, that the routines 'did *not* work'. And further investigations, sometimes taking years due to the 'secrecy' of the 'research', often revealed as reasons lack of fantasy and/or lack of minimal professional 'craftsmanship'. My repeated conclusion is, that there are too many naval architects employed at model basins.

Expertise required

All techniques necessary and routines developed for successful application of my procedures are described in great detail in worked examples, papers, lectures and letters documented on my website.

To be specific, the expertise required includes the capabilities:

- to solve ill-conditioned systems of linear equations using singular value decomposition,

- to analyse the remaining residua using advanced methods, statistical in particular,

- to estimate spectra from truncated records using auto-regressive models,

- to identify systems in noisy feed-back loops using correlation with test signals independent of the noise, to avoid systematic errors due to feed back of noise,

- and, last but *not* least, to understand the implications and the use of the conventional approach.

NEED FOR CHANGE

Some history

Based on investigations of 'unconventional' propulsors since 1959 and on results of systematic model tests with ducted propellers for seagoing vessels in 1961 I have soon been convinced, that the deficiencies of the traditional approach could no longer be overcome in the context of the traditional framework, or as Einstein said more generally and concisely, 'that problems can never be solved by the methods, which have caused them'.

Consequently I have reconstructed the theory of ship propulsion starting from first principles, conceiving a rational theory of propulsion since 1968, axiomatically since 1980. And over the past nearly forty years I have paradigmatically developed some fundamental applications to 'cer-

tain' states of maturity. Though referring to that meanwhile 'historical' development the subject of this paper and the related presentation is *not* the past, but the future.

As neither 'standard' propeller design, nor 'standard' power prediction belonged to my duties at VWS, the Berlin Model Basin, my development of the rational theory 'took place beside' the traditional mainstream, thus permitting to shed light on that stream and on future developments.

Management of change

A 'disadvantage' of 'traditions' is that they tend to live longer than 'reasonable'. In a recent paper on 'Why we don't believe, what does *not* suit us' Retzbach (2017) has quoted the results of research projects concerning this inherent feature of human psyche to deal with 'cognitive dissonance'.

Thus it often takes two or three generations, even centuries, before a change takes place. But for competitive reasons that pace is often no longer acceptable. Needs for change identified 'every where' have resulted in a vast literature concerning the management of change.

Two pertinent, very instructive animal fables (!), published in slim volumes, have found wide distribution, the first one by Johnson, author of the 'One Minute Manager': 'Who Moved My Cheese', describing and promoting the strategy of mice, and the later one by Kotter 'Our Iceberg is Melting', describes the 'penguin principle'.

Deficient trials 'codes'

Triggers for me to demand change now have been the error prone procedure ISO 15016: 2002-06 and its recent revision and the related, 'incredible' STAIMO method of MARIN, based on a joker to be pulled out of the sleeve, its rash integration into the 'ITTC 2012 Guidelines', the *contra legem* approval of the latter by the Executive Committee of the 27th ITTC and its passing on to the MEPC of IMO, without any critical participation and/or reactions by the towing tank community.

All traditional trial 'guides' and 'codes', including those mentioned and the recent update of the SNAME Technical and Research Bulletin 3-47 'Guide for Sea Trials' of August 2015, suffer from fact, that the procedures are error prone and hence the results are *not* reliable, *not* trustworthy, but open for manipulation due to lack of coherency and transparency.

Severe reservations

Despite severe reservations of many yards ISO 15016: 2002-06, standardizing the unsatisfactory practice of our grandfathers, has been adopted following the consent of most pertinent National Standards Groups. Only the Korean Group opposed the new standard, but for a wrong reason. They wanted to introduce more hydrodynamics, an even more fancy sea-keeping theory than the Japanese, 'based' on shaky grounds, on the crude estimates of the sea state usually only available.

Ship owners have always felt the results of the traditional evaluations of 'speed trials' to be *not* particularly reliable and trustworthy. And this situation has *not* only been unsatisfactory, but found to be unacceptable as on the basis of the results contractual disputes are to be settled. Accordingly I have timely and strongly demanded a serious discussion *not* only of the details, but of the fundamentals in the first place.

Incredible practice

While earlier there has necessarily been a strong feedback between trials and predictions, at present the latter appear to be more or less 'self-contained'. It is worth mentioning in this context, that the CFD mono-culture is *not* a substitute for ship theory.

And as long as it is accepted practice, that the same 'people', who have produced the predictions, are procuring the standards and are 'accordingly' evaluating the data of trials based on the results of their predictions, nothing will be changed.

META-THEORY

Facts are based on theories ...

We describe the world in terms of currently, widely accepted conventions. This fundamental observation applies of course to all human 'research'.

Goethe already explicitly referred to the fact, that all '*facta*' are theory-laden, noting in his 'Maximen und Reflexionen', posthumously published 1833:

"The utmost would be: to understand,
that all facts are already theory."

Now it is a platitude in the philosophical literature to refer to this fact (Faye, 2000/171):

"It is part of the folklore of today's philosophy of knowledge that perception is theory-laden."

But the naïve belief in 'solid' facts, *not* to forget the fashionable 'alternative' facts, is still widely entertained.

... and theories are based on principles

*"In principio erat verbum ...
In the beginning was the Word ..."
Gospel of St. John 1. 1*

Marc Twain also knew this in 1900, when he pinpointed this fact in his speech on 'The Disappearance of Literature':

"You cannot have a theory without principles.
'Principles' is another name for 'prejudices'."

And in his introduction to 'The Problems of Philosophy' of 1912 Bertrand Russell clearly stated (1981/25):

"All knowledge, we find, must be built up upon our instinctive beliefs, and if these are rejected, nothing is left. But among our instinctive beliefs some are much stronger than others, while many have, by habit and as-

sociation, become entangled with other beliefs, *not* really instinctive, but falsely supposed to be part of what is believed instinctively."

One 'fact' is immediately evident: Scientists adhere to different prejudices and beliefs and (even 'worse') depend on different sponsors. So the wide-spread 'doubts' in 'facts' are *not* at all surprising.

Rational criticism: Another belief!

"Didactylos shrugged. 'Could be. Could be. We are here and it is now. The way I see it is, after that, everything tends towards guesswork.'

'You mean you don't *know* it's true?' said Brutha.

'I *think* it might be,' said Didactylos. 'I could be wrong. *Not* being certain is what being a philosopher is all about.' "

Terry Pratchett: Small Gods (1993/186).

Karl Popper has much later stated exactly the same fundamental observation concerning the foundation of our knowledge (1983/28), lucidly phrased by Mark Twain and Bertrand Russell. But his intricate expositions, even in his 'Postscript', are open for misinterpretations, as mine may be.

According to my comprehension he 'avoids' the infinite regress of beliefs and 'replaces' it by infinite rational criticism. But Edward Forster's dictum: "I do *not* believe in Belief", quoted by Karl Popper, explicitly confirms Terry Pratchett's subtle remarks, implying, that we cannot get along without beliefs. Incidentally, Terry Pratchett's various 'studies' of the 'Disc-World' based on 'the' Tortoise are enlightening 'all the way down'.

In view of the historical development of rationality and objectivity studied by Lorraine Daston (2000) and Peter Galison (2007) scientists have adhered to and are adhering to various concepts of rationality. The repeated claim, that the conventional trials codes are 'rational' as well, is in fact at the root of my work on trustworthy trials, the reason for my 'falling out of step'.

Rational criticism is what I am asking for in my call to join forces, to forget the childish policy, carefully to avoid any reference to my work. To be specific, that criticism will be immanent, concerning the purpose of my proposals meeting the standards of rationality currently (!) widely accepted in science.

Hierarchies of coherent beliefs

In view of the state of affairs Bertrand Russell has already in 1912 clearly stated the task of 'philosophy', implying a pragmatic solution of the problem of foundation (1981/25):

"Philosophy should show us the hierarchy of our instinctive beliefs, beginning with those which we hold most strongly, and presenting each as much isolated and as free from irrelevant additions as possible.

It should take care to show that, in the form in which they are finally set forth, our instinctive beliefs do *not* clash, but form a harmonious system. There can never be any reason for rejecting one instinctive belief except that it clashes with others; thus, if they are found to harmonize, the whole system becomes worthy of acceptance."

The 'hierarchy' if traditional beliefs concerning powering trials does *not* form a harmonious system, and that is my incentive to continue my research. My *opus magnum*, a reconstruction of classical dynamics, is the hierarchy of my beliefs in the spirit of Bertrand Russell, in twelve years work cleaned from 'irrelevant additions', and containing 'relevant' theories of ship motions and propulsion, but only as examples.

That document of fourteen hundred pages, now on my website, though without live table of contents, is *not* a text book proper, but rather a 'reader', and readers in a hurry may just relish the subtle, 'ambiguous' motti, highlighting most of the sections and subsections.

Solved 'in principle'

All attempts to 'reduce' my approach to parameter identification indicate, that its essence has *not* been understood. The problem to be solved is coherently to define and to identify parameters. Professional parameter identification is 'only' a secondary, though necessary tool.

Talking in terms of incoherently defined parameters, identified with smartly invented instruments that cannot even be calibrated, *but have passed peer reviews*, comes next to plain nonsense and is an irresponsible waste of research resources.

Typical examples are speed logs and thrust meters. When somebody tells me and even tries to sell me a solution, that he has arrived at 'in principle', I am always responding by my favourite Radio Erivan joke:

'*Question*: Is it true, that Iwan in Moscow has won a car in a lottery? *Answer*: 'In principle yes, but' it was *not* Iwan in Moscow, but Igor in St. Petersburg, and it was *not* a car, but a bicycle, and he did *not* win it, but it was stolen from him.'

STANDARDS

Standards: Shared 'prejudices'

According to the rules of ISO and other organisations 'standards' are *not* necessarily based on the state of research, *if any*, but on the consensus of institutions eligible to take part in the development and in the vote.

'Consequently' the traditional conventions of powering trials have been perpetuated by ITTC, ISO und IMO, following the aggressively 'marketed' proposal STAIMO, dwarfing IMO to an appendix of MARIN, without any critical participation and/or reactions of the community.

After retiring from VWS, as a private person I was no longer 'eligible' to take part, unless paying a 'fortune', just

to be treated as 'minority'. I preferred to save my money and to inform members of pertinent groups about my discoveries and my mistakes by e-mails, also published on my website. Thus 'nobody' can claim to be 'ignorant'!

ITTC 'Activities'

Especially in view of the fact, that for years HSVA had already been relying on the rational approach the statement of the ITTC Committee on Trials and Monitoring in the Report to the 24th ITTC concerning these matters is particularly ridiculous.

The report of the Specialist Committee on Speed and Powering Trials provides a comparison of all trials codes in use (2006). The method I proposed has been considered as "a category by itself. It does *not* really follow the same format as all the other methods and hence was *not* used in the comparison of factors reviewed in each method."

The Committee missed to note, that my work purposely does *not* follow the same format! According to my experience and to the ISO example the problem is *not* so much to analyse random errors of the traditional approach, but the problem is still to avoid its fundamental conceptual deficiencies, *not* even mentioned by the Committee.

In the Report to the 25th ITTC (2008) the conceptual problems of trials evaluation are no longer dealt with although many establishments are working on the problems, mostly 'secretly'. Instead, one finds a large number of studies concerned with the application of CFD methods.

Shying clients away!

Though in a presentation and paper of Hollenbach (2008) the essential arguments in favour of the 'HSVA method' are in every detail, even in wording, exactly the same as in my 'ISO Draft '98' (1998) Hollenbach in a letter to Wagner and in copy to me, 'argued', that an appropriate acknowledgement of my pioneering work was felt to shy away the clients addressed! The logic of this argument is felt to be far beyond the horizon of rationality I am trying to promote.

For the same 'reason' in 2015 at a 'research forum' of SVA Potsdam I have been bluntly interrupted, when mentioning the term 'quasi-steady'. In the meantime the research project 'ProRatio - Propulsionsprognose unter Anwendung von quasi-stationären Messungen und der Rationalen Methode' has been proposed, granted and started in 2016.

The most recent note by Verhulst (August 2017) on the state of development at Wageningen following Holtrup's earlier work already in the title "Propulsion tests: quasi-steady for efficiency and quality" uses my arguments, even in wording (!), explaining customers (!) in the sub-title, 'why the quasi-steady approach is gradually replacing the conventional method in model propulsion tests'.

As usual, in this statement the concept 'conventional' is mistaken for 'traditional'. The procedures I am promoting and which are developed at Wageningen are conventional

as well, 'but' more or rather less rational, respectively. As at HSVA and SVAP the copyright law and the doctrine of fair use appear to be unknown; see the Preliminaries of my website.

Many more related developments have been referred to in my contribution to the first International Symposium on Marine Propulsors smp 2009, Trondheim, Norway; paper and presentation to be found on my website.

CURRENT IDENTIFIED

Three commandments ...

Since my Schiffstechnik paper and the subsequent STG paper of 1980 I have described and demonstrated with increasing clarity and precision, how the basic problems of trials can be solved, if one 'only' adheres to the 'Commandments' of rationality, of inter-subjectivity, alias 'objectivity', and, last but *not* least, of efficiency:

'Thou shalt *not* talk in terms of informal, incoherent languages and incoherently interpreted concepts.'

'Thou shalt *not* introduce aggregate models with more parameters than thou can reliably identify without any prior data, as necessary for trustworthy results.'

'Thou shalt no longer adhere to traditional model testing and trials and monitoring, much more efficient and reliable quasi-steady trials, being necessary on full scale anyway.'

Moses: Pentateuch, 2, 20, 1 – 17. Paraphrases: MS.

... and a basic rule

'If thou cannot reliably identify the prevailing currents during fluid mechanics testing, at trials in particular, thou shalt forget any further analysis!'

Based on a half-sentence in my METEOR report of 1990/91 I have demonstrated in 1998, that in case of trials the current can be identified simply by solving a set of linear equations based on the data of the usually very few (!) runs up and down wind, without any expensive and delicate instruments, providing incoherent interpretations and impossible (!) to be calibrated anyway!

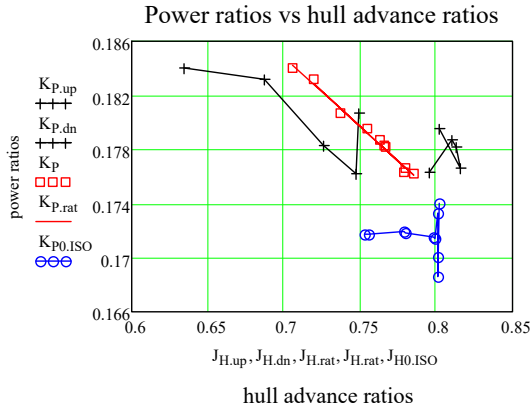
In the limited range of variation the propeller power characteristic in the behind condition can safely be considered as linear and consequently that power characteristic and the current can jointly and coherently be identified by solving a set of linear equations.

According to my knowledge some colleagues are already using my simple, robust and reliable procedure, in fact the only 'meaningful', as I have explained in a correspondence with Dott. Gennaro.

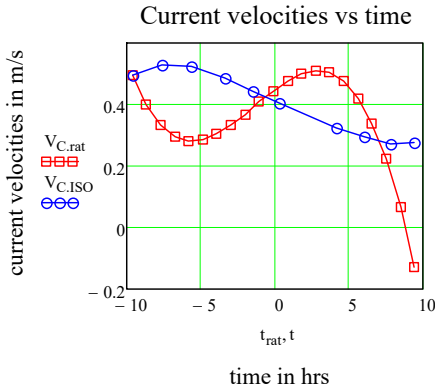
ISO 15016 example

That method I have immediately used to analyse the example in the Draft ISO 15016. And as the result shows, the rational procedure results in well behaved power ratio

versus hull advance ratio, while the result of the ISO procedure is unacceptable.



Similarly the corresponding values of the current identified differ in tendency and up to half a knot and even more.



A misprint in the ISO example has been clarified in a long correspondence documented on my website. But only during the workshop at Wageningen on January 15, 2009, I have been told, that another, more important sign error has been detected and corrected in the standard. Although 'everybody' knows about my interest in the 'criminal case' I have *not* been informed and *not* been asked to change the exposition of my previous findings accordingly.

After the 'calibration' the propeller power characteristic in the behind condition can be used for monitoring purposes, e. g. to determine the value of current velocity from measured values of the rate of revolution and of the torque.

Reactions: none ...

Although I have informed all bodies 'concerned' in time about the evident fundamental errors in the example and told them how to circumvent the problems, nobody felt 'concerned'. The draft became ISO 15016: 2002-06.

And despite the errors in the example in that standard it has with small changes and reference to the 'direct power method', but to my knowledge without example, again (!)

been approved by most national Standards Groups and published as ISO 15016: 2015(en).

My related correspondences with the Conveners and with colleagues concerning the obscure 'direct power method' are published and/or available on request.

... and hardly to be believed

Concerning the problem of identifying the current I found in the Final Report and Recommendations of the Specialists Committee on Performance of Ships in Service to the 28th ITTC 2017 at Wuxi among the Terms of Reference:

"3. Provide answers to the following aspects of the analysis of speed/power sea trial results: ...

b. ISO proposed „iterative method' as an alternative for mean of means method for current correction."

And after an 'incredible' students exercise of six pages I found the answer:

"Conclusions. In addition to the verification of accuracy reported in Strasser et al, 2015, convergence was further investigated in the Committee this term.

From the results of these studies, the Committee agreed to adopt the „Iterative method" as an alternative to the „Mean of Means" method in the revised recommended procedure."

This 'Conclusion' and the related Recommendation are absolutely 'incredible', *not* to ridiculous, in view of my extremely simple, reliable procedure, conceived and successfully applied, but 'consistently' ignored by the pertinent ITTC Committees since twenty years.

Environmental conditions identified

Further, the power required due to the resistance in water, in wind and in waves can be identified simultaneously by solving another set of linear equations. Identifying parameters of models from observed data, even visually observed wave data, has the advantage, that systematic errors in the observations are to a great extent 'automatically' accounted for.

This very simple, but fundamental example clearly shows that the present, very involved practice according to established and standardised procedures requiring a large number of doubtful conventions, mostly tacitly implied according to the state of the 'art' in naval architecture, is largely based on superfluous assumptions. But who likes to be told, that his deeply rooted beliefs, the basis of 'well' established procedures, are plain 'superstition'?

TRADITIONAL STEADY TRIALS

Pseudonyms requested

My work on traditional steady trials started only much later, due to lack of access to data. While towing tanks are (still) afraid, that mentioning my procedures might shy clients away, ship builders and owners are

afraid, that critical analyses of their precious trials data might get into the wrong hands.

But in two cases I have been asked to analyse comparative trials and I have even been permitted to publish my anonymised analyses. Hence the pseudonyms ANONYMA and PATEs (Post-ANONYMA Trials Evaluations). The complete details are to be found in the METEOR Festschrift, in Volume 1 and Volume 2, respectively.

Even before these exercises I never believed in traditional 'proofs' of 'superiority' of one or the other of two competitive designs, due to the lack of transparency, *not* to mention the inherent inconsistencies.

ANONYMA trials

Subsequent to the doubtful, traditional evaluation of two series of traditional ANONYMA trials off the coast of Morocco, performed to establish the influence of the trim on the powering performance, I had been asked to reanalyse the data.

And immediately my very sensitive procedure 'told' me, that something was seriously 'wrong' with the data acquired at the smaller trim. But it took me a while to realise, that at the prevailing sea state the propeller at the smaller nominal submergence 'happened' to ventilate during the up wind runs.

Consequently the few data of the remaining runs up and down wind had to be treated separately, but were *not* sufficient to identify the mean and the tidal components of the current at the second, the smaller trim. The only way to 'save' the project and to arrive at reliable results has been to extrapolate the current identified at the larger trim.

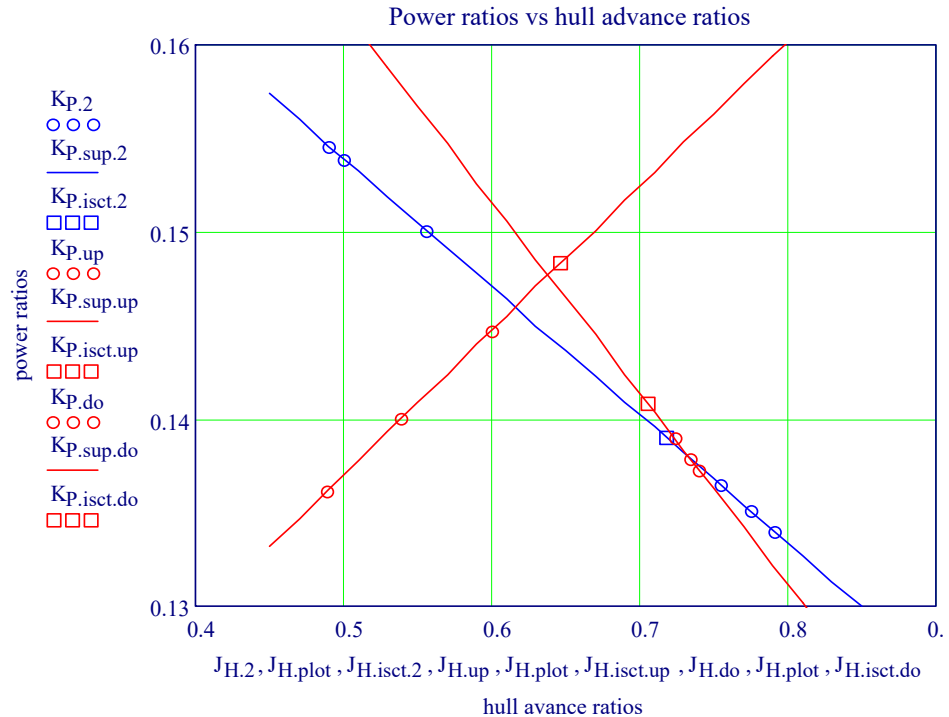
The lesson learned

The lesson learned from this exercise is evident. Any routine evaluation according to ISO 15016 and STAIMO is doomed to fail in such cases and has failed, unnoticed during the evaluation at a renowned institute!

'In principle', any reference to the performance of deeply submerged (!) model (!) propellers in open water (!), as usual in most trials codes is unacceptable, as they require data to be sucked from the thumb or a joker to be pulled out of the sleeve, as 'required'.

For my taste the way the STA procedure has been 'sold' and followed as 'industry standard' is a particularly

drastic example of Andersen's archetypal tale of 'The Emperor's New Clothes'. I have copied the plot found in Wikipedia and published it in the second volume of the METEOR Festschrift, as colleagues, even at Copenhagen, claimed *not* to know it. For ready reference I reproduce it here again.



The procession continued

Each boy proudly identifies himself with the little child 'dismantling' the emperor and his weavers in Hans Christian Andersen's tale. But growing up nearly all of them forget the lesson learnt and join the crowd, instead of using a little bit of common sense to expose the crowd.

"A vain Emperor who cares for nothing except wearing and displaying clothes hires two swindlers who promise him the finest, best suit of clothes from a fabric *invisible to anyone who is unfit for his position or 'hopelessly stupid'*. The Emperor's ministers cannot see the clothing themselves, but *pretend that they can for fear of appearing unfit for their positions* and the Emperor does the same. Finally the swindlers report that the suit is finished, they mime dressing him and the Emperor marches in procession before his subjects. *The townsfolk play along with the pretense not wanting to appear unfit for their positions or stupid.* Then 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.*"

Analogies of the various aspects addressed are self-evident, and thus need no explicit elaboration.

FROUDE'S APPROACH RATIONALISED

Need for new conventions

Not all problems are as simple as the evaluation of speed trials, getting along without any ship theory.

Froude's interpretations of the basic concepts of resistance and propeller advance speed, introduced at his time for well understood reasons, suffer from the fact, that they are *not* only incoherent, but worst of all, are *not* applicable on full scale under service conditions.

Coherently defining the concepts of hull resistance and propulsor advance speed behind the hulls at the condition of self-propulsion in the context of an axiomatic system of conventions provides the only rational way to solve the basic problems at hand, to replace propeller open water and hull towing tests by conventions applicable on model and full scale in the same way.

Consequently Fritz Horn at Berlin, Professor for the Theory of Ships, already in the 1930s proposed a convention to identify the propeller advance speed solely from data of propulsion tests, in order to get rid of the 'disturbing' rotative efficiency.

Horn's Copernican turn

Instead of looking at the effect of the propeller at the stern of the ship, Horn turned around and looked at the effects behind the propeller. He exploited the model of an ideal propeller in uniform energy and displacement wakes and of an equivalent (!) ideal propeller 'far behind', 'outside' the displacement wake, already proposed by Fresenius in 1924.

In the context of the rational theory this model permits to derive a thrust deduction theorem and, as an approximation, a very robust thrust deduction convention, explicitly on my website.

Equivalent propellers

Equivalent ideal propellers are intuitively conceived as pumps with the same flow rate and the same head. To my surprise Professor Bavin at St. Petersburg claimed, that he and his colleagues 'adhere' to another, less intuitive and obvious concept.

Depending on the different pressure levels prevailing in the ideal wakes equivalent propellers are operating in, equivalent ideal propellers have different diameters.

Thus, if in model testing a given propeller is located more or less aft, the propulsive efficiency changes due to the fact, that the 'propellers' at the different positions are *not* equivalent. Comparing their performances is similar to comparing apples and pears.

Recent developments

Horn's tests and Troost's at Wageningen, reported at the 4th ITTC 1937 at Berlin, were seriously hampered by the inadequate conceptual, instrumental and computational tools at their time and further developments were disrupted by the war.

But when I realised, that in the meantime tools, missing before, had been developed and were at my disposal, I started the development anew with my fundamental work on performance criteria (1968/70) and my axiomatic theory of hull-propeller interaction (1980).

Model based theories

While logicians are teaching us, that axiomatic models may be pulled out of the hat, useful axiomatic systems are 'model based', arrived at intuitively and efficiently by adopting adequate, 'sufficiently rich' hydro-mechanical models.

In traditional teaching and arguing these models, *if any*, and their consequences are being referred to only more or less implicitly, rather cursory, while following Fritz Horn, I have used the powerful concept of equivalent propellers explicitly, e. g., deriving the thrust deduction theorem after introducing of the equivalent propeller outside the displacement wake.

The abstract theory formalises Froude's conceptual framework for 'open' propellers behind 'slender' hulls. The axiomatic system of conventions defines a representation space adequate for the purpose at hand, even if the physical separation of hulls and propellers is no longer meaningful, as in case of hull integrated propulsors, or is practically *not* possible, as on full scale.

Three lines of development

Three lines of work I followed are clearly to be distinguished:

traditional hull-propeller configurations undergoing traditional steady trials, *not* requiring any reference to hydrodynamic and ship theory, but only to the principle of 'objectivity', Buckingham's Π -theorem;

traditional hull-propeller configurations, where hull and propeller can no longer be separated physically, but only conceptually, requiring a 'momentum based' abstract theory of hull-propeller interactions;

advanced hull-integrated propulsor configurations, where even the conceptual separation of hull and propulsor is *not* possible and thus the concept of interaction is no longer meaningful, requiring an 'energy based' abstract theory treating interactions implicitly as in pump design and testing.

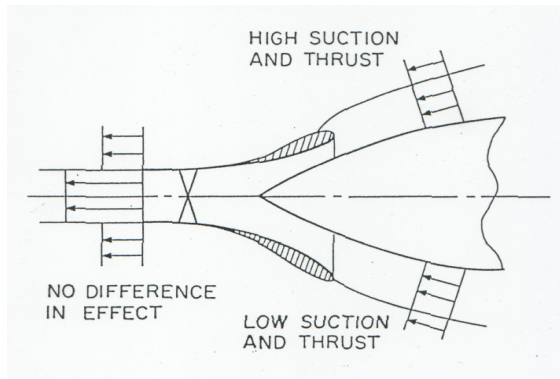
Application: Ducted propeller

Basic for the rational approach has been my fundamental observation, that most interactions take place between hulls and ducts (1961/1968). According to Ber-

noelli's law the additional (!) thrust at the ducts and the suction at the hulls constitute energetically neutral hydrodynamical short circuits as in case of interaction of hulls and open propellers. Thus the higher the thrust of a duct the higher the suction at the hull and the higher the frictional losses at duct and hull.

But my experimental findings concerning hull-propulsor interaction 'happened' to contradict the deeply rooted prejudices of my director and my supervisor. 'Consequently' my report was *not* registered as the VWS Report proper and banished into the basement. But observations and conceptions cannot be locked 'away'. Although dismantled as plain superstition the prejudices mentioned are still popular among 'experts'.

In view of the large variety of configurations it is felt, that the current academic and industrial activities to optimize ducted propulsors in open water using CFD methods



are *not* yet facing and addressing the real problems. There is no way to proceed along the traditional approach to account efficiently for hull-propulsor interactions.

In a design project it has been demonstrated, that a ducted propeller system can be designed without reference to thrust, all (!) interactions accounted for implicitly as in pump design. All pertinent documents publish in the section on ducted propulsors on my website.

QUASI-STEADY TRIALS: FULL SCALE

Objective followed since 1980

In my inaugural 'Schiffstechnik' paper of 1980 and the subsequent STG paper I restarted Horn's development, aiming to derive the powering performance solely from data acquired during propulsion tests, *not* only on model scale, but on full scale in the same way.

Thus the problem to be solved was, to develop conventions replacing the incoherent hull towing and propeller open water tests, impossible to be performed on full scale at service conditions anyway.

The 'considerable' potential gains in time, costs and reliability at the same time offered by quasi-steady trials I since have promoted will sooner than expected result in requests by clients and require major revisions of existing model test and trial procedures and codes. 'Our iceberg is

melting!' It is high time to study the strategy of penguins. The report by Verhulst has already been mentioned.

METEOR project

In order to demonstrate the applicability of the technique full scale, even in 'adverse' weather conditions, in heavy seas, I have started with the most intricate problem and performed quasi-steady propulsion tests with the German research vessel METEOR in the Arctic Sea between Spitzbergen and Greenland already in November 1988.

The METEOR tests and its results are the spectacular triumph of Horn's vision of propulsion tests evaluated without reference to model hull towing and model propeller

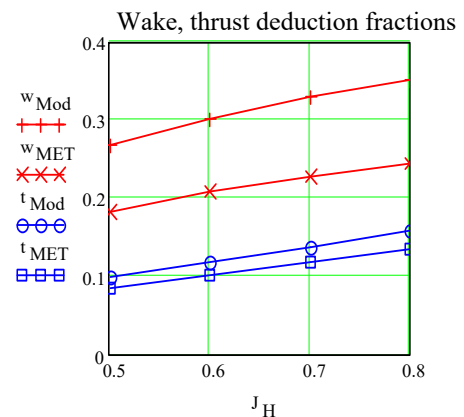


open water tests.

The methods and the results have been discussed at the 2nd Interaction Berlin '91 with the ITTC Powering Performance Committee attending. The Proceedings are to be found on my website.

Scale effects identified

Scale effects in wake and thrust deduction fractions have been determined experimentally, to my knowledge world wide for the first time, by comparing model and full scale results obtained according to the same experimental and analysis methods.



Neither theoretical considerations nor the experimental results support the traditional 'axiom', that 'there is practically no scale effect in the thrust deduction fraction'.

From thereon it took me another twenty-five years of hard work to reach the present state of maturity. Although the need for full scale tests is ritually repeated, so far nobody appears to have undertaken tests similar to the METEOR tests.

Thrust measurements

As a marine engineer to-be I had been taught, that the traditional procedures require precise measurements of torque and, additionally, of thrust, necessary for the analysis of the powering performance.

But when I conceived the METEOR project I 'noticed', that all the 'smart' proposals and expensive developments of thrust meters so far had turned out *not* to be routinely applicable, and even worse, *not* to be sufficiently reliable, lacking adequate calibrations under service loads including calibration of the cross talk of torque on the thrust signal.

Thus I used a 'shaft dynamometer', a hollow section replacing an original section of the shaft, instrumented and calibrated as a six component balance in the range of service loads. For 'routine' applications on given ships short, carefully calibrated two component shaft dynamometers should be sufficient and *not* expensive, if designed and ordered as section of the shaft.

Latest insights

But, according to my latest insights gained during further evaluations of the results of the 'model' trial of 1986, thrust measurements, full scale routinely impossible anyway, are *not* necessary for the detailed analysis of the powering performance.

Currently I try to find out, if the published METEOR results, based on the (to my knowledge) only reliable thrust measurements ever performed, are sufficient for the full scale validation of my procedure.

Feed back of noise

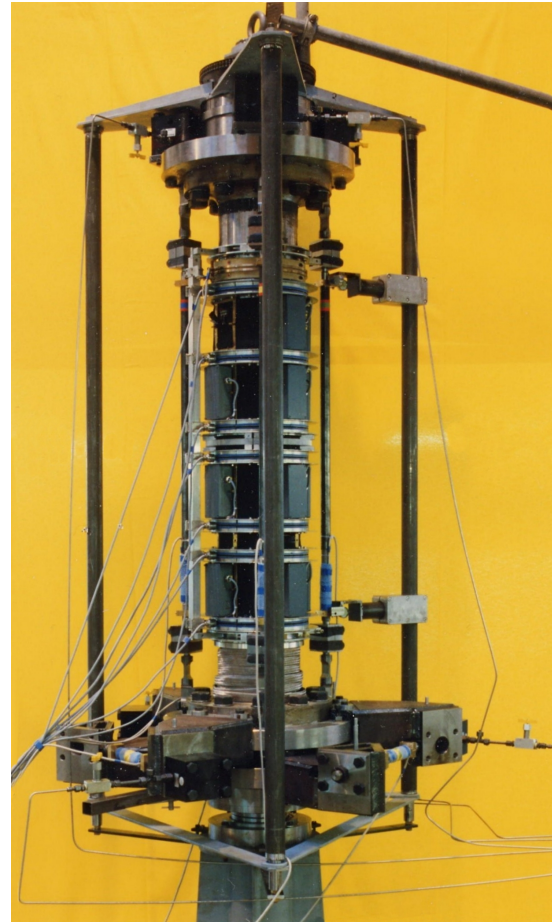
In any case a mandatory requirement for the success of trials in a seaway is to prevent systematic errors due to feed back of noise. This can be done by correlating all data with signals, independent of the noise, fed into the loop. In the METEOR project the rate of shaft revolutions has been linearly lowered about 10 % and raised again during measurements of about twenty minutes. The small rate of change had been chosen to avoid any hysteresis, in hindsight too cautiously.

'Related' work

In a SNAME paper of 1988, presented at the same time the quasi-steady METEOR tests took place in the Greenland Sea, Abkowitz and Liu have described the use of extreme engine manoeuvres, to identify the propulsive

performance of ships. But evidently extreme engine manoeuvres result in flow conditions completely different from those prevailing 'around' the operational conditions, thus providing data 'by definition' *not* at all suitable for the identification of the powering performance of interest.

And these manoeuvres are *not* only theoretically unacceptable, but definitely *not* practical at all. Chief Engineers will *not* perform such manoeuvres again and again to monitor the powering performance and Captains will *not* permit to perform such manoeuvres under service conditions, definitely *not* in 'adverse' weather.



In contrast my axiomatic model published in 1980 and for the first time put into operation in 1988 to identify the powering performance of the German research vessel METEOR, requires only very moderate engine manoeuvres taking only about twenty minutes, which can be executed once in a while, even in severe weather as demonstrated, and will hardly ever be noticed by Captains and Chiefs.

Not appropriate!

I still wonder how the 'student's exercise' of Abkowitz and Liu could possibly pass SNAME's peer review, particularly in view of the two subsequent 'events'. The soft draft of a paper on insights gained in the METEOR project,

proposed for presentation at the SNAME Annual Meeting 1991, was turned down by Abkowitz, *not* understanding what had been achieved in following Horns ideas. Admittedly, at that time the conceptual solution of the wake problem was still lacking the maturity and robustness required and still under scrutiny.

And more recently a paper proposed on the 'Rational theory ... ', to be presented at the SNAME Annual Meeting 2008, was turned down with the 'argument': "that the material may *not* be appropriate for this forum." The question concerning another, appropriate forum was *not* answered.

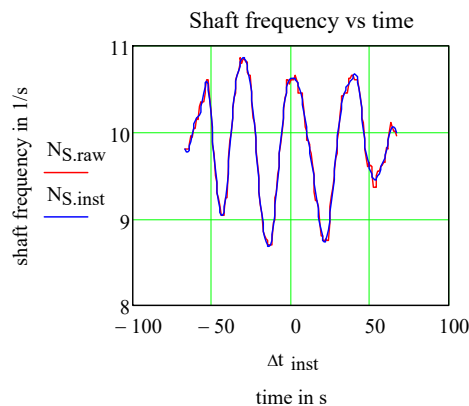
These responses are mentioned *not* only to contribute to the history of science, but in view of the future. Hopefully my present paper is appropriate for the forum it has been prepared for.

2nd INTERACTION Berlin '93

Details of the measurement system and checks of its stability on board are to be found in the METEOR Report, which is included in the Proceedings of the 2nd INTERACTION Berlin '93', my international workshop dedicated to the METEOR project.

To repeat: According to my latest insights based on the results of the 'model' trial of 1986 thrust measurements are no longer necessary for the detailed analysis of the powering performance.

QUASI-STEADY 'MODEL' TRIAL 1986

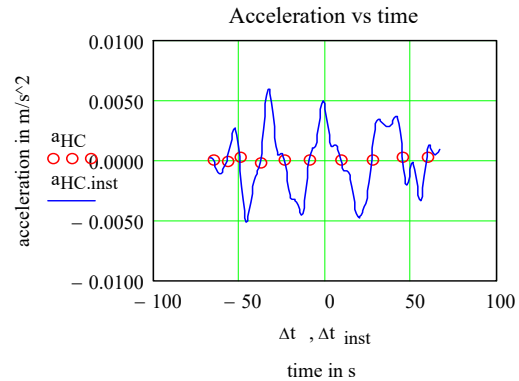


Runs of two minutes duration

The runs of my quasi-steady 'model' trial of 1986, performed prior to the METEOR tests to demonstrate the feasibility of quasi-steady testing, have been manually controlled, keeping the self-propelled model free of collisions under the towing carriage.

The raw data of shaft frequency, torque and thrust, of carriage speed and of model surge and frictional deduction acquired during a run of only two minutes duration and documented in a report have been again and again been

subject of my continued analysis, the 'last' revision published only recently.



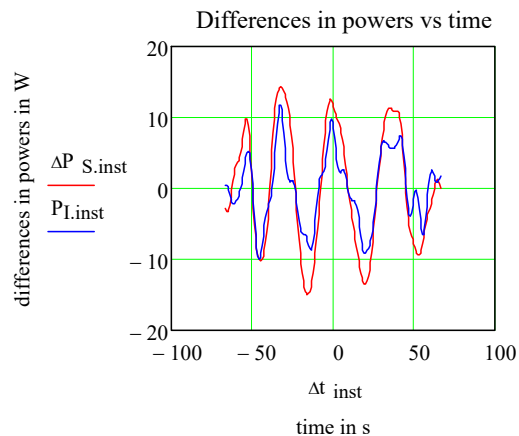
Ten quasi-stationary states identified

The example shows, that during the trial of only two minutes duration ten quasi-stationary states have been identified.

Subsequently the data of hull speed through the water and shaft frequency, torque and thrust at these states have been analysed using the procedures developed for the analysis of traditional trials.

Propulsive efficiency identified

At the stationary conditions the supplied and required powers balance each other, but in general they differ and their difference differs from the inertial power of the ship and the surrounding water.



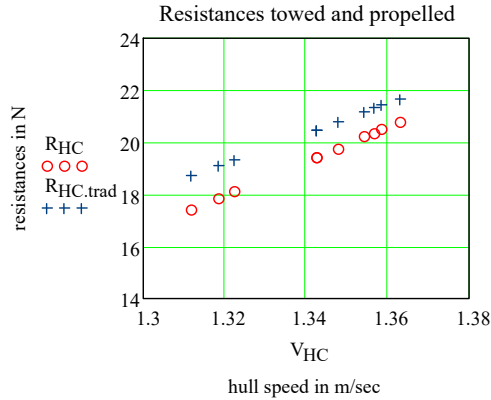
The ratio of the inertial power and of the difference of the powers supplied and required is nothing else but the propulsive efficiency.

Resistance and thrust values identified

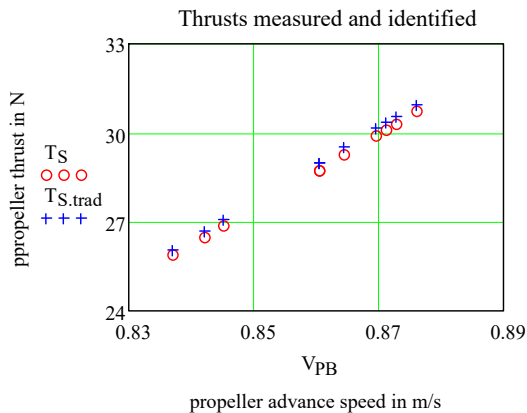
And with the values of that efficiency identified the values of the resistance of the model and of the thrust of the

equivalent propeller outside the displacement wake at the quasi-stationary flow conditions can be derived.

In order to prevent any misconception I state explicitly, that the values of the 'resistances' plotted are values of two differently defined and interpreted concepts!



The following slide shows the thrust measured on model scale (!) and identified.



Evidently such tests can be performed at any model basin requiring no extra instrumentation, time and costs. Currently I try to find out, if the METEOR results published are sufficient for the full scale validation of my procedure.

Further evaluations

Following Horn I derived a thrust deduction theorem already in 1968 and later, as an approximation, a robust thrust deduction convention. Lacking a wake theorem I pulled a corresponding, apparently reasonable, wake convention out of my hat, or rather out of my head, noticing only in hindsight, that I evidently had introduced a singularity.

Further, a student of mathematics noticed, that my fancy 'engineering' ideas concerning the solution non-linear equations were much too naïve. And at that stage I realised, that I tried to identify far too many parameters and returned

to the favourite principle of engineers: KISS: Keep it simple, stupid!

After solving the remaining nonlinear equation all details of the powering performance including the values of resistance and thrust, partial efficiencies and wake components have been derived as published as the 'last', the fifth revision of 'model' analysis, still under scrutiny. That work has only been disrupted in favour of the present effort to spread my gospel.

CONCLUSIONS

Feed back!

The current error prone standards for trials and monitoring are based on the tradition and the consensus of the community, which is also providing the powering predictions based on the results of incoherent experiments with physical and/or numerical models.

Independent, reliable feedback, necessary for trustworthy validation of the predictions and for far-reaching decisions of clients, had *not* been developed at model basins and related institutes, being impossible in the traditional conceptual framework.

Realising this unacceptable situation I have over the past four decades paradigmatically developed some 'satisfactory' solutions to maturity based on adequate conceptual 'power' tools, widely used in other fields.

DNV GL Merger, effective Sept. 12, 2013

"Standards are improving, but there is a lack of international governance. The industry needs strong, independent players that promote greater openness, consistency and effectiveness in the profession and push the development of new adequate measures and standards. ... We aim to deliver technical solutions that are practical and in the best interests of our customers and other stakeholders."

Henrik O. Madsen, CEO of the DNV GL Group.

Evidently leading persons are aware of the problems I have addressed, though here only in the constitutive, delicate, though neglected field of trials. For the coverage concerning the fundamental field of 'Quantities', in German and French *not* less ambiguous 'Größen' and 'Magnitudes', respectively, I refer to my website.

Join forces!

The 3rd, virtual INTERACTION opened on my website is a repeated invitation to join forces, a forum for the joint (!) discussion of and work on further developments of solutions so far and on further applications.

The considerable potential gains in time, costs and reliability offered by quasi-steady trials, I have promoted since 1980, are expected soon to result in requests by clients.

Thus ITTC will certainly have to organise at least a Group Discussion on quasi-steady model tests and full scale trials and monitoring, *not* only concerning powering performance, if *not* now at Wuxi, but at least in three years time.

'*Not invented here*' is an extremely inefficient doctrine. Though many institutes are working on related problems they are reluctant to communicate and join forces. In the 25th ITTC Propulsion Report Justin (?) Kerwin is quoted: "Progress in research might well benefit from greater interaction between developers of different approaches."

Dare to think yourself!

But of course anybody seriously interested in the solution I have successfully developed to maturity and repeatedly applied in delicate cases, will have to try the solutions himself in his own way and environment. The large number of explanatory notes, I have published for any taste in response to diverse questions since 1980, may be helpful, but:

The proof of the pudding is in eating it – yourself!

Do *not* believe anybody, *not even me*, but stick to Kant's slogan of 'enlightenment', in German less 'divine', of 'explanation' (Aufklärung) (1784):

Sapere aude, dare to think yourself!

Reading my papers may endanger your 'principles', but it is never too late, to give up your prejudices!

"So when Pooh Bear experienced the burning pain of [removing] a bee sting, this symbolized the philosophical pain of discarding a cherished hypothesis. We note the unhesitating courage with which he performed this painful duty." [Addition]: MS.

John T. Williams: Pooh and the Philosophers (1996/13).

ACKNOWLEDGEMENTS

Extensive in-depth discussions with Dr.-Ing. habil Klaus Wagner of Rostock, Dott. Ing. Giulio Gennaro of Genova and (in the meantime MSc) Daniel Wiens of Ulm University, substantially contributing to the developments reported, have been published where appropriate and are again gratefully acknowledged.

REFERENCES

As a matter of efficiency and of convenience all my work, including presentations, discussions etc, is published on my website. As copyright protected publication it is regularly collected and permanently archived by the Deutsche Nationalbibliothek in accordance with the DNB Law of July 22, 2006.

Complete references to my work on propulsion and trials are to be found in the sections on propulsion in general and on ship powering trials, in the bibliographies in particular including links to publications and presenta-

tions. Here only survey publications are mentioned. For ready reading and reference many of the pdf-files may conveniently be printed as DIN A5 (210 x 148 mm) brochures.

My most recent work, the 'last' revision of the evaluation of the 'model' trial of 1986 in particular, can be directly accessed under the 'News flash'.

Selected pertinent publications

"All my poems are occasional poems, they are inspired and deeply and firmly rooted in reality. I do *not* believe in poems plucked out of the air."

Johann Wolfgang Goethe, in conversation with Johann Peter Eckermann on 18.09.1823.

Translation: MS.

- Schmiechen (2014), M. From METEOR 1988 to ANONYMA 2013. Future Ship Powering Trials and Monitoring Now! Volume 3: Report on the the further advanced evaluations of the quasi-steady 'model' propulsion test of 1986, showing that detailed powering analyses require neither prior data nor thrust measurements, with related notes and correspondences. Published on occasion of the 27th International Towing Tank Conference, Copenhagen, August 31 to September 05, 2014. VWS Mitteilungen Heft 64, post mortem, Berlin 2015. In memoriam Versuchsanstalt für Wasserbau und Schiffbau, Berlin.
- Schmiechen (2014), M.: From METEOR 1988 to ANONYMA 2013. Future Ship Powering Trials and Monitoring Now! Volume 2: The first PATES: Post ANONYMA Trial Evaluations, the continued evaluations of a quasi-steady 'model' propulsion test of 1986, demonstrating the feasibility and 'efficiency' of quasi-steady trials, pertinent documents and discussions added. Published on occasion of the 27th International Towing Tank Conference, Copenhagen, August 31 to September 05, 2014. VWS Mitteilungen Heft 63, post mortem, Berlin 2014. In memoriam Versuchsanstalt für Wasserbau und Schiffbau, Berlin.
- Schmiechen (2013), M.: Future Ship Powering Trials and Monitoring Now! Principles of rational conventions further clarified, consistently applied in a particularly delicate case and lessons (to be) learned. VWS Mitteilungen Heft 62, 1-44. Berlin 2013. See also the following Volume 1 of the METEOR Festschrift.
- Schmiechen (2013), M. From METEOR 1988 to ANONYMA 2013. Future Ship Powering Trials and Monitoring Now! Volume 1: Principles of rational conventions further clarified, consistently applied in a particularly delicate case and lessons (to be) learned, various subsequent presentations and written discussions added. Published on occasion of the 108th Annual Meeting of STG, the Schiffbautechnische Gesellschaft, Berlin, November 20 to 22, 2013. VWS Mitteilungen Heft 62, post mortem, Berlin 2013. In

- memoriam Versuchsanstalt für Wasserbau und Schiffbau, Berlin.
- Schmiechen (2011), M.: Vorschlag für eine Neu-Ausgabe von DIN 1313: 1998-12: 'Größen' [Concepts and Magnitudes, alias 'Quantities']. [Detaillierter und annotierter] Vor-Entwurf für die Diskussion im FBR des DIN NA 152-01 und in anderen interessierten Gruppen. Berlin: Anfang März 2011.
- Schmiechen (2009), M.: 50 Years Rational Theory of Propulsion. Recent Results and Perspectives. Paper presented at the International Symposium on Marine Propulsors smp 2009, Trondheim, Norway, June 22-24, 2009. Proceedings 1st SMP (2009) 117-128. See also Paper and Presentation.
- Schmiechen (2009), M.: Newton's Principia and related 'principles' revisited. Classical dynamics reconstructed in the spirits of Goethe, [Aristotle,] Euler and Einstein. Elementary Mechanics from an advanced standpoint and vice versa. Second edition of work in progress. Berlin, Summer 2009. Published in three volumes. Norderstedt/Hamburg: Books on Demand, 2009. Now freely available as pdf/a file of ca. 1500 pages on my website, though without live Table of Contents. Of particular interest in the present context Chapter 22 'Propulsion mechanics', in Volume 3 'Global and propulsion mechanics'.
- Schmiechen (2006), M.: Propulsor Hydrodynamics. Theme lecture. Presented at the International Conference on Marine Hydrodynamics, MAHY 2006, held January 05 to 07 at the Naval Science and Technological Laboratory at Visakhapatnam, India. Proc. Int'l Conference in Marine Hydrodynamics 2006, Vol.2, 611-631. See also Paper, Handout and Presentation.
- Schmiechen (2005), M.: 25 Jahre Rationale Theorie der Propulsion. Fritz Horn zum 125. Geburtstag. Prepared for the STG Summer Meeting at Magdeburg 17.-19.05.2005, which had to be cancelled. The paper has been presented at the 100th STG Annual Meeting at Berlin, held November 16 to 18, 2005. With many references to files containing detailed derivations of results. Jahrbuch STG (2005). Closely related is the following theme lecture.
- Schmiechen (2004), M. (Author, Editor and Publisher): MARIC Lectures On the Rational Theory of Ship Hull-Propeller Interaction and its Applications. Lecture Notes published on occasion of a course on Marine Propulsion held at the Marine Design and Research Institute of China, MARIC, Shanghai May 26-31, 2004, with participants from Shanghai Ship and Shipping Research Institute, China Ship Scientific Research Centre and Shanghai Jiao Tong University. VWS Mitteilungen Heft 61, post mortem, Berlin 2004. In memoriam Versuchsanstalt für Wasserbau und Schiffbau, Berlin.
- Schmiechen (2003), M.: Beiträge der VWS zur Erforschung der Propulsion und Bewegungen von Schiffen. STG-Nr. 3010, VWS Mitteilungen Heft 60, post mortem, Berlin 2003, 139-202.
- Schmiechen (2002), M.: Rational Evaluations of Traditional and Quasisteady Ship Speed Trials. Published on the occasion of the 23rd ITTC at Venice 2002 and of the Centenary of VWS, the Berlin Model Basin, in 2003. Mitteilungen der VWS, Heft 58, post mortem, in memoriam Versuchsanstalt fuer Wasserbau und Schiffbau, Berlin, 2002.
- Schmiechen (2001), M.: Evaluating Ship Speed Trials: Identifying Parameters of Powering Models. Presented and discussed during the Lavrentiev Lectures Saint-Petersburg 2001, at the International Symposium on Ship Propulsion, held on June 19/21, 2001 at the Saint-Petersburg State Marine Technical University. Lavery Lectures, paper 16. Proceedings (2001) 143-152. See also the original paper, the paper with active links and an extended presentation.
- Schmiechen (1998), Michael and Bruce Johnson: Some Fundamental Considerations Concerning the History and Recent Development of the ITTC SaT List, the International Towing Tank Conference Symbols and Terminology List. Proceedings First International Conference on Maritime Terminology, (ISTI Brussels, May 15-16, 1998) 126-144. Brussels: Editions du Hazards, 1999.
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- Schmiechen (1991), M.: The Propulsive Performance of METEOR and Her Model identified from quasi-steady propulsion tests. Soft draft of a paper proposed for presentation at the annual meeting SNAME at New York in November 1991. See Soft Draft. TUB/Archive: Draft as submitted and draft with notes of two different reviewers, one of them Prof. Martin Abkowitz.
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- Schmiechen (1987), M.: Wake and Thrust Deduction from Quasisteady Ship Model Propulsion Tests Alone. VWS Report No. 1100/87, 1987. Published on occasion of a visit to Korean and Japanese ship research institutes and the 18th ITTC at Kobe in October 1987

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- Schmiechen, M.: Modellversuche mit Kort-Duesen fuer Seeschiffe. Abschluss-Bericht zum ERP-Vorhaben S 1100. 1961. TUB/Archive: The report that was banished into the basement, the fundamental results *not* conforming to the prejudices of my director and supervisor and still entertained by 'experts'.

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After graduation from the Technical Universities at Braunschweig and Berlin and post-graduate studies at the Imperial College in London I have for forty years been employed at VWS, the former Prussian Navy Tank in Berlin, 'carefully' destroyed during the war, and served the ITTC as Secretary of the Executive Committee from 1969 to 1975 and as Member of the Symbols and Terminology Group from 1975 to 1990.

At times I happened also regularly to attend ATTCs and co-authored a paper on tests of a partially cavitating foil for the Boeing Company at eattle in the large, free surface cavitation tunnel of VWS, presented during the 19th ATTC at Ann Arbor 1980.

Leaves of absence for research as Research Fellow at the MIT 1968/69 and as Visiting Professor at the Tokyo University 1973 and teaching as apl. Professor on Hydro-mechanical Systems, marine vehicles in particular, at TU Berlin for forty years have further widened my horizon.

'apl. Prof.', *ausserplanmässiger* ('additional') Professor, is a German academic degree, awarded after an involved habilitation procedure and five years of successful teaching as 'Privat-Dozent'. It is coupled with the duty, each semester to announce a lecture and, according to the old rule, to deliver that lecture, if at least two students are interested: *tres faciunt collegium*. After twenty-five years, formally released from this duty, I continued to lecture for further fifteen years.

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