

Symbols and Terminology Group

Final Report and Recommendations to the 21st ITTC

1 GENERAL

1.1 Membership

The membership of the 21st ITTC Symbols and Terminology (SaT) Group is as follows:

Prof. Bruce Johnson, U. S. Naval Academy, Annapolis, USA (Chairman),

Prof. Michio Nakato, Fukuyama Polytechnic College, Japan,

Prof. Carlo Podenzana-Bonvino, University of Genova, Italy,

Prof. Michael Schmiechen, VWS, the Berlin Model Basin, Germany (Secretary).

So far, corresponding members have been:

Prof. Stanley S. Yuan, Shanghai, China,

Dr. David Clarke, University of Newcastle upon Tyne, UK,

Dr. Kostadin Yossifov, Bulgarian Ship Hydromechanics Centre, Varna, Bulgaria.

1.2 Meetings

An informal meeting of the SaT Group was held at San Francisco in September, immediately after the nomination at the 20th ITTC. Further meetings have been held at:

INSEAN Rome October 24, 1994,

CSSRC Wuxi October 30, 1994,

USNA Annapolis June 05-08, 1995,

USNA Annapolis Jan. 04-06, 1996.

The results of the meetings have been documented in the Minutes of the Meetings, available on request, and reported in the ITTC NewsLetters (NL) 31 and 32. The entry in NL 31 refers back to the NL 29, as well as NL 30, so that the work of the Group has not only been consistently documented, but made available promptly to the community.

1.3 Recommendations adopted by the 20th ITTC

Recommendation to the Conference

The Conference should approve, as a reference document, the 1993 Version of the ITTC Symbols and Terminology List.

Recommendations for Work of the SaT Group

Symbols. The Symbols and Terminology Group to make appropriate corrections to the 1993 Version of the ITTC Symbols and Terminology List and additions to the document which may include specialized topics and illustrative sketches as well as sections on measurement uncertainty, wave cut analysis and other suggestions from the Technical Committees.

The Symbols and Terminology Group to pursue the conversion of the 1993 Version of the ITTC Symbols and Terminology List from a word-processor format to an object-oriented

database format. This will enable users to prepare subsets of the ITTC Symbols and Terminology List more readily.

Formats. The Symbols and Terminology Group to continue monitoring the international efforts in the field and to coordinate the development of neutral formats for the exchange of information between ITTC member organizations and their clients.

2 WORK OF THE GROUP

2.1 SaT List: General Considerations

Group Activities. The main activity of the SaT Group during this conference period was to develop the 1993 Version of the SaT List further along the structure originally proposed and to distribute the most recent version of the SaT List via the World Wide Web. This work included re-arrangement of material to make the document more consistent, avoiding unnecessary duplications, and deleting cryptic notation.

Inputs. The essential task was to consider in detail the various suggestions from members of the SaT Group and from ITTC related individuals. Among the contributions were those from Prof. Nakato on Ships in General, Prof. Podenzana on Special Craft in general and Sailing Boats in particular, Prof. Vantorre on sinkage and trim, Dr. Pylkkanen on various inconsistencies, Dr. Wagner on propulsors in particular, Prof. Nakatake on various symbols, Mrs. McCreight on seakeeping, Prof. S. S. Yu on the Geometry of Ships in general.

Some of the inputs, which are all gratefully acknowledged, were discussed by all members jointly, some were taken care of by individual members and are incorporated in the 1996 Version of the SaT List.

DIN 81209. Other related inputs mentioned and discussed at some detail were the activities

concerning the draft DIN 81209 on Symbols for Geometry and Stability of Ships. This German standard was found to be too detailed for inclusion into the SaT List.

Corrections to 1993 Version. It was agreed that in implementing the corrections and additions the object oriented structure of the SaT List should be maintained, so that the mechanism of inheritance could be taken advantage of as far as possible and all changes would be systematic and consistent.

Rearrangement of the SaT List. The chapters in the SaT List were rearranged and renumbered starting with Ships in General in order to make the list more user friendly for routine applications. Basic Quantities were moved to the first section of Ships in General and many subsections were divided into Basic Quantities and Derived Quantities.

New sections. A new subsection on Points and Centers and one on Static Stability Levers was added to the Hydrostatics section. In the Special Craft Sections, Planing and Semi-Displacement Vessels were combined into a single subsection and Catamarans and SWATH ships were combined into a single subsection on Multi-Hull Vessels.

A new subsection on Wind was created in the Environmental Mechanics Section. Finally, the Background and References section and the detailed Table of Contents was moved to the end of the document to make electronic searches more efficient.

Figures. The implementation of the figures proposed for inclusion into the SaT List, may be accomplished during the summer of 1996 for the final 1996 Version.

File Handling. The document is now treated as a single document in WordPerfect, no longer as a master document which can be condensed with individual files for the different sections.

This organisation was only necessary during the early development phase.

ISO Document. A goal of the SaT Group is to produce a document that can replace the ISO Standard 7462/7463 on Shipbuilding Symbols for Computer Applications first edited on September 15, 1990 based on the now obsolete 1975 Version of the SaT List.

2.2 SaT List: Detailed considerations

Concepts. Concerning the terminology a change was made from Concepts to Quantities where possible. In order to improve the usability of the SaT List some headings of sections were changed to more suggestive names.

Basic and Derived Quantities. The separation into basic and derived quantities should be continued in future versions. The distinction is evidently not unique and led to confusion in the discussion with the Waterjets Group. This point was taken up again in a discussion with Mr. MacPherson, Technical Director of HydroComp, a database oriented company that has requested better model test distinctions in the SaT List.

In the discussion on the distinction between basic and derived quantities the point was made that derived quantities need not be stored in a database, but can be derived from the measured quantities. It was pointed out although that from a theoretical point of view basic quantities are very often not measurable quantities.

Data Storage. The most efficient method of storing data in a database is to store only values of basic quantities in SI units. Derived quantities are redundant and definitions vary widely. In the STEP/EXPRESS Model Hydromechanics developed at VWS, the Berlin Model Basin, these ideas have already been implemented on the basis of the object oriented structure of the SaT List and on a level that in the long run may lead to an ISO application protocol.

Unique Identifiers. Already in a letter to the SaT Group of November 02, 1994, Mr. MacPherson of HydroComp had stressed the importance of the uniqueness of names and computer-compatible symbols. Names longer than 8 characters are now acceptable by most programming languages and are preferable to shorter acronyms.

Circled Symbols. There was quite an extended discussion on the circled symbols and their typographical representation. The solution which evolved was the operational notation with an exponent C, the F, for Froude, already being used for Fourier transforms. In view of the frequently inconsistent units entering circled quantities it was decided not to specify any units in the last column.

ISSC Symbols. The now obsolete ISSC List of Standard Symbols (last updated in the early 1970s) and the various lists of symbols in the *Principles of Naval Architecture* (PNA) were considered. Concerning the ISSC List, it was felt that many of the concepts were already integrated in the present SaT List. The PNA symbols were considered inconsistent since they are based on the 1974 SaT List.

Trial Codes. Contributions to the work on the ISO Code for Trials Evaluation proposed by the SR-208 Panel of the Shipbuilding Research Association of Japan as well as the contributions to the work of the ITTC Waterjets Group promoted the ideas developed by the SaT Group.

2.3 SaT List: Specific Symbols

Sinkage and trim. The subject of sinkage and trim caused a long discussion, which was partly related to the problem of orientation of coordinates. For sinkage this problem can be resolved by introduction of the symbol 's', the word implying the direction down positive.

For trim this is not possible, national and professional traditions of usage being quite different, either bow-up positive or vice versa. As a related problem the keel drag was discussed at length, a special symbol being introduced and explicitly taken into account in defining the trim in terms of draught.

Levers. Special problems are the levers with reference to the centre of gravity, or rather the centre of mass. Firstly the levers are derived quantities in terms of mechanics in general, secondly the centre of mass is frequently not an appropriate reference point for hydromechanical moments. This point of view was confirmed by Prof. Roger Compton, chairman of the High Speed Group. He prefers the transom as reference. The new section on Points and Levers is listed as 'under construction'.

Seakeeping. The suggested changes by the Seakeeping Committee were viewed as needing further work in light of the rearrangements to the SaT List. In particular it was felt that a section on linear systems dynamics should be included as Section 'Systems related Concepts' in the Chapter on Mechanics in General.

Added mass. The concepts of added mass and damping have been added to the Inertial and Hydrodynamic Properties section of Solid Body Mechanics. It was clear that other concepts are also inappropriately placed and need to be moved. All members of the SaT Group and interested parties have been asked to trace such cases and propose remedies as soon as possible.

Forces and Moments. It was also agreed that the 'traditional' notation for forces and moments in the SemiDisplacement Craft section according to Hadler and Savitsky essentially duplicates the notation in Mechanics in General including the reference frames fixed in the waterline or mean buttock line. A remark will explain this situation as there is presently no

chance to get away from the standard references.

Stresses. Introducing symbols on the distribution of stresses equivalent to the sectional loads already covered was discussed, as was distinguishing between Rigid and Elastic Bodies. These additions will be incorporated into later Versions of the SaT List after consultation with the appropriate ISSC members.

Special Craft. The new unified Planing and Semi-Displacement Craft section, to be the first section in Chapter 2, is divided into Geometry and Hydrostatics and Resistance and Propulsion as before, but both sections to be further subdivided into Basic and Derived Quantities. The same applies to the new Multi-Hull section.

Lifting Surfaces. A major item was the rearrangement of the Lifting Surface section. A lot of material was shifted from Hydrofoil Boats to the Lifting Surfaces section and the Flow Angles were newly defined based on the input on Propellers received from the Brodarski Institute at Zagreb. The new order of material agreed upon is as follows: .1 Geometry, .2 Flow Angles, .3 Forces, .4 Sectional Coefficients.

Waterjets. In response to the request from the Waterjets Group considerable contributions have been made by a member of the SaT Group concerning the evaluation of waterjets. The results of the discussion not only relating to the symbols will be documented by the Waterjets Group in their Report to the 21st ITTC.

2.4 SaT List: Ease of use

Order of Chapters. In order to make the SaT List more user-friendly it was agreed to re-arrange the 1993 Version of the SaT List and re-number it accordingly. The order of chapters is as follows: Preface, 1. Ships in General, including Basic Quantities without the Balances section, 2. Special Craft, 3. Mechanics in Gen-

eral, including a System Related Quantities section with the Balances section as the first input, 4. Remarks and References.

Concise Lists. There was quite an extensive discussion on the need for concise and specialized lists of symbols for use by specialised groups. But it had to be admitted that it was not easy to find a rationale to decide on the symbols to be included and an effective method to produce such lists.

It was felt that it was impossible for the Group to create these dialects. In order to improve the user friendliness of the SaT List appropriate repetitions are included. In addition, the electronic version has many hypertext links and a search engine to find specified keywords.

Call for input. The ITTC SaT List needs continuous updating, revision, and extensions and the Hypertext Version should be updated and re-issued at least on an annual basis. Consequently Technical Committees, Specialist Groups, Member Organizations and other parties interested are encouraged to contact the SaT Group with suggestions for necessary additions to and improvements of the SaT List because its quality and usability strongly depends upon user inputs.

For that purpose the SaT Group needs to continue to implement methods for wide dissemination of the ITTC Symbols and Terminology List in various media to the Member Organizations and other interested parties such as naval and commercial shipbuilders, universities and organizations e. g. ISO, ISSC.

2.5 SaT List: Promotion

Distribution. A serious problem discussed was the very limited distribution of the 1993 Version of the SaT List. It was argued that a printed version of the document will still be required for a long time and that the Group should try to find funds and ways for the

printing and distributing the SaT List independent of the Hypertext Version on the WWW since some organizations may still have limited access to the Internet.

Intermediate solution. As an intermediate solution, the Hypertext Version 1996 will be distributed in Acrobat.pdf format on the WWW and as a 3 1/2 inch diskette along with the free Acrobat viewer. Floppy distribution of the WordPerfect files can also be implemented for the 21st ITTC as was done for the 20th ITTC.

The WordPerfect files were also converted to Microsoft Word 7.0 format, losing only the equations for the hydrostatic levers in the process. Attempts to convert the Word Perfect files to previous versions of MS Word were unsuccessful. A copy of one of the word processor files is necessary for electronic copying and pasting into other documents because many symbols and subscripts are incorrectly translated when copying from a .pdf file.

Hypertext Version. The first (Alpha) Hypertext Version 1995 on the home page of the David Taylor Model Basin was based on the revision of the 1993 Version. The newly formatted Beta Version 1996 was distributed in April 1996 and the final Version 1996 will be available during the summer of 1996.

The 1996 Version is available from several Web sites including: the David Taylor Model Basin (<http://www50.dt.navy.mil/code521/ittc/>) and the U. S. Naval Academy Hydromechanics Lab (<http://web.wse.nadn.navy.mil/nahl/>).

IMD. Organizations which agree to serve as geographic area ITTC Web Site repeaters should contact Professor Johnson at johnson@greatlakes.nadn.navy.mil. He will then notify the Webmaster when updated version of the SaT List become available.

Versions 1995 and 1996 can be printed by using the free Acrobat viewer available over the

Internet. The possibilities were demonstrated at the first meeting in Annapolis as was the WWW. Further the on-line projection and correction of the SaT List practised during the meetings at Annapolis proved to be extremely efficient.

Diskettes. Distribution of the SaT List will also be made by diskettes containing the document and the appropriate viewing and printing software which can run on any computer. Searches of the symbols list using a document-viewer or web-browser are made efficient by color coding keywords in the original Word-Perfect file. Hypertext links to the Table of Contents are then added so that clicking on a color-coded table entry transfers the user to the appropriate page in the document.

Example. For example, selecting the Seakeeping section from the table of contents takes the viewer to Seakeeping materials in Chapter 1 where additional hypertext keywords can be used to call up sections in Chapter 3 on Time-related Concepts, Stochastic Processes, Solid Body Mechanics, Rigid Body Motions and Waves. Additional cross-references should make the SaT List more friendly to users not familiar with the structure of the list.

In a demonstration to members of the SNAME Hydromechanics Committee in the spring of 1995, most attendees preferred the Hypertext Version of the list to the present status of the database version. Equivalent hypertext links to relational databases are presently being developed.

2.6 Terminological data base

Knowledge engineering. Knowledge engineering aspects have been discussed in great detail. The proposal was made to introduce two new columns in the SaT List for Rational Symbols and Rational Names, respectively. In the simplest cases these would be useful for the automatic generation of indices. A terminological

data base is considered as pre-requisite for the implementation of the project mentioned and the inclusion of sketches.

Data base. Work on the conversion of the SaT List to a data base format is being delayed until the Unicode character set becomes available in commercial databases in 1996/97. The question arose whether this conversion will still be necessary in view of the capabilities of modern word processors with hypertext features in the Windows environment. The conversion of the symbols list to database format is dependent on the ongoing development of the Unicode character encoding standard, an international standard character subset of ISO/IEC 10646.

Unicode. To quote one of the Unicode articles: 'Unicode promises to make multilingual software easier to write and international information exchange more practical. In the international arena, the ability to share information from a variety of writing systems in a straightforward manner will be increasingly important, especially for applications like large databases.' Unicode has not yet been incorporated into existing commercial databases.

When that happens the SaT Group of the 22nd ITTC can begin the conversion of the symbols list to a new database format. Dr. Murray Sargent of Microsoft corporation, who is coordinating the mathematics extensions for the Unicode character set, has stated that he expects the Microsoft database management systems to incorporate Unicode sometime in 1996, which is unfortunately too late for the 1996 Version of the SaT List distributed at the 21st ITTC.

Acrobat. While waiting for a Unicode-based database, the SaT Group intends to distribute the 1996 and succeeding versions of the ITTC Symbols and Terminology List as an Adobe Acrobat .pdf file. Acrobat has free MAC and Windows-based document-viewers available over the Internet. Multiple formats are being used to maximize the number of computer plat-

forms which can view and search the symbols list for desired information.

The document-viewers have search engines to find specific keywords including computer-compatible symbols and concepts like Froude Number. The viewer still cannot search for non-ASCII characters: that capability must wait for implementation of Unicode character sets.

2.7 Standard formats

Monitoring. The Symbols and Terminology Group has continued to monitor the international efforts in the field of neutral data formats, e. g. STEP developments, and to coordinate the development of neutral formats for the exchange of information between ITTC member organizations and their clients.

IMSA IDF file format. The pragmatic recommendation of the SaT Group at the 20th ITTC was to use the IMSA IDF file format as an interim standard until the STEP application protocols are sufficiently developed for practical use, even in towing tanks.

INSEAN Database. The INSEAN Ship Model Database, described in a brief note by R. Penna of May 1995, previously mentioned in the discussion of Bulgarelli at the 20th ITTC (Proc. Vol. 2, p. 29), has now been realized using ORACLE RDBMS on a UNIX Server. It will be further developed to include CFD and Full Scale results.

STEP Formats. The much more ambitious ISO activities concerning neutral data formats for the exchange of ship product data are focussed in the ShipSTEP model promoted by Lloyds Register and others. A good survey of the activities in general has been presented at the European Product Data Technology (PDT) Days '95 in Munich under the title 'Using STEP in Industry'. The meeting was organized by the

PDT Advisory Group of ESPRIT 9049 and was co-sponsored by the European Commission.

Shipbuilding in general. 'The History and Future Outlook of PDT within Shipbuilding' has been presented in a paper of twenty pages with nine references by Lehne of Vulkan Verbund and S. Mehta of Det Norske Veritas Research. The authors cover in detail not only the background and motivation in general, but the interrelation of the NIDDESC project in the United States, the CIMS project in Japan, the European ShipSTEP project coordinated by Lloyds Register and the ITiS project in Germany as well as NEUTRABAS and MARITIME, two other European projects.

Moulded forms and hydromechanics. At the Technical University Berlin partial data models for Ship Moulded Forms (Nowacki /Stolte, ISM) and for Ship Hydromechanics (Schmiechen/Stolte, VWS) have been developed in the standard object oriented EXPRESS language within the framework of a large scale research effort to utilise advanced information technologies.

Hydromechanics Data Model. The Hydromechanics Data Model (VWS Report No. 1251 /95) is based on the new object oriented format of the SaT List and on a corresponding activity model. Activities are distinguished according to the methods applied: estimation based on past experience, computations including CFD, and measurements on model or full scale.

Activities concern the configurations described by their overall design parameters, the geometry of their components and their operational parameters. The hydromechanical aspects presently covered include propulsion, manoeuvring and seakeeping still to be developed.

3 CONCLUSIONS

The Symbols and Terminology Group feels that further detailed work on the symbols proper is necessary on a much broader scale. This will now be possible with the distribution of promptly updated versions of the Symbols and Terminology List via the World Wide Web.

In view of the developments in computer aided knowledge engineering this work should continue along the lines developed in the 1993 Version and the 1996 Version, maybe even more rigorous. The creation of a terminological data base will remain a basic requirement for that purpose.

The developments in the field of product data technology need to be further carefully monitored by the ITTC in view of the efficient participation in the distributed work on hydromechanical problems including a wide variety of data systems.

4 RECOMMENDATIONS TO THE CONFERENCE

The Conference should approve, as a reference document, the 1996 Version of the ITTC Symbols and Terminology List.