

The Symbol and Terminology Group

Final Report and Recommendations to the 22nd ITTC

1. GENERAL

1.1 Membership

The Membership of the 22nd ITTC Symbols and Terminology (SaT) Group is as follows:

Prof. Bruce Johnson, U. S. Naval Academy, Annapolis, USA (Chairman),
Dr. David Clarke, University of Newcastle upon Tyne, UK (Secretary),
Prof. Carlo Podenzana-Bonvino, University of Genova, Italy,
Prof. Kazuhiko Hasegawa, Osaka University, Japan.

“Corresponding Members” are:

Prof. Michael Schmiechen, retired from VWS, the Berlin Model Basin, Germany,
Prof. Michio Nakato, retired from Hiroshima University, Japan,
Dr. Kostadin Yossifov, Bulgarian Ship Hydromechanics Centre, Varna, Bulgaria,
Prof. Stanley S. Yuan, retired from Shanghai Jiao Tong University, China.

1.2 Meetings

An informal meeting of the SaT Group was held in Trondheim in September, 1996, immediately after the Members nomination at the 21st ITTC. Three meetings have been held

during the period of the 22nd ITTC, as follows:

Brussels, Belgium, 13 -17 May, 1998,
Washington, D. C., USA, 9-14 August, 1998,
Genova, Italy, 9-12 March, 1999.

The new member of the Group, Professor K. Hasegawa of Osaka University, visited Professor Johnson in January 1997 to discuss the tasks of the Group. A problem with imbedded fonts in the final version 1996 was pointed out by colleagues at the Technical University of Berlin and this problem has been corrected by a two step printing based on Acrobat Distiller.

The full membership of the SaT Group met 13-17 May 1998 during the First International Conference on Maritime Terminology in Brussels, Belgium. The meeting included a paper presented to that conference by Prof. Schmiechen on the “History and Recent Developments of the ITTC Symbols and Terminology List”. As part of the preparation of this paper, Dr. Clarke and Prof. Schmiechen researched the history of the SaT Group and its predecessors, the Information Committee, the Presentation Committee and subgroups of other Committees, that recommended standards for the presentation of towing tank data. The 1999 Version of the ITTC SaT List will contain the names of all known former members of these Committees (See Appendix A).

A reduced membership met in August 1998, during the 22nd Symposium on Naval

Hydrodynamics in Washington, D. C., USA, which commemorated the 100th anniversary of the David Taylor Model Basin. Contact was made with other ITTC Committee Members who were present at the Symposium. The SaT Group had contact with Members of the Stability Committee concerning some suggested symbols changes and clarifications, the Loads and Responses Committee and IAHR representatives concerning changes and additions to Section 3.4 Environmental Mechanics. A number of symbols will be added to the list of multidirectional sea state parameters and a greatly expanded Section 3.4.2 on Wind has been added. The ITTC Quality Systems Group suggestions concerning the recommended procedures of the ITTC, which do not currently reference any SaT Group procedures, will be a likely task of the SaT Group for the next Conference. The activity of the Quality Systems Group will encourage necessary feedback of the Committees and Groups with the SaT Group. In addition, Prof. Schmiechen has brought the Secretary of ISO/TC/SC10 up to date on our progress towards a proposal to replace ISO Standard 7463.

1.3 Recommendations adopted by the 21st ITTC

The Conference should approve, as a reference document, the 1996 Version of the ITTC Symbols and Terminology List, the Hypertext Version on the World Wide Web to be updated as soon as major revisions come into effect.

Carry out the continuous updating, revision and extension of the ITTC Symbols and Terminology List, including sections of the obsolete ISSC list not presently covered.

Widely disseminate the ITTC Symbols and Terminology List in various media to the Member Organizations and other interested parties, such as naval and commercial shipbuilders, universities, ISO, IMO and ISSC.

Monitor the international efforts in the field of neutral data formats and co-ordinate the development of neutral formats for the exchange of information between ITTC Member Organizations and their clients.

Convert the ITTC Symbols and Terminology List to a terminological database.

Produce a document that can replace the ISO Standard 7463, First Edition, September 15, 1990, which is based on the obsolete 1975 Version of the SaT List.

1.4 Additional request by the Advisory Council

At the meeting of the Advisory Council in September, 1998 it was agreed that the Symbols and Terminology Group should be asked to advise on the use of electronic forms for ITTC questionnaires.

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 1999 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.

Rearrangements and Additions. Professor Matusiak of the Stability Committee made the suggestion that the heading of Section 1.2.4 of the SaT List should be changed to Hydrostatics and Static Stability and an additional Section 1.2.5 on Dynamic Stability be added. This was a very good idea and has been implemented for the 1999 Version of the SaT List along with some suggested additions to the list of symbols from the Stability Committee. This course of action gives rise to several

anomalies in the additional notation, which must be resolved with the Stability Committee's concurrence.

Section 5.1 on Waterjet Symbols was split into Section 1.2.3.3 under Propulsor Geometry and Section 1.3.5 on Waterjet Propulsion Performance. The Waterjets Committee should decide whether Section 1.3.5 needs to be split into Basic and Derived Quantities.

The Loads and Responses Committee suggested changes and additions to Section 3.4 Environmental Mechanics. The recent Proceedings of the IAHR Seminar on Multidirectional Waves, and their Interaction with Structures, contain an update for multidirectional waves for the IAHR List of Sea State Parameters. Appropriate sections from this update have been added to the 1999 Version of the SaT List. Several symbols have been added to the list of multidirectional sea state parameters and a greatly expanded Section 3.4.2 on Wind has been added.

ISO Document. A goal of the SaT Group has been to produce the 1999 Version of the SaT List as a document that can replace the ISO Standard 7462/7463 on Shipbuilding Symbols for Computer Applications. This, it will be recalled, was first edited on September 15, 1990 based on the now obsolete 1975 Version of the SaT List.

2.2 Unresolved Issues Involving Symbols

Sinkage and trim. The subject of sinkage and trim continues as a standardization problem, which is partly related to the matter of orientation of coordinates. For sinkage this problem can be resolved by introduction of the symbol "s", the word implying the down direction as positive. For trim this is not possible, national and professional tradition 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.

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 that should be expanded to include trimaran characteristics.

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 hydro-mechanical moments. The High Speed Committee of the 21st ITTC confirmed this point of view, since they prefer the transom as a reference. This Section continues to be listed as "under construction".

Forces and Moments. The new terms of reference of the High Speed Committee include only safety problems, all other subjects having been assigned to Technical Committees. The 'traditional' notation for forces and moments in the Semi-Displacement 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.

ISSC and PNA Symbols. The obsolete ISSC List of Standard Symbols, which was last updated in the early 1970s, and the various lists of symbols in the SNAME textbook Principles of Naval Architecture (PNA), have been considered for integration within the SaT List. Concerning the ISSC List, it was initially felt that many of the concepts were already integrated in the present SaT List, but recent communications from the Loads and Responses Committee indicate that this whole



subject should be revisited. The old PNA symbols were considered inconsistent since they are based on the 1974 SaT List, but the new PNA 2000 edition is allegedly based on the current SaT List.

Figures. The implementation of the figures proposed for inclusion into the SaT List will have to be considered by the next SaT Group, as an efficient and satisfactory format for the figures is still under discussion by the computer software community. The SaT Group is making slow progress on developing appropriate illustrative sketches to convey the relationships between various symbols and their terminology. The present SaT List, currently without figures, is downloaded as a single .pdf file over the Internet. By the time of the 23rd ITTC, the intent is to create a separate hypertext-linked document, which contains an expandable set of sketches and drawings. These two documents can be used in parallel when sketches and drawings need to be consulted for clarification.

2.3 Promotion of the SaT List

Distribution. A serious problem discussed was the very limited distribution of the 1993 and previous versions of the SaT List. It was argued that a printed version of the document would still be required for some time. Area Representatives should be responsible for printing and distributing the SaT List to their Area Organizations that may have limited access to the Internet.

WWW Hypertext Versions. The first Hypertext Beta Version 1995 on the home page of the David Taylor Model Basin was based on the revision of the 1993 Version. The revised Final Version 1996 (dated May 1997) of the Symbols and Terminology List with hypertext-linked table of contents can be downloaded from several locations: the ITTC Home Page in Korea,

<http://www.kriso.re.kr/ITTC/>

the NSWC David Taylor Code 52 site,

<http://www50.dt.navy.mil/code521/ittc/>

and the Naval Academy Hydromechanics Lab World Wide Web site,

<http://wseweb.ew.usna.edu/nahl/hydro.htm>

The USNA site contains both the WordPerfect 8 file and an Acrobat .pdf file. The WWW Virtual Library in Naval Architecture and Ocean Engineering site on the Internet,

<http://wwwvl.naoe.ish.dtu.dk>,

contains links to both of the sites.

The draft 1999 Version will be made available as soon as it is finished in June 1999 before the 22nd ITTC. The final Version 1999 will be made available following inputs made during the 22nd ITTC. Organizations who agree to serve as ITTC Web Site repeaters for a geographic area, should contact Professor Johnson at

johnson@nadm.navy.mil

who will then notify the Webmaster when each updated version of the SaT List becomes available.

Users of Versions 1996 and 1999 can print any or all sections of the list using the free Acrobat viewer available over the Internet.

Call for input. The ITTC SaT List needs continuous updating, revision, and extensions. It is important that 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 strongly depends upon user inputs.

For that purpose, the SaT Group needs to continually 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, such as the ISO and the ISSC.

2.4 Terminological Data Base

Dictionary of Ship Hydrodynamics. The Group discussed the ITTC Dictionary of Ship Hydrodynamics, produced in 1978 by the precursor of this Group, which was then called the Presentation and Information Committee. The Dictionary was published by the Royal Institution of Naval Architects (RINA) as Maritime Technology Monograph No.6. The SaT Group determined that the copyright to this document resides with RINA. In discussions with RINA it was established that they would agree to the Dictionary being made available on the ITTC Website, provided a link is made to the RINA Website. Although the Dictionary could be made available in this way providing a method could be developed for converting the original Dictionary and the volume of European language translations into electronic format. The second volume of translations of the Dictionary would present funding challenges, because of the unsolved difficulties in dealing with the Russian, Chinese, Japanese and Korean character sets. It was agreed that an interim solution would be to arrange with SNAME to hold stocks of the two documents, which would be available in hard copy on request.

Symbols Database. It now appears that the existing word processor format for the symbols list can be converted to XML which will support mathematical symbols, including the Greek alphabet, superscripts and subscripts, so it now should not be necessary to convert the existing SaT List to a Unicode- based terminological database. When the SaT List in word processor format is converted to XML it

will contain links to subsets of the SaT List and sketches, which can be down-loaded only if desired (See Appendix B).

3. RECOMMENDATIONS TO THE 22ND CONFERENCE

3.1 Conclusions of the Group

The conversion of the Symbols and Terminology List to a database format will be unnecessary since the new Internet Language, XML, will enable the SaT List to be converted directly into a searchable web document.

3.2 Recommendations to the Conference

The Conference should approve, as a reference document, the 1999 Version of the ITTC Symbols and Terminology List.

3.3 Draft Recommendations for the Future Work of the SaT Group

Develop recommended procedures for the SaT Group based on suggestions from the ITTC Quality Systems Group.

Replace ISO Standard 7463 for Symbols and Terminology with the 1999 Version of the SaT List when it has been finally agreed by the S&T Group.

Continue to explore ways to improve and maintain the ITTC Symbols and Terminology List, making it more available by using a variety of formats.

According to the Advisory Council request of September 1998, the SaT Group should advise on the use of electronic forms for ITTC questionnaires. The current Group recommends that this matter be addressed by the next SaT Group, after input from the Technical Committees on the nature of their



questionnaires.

4. APPENDICES

4.1 Appendix A: ITTC Symbols and Terminology Group Membership

Introduction. The current members of the Symbols and Terminology Group discussed how many different titles the Group had been known by within the ITTC Organisation and how many different members had served on the Committee. So they decided to look back through all the earlier Conference Proceedings to clear the matter up. In doing so they traced back to the original inaugural International Conference of Tank Superintendents at The Hague in 1933.

The Group were astonished to find that Recommendation No.9 of that first Conference was concerned with the question of a standard presentation of resistance data and the use of standard symbols. However, the Conference were quite prepared to leave any further consideration the subject to the very senior Superintendents of that era, who were actually referred to in the text of the Report as the “Committee of Four”. These were Messrs. Baker and Barillon, and Drs. Kempf and Troost, who can safely be regarded as the “founding members” of what we now call the Symbols and Terminology Group.

It is interesting to realise that the community at that time thought that this topic was important enough to warrant the direct attention of the leading men of their day in this area of hydrodynamic research. At this time, the concern was mainly the presentation of resistance and propulsion data, but since then the ITTC has always been wise enough to have a committee or group dealing with the continuously changing need for standardisation in the use of symbols in new subject areas. Of course the Symbols and Terminology List is widely available on the Internet. The

significant developments in the subject of symbols and terminology will be referred to under each conference below.

1933 The Hague (1st). As was referred to in the introduction, the Conference Decision No. 9, Symbols and Terminology, stated that

‘It is left to the “Committee of Four” to settle the terminology for the defining of certain coefficients and symbols’.

The members of the “Committee of Four” were some of the most eminent men of their day, whose names are still well known to all, they were:

Mr. G. S. Baker, Teddington,
Mr. E. G. Barrillon, Paris,
Dr. Ing. G. Kempf, Hamburg,
Dr. L. Troost, Wageningen.

The “Committee of Four” did not have any specific name or title for symbols and terminology at that time but they can be regarded as the founding members of the Group.

1934 London (2nd). There was no specific mention of the subject of symbols and terminology at this conference.

1935 Paris (3rd). At this Conference there was some agreement on the use of symbols concerned with resistance and propulsion tests and the use of Froude’s method of skin friction correction. A list of symbols was accepted and the definition of propeller geometry and thrust and torque coefficients. They also discussed methods being used on full-scale ship trials.

1937 Berlin (4th). Again, there was no specific mention of the subject of symbols and terminology at this conference.

1939 Rome. This proposed conference never took place.



1948 London (5th). This was the Fifth International Conference of Tank Superintendents. The list of delegates showed that three of the original "Committee of Four" were present, only Mr. Baker was not there. Although there was no specific discussion of symbols there is an appendix giving a list of symbols to be used for the co-operative propeller testing programme, which was commenced at this Conference. The first Technical Committees were elected at this Conference, which were Cavitation, Propeller and Skin Friction.

1951 Washington (6th). Although no Committee was elected at the 1948 London Conference, on page 12 of the 1951 Conference Proceedings, the following are referred to as the Interim Committee, and a session was held on Subject 7, Presentation of Resistance and Propulsion Data,

Capt. H. E. Saunders (Chairman),
Capt. M. L. Acevedo,
Dr. J. F. C. Conn,
Mr. J. M. Ferguson,
Dr. H. F. Nordstrom.

However, it is not clear from the Proceedings as to how and when, prior to the 6th Conference, this Interim Committee was appointed. The above named are later referred to as the Committee on Presentation of Resistance and Propulsion Data, appointed by the 6th International Conference. There was also a Conference decision to adopt a tentative list of symbols for use in all published work. This was based upon Project H-2 of the Hydrodynamics Committee of SNAME, and is published on page 13 of the Conference Proceedings, as revised in May 1952. This list is considered to be the precursor of the current ITTC Symbols and Terminology List.

1954 Scandinavia (7th). The same Committee are present at this Conference, namely,
Capt. H. E. Saunders (Chairman),
Capt. M. L. Acevedo,

Dr. J. F. C. Conn,
Mr. J. M. Ferguson,
Dr. H. F. Nordstrom.

However in the list of Committees appointed by the Conference, under Subject No. 7 "Presentation of Resistance and Propulsion Data", it is stated that this subject should be omitted at the next Conference.

However the most significant occurrence at this Conference was the adoption by the Standing Committee of a new name, "7th International Conference on Ship Hydrodynamics". This name was used throughout the Conference and on all the documentation. The Conference, however, rejected this name and adopted instead the current name of "International Towing Tank Conference".

1957 Madrid (8th). The Committee was still in existence at this Conference as the Presentation of Resistance and Propulsion Data Committee,

Capt. H. E. Saunders (Chairman),
Capt. M. L. Acevedo,
Dr. J. F. C. Conn ,
Mr. J. M. Ferguson,
Dr. H. F. Nordstrom.

1960 Paris (9th). At this Conference there was a change of Membership as well as an increase in number from five to seven, but the name remained as the Presentation of Resistance and Propulsion Data Committee,

Capt. H. E. Saunders (Chairman),
Prof. E. Castagneto,
Mr. J. M. Ferguson,
Mr. H. Lackenby (Secretary),
Mr. S. T. Mathews,
Dr. H. F. Nordstrom,
Prof. S. Silovic.

1963 London (10th). Prior to this Conference the Chairmanship of the Presentation of Resistance and Propulsion Data Committee passed to Dr. F. H. Todd, following the death



of Capt. H. E. Saunders in November 1961. Sadly Mr. J. M. Ferguson died November 1962, but was not replaced on the Committee,

Dr. F. H. Todd (Chairman),
 Prof. Dr. Ing. H. Amtsberg ,
 Prof. E. Castagneto,
 Mr. H. Lackenby (Secretary),
 Mr. S. T. Mathews,
 Prof. S. Silovic,
 Dr. H. A. Walderhaug.

1966 Tokyo (11th). The name was now shortened more simply to Presentation Committee,

Dr. F. H. Todd (Chairman),
 Prof. Dr. Ing. H. Amtsberg,
 Prof. E. Castagneto,
 Mr. H. Lackenby (Secretary),
 Prof. S. Silovic,
 Dr. H. A. Walderhaug.

1969 Rome (12th). The Chairmanship of the Presentation Committee passed to Mr. H. Lackenby,

Mr. H. Lackenby (Chairman),
 Prof. Dr. Ing. H. Amtsberg,
 Prof. E. Castagneto,
 Prof. E. V. Lewis,
 Prof. Dr. L. de Mazarredo (Secretary),
 Prof. S. Nakamura,
 Prof. S. Silovic,
 Dr. H. A. Walderhaug.

1972 Hamburg-Berlin (13th). The Presentation Committee retained the same Membership. In 1971 the first ITTC List of Standard Symbols was published as BSRA TM 400,

Mr. H. Lackenby (Chairman),
 Prof. Dr. Ing. H. Amtsberg,
 Prof. E. Castagneto,
 Prof. E. V. Lewis,
 Prof. Dr. L. de Mazarredo (Secretary),
 Prof. S. Nakamura,
 Prof. S. Silovic,

Dr. H. A. Walderhaug.

1975 Ottawa (14th). Several changes occurred to the Membership of the Presentation Committee,

Dr H. Lackenby (Chairman),
 Dr. G. Collatz,
 Dr. M. Fancev,
 Prof. E. V. Lewis,
 Prof. E. Luise,
 Prof. Dr. L de Mazarredo (Secretary),
 Prof. S. Okada,
 Dr. H. A. Walderhaug.

1978 The Hague (15th). The name was now changed to Presentation and Information Committee. The Chairmanship passed to Prof. Dr. L. de Mazarredo, but Dr. H. Lackenby remained a Member of the Committee. An enlarged edition of the ITTC List of Standard Symbols was published in 1976 as BSRA TM 500.

The ITTC Dictionary of Ship Hydrodynamics was published as RINA Maritime Technology Monograph No 6 in 1978,

Prof. Dr. L. de Mazarredo (Chairman),
 Dr. M. Fancev,
 Prof. B. Johnson,
 Dr. H. Lackenby,
 Mr. M. D. Miles (Secretary),
 Dr. E. P. Nikolaev,
 Prof. S. Okada,
 Prof. Dr. Ing. M. Schmiechen.

1981 Leningrad (16th). Chairmanship passed to Dr. M. C. W. Oosterveld, but the name remained as the Presentation and Information Committee,

Dr. M. C. W. Oosterveld (Chairman),
 Prof. B. Johnson,
 Mr. G. K. Knight,
 Prof. T. Koyama,
 Mr. M. D. Miles (Secretary),
 Dr. E. P. Nikolaev,
 Dr. N. H. Norrbin,

Prof. Dr. Ing. M. Schmiechen,
Mr. H. Sierra.

1984 Gothenburg (17th). The Translations of the 1978 ITTC Dictionary of Ship Hydrodynamics into French, German, Italian, Portuguese and Spanish, were published by CETENA and the University of Genova. The University of Tokyo published further Translations into Russian, Japanese, Chinese and Korean. At this Conference the Presentation and Information Committee was disbanded,

Dr. M. C. W. Oosterveld (Chairman),
Prof. B. Johnson,
Mr. G. K. Knight (Secretary),
Prof. T. Koyama,
Prof. S. Marsich,
Dr. E. P. Nikolaev,
Dr. N. H. Norrbin,
Mr. M. Perez-Sobrino,
Prof. Dr. Ing. M. Schmiechen.

Two of the members remained to form the nucleus of the new Symbols and Terminology Group, which was elected by the Executive Committee rather than the Conference as a whole.

1987 Kobe (18th). The Symbols and Terminology Group was formed following a meeting of the Executive Committee in May 1985, and was as shown below. A draft list of Symbols was distributed at the Conference,

Prof. B. Johnson (Chairman),
Dr. D. Clarke,
Dr. M. Matsumoto,
Prof. C. Podenzana-Bonvino (Secretary),
Prof. Dr. Ing. M. Schmiechen.

1990 Madrid (19th). The Membership of the Symbols and Terminology Group remained the same,
Prof. B. Johnson (Chairman),
Dr. D. Clarke,
Dr. M. Matsumoto,
Prof. C. Podenzana-Bonvino (Secretary),

Prof. Dr. Ing. M. Schmiechen.

1993 San Francisco (20th). Two new members joined the Symbols and Terminology Group,

Prof. B. Johnson (Chairman),
Dr. D. Clarke,
Prof. M. Nakato,
Prof. C. Podenzana-Bonvino (Secretary),
Prof. Dr. Ing. M. Schmiechen.
Dr. K. Yossifov

1996 Bergen-Trondheim (21st). Symbols and Terminology Group was now as shown below. Prior to the Conference the Symbols and Terminology List had been made available on the Internet,

Prof. B. Johnson (Chairman),
Dr. D. Clarke,
Prof. M. Nakato (Secretary, initial period),
Prof. C. Podenzana-Bonvino,
Prof. Dr. Ing. M. Schmiechen (Secretary, final period).

1999 Seoul-Shanghai (22nd). Symbols and Terminology Group produced 1999 Version of the Symbols and Terminology List, which is also available on the Internet,

Prof. B. Johnson (Chairman),
Dr. D. Clarke (Secretary),
Prof. K. Hasegawa,
Prof. C. Podenzana-Bonvino.

4.2 Appendix B: Mathematics on the Web: MathML and MathType

The following text was downloaded from the following web address,

<http://www.mathtype.com/>

Currently, there is no effective way of expressing standard mathematical notation in Web pages. Equations can be displayed as GIF images but printing is poor, pages can



download slowly and they don't adapt to the browser user's font choices.

MathML is a proposed solution to the problem. It is based on XML (Extensible Markup Language), a proposed standard by the W3C (World Wide Web Consortium) as a successor to HTML (HyperText Markup Language), the language of the Web,

<http://www.w3.org/XML/>

MathML can be used to express both the presentation of mathematics and its meaning (through high school level mathematics). MathML is human-readable but not designed to be written by humans but by software.

MathType 4.0, its next major release, will be able to generate MathML for use in authoring Web pages with mathematics. It will do so via a new translator mechanism. Translators are defined using a simple language and may be customized by the end user. A MathML translator definition file will be supplied with MathType 4.0 that will produce MathML presentation tags. With support for XML/MathML by the major browser vendors and authoring tool suppliers, MathML will be a good mechanism for bringing mathematics to the Web.

XML will enable scientific organizations such as the ITTC, SNAME and so forth, to publish scientific papers directly on the WWW without resorting to .pdf formats which do not allow for easy cut and paste operations of anything other than ASCII text.

Unicode. Professor Johnson has been contact with the persons in charge of the mathematical extensions to MathML and Unicode. They have assured the Group that the overstrikes needed in the hydrostatic lever symbols are included in the new symbol sets.

4.3 Appendix C: Data Exchange Formats

The current status of data exchange formats

was prepared by George Hazen, of Proteus Engineering and IMSA. The summary updates the material submitted for the 21st ITTC SaT Report by the same company.

A number of the efforts to create data exchange mechanisms have focused on the need to build commonly accepted data models, as a necessary precursor to developing specific file formats to transfer that data. The ISO STEP standards are a good example of this thinking. It is suspected that the long-term legacy of STEP and efforts like NIDESC will be the underlying data models that they support. While files will always be useful for storing such data, the need for neutral formats will likely diminish, as more of the data is associated with components that have well defined interfaces.

In such an environment, the component is free to store the data in any manner that suits its developer, since an outside user of the data will only access the data through the component's (published) interfaces. This means that the archived data file can make use of compression techniques to reduce storage requirements without requiring that every potential client know the details of the data storage scheme. Similarly, data can reside in specialized storage media and only the component that is responsible for extracting the data need know how to access it. In short, the components' public interfaces replace the neutral files.

For data to be useful, one has to know that it exists, what it contains, and how to access it. In systems like GSCAD and others based on component technology, data repositories provide much of this information. The repository is a database of metadata that describes the components, their interfaces and their relationship to one another. Such a repository becomes a common resource where clients and contributors alike can retrieve and store information. A good repository will have readily accessible tools to allow a user to explore the data models resident. In the case of



the Microsoft Repository, the data is stored using the Unified Modeling Language (UML). UML is widely used by the object-oriented design and analysis community and is the result of merging three of the best-known and accepted independently developed modeling languages. The language is inherently visual in that it is best expressed using diagrams. This is somewhat in contrast with the EXPRESS language used by the STEP community to convey data schemes, however conversion from EXPRESS to UML is certainly possible.

Let us close with a final thought on data models and data exchange. As may be seen, a growing interest in 'Smart Product Models' (SPM), it is becoming increasingly clear that any such model is inherently evolutionary. As new analyses become available allowing the prediction of previously unpredictable behavior, there needs to be a way to assimilate this information and extend an existing SPM. Once again, it is found that component technology offers a practical method for achieving this goal. While it has always been important for communication of any type to start with a core of common concepts, the extension of knowledge and its conveyance requires that the communication mechanisms have built-in extensibility. The committees that have given us "commonly accepted" data models, such as STEP, have spent much of their time determining the core of common concepts from which we can develop more elaborate models.

This has been a laudable activity, but it is sincerely doubted whether any committee will ever be able to foresee and implement all concepts necessary for the communication of all data and ideas, even within a single discipline. For that to happen, we need to look to a mechanism such as networked component technology to allow us all to extend the knowledge envelope. This idea has fueled much of the explosive growth in the WorldWide Web, and is equally applicable to general engineering endeavors