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National PDES Testbed Report Series

Status of PDES - Related Activities

(Standards & Testing)

NATIONAL PDES TESTBED

NIST

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STATUS OF PDES-RELATED ACTIVITIES
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I. Introduction

This report describes the standards and testing activities that relate to PDES (Product Data Exchange using STEP). PDES is the name given to the United States organizational activity that supports the development and implementation of the international Standard for the Exchange of Product Model Data, informally known as STEP. The definition of PDES was made more explicit in March 1990 by altering the meaning of the acronym from its earlier one, "Product Data Exchange Specification."

Much of the information in this paper was originally collected as part of the justification for a national initiative to implement automated product data sharing. Other papers describing product data sharing in various industrial sectors were also produced and the set will be published in late 1990.

II. Standards Organizations Developing STEP

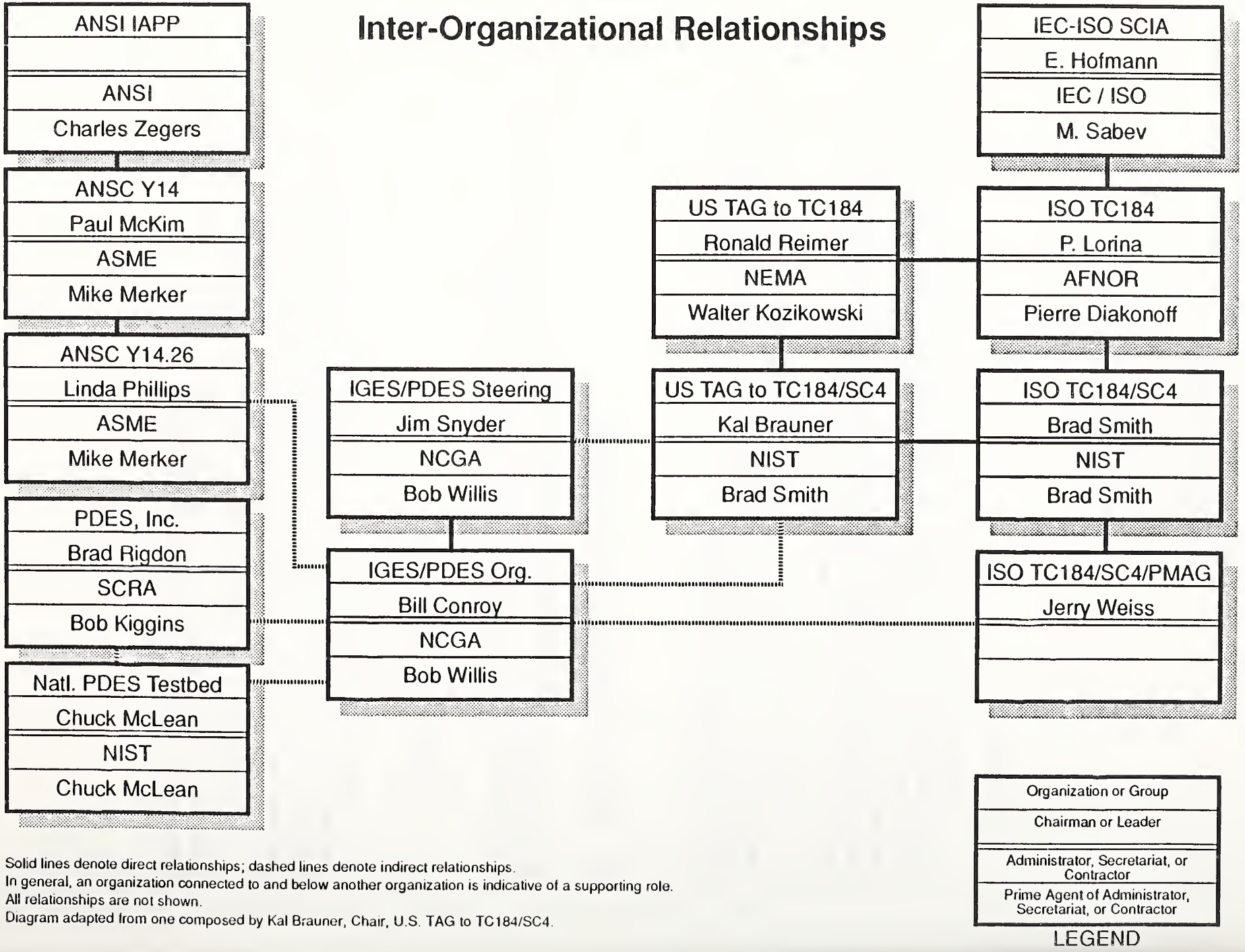
A number of organizations are working both nationally and internationally to develop an exchange specification for product data, known as STEP. This section describes the efforts of three of these organizations and their relationships [Figure 1]:

- ISO Committee TC184/SC4,
- IGES/PDES Organization, and
- ANSI U.S. Technical Advisory Group.

ISO Committee TC184/SC4 - In 1983, the International Organization for Standardization (ISO) reached unanimous agreement on the need to create a single international standard which would represent a computerized product model in a neutral form throughout the life cycle of the product without loss of completeness and/or integrity.

In December of that year, the ISO initiated Technical Committee 184 (TC184) on Industrial Automation Systems and formed Subcommittee 4 (SC4) to work in the area of representation and exchange of digital product data [1].

Figure 1
Inter-Organizational Relationships



Solid lines denote direct relationships; dashed lines denote indirect relationships.
In general, an organization connected to and below another organization is indicative of a supporting role.
All relationships are not shown.
Diagram adapted from one composed by Kal Brauner, Chair, U.S. TAG to TC184/SC4.

Today 26 countries are involved in the work of SC4, 18 are participating members (P-members), and 8 are recognized as Observers. The United States is a P-member, and as such, has one vote on issues before SC4. The SC4 Secretariat is currently held by NIST [2]. Technical support for SC4 comes predominantly from Working Groups (WG2-7).

IGES/PDES Organization (IPO) - Within the United States, technical activities to support the development of STEP have been ongoing since 1985. The U.S. organization which has led these activities is the IGES/PDES Organization [3]. The IPO is composed of over 550 volunteers from government, industry, and academia and is chaired by a representative from the National Institute of Standards and Technology (NIST).

The concept for the development of a standard such as STEP grew out of an earlier effort by the IPO known as IGES (Initial Graphics Exchange Specification). The goal of IGES was to develop a neutral data format which would allow the digital exchange of information among computer-aided design (CAD) systems.

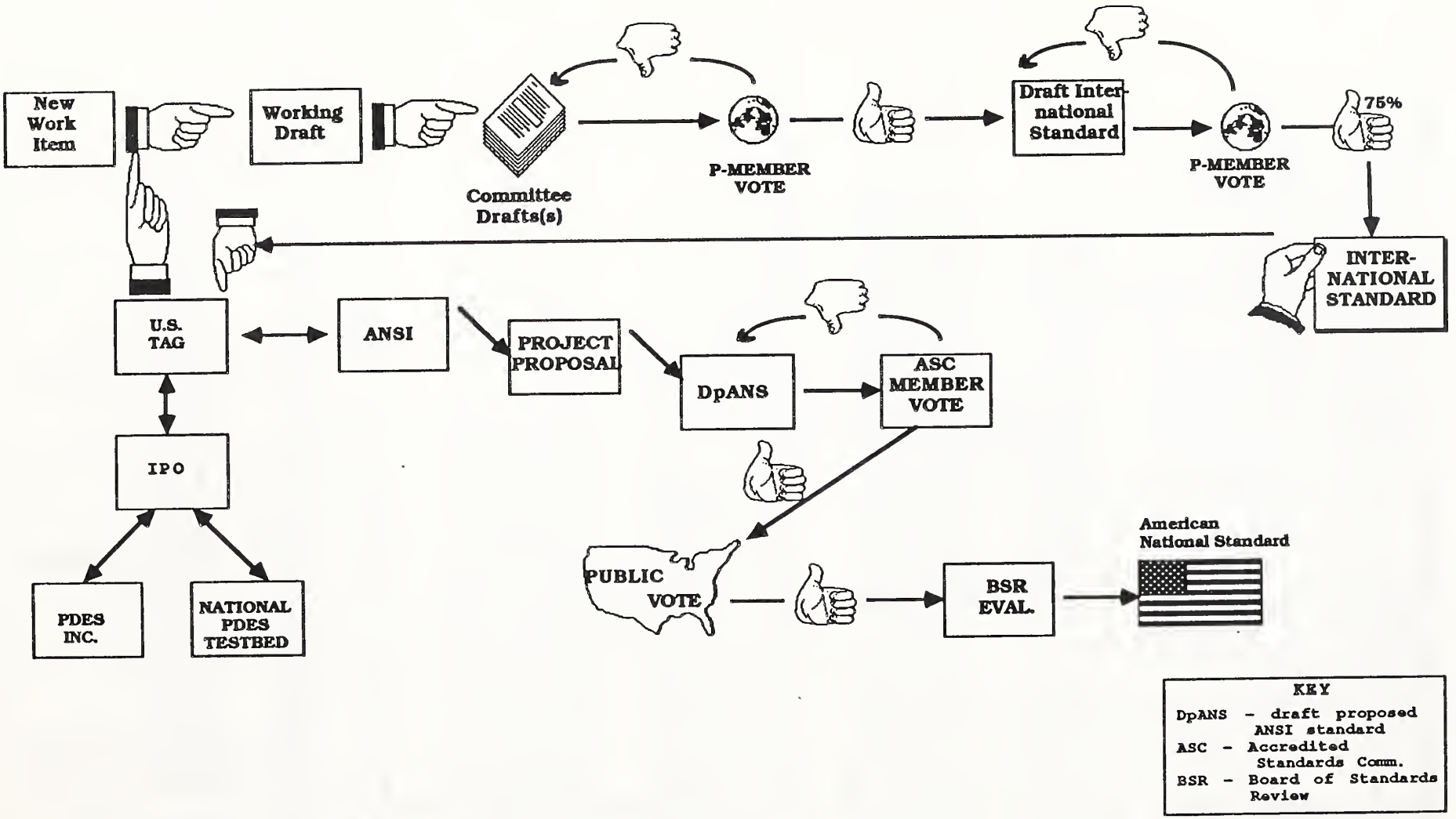
The first version of IGES was published in 1980 and was adopted as ANSI (American National Standards Institute) Standard Y14.26M in 1981. Additional versions of IGES were issued in 1983, 1986, and 1988. The last two were adopted as ASME/ANSI standard Y14.26M-1987 and ASME/ANSI standard Y14.26M-1989, respectively. IGES Version 5.0 was released in September 1990 [4].

With IGES, the user can exchange product data models in the form of two- and three-dimensional wireframe representations as well as surface representations. Translators convert a vendor's proprietary internal database format into the neutral IGES format and from the IGES format into another vendor's internal database. The IGES effort has not focused on specifying a standardized information model for product data. IGES technology assumes that a person is available on the receiving end to interpret the meaning of the product model data.

Members of the IPO, drawing on experience gained with IGES, recognized that a more sophisticated standard would be required to support the integration of different types of product life cycle applications. In 1985 a formal study, called the PDES Initiation Effort, was begun which established a framework and methodologies for the subsequent PDES activities. The PDES effort is focusing on developing a complete model of product information that is sufficiently rich to support advanced, state-of-the-art applications [5].

Approximately 250 technical representatives from the United States and other countries meet four times a year for a week at a time to address IGES/PDES/STEP-related technical issues. Twice a year, these IPO Quarterly Meetings are held concurrently with ISO Committee TC 184/SC4 working group meetings. Many of the technical participants from the U.S. and other countries are active in both organizations.

In November 1988 the PDES development work [6], which included the Integrated Product Information Model (IPIM), was presented as a working draft to ISO Committee



STEP/PDES STANDARDIZATION PROCESS

Figure 2

TC184/SC4. The Committee voted to register the working draft with the ISO Secretariat as Draft Proposal (now Committee Draft) 10303 and send it to all participating countries and liaisons for ballot. This international Committee Draft is unofficially named STEP--the Standard for the Exchange of Product Model Data.

It is important to note that the U.S. is not pursuing a separate national standard through the ASME Y14.26 Committee as has been done with versions of IGES. The PDES strategy is to gain international consensus on STEP and then adopt this work under ANSI procedures. This supports the SC4 Committee's development plan of one standard for worldwide use.

Figure 2 depicts the ISO standardization process, the U.S. role in this activity, and the follow-up process of nationalizing the international standard.

ANSI U.S. Technical Advisory Group - The American National Standards Institute (ANSI) is the recognized U.S. representative to ISO and provides the basis for U.S. participation in the international standards activities relating to STEP. To ensure that the positions on standards that are presented to ISO are representative of U.S. interests, ANSI established a mechanism for the development and coordination of such positions. The body which develops national standards in a particular standards area determines the U.S. position in related international standardization activities. Such bodies are designated by ANSI as "U.S. Technical Advisory Groups" (TAGs) for specific ISO activities.

The current U.S. TAG to TC184/SC4 was formed in 1984. Its membership is primarily comprised of technical experts from the IPO. This type of representation ensures that the technical changes that the U.S. believes are necessary are submitted to ISO for consideration at regular TC184/SC4 meetings and through the ballot process. NIST currently serves as Administrator for the TAG.

To foster a better appreciation for the international and national standardization environment in which STEP will play a part, a tutorial on the generic processes is included as an Appendix.

III. Standards Activities Related to STEP or PDES

NIST-Wide Product Data Exchange Task Group - NIST founded the NIST-Wide Task Group to facilitate its work in providing integrated and effective service to U.S. technical and industrial communities who are recognizing the importance of the emerging technology and standards associated with electronic product data exchange to U.S. competitiveness and defense preparedness. The membership of the Task Group consists of technical-professionals actively engaged in research, technical development, standards

adoption, and validation testing of product data exchange specifications, implementations, and applications. Members represent the spectrum of NIST interests.

Digital Representation of Product Data Standards Harmonization Organization - This is a new organization reporting to ANSI [7]. The goal of the organization is to facilitate the development of electrical and electronics digital product data standards, with initial emphasis on electrical/electronic product data and its relationship to STEP. The Executive Board is composed of representatives from organizations that develop and approve electrical and electronic product definition standards. In addition to the Executive Board, the organization consists of a Business Needs and Planning Council, a Standards Development Coordination Council, and a Tools and Technology Council.

NIST's Center for Electronics and Electrical Engineering plans to establish a testbed to support the testing requirements identified by the Tools and Technology Council. In addition, NIST is responding to needs for a government-sponsored electronics components data library. Workshops are being scheduled to explore topics such as applicable standards, commercial interests, and existing Department of Defense (DoD) projects.

Navy/Industry Digital Data Exchange Standards Committee (NIDDESC) - NIDDESC is a cost-sharing venture between private firms and government organizations [8]. This effort arose from the Naval Sea Systems Command (NAVSEA) in cooperation with the National Shipbuilding Research Program. The members include leading professionals in the marine industry from major design firms, private shipyards, naval shipyards, and government laboratories. All members are directly involved in CAD/CAM (computer aided design/computer aided manufacturing) in their organizations and together represent a broad spectrum of experience and perspectives.

NIDDESC has subcommittees devoted to specific areas of digital data transfer. The basic objectives are to develop an industry-wide consensus on product data models for ship structure and distribution systems, and on the digital exchange of product model data. Efforts include contributions to IGES, STEP, and the PDES activity, preparation of a Recommended Practices Manual, and the analysis of ship production data flows. NIDDESC has made contributions to the development of DoD standards including MIL-STD-1840, MIL-M-28001 (SGML: Standard Generalized Mark-up Language), and MIL-D-28000 (IGES).

ASME Standards Development Committee Y14 - This is an ANSI-accredited standards making body of the American Society of Mechanical Engineers (ASME). It develops standards for engineering drawings and related documentation practices. Some versions of IGES are submitted for national standards approval via Subcommittee 26, Computer-Aided Preparation of Product Definition Data.

Mathematical Definitions of Dimensions and Tolerances - The Y14 Committee formally established working group Y14.5.1 at its meeting in May 1990. This group has been meeting as an *ad hoc* committee for over a year. It is working on a document that "presents a mathematical definition of geometrical dimensioning and tolerancing consistent with the principles and practices of ANSI Y14.5, Dimensioning and Tolerancing, enabling determination of actual values." A draft standard is expected to be issued within a year.

Apparel Product Data Exchange Specification - The Computer Integrated Manufacturing Committee of the American Apparel Manufacturers' Association has been approved by ANSI as an accredited standards-setting organization. The Committee has established a working group on neutral file representation of apparel product data. Plans call for establishing a short-term guideline of using as a *de facto* standard one of the commonly used proprietary formats, but to develop extensions to STEP for apparel as the long-term solution. The work at this point is focused on establishing functional requirements for an exchange format: basically, how much of the apparel life-cycle should be supported. NIST, under sponsorship of the Defense Logistics Agency, is supporting this effort. NIST has utilized the STEP methodology in preparing a draft specification for 2D pattern making [9].

Application Interface Specification (AIS) - The CAM-I (see page 12 for CAM-I description) Product Modeling Project is trying to establish the AIS as a standard interface to product modelers (formerly known as geometry modelers). AIS was recently redefined in the STEP specification language (Express), and there are strong efforts within both CAM-I and the STEP community to integrate AIS with the STEP Data Access Interface Specification (SDAIS). AIS will be released under ANSI procedures as a draft standard for trial use.

Dimensional Measurement Interface Specification (DMIS) - DMIS, developed by the CAM-I Quality Assurance Project, was approved recently as an ANSI standard. It specifies an APT-like language for two-way communication of inspection information between inspection equipment and a CAD environment. DMIS includes a substantial amount of geometry and tolerance definition, which overlap STEP capabilities, as well as control and measurement result constructs. CAM-I now plans to reorient DMIS around its Application Interface Specification, which will bring DMIS much closer to STEP.

IV. Testing Activities

There are two types of testing activities: 1) testing a standard itself and 2) testing implementations to a standard [10]. The National PDES Testbed, PDES, Inc., Computer-aided Acquisition and Logistic Support (CALS) Test Network, and the IPO Testing Project's Application Validation Methodology Committee are all involved with testing product data standards.

Conformance testing is the testing of a candidate product for the existence of specific characteristics required by a standard specification. It includes testing the extent to which an implementation is a conforming implementation [11]. ISO TC184/SC4/WG6 on Conformance Testing is working to establish conformance criteria for STEP [12]. Three subcommittees of the IPO Testing Project (Testing Methodologies, Interoperability Testing Methodology, Test Case Development), NIST Federal Information Processing Standards (FIPS) testing and the National PDES Testbed, are providing means of testing implementations to the standard through conformance testing.

National PDES Testbed - NIST established the National PDES Testbed at its Gaithersburg, MD site in 1988 to support PDES/STEP development activities. Under the sponsorship of the DoD CALS program, the Testbed has assumed a critical role in the development of STEP. The goal of the Testbed is to provide technical leadership and a testing-based foundation for the rapid and complete development of a STEP standard [13].

The staff of the National PDES Testbed recognize that establishing a STEP standard is very much a consensus-building process. It can only be achieved with support from, and cooperation among standards organizations, industry, government, and academia. The National PDES Testbed is working closely with representatives from all of these different sectors.

Some of the major objectives of the National PDES Testbed are to

- Identify the types of computer applications which will use STEP and model the data used by the applications,
- Specify the technical requirements of these systems with respect to STEP,
- Validate that the STEP specifications satisfy the technical requirements of those systems,
- Design and implement prototype systems which support testing and provide a foundation for future development efforts,
- Maintain control over the many versions of specifications, software tools, and test procedures/data generated by the standards and technical development activities,
- Improve communication and interaction between the various programs and organizations which have a stake in the development of STEP,
- Develop conformance testing procedures which can be used by independent testing laboratories.

PDES, Inc. - In April 1988, several major U.S. technology companies incorporated as PDES, Inc. [14] with the specific goal of accelerating the development and implementation of STEP. In August 1988, the South Carolina Research Authority (SCRA) was awarded the host contract to provide technical management in the implementation of the program. The technical participants provided by the PDES, Inc. member companies and SCRA's subcontractors are under the direction of the PDES, Inc. General Manager from

SCRA. NIST is a government member and provides a testbed facility and technical team members to support the PDES, Inc. effort. PDES, Inc. maintains continual coordination with the IPO.

PDES, Inc. has a multi-phased plan for the acceleration of STEP development. Phases I and II of the plan are each defined to be eighteen-month efforts. The Phase I focus was on testing and evaluating a subset of the December 1988 Committee Draft. The emphasis of the testing and evaluation effort has been placed on a data exchange implementation of mechanical parts and rigid assemblies. Phase II, which began in March 1990, focuses on identifying software implementation requirements, construction of prototypes, development of additional context-driven integrated models (CDIMs) for small mechanical parts, and broadening the program scope to include such areas as electronics, sheet metal, and structures.

CALS Test Network - In January 1988, the Air Force was tasked to take the lead in planning and coordinating testing of CALS standards. The DoD CALS Test Network (CTN) was established, with lead management at the Air Force Logistics Command [15]. The goals of the CTN are to test, evaluate, and demonstrate thoroughly the use of CALS standards in ways that will support accelerating their use and implementation into the digital technical data delivery process for DoD's weapon systems. The CTN performs user-application testing and supports creation of other testing capabilities. The CTN has evolved into a 90-member confederation of industry and government agencies dedicated to supporting that goal.

IGES Testing - IGES has had no conformance requirements in the specification, however the IPO Testing Project has introduced conformance requirement language in IGES, Version 5.0.

NIST sponsored the Society for Automotive Engineers to conduct a testing program for IGES. The IPO Testing Project is evaluating the program's merits and initial testing results, while the IPO Steering Committee is considering "next steps" for IGES testing.

Under the auspices of the CALS Test Network, MIL-D-28000 [16] Class I and II drawings are to be tested by the David Taylor Research Center in 1990, while developing a master test plan for MIL-D-28000 for future years.

Federal Information Processing Standards (FIPS) - The National Computer Systems Laboratory (NCSL) at NIST participates in the development of U.S. Government-wide standards for computer software, hardware, data management, networks, and security. NCSL works through voluntary industry standards organizations to develop standards that will meet the needs of Government users and can be implemented in off-the-shelf commercial products. Those standards that promise sizable benefits to the Government are issued as FIPS.

FIPS and the specifications they adopt are implemented into computer products. Through past experience in research and testing, NCSL sees a need for expansion of its

efforts in structuring conformance testing to these FIPS, and is in the process of formulating a program.

SGML (Standard Generalized Mark-up Language) and SQL (Structured Query Language) are two standards being utilized by PDES activities. They can be used as examples of how NIST can support the testing of standards:

SGML - As a 1987 CALS deliverable, NIST developed an SGML validation suite and reference parser. These are both public domain and available through the National Technical Information Service of the Department of Commerce [17]. A Committee in ANSI X3V1 is currently developing standardized test cases under the "conformance testing initiative." These test cases, as they are approved, will also be publicly available as a reference application to test for conformance to SGML.

SQL - A test suite, version 2.0, was released in January 1990. This suite tests compliance with FIPS 127, Database Language SQL [18]. Approximately 60 vendors, integrators, standards organizations, and certification agencies presently use the SQL test suite, Version 2.0, or its predecessor, Version 1.2 (which was released May, 1989) [19]. A commercial conformance testing service began at NIST in April 1990.

VI. International Programs

Commission of the European Communities (EC) - The EC is acting swiftly and deliberately to turn the twelve European countries into a single, integrated market of 320 million people by the end of 1992. The basis for this effort is a 1985 EC White Paper entitled "Completing the Internal Market." That paper sets a timetable for the measures needed to ensure the free circulation of persons, products, service, and capital among the twelve member states. The EC already initiated a program to eliminate the many differing national standards and technical regulations; it has drawn up more than 200 EC directives aimed at harmonizing the various national requirements [20].

The task of establishing European technical standards for products will be left to European standardization bodies set up by industry and other European governments. In the absence of standards to be harmonized or cited, these organizations are to develop standards based on international standards developed by such groups as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

Conformance Testing Services (Phase) Two - In support of the EC economic goal of 1992, the United Kingdom, Germany, and France are collaborating on a common objective for CAD/CAM systems data exchange interfaces: to provide harmonized conformance testing services within Europe for the transfer of product models between different CAD systems using neutral formats. Started in December 1988, this service will be ready for use in time

for the approval of ISO STEP and will offer interim services for IGES (US-based), VDAFS (German-based) and SET (French-based). Both the development of the test tools and the establishment of operational Testing Laboratories offering testing services are covered in the project. In addition to the three full partners, there is one associate partner, Sweden, a non-EC participant. Beyond national commitment of resources and money, the EC members are funded by the Commission of the European Community.

Established as a multi-phased project, the current phase is commonly known as CTS2, Conformance Testing Services (phase) Two [21]. This is a three-year program completing its second year. {NOTE: The IPO Testing Methodologies Committee under the IPO Testing Project committed to harmonize the procedures and policies being developed under the CTS2 banner. This commitment was made at the April 1990 meeting.}

European Strategic Programme for Research and Development in Information Technology (ESPRIT) - The EC defined ESPRIT after a thorough analysis undertaken in close liaison with industry in 1982 and 1983 [22]. ESPRIT has the following three objectives:

- Provide European Information Technology industry with the basic technologies to meet the competitive requirements of the 1990s;
- Promote European industrial cooperation in Information Technology; and
- Pave the way for standards.

The first phase of the ESPRIT Program started in 1984. The total R&D efforts of the first phase amounted to 1,500M ECU (1 ECU = $1.10), 50% of which were born from the Community budget, the other 50% by the participants in the Program.

The Program is implemented by projects selected from public calls for proposals and based upon the annually updated Workplan. The Program comprises collaborative pre-competitive research and development projects, carried out across frontiers by community companies, universities, and research institutes.

The second phase was initiated in 1988. It is a larger scale operation, but still uses the same mechanism as before: the cost-sharing between the Community and partners, the consensus-building, the Workplan and the on-going assessment principle. The total for this phase is 3,2000M ECU, of which 50% is allocated from the research budget of the Community - about 5% of the R&D expenditure in the Information Technology industry. However, relative to the precompetitive part of R&D, its share is much larger, and it has played an important catalytic role in stimulating a growth of total R&D investment.

STEP/ENV (Draft European Standard) - This is a CEN/CENELEC (European Committee for Standardization/European Committee for Electrotechnical Standardization) project to

- Establish European requirements for implementation and use of STEP,
- Define a framework for European implementation of STEP and any necessary companion standards, and
- Publish an ENV based on STEP.

Participants are Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, and the UK [23] .

STEP/ENV is not intended to be different from STEP in any way -- it is a mechanism to allow the STEP standard to be published and harmonized throughout Europe. The project's current mandate finishes in September 1990. STEP/ENV was to be prepared and published in July 1990. It was to consist of a 'cover page' attached to whatever is available from ISO TC184/SC4 in Committee Draft or Technical Report form after the June, 1990 Goteborg meeting.

Advanced Project for European Information Exchange (APEX) - This is a five-year program which began in 1986 with an expected total expenditure of $30M (U.S.). Its members are primarily aerospace industries from Italy, France, the UK, Spain, and Germany. There are four projects: procurement, email, product support of technical documentation, and design engineering. The objective is to develop, qualify and match methodology to products and in turn to services, all based on ISO standards. The design engineering project manager is now (since Paris, 1/90) attending ISO/STEP meetings to coordinate with ISO TC184/SC4 activities.

Japanese STEP Translator Development Project - This is a four-year project that was launched in FY90. The total anticipated cost is $6M (U.S.). It has not been determined (as of the date of this paper) whether they will be writing prototypes or products.

Computer-Aided Manufacturing - International (CAM-I) - CAM-I is an international not-for-profit consortium whose purpose is to advance computer-based manufacturing technology and standards [24]. Its work primarily consists of funding research projects and standards activities. Participation in CAM-I activities generally requires that the organization join the consortium and pay a general membership fee. Member organizations send representatives to periodic CAM-I meetings to establish the technical direction of CAM-I programs.

Current STEP-related programs in CAM-I include Advanced Numerical Control, Quality Assurance, Product Modeling, and Process Planning. CAM-I has shepherded the DMIS (see page 7 for more description) into its adoption as an ANSI standard. CAM-I is actively pursuing adoption of its AIS (see page 7) as a standard software interface to CAD/Solid Modeling systems. To this end, representatives from CAM-I have been participating in STEP committee meetings in a harmonization effort.

A European Computer Integrated Manufacturing Architecture (AMICE) - The objective of project 688 of the ESPRIT Consortium AMICE is to design an open systems architecture for CIM: CIM-OSA (Computer Integrated Manufacturing - Open System Architecture) [25][26]. Twenty-one major European companies in AMICE have joined to produce this framework for enterprise integration in manufacturing. The proposal they have submitted to the ISO committee on Systems Integration and Communication (TC184/SC5/WG1 [27]) consists of three dimensions in a 3X3X4 arrangement. One dimension goes from generic to particular. The second dimension represents three stages in the development process from design to implementation. The final dimension represents four different views from the functional to the organizational.

VII. Summary

This report has briefly described the roles, relationships and technical goals of the current standards and testing activities that relate to product data exchange using STEP. A bibliography is given as a resource if more detailed information is desired about one or more of these activities.

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Appendix

National and International Standards Processes

ISO Procedures. (source: Cargill, Carl F., Information Technology Standardization Theory, Process, and Organizations, Digital Equipment Corporation, Digital Press, USA, 1989.)

The International Organization for Standardization (ISO) was established in 1946, as a completely voluntary organization. The purpose of ISO is to facilitate the international interchange of goods and services, and to encourage cooperation in economic, intellectual, technological, and scientific endeavors. It is this broad range of interests and concerns that qualifies ISO as the premier standards organization in the world.

The process of creating an international standard is relatively lengthy, but it ensures that consensus is reached. However, in the case of a contentious or complex subject, especially, the leadership and the membership of the originating committee become vitally important if the proposed standard is not to die in internecine wars.

A proposal for a new work item (NWI) is drafted by a P-member, SC, or liaison organization and submitted to a TC for ballot for acceptance. If it passes this first hurdle, it is assigned to an SC for standardization activity. Usually, a WG of the SC creates a Working Draft (WD) and forwards it to the SC for vote. If the SC vote indicates that consensus has been achieved, the WD becomes a Committee Draft (CD), which is then registered and circulated to the full TC. If there is consensus on the CD, it is forwarded to the Central Secretariat for registration as a Draft International Standard (DIS). The Central Secretariat verifies that the DIS meets the requirements of an ISO standard and then circulates it among ISO members for their review and approval; again, consensus is of paramount importance. After receiving the approval of a majority of TC members and 75 percent of ISO voting members, the standard is submitted to the Council for publication as an International Standard (IS).

ANSI Procedures. (source: Cargill, Carl F., Information Technology Standardization Theory, Process, and Organizations, Digital Equipment Corporation, Digital Press, USA, 1989.)

ANSI is the primary interface with the U.S. government on matters relating to standards, providing a mechanism by which the organization and company members can make their needs and desires known to the legislative and regulatory agencies. ANSI is also the recognized representative to ISO and the IEC (International Electrotechnical Commission), the two major international nontreaty standards organizations. The following process outlined, is generalized and may vary depending on the standards group involved. It does give an idea of the checks and balances that are built into the system. In this description, the term "Accredited Standards

Committee" (ASC) will be used to refer to Accredited Organizations and Accredited Canvass groups as well as ASC's. Thus, "ASC" refers to the three types of accredited standards-developing organizations.

A standard begins as a Project Proposal, which may be developed and submitted to an ASC by any individual. The proposal usually is reviewed within the ASC to determine if it fits within the mission of the ASC, as well as to review economic and functional validity. If the ASC believes that the proposal is valid, the full committee, or a representative portion, votes on it. If the vote is positive, the proposal is assigned to an appropriate ASC subcommittee, and the ASC Secretariat usually issues a press release soliciting technical contributions and membership. The subcommittee then develops a calendar and work plan and begins work on the proposal. When the draft proposed American National Standard (dpANS) is completed, the ASC community votes to determine if the document is ready for public review. The dpANS is also liable to review by an ASC subcommittee to verify that it complies with the approved proposal that started the development process. After the ASC review, the dpANS is ready to be forwarded for open public review.

The ASC Secretariat initiates public review of the dpANS. The ANSI publication Standards Action provides a brief description of the standard and announces that it is available for review and comment for the next four months. (It is during this phase that the concept of consensus comes into critical play.) Once consensus is reached, the full ASC votes on the proposal via letter ballot. The ASC Secretariat then forwards the proposal to the ANSI Board of Standards Review (BSR), which verifies that due process was observed and that consensus was, in fact, achieved. When the BSR is satisfied, the dpANS is approved and published as an American National Standard.

The National to International Link. (source: Procedures for U.S. Participation in the International Standards Activities of the ISO, Approved by ANSI Board of Directors, March 19, 1986.

Participation in international standards activities of interest to members of ANSI requires membership in the two nontreaty standardization organizations, ISO, and IEC. For discussion on PDES, NIST will address the relationship specifically between ANSI and ISO, of which ANSI is the U.S. member body. To assure that positions presented to ISO are representative of U.S. interests, a mechanism must exist for the development and coordination of such positions. ANSI normally looks to the body which develops national standards in a particular standards area to determine the U.S. position in a similar international standardization activity. Such bodies are designated by ANSI as "USA Technical Advisory Groups" for specific ISO activities. Where no national standards group exists, or is available to serve, or where several separate national standards groups exist, special bodies will be established for this purpose. (See page 4 for information specific to PDES.)

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This report describes the current national and international standards and testing activates that relate to PDES (Product Data Exchange using STEP). PDES is the name given to the United States organizational activity that supports the development and implementation of the international standard, STEP (Standard for the Exchange of Product Model Data). The definition of PDES was made more explicit in March 1990 by altering the meaning of the acronym from its earlier one, "Product Data Exchange Specification."

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

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