CALS TEST NETWORK

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Recommendations for PDES/STEP Modifications and Enhancements Report

18 December 1992

Prepared for the CALS Test Network
Air Force CALS Program Office
HQ Air Force Materiel Command
HQ AFMC/ENC
4027 Col Glenn Hwy Suite 200
Dayton OH 45431-1601

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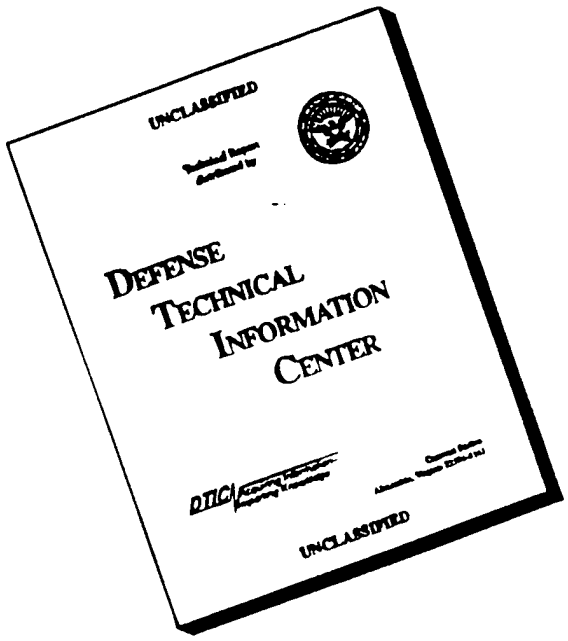

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Joint
Computer-aided Acquisition
and Logistic Support (JCALS)
CALS Technology Center (CTC)

RECOMMENDATIONS FOR PDES/STEP MODIFICATIONS AND ENHANCEMENTS REPORT

18 December 1992

FINAL

Prepared by:

Department of the Army
PM JCALS

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RECOMMENDATIONS FOR PDES/STEP MODIFICATIONS AND ENHANCEMENTS REPORT

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Department of the Army
PM JCALS

Prepared By:

Accurate Information Systems, Inc.
Meridian Center 1
2 Industrial Way
Eatontown, New Jersey 07724

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EXECUTIVE SUMMARY

This report provides a recommended approach for Program Management Joint Computer-aided Acquisition and Logistic Support (PM JCALS) to take advantage of the emerging Product Data Exchange Using STEP/Standard for the Exchange of Product Model Data (PDES/STEP) Standard technology in the development of the Integrated Weapon Systems Data Base (IWSDB) and the upgrade of the CALS Standards. A closer relationship and better coordination between JCALS and the organizations involved in PDES/STEP, Such as PDES, Inc., will facilitate the eventual integration of the CALS and STEP Standards.

STEP Version 1.0 will be released as a Draft International Standard (DIS) in mid-1993. PM JCALS is in a position to become an important player in the initial and future releases of the STEP Standard by becoming actively involved in the STEP Standard development and implementation process. There is considerable work to be done in the Application Protocol (AP) development for the logistics and technical manual areas, which form the nucleus of the JCALS Program. STEP development work has been slow in these areas, in comparison to AP development for the design and manufacturing (i.e., draughting) and specific application (i.e., mechanical, electrical, and shipbuilding) areas. The risk factor for the JCALS Program is that if it does not stay at the forefront of STEP development, then the JCALS requirements may not be supported adequately in a timely manner, if at all.

The CALS Technology Center (CTC) facilities can be used for the STEP technology transfer of current tools and the development of Application Protocols (APs) for logistics and technical publications related to specific JCALS functional areas (i.e., Interactive Electronic Technical Manuals [IETMs]). The resources of the CTC can also be used in coordination work between PM JCALS and the PDES, Inc. and Air Force F-22 groups. Because the CTC is part of the overall CALS Test Network (CTN), the lessons learned from AP development and testing at the CTC can be shared throughout the services. The CTC is poised to become the focal point for the CALS-STEP interface and STEP concept delvelopment and validation can lead to P3I of JCALS.

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SECTION 1

INTRODUCTION

1.1 Background

Product Data Exchange Using STEP/Standard for the Exchange of Product Model Data (PDES/STEP) is an emerging International Standard for the computer-interpretable representation and exchange of product data. The Joint Computer-aided Acquisition and Logistics Support (JCALS) Program can take advantage of this technology in the development of the Integrated Weapon Systems Data Base (IWSDB). Currently, there is little coordination between JCALS and the organizations involved in PDES/STEP.

A previous report, entitled *Evaluation of IGES, PDES/STEP, and JCALS Relationships*, Draft, 19 October 1992, provided an overview and current status of the Initial Graphics Exchange System (IGES), PDES/STEP, relationships between IGES and PDES/STEP, data in the JCALS environment, and the status of product data utilization by various Department of Defense (DoD) weapon systems. This report enumerates, in detail, recommendations for PDES/STEP modifications and enhancements related to the JCALS Program.

1.2 Purpose

The purpose of this report is to provide:

- a recommended approach for JCALS to use the PDES/STEP Standards;
- a review of the status of the STEP Standard;
- proposed plans for STEP efforts at the CALS Technology Center (CTC);
- proposed plans for PM JCALS to work with other organizations involved in the STEP effort; and
- proposed plans for STEP Application Protocol (AP) development efforts.

1.3 Scope

The scope of this report will:

- provide a summary of the current status of the STEP Standard;
- suggest future projects/tasking for the use of STEP by JCALS;

- present recommendations for joint work between PM JCALS and other organizations involved with the STEP effort; and

- evaluate the relationship between the current, and pending, STEP Application Protocols (APs) and the need for new APs for the JCALS Program.

SECTION 2

PDES/STEP OVERVIEW

2.1 The STEP Standard

STEP is a series of International Standards (IS) for the computer-sensible representation and exchange of product data. The objective is to provide a mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. This makes it suitable not only for file exchange, but also as a basis for implementing and sharing product data bases and archiving.

Each of the STEP functional documents is called a Part. Parts are grouped into one of the following classes: description methods, integrated resources, application protocols, implementation forms, and conformance testing.

The International Standards Organization (ISO) and the IGES/PDES Organization (IPO) are the main bodies involved in the development of the STEP Standard. Together, they are following an ambitious schedule towards the release of STEP as a Draft International Standard (DIS) in mid-1993. Currently, this work is proceeding according to schedule.

2.2 Overview of STEP Version 1.0

Version 1.0 of the STEP Standard will be composed of the various Parts required for initial implementation. Parts 11, 21, and 31 were approved at the committee level and registered with the ISO as Draft International Standards in August 1992. All of the other Parts for the first release of STEP are undergoing their second round of Committee Draft (CD) balloting in late-1992. The planned Version 1.0 release, in mid-1993, includes the Parts listed in Table 1. A report produced for the IPO on the status of STEP APs, entitled *STEP Application Protocols - Status and Summary Report*, dated 1 October 1992, is included in Attachment A of this report.

Table 1. Parts in STEP Version 1.

	Part	STEP Version 1.0 Part Title
Overview & Methods:	1	Overview & Fundamental Principles
	11	EXPRESS Language Reference Manual
	21	Clear Text Encoding of the Exchange Structure
	31	Conformance Testing - General Concepts
Generic Resources:	41	Product Description and Support
	42	Geometric and Topological Representation
	43	Representation Structures
	44	Product Structure Configuration
	46	Visual Presentation

Table 1. Parts in STEP Version 1 (Continued)

	Part	STEP Version 1.0 Part Title
Application Resources:	101	Draughting
Application Protocols:	201	Explicit Draughting
	203	Configuration Controlled Design

2.3 STEP Data Model Architecture

The STEP data models fall into three categories: Data Models, Resource Models, and Application Protocols.

Data Models contain all of the data definitions required for a particular general purpose functional area. For example, Part 42, Shape Representation, contains all of the data models for geometry and topology (i.e., the standard STEP definitions and relationships for points, lines, circles, curves, surfaces, solids, transformations, etc.); also, Part 44, Product Structure and Configuration Management, contains all of the data models for defining versions of parts, release and approval, assemblies of parts, configuration management of assemblies, etc.

The next level of data models is Resource Models. Resource Models are intended to provide all of the information that may be required in a generalized applications domain. Resource Models primarily draw their data models from the core Data Models, but have the ability to add specialized data when required (for example, in Part 104, Finite Element Analysis, or in Part 105, Kinematics).

The highest level of a data model is the AP. APs contain the data required for a specific application domain, they draw all of their data definitions from the Resource Models, and are the portion of STEP that is intended to be implemented. Requirements for STEP applications compliance includes the ability to support all of the data defined in an AP. As the initial focus of STEP is on mechanical, and electrical and electronics parts, most of the current data models reflect this bias. However, STEP is designed to be extended, and groups are currently working on a range of other models, such as Automobile, Shipbuilding, Composite Material for Aircraft, Technical Publications, and Product Life Cycle data models, etc. These models will go through the same development and approval process as the current STEP parts, eventually emerging as full-fledged STEP Parts.

2.3.1 Application Protocol Framework

The type of products covered by STEP include almost all man made products and non-product specific domains. A framework for an AP classification is currently being defined. One of the possible AP classifications is defined by three major categories as presented in the list below.

- **Product Type Independent APs**

Product Design Representation
    Technical drawings
    Technical Publications
    Product Models
Product Configuration Management
Product Data Management
Product Life-Cycle Functions
Product Process Plan
    Manufacturing Process Plans
    Test and Inspection Plans
Standard Parts

- **Product Specific APs**

Aerospace
    Aircraft and Equipment
    Missiles and Space Vehicles
Apparel and Textile
Automotive
Construction Components and Facilities
    Offshore Oil
    Process Plants
    Infrastructure Facilities
Electric/Electronic
Production and Manufacturing Equipment
    Industrial Instruments and Equipment
    Medical and Dental Instruments and Equipment
Mass Transportation
Shipbuilding
    Ship Electrical Distribution
    Ship HVAC
    Ship Outfit and Furnishing
    Ship Piping
    Ship Structural
Software

- Technology Specific APs

  Advanced Materials Technology
    Ceramics
    Composites
    Metallic
    Polymers
  Sheet Metal Technologies

A good AP classification method will provide a basic framework for defining AP scopes and for assessing the adequacy of the coverage of the existing APs as well as the planning of future extensions.

2.3.2 Contents of a STEP Application Protocol

This section provides an overview of the contents of a STEP application protocol (AP). A protocol is a set of conventions or rules that govern the interactions of processes to achieve communication. APs provide a formal data model for specifying application-specific STEP constructs. A standard table of contents for a STEP AP follows.

Foreword
Introduction
1 Scope
2 Normative references
3 Definitions
4 Information requirements
  4.1 Construct definitions and assertions
5 Application interpreted model
  5.1 Mapping table
  5.2 AIM EXPRESS short form
6 Conformance requirements and test purposes
  6.1 Conformance requirements
  6.2 Conformance test group structure
  6.3 Conformance test purposes

Annexes
A AIM EXPRESS long form (required and normative)
B AIM entity and type abbreviations (required and normative)
C PICS (Protocol Implementation Conformance Statement) proforma (required and normative)
D Implementation specific requirements (required and normative)
E Application activity model (required and informative)
  E.1 AAM definitions
  E.2 AAM diagrams

F Application reference model (required and informative)
- **F.1** Units of functionality
  - **F.1.1** UOF definitions
  - **F.1.2** UOF and ARM correspondence
- **F.2** ARM specification and diagrams

G AIM EXPRESS-G (required and informative)
H Application protocol usage guide (optional and informative)
J Technical discussions (optional and informative)
K Bibliography (optional and informative)
L Resource entity definitional references (optional and informative)
Index

The process for developing an AP starts with the definition of the application context and an application activity model (AAM). These elements are used for identifying the information requirements of the application and documenting them in an application reference model (ARM). The ARM is then used to select the constructs from the integrated resources and identify constraints or specializations of entities for describing the required information in an application interpreted model (AIM).

The four major components of a STEP AP are:

- the scope and functional requirements;
- the application reference model of the information requirements;
- the application interpreted model that specifies the required use of the STEP integrated resource constructs; and
- conformance requirements and test purposes.

A standard abstract test suite (ATS) is available for each application protocol in STEP. Each standard abstract test suite is a separate STEP Part and is referenced by the corresponding application protocol as a normative reference.

2.4 Testing Methodology

When a standard is implemented, several different types of tests need to be performed before that implementation can be used with confidence. These tests include conformance testing, robustness testing, interoperability testing, acceptance testing, and performance testing. All of these tests are relevant to STEP implementations. Conformance testing has been covered in detail in Part 31 of STEP, but the other types of testing are not covered in STEP. The following sections discuss the two types of testing that are most relevant to the testing of STEP data: conformance testing and acceptance testing.

2.4.1 Conformance Testing

Part 31, Conformance Testing, provides a framework and describes the general concepts for conformance testing of implementations of STEP. The objective of product data exchange cannot be completely achieved unless systems can be tested to determine whether they conform to the relevant product exchange standards. There is an industrial need to establish conformance testing services for implementations of STEP. Part 31 provides the foundation for the conformance testing class (which includes Parts 32, 33, and 34) which are required to establish conformance testing services and hence meet this industrial need. The following paragraphs summarize the main points expressed in Part 31.

Part 31 defines the meaning of conformance. Conformance can be expressed in terms of an AP combined with an implementation form. The conformance requirements in a standard could be: mandatory, conditional, or optional. To evaluate the conformance of a particular implementation, it is necessary to have a statement of the options which have been implemented so that the implementation can be tested for conformance against relevant requirements and those requirements only. Such a statement is called Protocol Implementation Conformance Statement (PICS). The PICS proforma is a standardized document included in Annex C of each AP document (see Section 2.3.2, Contents of a STEP Application Protocol). Part 31 also describes the standard test suites referenced by the APs which are used to test the conformance of an implementation.
The objective of conformance testing is to establish whether the implementation under test (IUT) conforms to the requirements stated in the relevant AP. Two types of testing are distinguished: basic tests, which provide the preliminary evidence that an IUT conforms; and capability tests, which are comprehensive tests to test the capabilities claimed in the PICS. For testing, an additional document called Protocol Implementation eXtra Information for Testing (PIXIT) is required, which contains relevant information about the implementation and its operating environment.

Four phases of the conformance assessment process are defined as:

- preparation for testing, which consists of activities like preparation and review of PICS, PIXIT and identification of abstract test suite and method;
- test campaign, which is the process of running actual tests and recording results;
- analysis of results, which is the action of evaluating test outcomes and issuing a verdict of pass, fail, or inconclusive;
- conformance test report production, which is the documentation of the results of conformance testing.

The conformance testing process should ensure the repeatability, comparability, and auditability of results.

Various APs specify standard test suites called abstract test suites which are to be used for testing an implementation for conformance to the AP. The abstract test suites have a hierarchical structure in which the lowest level is a test case. An abstract test case satisfies the requirements of a test purpose documented in the corresponding application protocol. An executable test case is derived from an abstract test case and allows it to be run in the IUT environment. The different components of an executable test case and the procedure to derive it from an abstract test case are presented in Part 33.

2.4.2 Acceptance Testing

When data is delivered to the government by contractors, it is required to undergo acceptance testing. The objective of acceptance testing is to assure that the delivered data meets all of the government requirements, which include not only conformance to data representation standards like STEP, but additional requirements which may be stated in relevant military standards or in contracts. An acceptance test is much more comprehensive than a conformance test. As an example, in the case of raster data the representation standard is CCITT Group IV; however, a delivery of raster data to the government has to satisfy many additional requirements such as conformance to MIL-STD-1840A, legibility/reproducibility requirements, page layout requirements, etc.

Currently, the government receives engineering drawings from the contractors in both raster and vector formats. The key identifications such as drawing number, size, Commercial and Government Entity (CAGE) code, and revisions within the title block of the engineering drawing are used to provide the information for that particular drawing as specified in MIL-STD-100E. The information can be used for many applications including data management and data acceptance automation. An ongoing effort to automate the government quality assurance (QA) process under JCALS is Computer-Assisted Data Acceptance (CADA) development at the CTC. Under this project, engineering drawings to be delivered to the Army Digital Storage and Retrieval Engineering Data System (DSREDS), the Air Force Engineering Data Computer Assisted Retrieval System (EDCARS), and the Navy Engineering Drawing Management Information System (EDMICS) sites will be inspected by CADA software. CADA software will evaluate the image quality and check the key Identification Data (ID) fields within the engineering drawing. When STEP is adopted into the JCALS Standards, the data acceptance and quality assurance of STEP data test procedures will need to be established.

2.5 Configuration Management

Part 203, Configuration Controlled Design, specifies an application protocol (AP) for the use of product data within a defined context which satisfies an industrial need to exchange configuration controlled three-dimensional (3-D) product design data. It is concerned solely with the design phase of the product life cycle. The designs of mechanical parts and assemblies may be exchanged using this specification.

Although important to the design of the product, the shape of the product is not the primary focus of Part 203. The primary focus of this Part is on the data which controls the tracking

and management of the product and includes:

- the identification of a product to an organization's customers and the link of the design identification of the components which comprise the product;
- the documentation of formal change and release of designs for the product;
- the history of the development of the product as it goes through the formal initiation, change and release process;
- the structure of the relationship of each of the components of the product to the whole;
- additional information concerning materials, processes, finishes, and other design requirements about the product; and
- the identification of qualified suppliers for the product or the design of the product.

There is a definite relationship between Part 203 and the types of data used in JCALS. As JCALS defines and migrates towards the Integrated Weapon Systems Data Base (IWSDB) concept, design data will need to be represented in STEP format.

SECTION 3

RECOMMENDATIONS FOR MODIFICATIONS AND ENHANCEMENTS

3.1 Review of the STEP AP Framework

The PDES/STEP AP framework was produced in an *ad-hoc* fashion by international committees. A detailed evaluation of the current PDES/STEP AP framework against the JCALS architecture is required to identify possible missing APs and to identify those APs that are critical to the development of the JCALS IWSDB. Priorities of AP development should be given to those APs that are needed for the IWSDB development.

The review of the AP framework will also include the interoperability capability among the APs. STEP was intended to address the data exchange needs of an extremely wide variety of subject areas. Not only was it supposed to satisfy the product data communications needs of a product (any product) throughout it's life-cycle, but also to handle product data across different industries. The operational interoperability of the current AP framework is not well organized nor emphasized under current ISO/IPO activities. The interoperability of APs is critical to the interface of large disparate, heterogenous systems such as JCALS. JCALS needs to take a pro-active position in the definition of the interoperability of APs.

3.2 Review of Current APs in Relation to JCALS

A preliminary functionality mapping between the JCALS functions, as delineated in the JCALS Functional Description (FD), and the STEP APs revealed that there is extensive work needed in AP development for the logistics and technical publications areas. Tables 2 through 4 list which APs are approved or planned, and which, the authors' believe, need to be developed to support the JCALS Program. The APs listed with a part number have been approved by the IPO. Those APs preceded by the label PL are in the planning stages (no official part number has been assigned). Those APs preceded with the label MS are those which have been identified as being needed by JCALS, but not yet considered by the IPO. (The prefixes PL and MS, and the numbers following them, are used for the convenience of this report; they are not recognized by the IPO.)

Table 2. Currently Defined Application Protocols

Part	Title
201	Explicit Draughting
202	Associative Draughting
203	Configuration Controlled Design
204	Mechanical Design Using Boundary Representation
205	Mechanical Design Using Surface Representation

Table 2. Currently Defined Application Protocols

Part	Title
206	Mechanical Design Using Wireframe Representation
207	Sheet Metal Dies and Blocks
208	Life Cycle Product Change Process
209	Design through Analysis of Composite & Metallic Structures
210	Electronic Printed Circuit Assembly, Design and Manufacture
211	Electronic Test Diagnostics and Remanufacture
212	Electronic Plants

Table 3. Planned Application Protocols.

Part	Title
PL213	Automotive Design
PL214	Composites
PL215	Electric/Electronic
PL216	Product Life Cycle
PL217	Manufacturing Process Plans
PL218	Polymer Testing
PL219	Sheet Metal
PL220	ShipBuilding
PL221	Life Cycle Management
PL222	NC Process Plan for Machine Parts
PL223	Electronic Printed Assembly, Design and Manufacture
PL224	Product Operation
PL225	Product Procurement
PL226	Ships Electrical Systems
PL227	Ship HVAC Systems
PL228	Ships Library Parts
PL229	Ships Outfit & Furnishing
PL230	Ships 3D Piping Systems
PL231	Ships Structural Systems
PL232	Software Product
PL233	Product Maintenance

Table 4. Missing Application Protocols

Part	Title
MS234	Technical Publications
MS235	Product Life Cycle Support
MS236	Product Life Cycle Support Data Element Exchange
MS237	Product User Training
MS238	Product Fielding
MS239	Cataloging and Provisioning

The mapping of the previously mentioned APs to the JCALS FD is shown in Table 5,below. Again, note that the PL and MS prefixes, along with the numbers following them, are used for the convenience of this report. It should be noted that this table is a tentative analysis which should be verified by functional experts.

Table 5. Tentative Analysis of JCALS Required Application Protocols

JCALS FD PARAGRAPH	JCALS FUNCTIONS	REQUIRED STEP APPLICATION PROTOCOL
2.3.2.2.1	Program Management Functional Area	
2.3.2.2.1.1	Procurement Data Package/Data Requirements Document/Technical Data Package (PDP/DRD/TDP)	PL216, PL221, PL225, MS234
2.3.2.2.1.2	Acquisition Plan	PL225
2.3.2.2.1.3	Integrated Logistics Support Plan (ILSP)	PL216, PL221, PL225, MS234
2.3.2.2.1.4	Depot Maintenance Support Plan (DMSP)	PL216, PL221, PL225, MS234
2.3.2.2.1.5	Basis of Issue Feeder Plan (BOIFP)/ Qualitative and Quantitative Personnel Requirements Information (QQPRI)/ New Equipment Training Plan (NETP)	PL225, PL233, MS234 PL225, PL233, MS234 PL225, MS237, PL233
2.3.2.2.1.6	Material Fielding Plan (MFP)	PL225, MS238
2.3.2.2.2	Concurrent Engineering Functional Area User Activities	
2.3.2.2.2.1	Logistic Support Analysis/Record (LSA/LSAR)	PL221, PL216, MS235, MS236
2.3.2.2.2.2	Engineering Change Proposal (ECP)	AP208, PL233
2.3.2.2.2.3	Equipment Performance Report (EPR)	AP208, PL233
2.3.2.2.2.4	Equipment Improvement Report (EIR)/ Quality Deficiency Report (QDR)	AP208, PL233
2.3.2.2.2.5	Product Improvement Management Information Report (PRIMIR)	AP208, PL233
2.3.2.2.2.6	Sample Data Collection System (SDC)	AP208, PL233
2.3.2.2.3	Logistics Management Functional Area User Activities	
2.3.2.2.3.1	Technical Publications	MS234
2.3.2.2.3.2	Provisioning	PL221, MS239
2.3.2.2.3.3	Cataloging	PL221, MS239

It is recommended that immediate attention be paid to all of the APs in the above mapping that are relevant to JCALS but are not being addressed by the IPO. The CTC could be instrumental in the development of the JCALS-oriented logistics and technical publications APs.

3.3 Enhancement of the Technical Publications AP

An integral part of product development is the generation of technical text/graphic publications which describe its design, operation, maintenance, etc. STEP Standard development has not adequately addressed this area at the present time. Because technical publications are an important part of the overall JCALS design, PM JCALS must become actively involved in the IPO Technical Publications Working Group (TPWG) to insure that JCALS technical publications requirements are included in STEP.

3.3.1 Technical Publications Information Model (TPIM)

The IPO Technical Publications Working Group (TPWG) is working on the Technical Publications Information Model (TPIM) as a prelude to AP development. In the TPIM, the TPWG is attempting to define the relationship between Standard Generalized Markup Language (SGML) document tags and STEP. The current topic of discussion, within the TPWG, is whether to define SGML in STEP or to define the interface between SGML and STEP. Since the JCALS Program has the overall responsibility for DoD technical publications, it must work closely with STEP AP development in this area.

3.3.2 Integrated Weapon Systems Data Base

The JCALS Integrated Weapon Systems Data Base (IWSDB) is a logically centralized and heterogeneous distributed data base system. It will contain weapon systems data available to the JCALS System independent of location, physical storage method, or physical structure of the data.

Due to the continuous growth and constant change of technical information, it has become imperative that an electronic system for handling paper-based documentation be developed. The concept of the Content Data Model (CDM) was developed to work with the SGML Standard to develop technical manuals. CDM can provide five functions:

- display media,
- data primitives,
- tagging scheme,
- data organization, and
- data dynamics.

The CDM provides an explicit representation of technical information elements and their relationships. The CDM approach offers several advantages for the technical implementation of data. It specifies a neutral interchange format and does not restrict an authoring system to a specific environment. The primary concern of the CDM concept and development is that it is not clear whether the SGML and STEP Standards are on a compatible course. This compatibility issue needs to be investigated and resolved.

The exchange, management, and distribution of product data for the logistic support of weapon systems is a major part of the weapon system program life cycle. Many engineering drawings are used during the design and production phase. One of the objectives of the JCALS program is to shorten the design, development, production, and resupply times. Currently, CALS standards require engineering drawings to be delivered in either CCITT group IV raster or IGES format, as specified in MIL-D-28000 and MIL-R-28002. The raster images are obtained by scanning the engineering drawings from paper copies or from aperture cards. Vector graphics are most likely Computer-Aided Design (CAD) system generated engineering drawings in IGES format. As STEP Standards are incorporated in the JCALS program, all product data, including engineering drawings, will be represented in EXPRESS working form, which is the computer-interpretable representation for the exchange of product data. JCALS should study the acceptance test of STEP AP instantiation data from a data acceptance point of view. As explained in Section 2.4.2, the current STEP Standard does not address the acceptance test of the data delivered.

3.4 Enhancement of the Product Life Cycle Support APs

The IPO Product Life Cycle Support (PLCS) project actively supports the CALS initiative and recognizes the potential role of STEP in CALS implementations. PLCS currently has one AP (Life Cycle Product Change Process, AP 208) under development. Five more APs are in the planning stages: Product Life Cycle Support Data Element Exchange, Life Cycle Management, Product Procurement, Product Operation, and Product Maintenance. Many of the logistics functions identified as being an integral part of the JCALS Program fall within the scope of PLCS AP development.

It is evident that Version 1.0 of the STEP Standard does not have any APs to address logistics and support (including technical information). Some logistics and support related APs are in the planning stages and are not scheduled to be completed until 1996 and beyond. An accelerated schedule for the completion of these APs is necessary in order to meet the needs of JCALS IWSDBs.

3.4.1 Possible Role of the CTC in Concept Development and Validation

The resources of the CTC facilities could be used in identifying requirements, performing validation tasks, and integrating logistics and support related APs, as identified by the IPO.

- Product Life Cycle Support,
- Product Life Cycle Support Data Element Exchange,

- Life Cycle Product Change Process,
- Life Cycle Management,
- Product Procurement,
- Product Operation,
- Product Maintenance, and
- Technical Publications (include Technical Manuals/Technical Orders [TMs/TOs] and Integrated Electronic Technical Manuals [IETMs]).

The scope of the above APs, as currently defined by the IPO, need to be reviewed against the MIL-STD-1388-2B Logistics Support Analysis requirements before the implementation of these data models. Until all of the data items identified in MIL-STD-1388-2B are defined in a computer-interpretable form, such as STEP APs, logistics functions will have a difficult time interfacing with STEP design and manufacturing automation.

SECTION 4

CONCLUSIONS

STEP Version 1.0 will be released as a Draft International Standard (DIS) in mid-1993. PM JCALS is in a position to become an important player in the initial release, and future, of the STEP Standard by becoming actively involved in the STEP Standard development process. There is considerable work to be done in the area of AP development for the logistics and technical manual areas, which form the nucleus of the JCALS Program. STEP development work has been slow in these areas, in comparison to AP development for the design and manufacturing (i.e., draughting) and specific application (i.e., sheet metal) areas. The risk factor for the JCALS Program is that if it doesn't stay at the forefront of mechanical, electrical and STEP development, then the JCALS requirements may not be supported adequately by the STEP Standard in a timely manner, if at all.

4.1 Possible Role of the CTC as a STEP Technology Center

The CTC at Fort Monmouth, New Jersey, provides technical support to the JCALS program in the testing and evaluation of JCALS related standards and conducts concept development tasks in these areas. Technical support for the JCALS Program includes processing, storage, and management of data for the JCALS program, technical analyses and validation, and applying lessons learned from research. The CTC also performs analyses of heterogeneous data bases, computer systems, and legacy application integration. On-going research and development efforts concentrate not only on areas such as STEP research, LSAR applications, Integrated Weapon Systems Data Base (IWSDB) Environment development, and IETM implementation, but also focuses on the acceptance and conformance testing for JCALS related data.

In the process of performing concept devlopment tasks, testing JCALS and other emerging standards, such as STEP, IWSDB (including engineering drawings) and LSAR reliability, maintainability, and provisioning data will be exchanged between the CTC and other agencies. Also, as technology improves to the point where workstations and desktop Personal Computers (PCs) become more powerful, the use of scanned raster images, Computer-aided Design/Computer-aided Manufacturing (CAD/CAM) files, and other product data will increase within the CTC. This product data includes the geometry, topology, tolerances, relationships, attributes, and features necessary to define a part or an assembly for the purposes of design, manufacture, and product support.

The CTC provides the capability to receive, access, transmit, manage, and exchange product information with members of the JCALS community via wide area networks (WANs) such as the Defense Data Network (DDN) and various other media (e.g., WORM Optical disk, 9-track magnetic tape). The CTC provides technical capabilities which are supported by heterogeneous computer systems in the CTC and the selected network. Technically, the CTC is capable of testing and evaluating JCALS Standards, JCALS-related products, and emerging standards and technologies. These capabilities, and the heterogeneous platform at the CTC,

allows it to conduct STEP Conformance Testing for the JCALS-related application protocols.

Conformance testing is an important part of STEP implementation. In principle, the objective of conformance testing is to establish whether the implementation being tested conforms to the requirements stated in the relevant application protocol. This will ensure that the test results are consistent and comparable to the requirements which are specified in the application protocol. Utilizing the CTC's capabilities, a STEP testing laboratory can be established to perform not only basic and capability tests, but also to test the performance, robustness, and interoperability of the STEP data. The CTC serves many functions in relationship to PM JCALS and the Joint CALS community. The CTC has been recognized for its technical excellence, as well as being a cooperating player in the CALS Test Network (CTN) activities. Given the unique position of the CTC in the JCALS community, it can coordinate the Pilot STEP Data Base implementation and conformance testing, and provide procedures to the selected participating testing laboratories. The CTC's role in this area can also be expanded to include providing guidance from technical experts to aid testing laboratories in reaching a higher level of performance, resulting in the generation of improved engineering and product information. When new APs are developed to satisfy the JCALS requirements (or existing ones modified), the CTC can play a role in developing the conformance testing requirements and the abstract test suites for those APs.

The acceptance testing area is also an area in which the CTC can play an important role. The CTC is already in the process of developing and testing CADA for raster data. There are plans to extend these capabilities to other data types like IGES, SGML, etc. Because of the importance of STEP to JCALS, it should be one of the data standards to be handled in future versions of CADA. The first effort in this direction would be to define the requirements for acceptance testing of STEP data.

4.2 Coordination of CALS Standards with STEP Standards

The DoD CALS Program Office has developed a coordinated strategy for the update of CALS Standards related to STEP. As a part of this strategy, the IGES to STEP transition plan will be included in future MIL-D-28000 updates. Transition strategies which have been suggested are listed below.

- Version 4.2 of the IGES Standard will be accredited as an American National Standards Institute (ANSI) standard in the near future. Version 6.0 of IGES will be released in a year as the final version of the IGES standards. A guideline needs to be incorporated into MIL-D-28000 and MIL-HDBK-59 for the gradual transition from IGES to STEP, based on the data exchange needs of the various weapon system programs. This would allow for the lessons learned from the transition to be shared throughout the CALS program, increasing the ease and efficiency of later transitions from IGES to STEP.

- The MIL-D-28000 Classes I, II, and IV should be replaced by the following STEP APs:

- Part 201 - Explicit Draughting,
- Part 202 - Associate Draughting, and
- Part 203 - Configuration Controlled Design.

During the transition period, the MIL-D-28000 Classes I, II, and IV may evolve into the IGES Engineering Drawing AP, which is easily replaceable by STEP APs.

- The MIL-D-28000 Class III should be replaced by the STEP Electric/Electronic APs, which are currently under development by the IGES/PDES Organization. In the meantime, the MIL-D-28000 Class III can use EDIF-based information Models which will evolve into STEP APs.
- The MIL-D-28000 Class V, IGES 3-D Piping Application Protocol, should be replaced by the STEP AP for Ship 3-D Piping Systems.

PM JCALS needs to become actively involved in the transition from IGES to STEP to ensure that the design elements critical to the JCALS requirements are included.

4.3 Coordination with the Air Force F-22 STEP Data Base Implementation

A Memorandum of Understanding (MOU) is being developed to coordinate F-22 Data Base development and the JCALS Program. JCALS can possibly benefit from lessons learned of building a STEP-compliant F-22 data base in order to mitigate risks of the future usage of the STEP Standards as JCALS requirements and standards.

The Digital Data Package (DDP) of the F-22 Data Base is planning to use the STEP development method as it is currently available and will deal in an empirical way with some issues before JCALS faces them. It is important to assure that both STEP compliant and non-STEP-compliant data bases be compatible within the DoD-wide, multiple weapon system, IWSDB for which JCALS is responsible for implementing.

The interface between the JCALS IWSDB and the F-22 Data Base can be prototyped for the investigation of the transaction of data between the STEP-compliant data bases and the non-STEP-compliant data bases. Facilitating technology transfer from the F-22 Data Base effort to JCALS and vice versa will benefit both programs in using the STEP technology. The CTC facility can be used for development and validation tasks related to technology transfer and interfacing in order to mitigate technical risks.

4.4 Coordination with the IPO and PDES, Inc.

The previous sections identified areas in which the STEP Standard should be modified to meet JCALS requirements. In order to drive these activities, it is important for the JCALS program to work closely with organizations responsible for developing the STEP Standard,

IPO and PDES Inc. Representatives of PM JCALS should be involved in the development of the APs relevant to the program. Since the standard organizations have a large number of items on their agenda and have to satisfy the requirements of a large number of users, the priorities assigned to items relevant to JCALS and the inclusion of modifications relevant to JCALS can be greatly influenced by the active participation of JCALS in these organizations.

Currently, PDES, Inc. membership is comprised of over 20 major technology participants, representing more than 400 billion dollars in revenue each year. The benefits of joining the PDES, Inc. include:

- influencing the implementation of the emerging U.S. and International Standard -- PDES/STEP;
- obtaining hands-on experience using STEP and STEP Tools;
- providing focused cost sharing (e.g., people, software, dollars) as in the development of PDES/STEP capabilities; and
- gaining a head start -- based on the experience of working with PDES, Inc. -- on using the STEP standard to minimize the costly and time-consuming start-up learning curve. JCALS can benefit from PDES, Inc. in the lessons learned about using the STEP standard.

As a member of PDES, Inc., it will be easier to track the correlation of schedules for PDES/STEP AP development and implementation according to the overall JCALS Program schedule. The CTC facility can be used for development and validation tasks related to technology transfer and data interfacing in order to mitigate possible technical risks.

The CTC can be used for the STEP technology transfer of current tools and the development of APs for logistics and technical publications related to specific JCALS functional areas (i.e., IETMS and CADA). The resources of the CTC can also be used in coordination work between PM JCALS and the PDES, Inc. and Air Force F-22 groups. Because the CTC is part of the overall CALS Test Network, the lessons learned from AP development and testing at the CTC can be shared throughout the services. The CTC is poised to become the focal point for the CALS-STEP interface.

SECTION 5

GLOSSARY OF ACONYMS

AAM	Application Activity Model
AIM	Application Interpreted Model
ANSI	American National Standards Institute
AP	Application Protocol
ARM	Application Reference Model
ATS	Abstract Test Suite
BOIFP	Basis of Issue Feeder Plan
CAD	Computer-Aided Design
CADA	Computer-Assisted Data Acceptance
CAGE	Commercial and Government Entity
CALS	Computer-aided Acquisition and Logistic Support
CAM	Computer-Aided Manufacturing
CCITT	Consultative Committee for International Telephony and Telegraphy
CD	Committee Draft
CDM	Content Data Model
CTC	CALS Technology Center
CTN	CALS Test Network
DBMS	Data Base Management System
DDN	Defense Data Network
DDP	Digital Data Package
DIS	Draft International Standard
DMSP	Depot Maintenance Support Plan
DoD	Department of Defense
DRD	Data Requirements Document
DSREDS	Digital Storage and Retrieval Engineering Data System
ECP	Engineering Change Proposal
EDCARS	Engineering Data Computer Assisted Retrieval System
EDMICS	Engineering Drawing Management Information System
EIR	Equipment Improvement Report
EPR	Equipment Performance Report
FD	Functional Description
ID	Identification Data
IWSDB	Integrated Weapon System Data Base
IETM	Interactive Electronic Technical Manual
IGES	Initial Graphic Exchange Specification
ILSP	Integrated Logistics Support Plan
IPO	IGES/PDES Organization
IS	International Standard
ISO	International Standards Organization
IUT	Implementation Under Testing
JCALS	Joint Computer-aided Acquisition and Logistic Support
LSA/LSAR	Logistic Support Analysis/Logistic Support Analysis Record

MFP	Material Fielding Plan
MOU	Memorandum Of Understanding
NETP	New Equipment Training Plan
PC	Personal Computer
PDES	Product Data Exchange using STEP
PDP	Procurement Data Package
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
PLCS	Product Life Cycle Support
PM	Program Management
PRIMIR	Product Improvement Management Information Report
QA	Quality Assurance
QDR	Quality Deficiency Report
QQPRI	Qualitative and Quantitative Personnel Requirements Information
SDC	Sample Data Collection System
SGML	Standard Generalized Markup Language
STEP	Standard for Exchange of Product Model Data
TM	Technical Manual
TO	Technical Orders
TPIM	Technical Publications Information Model
TPWG	Technical Publications Working Group
TDP	Technical Data Package
WAN	Wide Area Networks

SECTION 6

LIST OF REFERENCES

Guidelines for the Development and Approval of STEP Application Protocols. Version 1.0. ISO TC184/SC4/WG4 N34 (P5), February 20, 1992.

International Standards Organization. *STEP Part 1 - Overview and Fundamental Principals.* ISO 10303-1, September 1992.

International Standards Organization. *STEP Part 11 - EXPRESS Language Reference Manual.* ISO 10303-11, April 1991.

International Standards Organization. *STEP Part 21 - Clear Text Encoding of the Exchange Structure.* ISO 10303-21, March 1991.

International Standards Organization. *STEP Part 22 - Standard Data Access Interface Specification (SDAI).* ISO 10303-22, October 1992.

International Standards Organization. *STEP Part 31 - Conformance Testing Methodology and Framework: General Concepts.* ISO 10303-31, January 1992.

International Standards Organization. *STEP Part 41 - Fundamentals of Product Design and Support.* ISO 10303-41, August 1992.

International Standards Organization. *STEP Part 42 - Geometric and Topological Representation.* ISO 10303-42, August 1992.

International Standards Organization. *STEP Part 43 - Representation Structures.* ISO 10303-43, August 1992.

International Standards Organization. *STEP Part 44 - Product Structure Configuration.* ISO 10303-44, August 1992.

International Standards Organization. *STEP Part 46 - Visual Presentation.* ISO 10303-46, August 1992.

International Standards Organization. *STEP Part 101 - Draughting.* ISO 10303-101, August 1992.

International Standards Organization. *STEP Part 201 - Explicit Draughting.* ISO 10303-201, August 1992.

International Standards Organization. *STEP Part 203 - Configuration Controlled Design.* ISO 10303-203, September 1992.

National Institute of Standards and Technology. *Product Data Exchange: The PDES Project - Status and Objectives.* NISTIR 89-4165, September 1989.

MIL-D-28000A, *Military Specification Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols*, February 1992.

MIL-M-28001B, *Military Specification Mark up Requirements and Generic Style Specification For Electronic Printed Output and Exchange of Text*, October 1991.

MIL-R-28002, *Military Specification Raster Graphics Representation in Binary Format, Requirement for*, October 1989.

MIL-D-28003A, *Military Specification Digital Representation for Communication of Illustrated Data, Computer Graphics Metafile (CGM) Application Profile*, November 1991.

MIL-HDBK-59, *Military Handbook Computer-aided Acquisition and Logistic Support (CALS) Program Implementation Guide*, December 1988.

MIL-STD-1388-2B, *Military Standard DoD Requirements for a Logistic Support Analysis Record*, March 1991.

MIL-T-31000, *Military Specification Technical Data Packages, General Specification*, December 1989.

National Computer Graphics Association. *IGES/PDES Reference Manual.* July 1992.

APPENDIX A

STEP APPLICATION PROTOCOLS STATUS AND SUMMARY REPORT

STEP Application Protocols Status and Summary Report

Draft for distribution at Dallas joint IPO/ISO meeting

1 October 1992

Note to the reader:

The purpose of this report is to provide a useful and comprehensive status report on projects engaged in delivering STEP application protocols (APs). This report currently provides summaries of AP projects in ISO TC184/SC4 and PDES AP projects in the IGES/PDES Organization. This report is intended to include summaries of AP projects under development in other national AP activities. The information in this report is based on the AP summary sheets and status reports provided by AP project leaders. Once an AP project proposal has been approved by SC4, the summary on that AP project will be moved into the SC4 AP project section.

Updates and corrections to summaries of SC4 AP projects shall be sent to the SC4/PMAG AP Coordinator, Mark Palmer. Updates and corrections to summaries of IPO AP projects shall be sent to the IPO Deputy PDES Project Manager, Haidee Rapacki. It is the responsibility of each AP project leader to communicate any changes to an AP project summary or status to the appropriate point of contact. Currently there are no PDES application protocols that are not also SC4 projects.

Your recommendations for improving this report are solicited. This report will help to inform interested parties on the domains that the STEP community are investigating for AP development and the status of specific AP projects.

Our goal is to update this information quarterly. It will be distributed at the ISO meetings and IPO meetings. Please submit your comments and additions by *1 December 1992*. Comments on the SC4 APs should be submitted to Mark Palmer and comments on the IPO AP sections should be submitted to Haidee Rapacki.

Haidee Rapacki
PDES Deputy Project Manager
Auto-trol Technology
12500 North Washington
Denver, Co 80241-2400
USA

Phone: +1 303 252 2886
FAX: +1 303 252 2249
E-mail: hairap@auto-trol.com

Mark Palmer
SC4/PMAG AP Coordinator
NIST
Building 226 Room B306
Gaithersburg, MD 20899
USA

Phone: +1 301 975 5858
FAX: +1 301 975 4032
E-mail: palmer@enh.nist.gov

FORWARD:

The number of STEP application protocols being developed is increasing. In order for industry and government to properly access which APs or AP projects may be applicable to their needs, they require a comprehensive summary of what is available. This report is intended to meet that need. With this report, individuals and enterprises can monitor the development of the various STEP application protocols and give input on STEP application protocols that are appropriate for their particular needs.

This report is divided into two main sections. The first are those APs under consideration by the ISO TC184/SC4 and the second are those APs under consideration by the IPO. Under each section are four sub sections: approved application protocol planning projects, proposed application planning projects, approved application protocols projects, proposed application protocols projects. Within the subsections the parts are listed by part numbers, or alphabetically.

The following information is contained in this report for each of the Application Protocols:

Part Number:

The ISO 10303 Part number assigned for a particular Application Protocol.

Application Protocol Title:

The title for the Application Protocol.

Documentation Number:

The documentation number assigned by SC4 or SC4/WG to the current AP document. The NXX number refers to the revision of the application protocol.

Scope Statement:

The Scope Statement states the range of information that the application protocol will cover. The Scope Statement is taken directly from the application protocols summary sheet.

Industry need:

The industry need identifies the evidence of international industrial need to communicate the information covered within the application protocol. This section is taken from the AP document or AP summary sheet submitted to the IPO/ISO.

Industry review:

This is a summary of the results of the industry review of the AP scope and requirements. It includes the names and industry affiliations of the reviewers and a summary of their evaluations.

Overlap with other APs:

This defines the overlaps and relationships between a particular AP scope and other APs.

Part Owner:

The person responsible for the Application Protocol and primary contact.

Part Editor:

The editor of the Application Protocol and secondary contact.

Percent Complete:

This is the percentage complete before CD ballot.

Status Table:

The table lists the different steps to completing an Application Protocol. These steps were adopted from "Guidelines for Developing STEP Application Protocol, Version 1.0 (SC$/ WG4 N34)".

Projected Date:

These are the scheduled dates that the individual projects are planning to complete the AP.

Actual Date:

This is the date the task was completed. This will give reference to how the development of the Application Protocol is progressing.

Approved ISO TC184/SC4 Application Protocol Projects

Part Number: 201

AP Title: Explicit Draughting

Documentation Number: SC4/WG3/N78 + N99

Scope Statement:

This International Standard specifies an Application Protocol for the representation for the purpose of exchange of individual technical CAD Drawings, especially for mechanical engineering and architecture, engineering and construction (AEC) applications. The Application Protocol supports the presentation of product shape by explicit 2D geometry and of product properties by explicit 2D annotation without association between geometry and annotation.

The 2D geometry is defined in "source" (2D world) coordinates to provide the exchange of the real size of the product(s) documented by the drawing, while the annotation is exchanged in view or sheet coordinates. The 2D geometric representation of product shape is further required to support not only visual equivalence of exchanged drawings but also for the use of that geometry by the receiving system where true geometric equivalence is required.

Industry Need:

Industry Review:

Overlap with other AP's:

Part Owner:

Peter Krusse
IMW TU Clausthal
Robert-Koch-Stasse 32
3392 Clausthal-Zellerfeld
Germany

Tel.: +49 5323 72 2270
Fax: +49 5323 72 3501
E-Mail:

Part Editor:

Julian Fowler
CADDETC
Arndale House
Headingley
Leeds LS6 2UU
United Kingdom
Tel.: +44 532 305005
Fax: +44 532 304488
E-Mail: julian@leva.icf.leeds.ac.uk

Percent Complete: 100%

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	X	
Candidate AP Summary submitted to PMAG	X	
Industry Reviews conducted on AP scope and requirements	X	
AP development and validation plan completed	X	
Application Reference Model (ARM)	X	
Validate ARM and submit to Qualification	X	
Application Interpreted Model (AIM)	X	
Validate AIM and submit to Qualification	X	
Conformance requirements and test purposes completed	X	
AP Part document completed and submitted to Qualification	X	
AP Part document submitted to Editing Committee	X	
Produce Abstract Test Suite (ATS)	X	
Develop AP Prototype Implementation		
Submit ATS to Qualification	X	
Submit ATS to Editing Committee	X	
AP CD Ballot Start Date	1 Sept. 92	
AP CD Ballot Closing Date	1 Dec 92	
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
ATS DIS Approval		

Comments:

This Application Protocol is divided into two volumes.

Part Number: 202

AP Title: Associative Draughting

Documentation Number: SC4/WG3/N105

Scope Statement:

This international standard specifies the information requirements to unambiguously exchange, access, and archive drawings. This Part of ISO 10303 is applicable to the inter-company exchange of computer-interpretable drawing information and associated product definition data. The following is within the scope of this part:

The drawing may depict any phase of design, approval or release.

The computer-interpretable product shape model and the transformations used for the generation of drawing views.

Administrative information used for the purpose of drawing management.

Administrative information regarding the product and its versions being documented by the drawing.

The drawing structure consisting of sheets, views, representations of the product shape, and annotation.

Computer-interpretable associations between CAD dimensions and the respective product shape geometry.

The requirements for this application protocol have been derived primarily from a mechanical products perspective. Although, it is believed that drawings from other application domains, such as AEC, can be supported.

This AP does not attempt to enforce varying drafting standards. The intent was to conform with known standards, not to integrate or redefine existing drafting standards. The AP allows flexibility to support drawings created in conformance with differing standards.

Part types are limited in that it must be capable to represent the entire product shape in a single shape model (i.e. one CAD model).

A Bill of Material (BoM) structure is not supported by this AP. This information may be conveyed only as annotation text on a drawing.

Industry Need:

Industry Review:

Overlap with other AP's:

Part Owner:

Kevin E. Freund
Dan Appleton Company
222 W Las Colinas Blvd Ste 1141
Irving, TX 75039
U.S.A
Tel.: 214 869-1066
Fax: 214 869-1099
E-Mail: 4300129@mcimail.com

Part Editor:

Diane L. Allen
Northrop Corporation
1 Northrop Ave 610/MB
Hawthorne, CA 90250
U.S.A
Tel.: 213 332-8860
Fax: 213 332-5853
E-Mail: 4229777@mcimail.com

Percent Complete: 50%

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG		
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)		
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)		
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Part Number: 203

AP Title: Configuration Controlled Design

Documentation Number: SC4/WG4/N99

Scope Statement:

This International Standard specifies the structures for the exchange of configuration controlled three-dimensional(3-D) product definition data focusing on mechanical parts and assemblies between enterprise's application systems. Configuration in this context only includes data and processes that control the 3-D product design data. Exchange is used as a scoping consideration to narrow the scope to only those data which are exchanged as part of the 3-D product definition between enterprise systems. Enterprises exchanging data within the scope of ISO 10303-203 have a contractual relationship which is outside the scope of this Part.

The following represents the scope of ISO 10303-203:

a) A product is defined as a small mechanical part or rigid assembly. The word part and product are used interchangeably in the context of ISO 10303-203

b) Product definition data and configuration control data pertaining to the design phase of a product's development are in scope;

c) Product definition data and configuration control data pertaining to any life cycle phase of a product's development other than design are out of scope;

d) Wireframe and surface geometry used to define the shape of a product are in scope. The geometric elements deemed as in scope for the AP are: point, axis system, transformation, line, circle, conic arc, b-spline, surface of revolution, right circular cylinder, b-spline surface. In addition, in order to specify the boundaries of surfaces and establish connectivity between surfaces, the following topologic constructs are in scope: vertex, edge, edge loop and face;

e) The use of solid geometry (i.e. b-rep and csg) for the representation of objects are specifically out of scope.

f) The change of a design and all of the related data to that function is in scope;

g) The business data for the management of a design project (e.g. budget, schedules) are out of scope;

h) Alternate representation of the data by different disciplines during the design phases (conceptual, preliminary or detail) of a product's life cycle are in scope;

i) Alternate representations of the data by different disciplines outside of the design phase (e.g. Manufacturing) are out of scope;

j) Government, industry, company or other specification for the design, process, surface finish and materials which are specified by a designer in the design phase of a products development are in scope;

k) The identification of government, industry, company or other standard parts for the purpose of their inclusion in a product's design is in scope;

l) Data which is used in or results from the analysis or test of a design are out of scope except for the design representation for an analysis or test function or any analysis data

which might be supporting evidence for a change to a design;

m) Data which are necessary for the tracking of a design's release are in scope;

n) Data which are necessary to track the approval of a design or design aspect or a configuration control aspect of a product are in scope.

o) The tracking of what contract under which a design is developed is in scope;

p) The tracking of the security classification of a design or design aspect is in scope;

q) Data which results in changes to the design during the initial design evolution (i.e. - drawing corrections from checkin; design iteration which effect the design before release) are out of scope.

Industry Need:

There is a need to effectively communicate configuration management data among industry partners and further to exchange that data with product shape information.

Industry Review:

Reviewed at many IPO/ISO meetings and with US Companies: Grumman Data Systems, Lockheed, Northrop, Boeing, IBM, CV, SDRC, Hughes.

Overlap with other AP's:

Part Owner:

Mitchell Gilbert
Grumman Data Systems
5300 International Blvd.
North Charleston, South Carolina 29418
Tel.: +1 803 760 3481
Fax: +1 803 760 3580
E-Mail: 3676136@mcimail.com

Part Editor:

Percent Complete: 70%

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	X	
Candidate AP Summary submitted to PMAG	X	
Industry Reviews conducted on AP scope and requirements	X	
AP development and validation plan completed	X	

AP Development Steps	Projected Date	Actual Date
Application Reference Model (ARM)	X	
Validate ARM and submit to Qualification	X	
Application Interpreted Model (AIM)	X	
Validate AIM and submit to Qualification	X	
Conformance requirements and test purposes completed	X	
AP Part document completed and submitted to Qualification	X	
AP Part document submitted to Editing Committee	X	
Produce Abstract Test Suite (ATS)	X	
Develop AP Prototype Implementation		
Submit ATS to Qualification	X	
Submit ATS to Editing Committee	X	
AP CD Ballot Start Date	8 Sept. 92	
AP CD Ballot Closing Date	1 Dec 92	
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number: 204

AP Title: Mechanical Design Using Boundary Representation

Documentation Number: SC4/WG3/N107

Scope Statement:

The scope of ISO 10303-204 is the use and exchange of boundary representation models in the mechanical engineering design context. This document describes an application reference environment for the generation and exchange of volume based design data in the Computer Aided Mechanical design process, together with appropriate data models and a physical file implementation form. The data represents all geometric and topological aspects of a complete description of the external form of a mechanical engineering part. The application for this Application Protocol is Mechanical Design using the CAD modelling technique Boundary Representation (BRep) Solid Modelling.

The given application area places fundamental requirements on model exchange and the neutral representation of models. A requirement of this application is the exchange of CAD models at different stages of the design and engineering processes.This results in data exchange requirements between design and engineering and manufacturing companies. The transfer and archiving of BRep models requires the following to be maintained: the completeness of mapping, the correctness of semantics, the accuracy of relationships between model entities.

The product data in this AP is composedof topological and geometric shape descriptions as well as material properties.In detail the following items are in the scope of this Application Protocol: Polyhedron, Elementary BRep, Advanced BRep, Elementary Geometry, Manifold topology, Bspline curves and surfaces, and Material information.

Beyond the scope of this Part are: assemblies of parts, administrative data, other than that relating to the file creation and contained in the file header section, presentation aspects of the product, dimensioning, tolerances, manufacturing information, wireframe models, surface models, CSG models, compound BReps, pcurves, 2 dimensional geometry, nonmanifold topology, and FEM models

Industry Need:

The geometric shape of a product is primarily fixed in the styling and conceptual design phases. Non-computerized tools dominate. The product shape is then typically detailed by the Department for Detail Design in utilizing CAD-systems.

The design data model - represented as a CAD data model - is transferred to a heterogenous CAD environment in a system-to-system approach by means of neutral files. The transfer medium might be electronic network, floppy or tape. The model may be transferred to other departments within the same company or to other companies, for further design, for analysis or for manufacturing purposes.

Depending on their applications shape representations of mechanical parts may be of different levels of completeness and constraints, Therefore, different model design methods are applied such as

- volume based design (B-rep, CSG),
- surface based design,
- wireframe based design.

The resulting representations differ from each other by model quality criteria as: completeness, conciseness, degree of freedom, complexity. They do in general not exist simultaneously for one product. In design, one of the alternatives is chosen dependent on product characteristics. However, conversions from one to another representation happen - in both directions. This Application Protocol supports surface based design.

The following exchange scenarios may be supported:

- from design to product analysis;
- from design to design;
- from design to manufacturing planing and manufacturing;
- from design to assembly simulation;
- from design to quality assurance.

The needs for surface model exchange and neutral representation mainly exist in aircraft, car and consumer goods industries. Today national and industrial standards as IGES, SET, VDA/FS, VDA/IS are in use. However, they only partly satisfy these needs. Especially is the whole variety of information that is part of a complete surface model - as described above - not sufficiently taken care of. Therefore, an international standard is required, a post-processor of the above mentioned ones applied to mechanical design surface modelling. This part is a first step towards a complete standard for the representation of mechanical design models.

Industry Review:

Developed as part of CADEX Project with 14 industrial partners including BMW, FIAT, HP.

Overlap with other AP's:

Fully Integrated with AP 205 and AP 206 with common AAM. Common geometry and topology with AP 203.

Part Owner:

Ray J. Goult
LMR Systems
33 Filgrave
Newport Pagnell
Bucks, MK16 9EZ
United Kingdom

Part Editor:

SAME

Tel.: 44 234 711653
Fax:
E-Mail:

Percent Complete: 80%

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		June 90
Candidate AP Summary submitted to PMAG		Oct 90
Industry Reviews conducted on AP scope and requirements		1990-92
AP development and validation plan completed		
Application Reference Model (ARM)		July 91
Validate ARM and submit to Qualification		April 92
Application Interpreted Model (AIM)	October 92	
Validate AIM and submit to Qualification	October 92	
Conformance requirements and test purposes completed	October 92	
AP Part document completed and submitted to Qualification	Dec. 92	
AP Part document submitted to Editing Committee	Feb. 93	
Produce Abstract Test Suite (ATS)	July 93	
Develop AP Prototype Implementation		May 92
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number: 205

AP Title: Mechanical Design Using Surface Representation

Documentation Number: SC4/WG3/N116

Scope Statement:

This Part of ISO 10303 specifies the representation of surface design data, as utilized in computer aided mechanical design, for the purpose of data exchange. This specification can both be exploited for neutral representation of the surface shape aspect of product models (as used for storage in databases) and for file based exchanged of surface models.

The following is within the current scope of this document:

- the representation of surface model shape,
- the representation of display properties for surface models,
- the representation of product structure including assembly information.

Surface models that are represented in correspondence to this Part may be utilized by other CAx-application than only CAD, such as CAM and FEA.

The following is outside the scope of this document:

- surface model representation and exchange that is not an output of the product design stage, by the result of further exploitation of surface model information; thus the representation of meshed surfaces as resulting from FEA and of NC-paths as resulting from NC-planning are out of scope.
- non-shape information as concerning e.g. physical properties (material, surface roughness, etc.), loads, configuration control.

This Part of ISO 10303 is applicable to industries where the CAD modelling technique "surface modelling" is utilized. Styling, mechanical design and engineering activities as in car, aeroplane and electro-mechanical industries are typical examples. Products of these industries are characterized by high priority design and sophisticated shapes.

Industry Need:

The geometric shape of a product is primarily fixed in the styling and conceptual design phases. Non-computerized tools dominate. The product shape is then typically detailed by the Department for Detail Design in utilizing CAD-systems.

The design data model - represented as a CAD data model - is transferred to a heterogenous CAD environment in a system-to-system approach by means of neutral files. The transfer medium might be electronic network, floppy or tape. The model may be transferred to other departments within the same company or to other companies, for further design, for analysis or for manufacturing purposes.

Depending on their applications shape representations of mechanical parts may be of different levels of completeness and constraints, Therefore, different model design methods

are applied such as

- volume based design (B-rep, CSG),
- surface based design,
- wireframe based design.

The resulting representations differ from each other by model quality criteria as: completeness, conciseness, degree of freedom, complexity. They do in general not exist simultaneously for one product. In design, one of the alternatives is chosen dependent on product characteristics. However, conversions from one to another representation happen - in both directions. This Application Protocol supports surface based design.

The following exchange scenarios may be supported:

- from design to product analysis;
- from design to design;
- from design to manufacturing planing and manufacturing;
- from design to assembly simulation;
- from design to quality assurance.

The needs for surface model exchange and neutral representation mainly exist in aircraft, car and consumer goods industries. Today national and industrial standards as IGES, SET, VDA/FS, VDA/IS are in use. However, they only partly satisfy these needs. Especially is the whole variety of information that is part of a complete surface model - as described above - not sufficiently taken care of. Therefore, an international standard is required, a post-processor of the above mentioned ones applied to mechanical design surface modelling. This part is a first step towards a complete standard for the representation of mechanical design models.

Industry Review:

Part 205 has been developed as part of ESPIRIT-project 2195: CADEX. Partners from industry as BMW and FIAT have contributed to the document. It has be commented on by companies as Volvo, Sikorsky Aircraft, Bosch and PDES Inc. Vendor experience as from HP and SNI have as well been taken into account.

The reviews confirm the structuring into Functional Levels and the link to visual presentation. The global units approach has been required explicitly as well as layers, groups and user-defined names. Compared to earlier versions elementary curve and surface descriptions had to be added. Replicas and assembly structures are results of review comments.

Overlap with other AP's:

Parts of the used geometry and topology are applicable to Parts 204 and 206 as well. In many respects Part 205 is a subset of Part 204 and a superset of Part 206. These relationships resulted in the design of AICs that are used by all three APs.

There is an overlap with Part 203 as well, as configuration controlled design is done based on B-rep, surface and wireframe models. This relationship has been taken care of in the design of the mentioned AICs.

It is anticipated that the geometric and topological AICs of Part 205 will be used by many

future APs.

Part Owner:

Jochen Haenisch
Senter for Industriforskning
P.O. Box 124, Blindern
N-0314 Oslo 3
Norway
Tel.: 47 2 452010
Fax: 47 2 452040
E-Mail: haenisch@si.no

Part Editor:

Percent Complete: 80%

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		May 90
Candidate AP Summary submitted to PMAG		June 90
Industry Reviews conducted on AP scope and requirements		89 - 92
AP development and validation plan completed		
Application Reference Model (ARM)		June 91
Validate ARM and submit to Qualification		April 92
Application Interpreted Model (AIM)		May 92
Validate AIM and submit to Qualification	July 92	
Conformance requirements and test purposes completed	October 92	
AP Part document completed and submitted to Qualification	Nov. 92	
AP Part document submitted to Editing Committee	Jan. 93	
Produce Abstract Test Suite (ATS)	June 93	
Develop AP Prototype Implementation		June 92
Submit ATS to Qualification	July 93	
Submit ATS to Editing Committee	Sept. 93	
AP CD Ballot Start Date	Feb. 93	
AP CD Ballot Closing Date	June 93	
AP CD Approval	July 93	

AP Development Steps	Projected Date	Actual Date
ATS CD Ballot Start Date	Oct. 93	
ATS CD Ballot Closing Date	Feb. 94	
ATS CD Approval	Feb. 94	
AP DIS Ballot Start Date	Oct. 93	
AP DIS Ballot Closing Date	April 94	
AP DIS Approval	July 94	
ATS DIS Ballot Start Date	May 94	
ATS DIS Ballot Closing Date	Nov 94	
ATS DIS Approval	Feb 95	

Comments:

Part Number: 206

AP Title: Mechanical Design Using Wireframe

Documentation Number: SC4/WG3/N114

Scope Statement:

The wireframe application protocol is defined in two stages.
Stage 1 is specified to satisfy the following criteria for the transfer of wire frame models:

- cover the same entities as existing file formats
- cover the entities used in the other APs defined in CADEX in a complementary way
- cover the entities used in the CAD and FEM systems interested in wire frame transfer
- make use of the improved functionality STEP can offer

The implementation of wire frame transfer using STEP is make to demonstrate the STEP can offer the same functionality for a limited range of entities as existing interfaces based on IGES and VDA/FS. The implementation should also demonstrate that the improved definitions of entities makes the transfer more reliable and faster.

Industry Need:

Industry Review:

Overlap with other AP's:

Part Owner:

Jon Aas
FEGS Ltd.

Part Editor:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG		
Industry reviews conducted on AP scope and requirements		
AP development and validation plan completed		

AP Development Steps	Projected Date	Actual Date
Application Reference Model (ARM)		
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)		
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number: 207

AP Title: Sheet Metal Dies/Blocks

Documentation Number: ISO TC184/SC4/WG3

Scope Statement:

To capture data pertinent to specification and design of dies and associated tooling to support production of sheet metal parts. The domain of this data extends from receipt of part data for die design to creation of die manufacturing data.

Major tasks covered within the scope domain are:

1) Manage Die Design
2) Conceptualize Die Design
3) Design Die
4) Produce Manufacturing Data

Main information classes to be represented by the data are shape and property definitions of parts and their associated dies, die design change control, design product structure, in-process part design, relationships between dies and parts, and further definitional information to enable part and die manufacturing.

Industry Need:

Comprehensive activity modeling efforts within General Motors (GM) C4 program determined that die design contributes significantly to car production lead time. Any time reduction therein would reduce car production lead time significantly, and thus bring cars to mark more quickly. This is perceived as a specific instance of a general industry problem involving producers and their major suppliers

In the aerospace industry small sheet metal part lot sizes create the need to produce die design more frequently. Due to product complexity, this industry typically has had a very broad, diverse set of suppliers. As in the automotive industry, reductions in lead times and turnaround would be very beneficial to the industry as a whole.

The main focus of this AP is unique to STEP: Parts (as in dies) that make other parts, and the relationship between them. The project also has significant focus on the producer-supplier relationship.

GM, Boeing, and NIST launched the PDES, Inc. Sheet Metal Project in September, 1990. Digital ha since joined, and input and support have been received from Ford, Chrysler, Grumman Aircraft, Craftline Engineering, and Capitol Engineering. The project actively solicits inters from IMPPACT, VDA, AIAG, PDES, Inc. and non-U.S. industry.

Industry Review:

Application experts from GM, Ford, Chrysler, Boeing, and Capitol Engineering worked with the team in conducting application expert workshops to scope the domain and information requirements of the AP.

Overlap with other AP's:

The project has specifically identified overlap with the data scope of the Automotive Design Planning Project's scope. Specifically the following are known to be data scope areas of overlap:

Shape Representation/Definition
Sheet Metal Part Definition
Sheet Metal Part Structure and Configuration
Manufacturing Process Information
Product Properties
Tolerances

In addition, it appears as though there will be some overlap of the project with the information contained in AP 203.

Part Owner:

Al Montana
General Motors/EDS
750 Tower Drive
2nd Floor, Cube 2278
Troy, MI 480098-7019 U.S.A.
Tel.: +1 313 265 4907
Fax.: +1 313 265 5770
E-Mail: amontano@mcimail.com

Part Editor:

Mike Strub
GM/EDS
750 Tower Drive
Troy, MI 48098-7019
U.S.A.
Tel: +1 313 265 7466
Fax: +1 313 265 5770
4404983@mcimail.com

Percent Complete: 30

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		10 Jan. 92
Candidate AP Summary submitted to PMAG		5 Feb. 92
Industry Reviews conducted on AP scope and requirements	June '92	26 June 92
AP development and validation plan completed		15 April 92
Application Reference Model (ARM)	June '92	1 July 92
Validate ARM and submit to Qualification		20 Sept. 92
Application Interpreted Model (AIM)	16 Oct. 92	

AP Development Steps	Projected Date	Actual Date
Validate AIM and submit to Qualification	09 Nov. 92	
Conformance requirements and test purposes completed	27 Nov. 92	
AP Part document completed and submitted to Qualification	30 Nov. 92	
AP Part document submitted to Editing Committee	07 Dec. 92	
Produce Abstract Test Suite (ATS)	27 Nov. 92	
Develop AP Prototype Implementation	25 Feb. 93	
Submit ATS to Qualification	30 Nov. 92	
Submit ATS to Editing Committee	7 Dec. 92	
AP CD Ballot Start Date	21 Dec. 92	
AP CD Ballot Closing Date	21 Mar. 93	
AP CD Approval	21 Apr. 93	
ATS CD Ballot Start Date	21 Dec. 92	
ATS CD Ballot Closing Date	21 Mar. 93	
ATS CD Approval	21 Apr. 93	
AP DIS Ballot Start Date	26 Apr. 93	
AP DIS Ballot Closing Date	26 Jul. 93	
AP DIS Approval	01 Aug. 93	
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number: 208

AP Title: Life Cycle Product Change Process

Documentation Number: SC4/WG3

Scope Statement:

The management of change of configuration worthy items. Includes the identification of a product anomaly, and its cause, the approval and performance of the resulting changes (repairs) to the anomalized product and/or process definition, and the authorization of corrective actions to prevent anomaly reoccurrence. The identified information provides change management support for activities across the life cycle of the product such as technical publication generation, retrofit planning, change proposal coordination, supply interface as well as material requirements planning.

Industry Need:

The aerospace, automotive and chemical industries, to name just a few, have a strong need to be able to communicate to their supplies, customers, clients, and/or contractors any product problems or anomies, the fixes for these problems and any resulting corrective actions or changes. Communications of this type are currently being performed in a manual, paper fashion that is very time consuming, error prone, and labor intensive; a more cost effective means is urgently needed.

Industry Review:

Overlap with other AP's:

Due to the nature of this AP (that of defining a product's change requirements) considerable interaction with other AP development efforts will occur. Specifically it is envisioned that Life Cycle Product Change Process AP requirements will be extracted through working relationships with Manufacturing Process Plans, Electrical/Electronics, Composites, Shipbuilding, and Technical Publication AP Planning Projects, as well as AP Project 203-Configuration Controlled Design. It is anticipated that the overlap between the project's scopes in the area of product change management will necessitate the joint development of several AICs as the individual projects AP AIMs are developed.

Part Owner:

Rick Bsharah
Rockwell International -NAA
201 N. Douglas St. Mail Code GC10
El Segundo, CA 90245
USA
Tel.: 213 647-6915
Fax: 213 647-6824

Part Editor:

E-Mail: rbsharah@cirs4.naa.rockwell.com

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	May '90	
Candidate AP Summary submitted to PMAG		
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)	Feb '92	
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)	Oct 92	
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		

AP Development Steps	Projected Date	Actual Date
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number: 209

AP Title: Design through Analysis of Composite & Metallic Structures

Documentation Number:

Scope Statement:

The goal is to link Design, Finite Element and Detail Structural Analysis applications in a manner that provides a bi-directional information exchange capability. This AP will address: The transfer of geometry (point, line curve and surface) information between design and Analysis applications primarily relying heavily on work from APs 201 through 205 as appropriate; specialized composite data such as contiguous ply boundaries, ply stacking sequence and ply fiber orientation angles(s); finite element (FE) mesh, loads, and boundary conditions, analysis controls, and a common analysis output data format for FE and Detail (such as panel buckling or joints) linear static structural and thermo-structural analysis.

The analysis of metallic structures will be within scope as homogeneous metallic material response is a subset of anisotropic composite material response. The material response description and the lack of specialized composite information are the only major differences between composite and metallic structural analysis.

The PDES Application Protocol Suite for Composites (PAS-C) program, with the aid of any interested parties, will continue to refine the scope and requirements until the June 1992 AP development starting date.

Industry Need:

The concurrence of the members of the IPO Composites committee, the IPO FEA committee, the ISO FEA project (WG3/P9), and the existence of the PAS-C contract led by the Air Force Systems Command Department of the Air Force Wright Patterson AFB. The members of the PAS-c team and the above committees and project represent a broad cross-section of industry.

Industry Review:

The PAS-C Industry Review Board(IRB) January 9. 1992, the IPO FEA committee and ISO FEA project concluded that the scope as it has been developed to date is sufficient to proceed with the initiation of this AP. Further PAS-C IRB, IPO and ISO reviews of the scope and requirements will be held. As mentioned in item 4 above, the PAS-C program will continue to coordinate the refinement of the scope and requirements until the June 1992 AP development starting date.

Overlap with other AP's:

This AP will force the issues of defining relationships necessary to unify the views of Product Data within and between Analysis and Design. This integration of Product Data

will be performed to a degree necessary to accommodate the goal of this AP. Issues of relationships to Parts, APs and Between APs need to be addressed. The PAS-C Framework/Building-Block (FW/BB) approach is critical tool to accomplish this task, along with other methodologies under development by the AP Framework committee. An initial assessment of the APs that will be required include 203, 204, 205 and a potential FEA Materials AP.

Part Owner:

Part Editor:

Keith Hunten
General Dynamics Fort Worth Division
P.O. Box 748, MZ2824
Fort Worth, Texas 76101
Tel: +1 817 777 2147
FAX: +1 817 777 2115
E-mail: fwr441@fin.af.mil

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	1/15/93	
Candidate AP Summary submitted to PMAG	2/12/92	
Industry Reviews conducted on AP scope and requirements	1/4-15/93	
AP development and validation plan completed	11/27/92	
Application Reference Model (ARM)	4/5/92	
Validate ARM and submit to Qualification	5/28/93	
Application Interpreted Model (AIM)	8/30/93	
Validate AIM and submit to Qualification	2/7/94	
Conformance requirements and test purposes completed	1/24/94	
AP Part document completed and submitted to Qualification	3/28/94	
AP Part document submitted to Editing Committee	4/11/94	
Produce Abstract Test Suite (ATS)	4/11/94	
Develop AP Prototype Implementation	8/15/95	
Submit ATS to Qualification	4/11/94	
Submit ATS to Editing Committee	4/11/94	

AP Development Steps	Projected Date	Actual Date
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number: 210

AP Title: Electronic Printed Circuit Assembly, Design and Manufacture

Documentation Number:

Scope Statement:

This STEP Application Protocol covers building printed circuit assemblies (PCA) from a detailed design that specifies all components to be assembled on the PCA. The AP shall cover the PCA Product Data to be shared between design engineering, Manufacturing Engineering, and Production. The AP shall address both bare PCAs (referred to as printed circuit boards or PCBs) and assembled PCAs.

Industry Need:

This PCA Application Protocol is one of the first STEP APs in the Electrical domain, A $200 billion world-wide market. Although focussed on PCAs much of the work will be applicable to a broader range of electronic products. In Addition, PCA design and manufacture is itself a $50 Billion world-wide market. This AP will enable data-sharing between design, manufacturing engineering and production. Although other electrical standards cover portions of the required data sharing, there is no current standard ability that covers the breadth of data that must be shared. This AP addresses that full breadth of data. Data-sharing will reduce redundant data entry and increase shared decision-making between design, manufacturing engineering and production. The result will be reduced product development cost, reduced product development cycle-time, and increased quality of product and process.

Industry Review:

Reviews with ISO-IEC JW9, IEC TC93, ANSI, HPS, and other EE standards bodies.

Overlap with other AP's:

No overlaps are seen with other APs. There is a relationship with the U.S. Air Force Project developing the AP for Electronics Test, Integrated Diagnostics, and Remanufacture. This relationship is being formalized with a memorandum of Agreement.

Part Owner:

Jack Corley
SCRA/PDES, Inc.
5300 International Blvd.
Charleston, South Carolina
U.S.A 29418
Tel: +1 803 760 3792
FAX: +1 803 760 3349
Email: corley@ccmail.scra.org

Part Editor:

Percent Complete: 50%

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Jan '92	Jan '92
Industry Reviews conducted on AP scope and requirements	June '92	June '92
AP development and validation plan completed	July '92	July '92
Application Reference Model (ARM)	Dec. '92	
Validate ARM and submit to Qualification	March '93	
Application Interpreted Model (AIM)	April '93	
Validate AIM and submit to Qualification	May '93	
Conformance requirements and test purposes completed	May '93	
AP Part document completed and submitted to Qualification	June '93	
AP Part document submitted to Editing Committee	June '93	
Produce Abstract Test Suite (ATS)	May '93	
Develop AP Prototype Implementation	June '93	
Submit ATS to Qualification	June '93	
Submit ATS to Editing Committee		
AP CD Ballot Start Date	June '93	
AP CD Ballot Closing Date	Sept. '93	
AP CD Approval		
ATS CD Ballot Start Date	Oct. '93	
ATS CD Ballot Closing Date	Dec. '93	
ATS CD Approval	Dec. '93	
AP DIS Ballot Start Date	Dec. '93	
AP DIS Ballot Closing Date	Dec. '94	
AP DIS Approval	Dec. '94	
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
ATS DIS Approval		

Comments:

Part Number: 211

AP Title: Electronics Test Diagnostics and Remanufacture

Documentation Number:

Scope Statement:

This AP will focus at the level of electronic integration represented by printed circuit boards (PCBs) and line replaceable modules (LRMs). The AP will encompass the test, integrated diagnostics, and remanufacture functions associated with this level of electronic integration.

Industry Need:

Recently published studies have concluded that 40% of the costs for PCB development is associated with test, and for DoD products this figure is 50%. The development of a PCB/LRM product also involves the integration of many piece parts from subcontractors. This common development scenario increases the need for information sharing. The development of an AP for the sharing of test, integrated diagnostics and remanufacture information will decrease initial development and life cycle support costs. The availability of remanufacture information will provide for more efficient handling of obsolescence problems now faced by many systems.

Industry Review:

Initial review of scope will be conducted 19 December 1991 and results of this review will be compiled and submitted to this organization.

Overlap with other AP's:

No overlap are seen with other APs or AP projects. There are no current relationships with other APs. There is a relationship with the PDES, Inc. Electrical/Electronics Project developing the AP for physical design and manufacturing. This relationship is being formalized with a Memorandum of Agreement at this time.

Part Owner:

William Russell Jr.
U.S. Air Force ManTech
Wright Laboratory
Bldg 653
Wright-Patterson AFB
Ohio 45433-6533
Tel. +1 513 255 7371
Fax: +1 513 476 4420
Email: russelwe@migate.mi.wpafb.af.mil

Part Editor:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG		
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)		
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)		
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
ATS DIS Approval		

Comments:

Part Number: 212

AP Title: Electrotechnical Plants

Documentation Number:

Scope Statement:

This International Standard defines a proposal for the exchange of product defining data among computer systems used in the design and engineering of electrotechnical plants. The protocol is applicable for all types of electrotechnical plants including the devices and components they consist of (e.g., power transmission, distribution, and generation; electrical machinery; electric light and heat; electrochemistry and electrometallurgy; control and automation systems).

This part of ISO 10303 allows the exchange of product defining data used for specifying the product and the design phase up to the erected-as-design status. The product defining data is the data necessary to describe the information contained in:

- schematic
- netlist
- terminal connection diagrams or tables
- interconnection diagrams or tables
- parts lists

Data that are necessary for the tracking of a design's release is in scope.

Data that are necessary to track the approval of a design or a design aspect or a configuration control aspect of a product is in scope.

The tracking of the contract under which a design is developed is in scope.

Product definition data and configuration control data pertaining to any life cycle phase of a product's development other than design is out of scope.

Data that results in changes to the design during the initial design evolution (i.e., drawing corrections from checking; design iterations that affect the design before release) is out of scope.

The business data for the management of a design project (e.g. budget, schedules) is out of scope.

Industry Need:

Almost each industrial product has some points of contact with electrotechnical or electronic systems. Either electrical devices are used in the manufacturing process of the product or the product itself incorporates electrical parts. Due to these facts it is a vital interest of the whole industry to be able to exchange the product defining data of electrotechnical and electronic products. The AP will cover some of the most urgent CAE data exchange requirements on this field.

Industry Review:

Development, review and approval of the proposed AP scope and requirements has been taken place by the following organizations or standardization bodies and its industrial

members.

Overlap with other AP's:

This AP will be the first one dealing with the special needs of engineering in the field of electrotechnical plants. Due to this fact there will be no redundancy to any existing part of STEP.

Part Owner:

Part Editor:

Reinhard Nerke
Siemens AG, ANL A5N
P.O. Box 3240
D08520 Erlangen
Germany
Tel.: 49 9131 7 28419
Fax: 49 9131 7 23732
Email:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Feb '92	Feb '92
Industry Reviews conducted on AP scope and requirements		Dec '91
AP development and validation plan completed		
Application Reference Model (ARM)	Nov '92	
Validate ARM and submit to Qualification	March '93	
Application Interpreted Model (AIM)		
Validate AIM and submit to Qualification	June '93	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		

AP Development Steps	Projected Date	Actual Date
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Approved ISO TC184/SC4 Application Protocol Planning Projects

AP Planning Title: Automotive Design

Documentation Number:

Scope Statement:

The Application Protocol Planning Project 'Automotive Design' will lead to one or more industrially usable standards for the car manufacturers and suppliers. They will enable an efficient and system independent data exchange and should cover the complete and currently known need for a shared product data environment along automotive process chains.

The identified process chains include the following processes:

Styling
Design (car components)
Pre Production
Tool Design
Tool Manufacturing and
Quality Check

The scope of the AP planning project is limited to the design process, including car body (exterior and interior components), engines and electrical components. Data connected to the series production or post production are out of scope. The focus is on the description of the data for the product itself, which is used as input for the special technologies, e.g. FEM analysis or manufacturing technology for sheet metal parts.

The full support of these products should be covered by other application protocols. Therefore any data connected to these processes (e.g. FEM data or NC programs) will not be included.

Industry Need:

The use of CAD/CAM systems in design and engineering by many automotive manufactures and their suppliers started in the 1970s. CAD/CAM has become a keystone in car body design and for the development of mechanical and electronic components. By this means the quality of tools and final products has been increased. Standardization of CAD/CAM led to a more efficient and economic design and manufacturing process.

Various studies of the design process in the German automotive industry have been undertaken. They have shown the need for a more complete standardized data description than is available today. This is necessary to support the relevant applications during the design process.

For example the potential first Application Protocol 'Automotive Mechanical Design' will take into account the requirements of today's industrial CAD/CAM applications. It will be of interest to the international auto industry, to handle the necessary data exchange between different applications along the mentioned process chains in an efficient and flexible manner, including the data exchange between car manufacturers and their suppliers.

Industry Review:

Overlap with other AP's:

In order to reduce the development work and to avoid duplication in the STEP standard the project participants intend to use the results of existing AP projects exhaustively. Therefore it has to be checked carefully whether these APs fulfill the requirements for data modeling and context constraints for the AP planning project 'Automotive Design'. The following Application Protocols will be intensively considered:

AP 201: Explicit Draughting
AP 202: Associative Draughting
AP 203: Configuration Controlled Design
AP 204: Mechanical Design using Boundary Representation
AP 205: Mechanical Design using Surface Representation
AP 206: Mechanical Design using Wireframe
AP 207: Sheet Metal Dies/Blocks

In many cases it is sufficient to apply only special 'subsets' of all the modelling capabilities for the product specification. As a consequence suitable structures have to be defined for this AP planning project.

For integration purposes and internal structuring of APs appropriate common mechanisms are desirable which allow the subdivision of APs and the combination of APs in a suitable and very effective manner. Therefore methods for interoperability of APs are strongly requested, e.g. the just upcoming AIC concept will be extensively used and considerable functional portions have to be defined as AICs to solve the overlaps to existing AP developments. Therefore the AP Framework and AP interoperability projects are of great importance for this AP planning project. The AP planning project members plan to participate in these activities.

Part Owner:

Juergen Mohrmann
Damiler Benz
CAP debis SH Engineering
Fasanenweg 9
D-7022 Leinfelden, Germany
Tel: +49 711 972 2149
FAX: +49 711 972 1905
Email:

Part Editor:

Comments:

AP Planning Title: Composites

Documentation Number:

Scope Statement:

The AP Planning Project wants to define the product definition data required in the life cycle of a composite product item. This scope includes verifying coverage and/or developing new entities required in the resource models for composite application protocols. This scope also covers the composite product item definition information needed to support applications such as Design/Analysis, Planning, NC Tooling, QA, Product Support and Fabrication. Information requirements needed to support both "AS-IS" and "TO-BE" composite technology will be considered.

The initial focus will be on polymer matrix composites. This focus is expected to expand to metal matrix and ceramic matrix composites as additional resources are identified.

Industry Need:

The number of parts being tailored-made through the use of composite fabrication technology is growing continuously. This is evident not only in the aerospace industry but also in other industries where lighter weight/higher strength components are required. Examples of concurrence with this need come from the members of the IPO FEA committee, and the ISO FEA project (WG3/P9). The existence of the US Air Force PAS-C contract and its Industry Review Board shows industry's support for APs in this domain. The members of the PAS-C team and the above committees and project represent a board cross-section of industry.

Industry Review:

Overlap with other AP's:

It is envisioned that this AP planning project will overlap and established many relationships with other APs and AP planning projects. Though the primary focus is composite part information, much of the any part's information is generic across many life-cycle application. The initial focus of the APs to be identified within this planning project pertain to the analysis, design, manufacturing, and support functional areas. Based on this, the initial assessment of the APs that may be required include 201, 202, 203, 204, 205, 206, 207, 208. APs 201, 202, 203, and 205 have the strongest relationship with this planning project.

Part Owner:

Glen Ziolko
SCRA/LTV
700 Highlander Blvd.
Suite 150

Part Editor:

Arlington, TX 76015
USA
Tel.: +1 817 472 9014
Fax: +1 817 472 8723
E-Mail: 0004863474@mcimail.com

Comments:

AP Planning Title: Electric/Electronic

Documentation Number:

Scope Statement:

The scope of this project is to facilitate the development of a properly coordinated set of resource models and application protocols (APs) covering product data related to electric/electronic (E/E) products. Under this project, the development of AP's covering E/E product data throughout the product life cycle will be addressed in a coordinated fashion, minimizing overlaps and maximizing the use of existing efforts available for E/E product data.

The strategic goal is the development of a family of E/E AP's for the exchange of product data which, taken together, will cover all significant areas of E/E products. In addition, this project will develop new STEP resource models to support the E/E APs as required because of the current status of the available STEP resource models.

Industry Need:

E/E products constitute a major portion of the products designed, manufactured, and sold worldwide. Such products involve a wide variety of product data exchanges, much of which are not currently accomplished in a fashion that is machine readable. Many efforts (e.g., EDIF, IGES, IPC, SET, VHDL, VNS) have been developed for representing and/or exchanging data related to E/E products at various points along the life cycles of those products. Unfortunately, none of these efforts has been developed using the STEP methodologies. As a result, the benefits of the STEP effort are not yet available to the E/E community. In addition, the absence of E/E involvement in the STEP process leaves uncertain the capability of the current STEP resource models to cover product data relating to E/E products.

Industry Review:

Overlap with other AP's:

The E/E APs developed under this project may relate to other STEP AP's. In such cases the E/E APs will be coordinated with the related APs; no overlap or duplication of coverage is intended.

Part Owner:

Tom Rhyne
MCC ATLAS Standard Laboratory
3500 W. Balcones Center Drive
Austin, Texas 87859-6509
USA
Tel: +1 512 338 3521
FAX: +1 512 338 3895
E-Mail: rhyne@mcc.com

Part Editor:

Percent Complete:

Comments:

AP Planning Title: Product Life Cycle

Documentation Number:

Scope Statement:

The specification for a suite of interoperable application protocols for the exchange of life cycle support information pertaining to a product which is produced by any action, operation, or work and is subject to historical tracing (change information management). This means that the support information needed to define, build maintain, or describe a product (or processes applied to a product throughout its life cycle) will be specified, while the usage of the information elements in managing the business is out of scope.

Product Items within the scope of product life cycle support definition are those that the enterprise wishes to maintain a change history about, such as; discrete parts or components, assemblies, systems, facilities, maintenance and modification kits, support equipment, training material and personnel. Additionally, product life cycle support definition must address the acquisition information requirements, quality assessment data needs, and procedure/task information required to support the Product Item definition.

The classes of definitional information to be defined include by are not limited to:

- Administrative Data
  - Funds
  - Security
  - Authorization (Contracts)
  - Approval
  - Warranty
- Handling Instructions
  - Storage Information
  - Transportation Information
  - Packaging Instructions
- Inspection Data
  - Failure Data
  - Certification/Qualification Data
  - Quality Control Instructions
- Procurement and Order Information
  - Lead Time
  - Recommended Level of Stock
  - Supplier History
    - Past Suppliers
    - Current Supplier List
- Configuration Maintenance Data (Including Modification, Repair)
  - Instructions/Procedures

Change History
Reliability Statistics
Change Point Effectivity
Operating Support Resource
People/Skill Information
Training Information
Tech Data/Instructions
Facilities
Price Data
Former Price History
Current Price
Funding Authority

A sampling of the activities that use product support information include those of Product Support Administration, Product Support Design Influence, Supply Support, Maintenance & Repair, Training and Training Support, and Product Operation

Industry Need:

Private and Government Industry does not presently have a standardized mechanism for defining and exchanging product life cycle support information. Each exchange of this kind is currently being performed by unique translators that do not adhere to any known standard or through a paper based mode of operation. The impact of this is cost in time and dollars. Further, a decrease in reliability due to communication errors and a reduction in global interoperability due to dissimilar data model is commonplace. Thus a strong need to be able to communicate product life cycle support definition information from an intra-industry perspective as well as to their suppliers, customers, clients, and/or contractors is required.

The United States Air Force is providing partial funding for development of APs under this planning project. This funding is based upon active support for the Computer-aided Acquisition and Logistics Support (CALS) initiative and the recognition of the potential role of STEP in CALS implementations. With this in mind, this planning project's activities have been designed and analyzed to ensure that they are consistent with attain CALS data interchange objectives. Wherever appropriate, the applicable military specifications and standards have been incorporated into the AP work items to facilitate ease of transition to the STP standard for total system life cycle data support. This will allow the STEP standard to fulfill the Integrated Weapon Data Base concept. As a particular step toward this objective, the Product Life Cycle Support (PLCS) Project (ISO/TC184/SC4/WG3-P8) has constructed a mapping between the data elements of US DoD Mil-STD-1388-2B and the STEP AP ARM entities within the scope of this planning project.

Industry Review:

Overlap with other AP's:

Due to the nature of this AP Planning Project (product life cycle support information definition) considerable relationships with other AP Planning Projects will occur. Specifically

it is envisioned that Product Life Cycle Support project requirements will be extracted through working relationships with Manufacturing Process Plans, Electrical/Electronics, Composites, Shipbuilding and Technical Publication AP Planning Projects. It is anticipated that the overlap between these projects will necessitate the joint development of several AICs as the individual projects AP AIMs are developed.

Part Owner:

Rick Bsharah
Rockwell International
201 N. Douglas St.
Mail Stop: GC10
El Segundo, CA 90245
Tel: +1 310 647 6915
FAX: +1 310 647 6824
E-Mail: rbsharah@idssun.naa.rockwell.com

Part Editor:

Percent Complete:

Comments:

AP Planning Title: Manufacturing Process Plans

Documentation Number:

Scope Statement:

This project will investigate the need for APs in the manufacturing areas of NC processes, routing, assemble, inspection, tooling and resource planning. The emphasis will be processes involved in the manufacture of mechanical parts.

Industry Need:

The aerospace and automotive industries, to name a few, have a strong need to automate the generation of and/or the transfer of the information within a manufacturing process plan to the shop floor.

The emergence of advanced feature-based design systems which can be used to automatically create NC tool paths.

The emphasis on rapid part acquisition practices by the CALs program

The high level of interest in industry in developing integrated manufacturing applications

The need to establish more efficient and responsive turnaround time on machine parts.

Industry Review:

Overlap with other AP's:

This project relates to these AP projects:

1. BREP AP (interoperability)
2. Life cycle APs (interoperability)

Part Owner:

William D. Cain
Martin Marietta Energy Systems, Inc.
PO Box 2009, MS 8291, Bldg 9111
Oak Ridge, TN 37831
Tel: +1 615 574 3235
FAX: +1 615 574 5458
E-mail:

Part Editor:

Percent Complete:

Comments:

AP Planning Title: Polymer Testing

Documentation Number:

Scope Statement:

To develop an application protocol which will enable STEP to be used for the exchange of test results data for polymeric materials. The application protocol will cover the data defined by ISO 11403 "Plastics -Acquisition and Presentation of Multipoint Data", currently a committee draft of TC61 (Plastics)/SC1 (Terminology).

The emerging standard ISO 11403 identifies the test conditions and procedures for the measurement and presentation of a substantial quantity of polymer test data. The multipoint data defined by ISO 11403 are most conveniently stored in computerized databases. The main purpose of the standard is to identify which data elements should be saved so that computer software developed for materials selection, comparison, or design can readily access the data from those materials suppliers who comply with the standard.

ISO 11403 does not specify any representation for the data which it identifies. Previous work by Leal has shown that Part 45 of ISO 10303 can be extended to represent this data without difficulty.

Industry Need:

The development of ISO 11403 has been pushed by major European plastics manufacturers. The UK National Physical Laboratory has funded a preliminary study of the suitability of ISO 10303, and Part 45 in particular, to support the exchange of data as defined by ISO 11403. The US ASTM Committee E49 (Computerized Material and Chemical Data) is also developing standards for plastic testing data which are intended to be compatible with ISO 11403.

ISO TC61 (Plastics)/SC1 (Terminology), ISO TC184/WG3/P4 (Materials), and ASTM E49 (Computerized Material and Chemical Data) all have heavy industry participation.

Industry Review:

Overlap with other AP's:

a) The development of an application resource model (100 level Part) on general testing of materials may arise.

b) An AP on composite materials is being proposed which may include testing data. These APs will be closely coordinated.

c) An AP on testing of electronic packaging materials may be proposed later in 1992. Again coordination will take place.

Both b) and c) will be related to this AP through a).

Part Owner: **Part Editor:**

John Rumble
NIST
A323 Physics Bldg.
Gaithersburg, MD 20877
U.S.A
Tel.: +1 301 975 2203
Fax: +1 301 926 0416
EMail: rumble@enh.nist.gov

David Leal
Caesar Systems
28 Caterham Road
London SE13 5AR
U.K.
+44 81 318 2169
+44 81 318 2169

Percent Complete:

Comments:

The scope and development plans for this project will be thoroughly reviewed at the July 1992 meeting of the SC4/WGs.

AP Planning Title: Sheet Metal

Documentation Number:

Documentation Number: SC4/WG3

Scope Statement:

This project will investigate the need for AP development and coordination pertaining to the specification, design and production of sheet metal products and the dies and associated tooling to support the production of sheet metal parts. The domain of this data extends from the conceptual phase of sheet metal part design, through die and tooling design, including creation of the data for die manufacturing, ending with the final use of that tooling and the actual production of the sheet metal product(s)

Industry Need:

Formed sheet metal parts are typically made using tooling called dies. These dies possess high-tolerance surfaces, strength and wear requirements, and kinematic requirements that make their design and construction akin to building an actual machine tool. Studies have shown that reduction of the life cycle time an cost associated with these tools has a very direct effect upon product lead time, and final cost for sheet metal products as a whole.

As recognition of this opportunity to apply STEP technology as a solution, the PDES, Inc. Sheet Metal Project was initiated in August of 1990 with the mission of the project as follows:

Working with the IPO/ISO, draft an International standard (Application Protocol for STEP) for sheet metal parts, in-process part data, and associated tooling to facilitate data sharing environments, reduce costs, improve quality, and reduce time to market.

From comprehensive activity modeling efforts within General Motors under the C4 program, it was determined that die design was an activity that contributed significantly to the lead time of car production. Any reduction in the time to design dies would significantly reduce the lead time for car production, hence bringing the product to market more quickly. This is perceived as a specific instance of a general industry problem involving producers and their major suppliers.

Within the aerospace industry small lot sizes of sheet metal parts create the need to produce die designs more frequently. Due to the complexity of the product, the aerospace industry typically has a very broad, diverse set of suppliers. As in the automotive industry, reductions in lead times for parts, and rapid turn-around would be very beneficial to the industry as a whole.

Industry Review:

In early 1992, work within the PDES, Inc. Sheet Metal Project yield several strong business cases for the employment of STEP technologies in the existing automotive and aerospace industries. These results were corroborated by a recent study, conducted by the Michigan Modernization Service, that has shown that there are significant opportunities to improve the digital data exchange capabilities in the tool and die industry. STEP was described as one of the important elements in such an improvement.

General Motors, Boeing, and NIST launched the PDES, Inc. Sheet Metal Project in Sep-

tember of 1990. Since then Digital has joined the project, and input and support have been received from Ford Motors, Chrysler, Grumman Aircraft, CraftLine engineering, and Capitol Engineering. The project is actively soliciting interest from groups such as IMPPACT, VDA, AIAG, PDES, Inc. and non-U.S. industry.

Currently the project plan to convene at all ISO and IPO meetings to solicit input and to coordinate scope and other issues with related products. The project has already initiated a periodic newsletter and mailing list to insure information dissemination on an international level.

Overlap with other AP's:

The focus of this AP planning project is product-oriented (as opposed to industry or technology oriented), and therefor spans multiple industry and technology focus APs:

AP 203, 204, 205, 206, 208

Automotive Design AP Planning project

Manufacturing Process Plans AP Planning Project

Design Through Analysis of Composite and Metallic Structures AP

This planning project is currently coordinating its AP development efforts closely with the Automotive Design AP Planning Project.

Part Owner:

Al Montano
General Motors/EDS
750 Tower Drive
2nd Floor
Troy, MI 48007
Tel.: 313 265 4907
Fax: 313 265 5770
E-Mail: amontano@mcimail.com

Part Editor:

Percent Complete:

Comments:

AP Planning Title: Shipbuilding

Documentation Number:

Scope Statement:

The Ship Design, Construction and Life Cycle Engineering Planning Project defines the information necessary to describe shipboard structural, distribution, and outfit systems to be exchanged between dissimilar product definition systems. The planning project concerns itself with four major application areas which correspond to major stages of a ships life cycle:

1. Contract/Functional Design
2. Detail Design
3. Production Engineering
4. Life Cycle Support Engineering

The specific applications to be supported by shipbuilding application protocols include but are not limited to:

Contract/Functional Design Phase:

- Equipment arrangement
- Distributive systems flow analysis
- Distributive system testing
- Distributive system connectivity check
- Graphic Representation

Detail Design Phase:

- Interference Analysis
- Connectivity check
- Bill of Materials
- Stress analysis
- Graphic Representation

Production Engineering Phase:

- Fabrication & assembly
- Installation & assembly

Life Cycle Support Engineering Phase:

- Product model cross reference to external product support databases

Industry Need:

The Ship design, construction and life cycle support process is one the most complex found in the world. These activities associated with design, construction and service life support must be accomplished by numerous different organizations, including design agents, shipbuilding, equipment vendors, and logistics agents. The AP's developed will enable the exchange of marine industry information between successive agents in this process. This need has been recognized and supported by the defense community through programs such as the Computer Aided Acquisition and Logistics Support (CALS) program and the PDES National Initiative.

Currently, six different application protocols are planned for this effort. They are:

1. Ships Piping
2. Ships HVAC
3. Ships Electrical and Wireways
4. Ships Structural
5. Ships Outfit & Furnishings
6. Library Parts

Industry Review:

All NIDDESC products are developed through the participation and consensus of various organizations involved in the marine industry. Marine Industry organizations through the NIDDESC effort determine scope and requirements and develop and approve application protocols representing industry consensus. Specific organizations involved in the development or review or NIDDESC products include:

General Dynamics, Electric Boat Division
Newport News Shipbuilding
Ingalls Shipbuilding
National Steel & Shipbuilding
Bath Iron Works
Jonathan Shipyard
Puget Sound Naval Shipyard
Mare Island Naval Shipyard
NIST
Maritime Administration
Naval Sea Systems Command
David Taylor Research Center
Neutrabas
Gibbs & Cox
JJH, Inc.
Lovdahl & Assoc
Angle, Inc.
Advanced Marine Enterprises

Overlap with other AP's:

The shipboard electrical applications area may overlap similar scope defined in the proposed Application Protocol for Electrotechnical Plants.

Part Owner:

James Murphy
Naval Sea Systems Command
Department of the Navy

Part Editor:

NAVSEA 507
Washington, D.C. 20362-5101
Tel (703) 602-7660
Fax: (703) 602-2216
EMail: Murphy_j@SEAA.NAVSEA.NAVY.MIL

Percent Complete:

Comments:

Proposed ISO TC184/SC4 Application Protocols

Part Number:

AP Title: Life Cycle Management

Documentation Number:

Scope Statement:

To provide the frame work for the documentation and exchange of scheduling and status information. Of particular focus is the control of the planning and execution of tasks; utilization or support resources; and their relationship to each other with respect to the design, development, manufacture and support of the product. The three aspects of status that will be tracked for product at any point in its life cycle are: abstract refinement, the degree of completion and the task view.

Industry Need:

Private and Government Industry does not presently have a standardized mechanism to exchange Life Cycle Management data. Each exchange of this kind is currently begin performed by unique translators that do not adhere to any known standard. The impact of this is cost in time and dollars. Further, a decrease in reliability due to communication errors and a reduction in global interoperability due to dissimilar data models is commonplace.

The United States Air Force is providing partial funding for development of this AP. This funding is based upon active support for the Computer aided Acquisition and Logistics Support (CALS) initiative and the recognition of the potential role of STEP in CALS implementations.

Industry Review:

Overlap with other AP's:

Due to the nature of this AP (that of defining a product's change requirements) considerable interaction with other AP development efforts will occur. Specifically it is envisioned that Life Cycle Product Change Process AP requirements will be extracted through working relationships with Manufacturing Process Plans, Electrical/Electronics, Composites, Shipbuilding, and Technical Publication AP Planning Projects, as well as AP Project 203-Configuration Controlled Design. It is anticipated that the overlap between the project's scopes in the area of product change management will necessitate the joint development of several AICs as the individual projects AP AIMs are developed.

Part Owner:

Mark Silvestri
33 Malley Ave.
Avon, Ma 02322
USA
Tel: +1 508 588 5760
FAX:
E-mail:

Part Editor:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	May '90	May '90
Candidate AP Summary submitted to PMAG		
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)		
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)		
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
ATS DIS Approval		

Comments:

Part Number:

AP Title: Numerical Controlled (NC) Process Plans for Machine Parts

Documentation Number:

Scope Statement:

The scope of the application protocol is the product definition information contained in a NC process plan for a machined mechanical part. This includes the sequencing of the plan as well as the information and relationships established between the product, the processes and the resources at each step of the plan.

This is one of a suite of APs to capture the information within the various type of process plans created for machine part. Covered in this AP are the detailed processes specified in what is commonly referred to as the NC process plan. The intent of this AP is to categorize the processes commonly used to specify NC process information for manufacturing a product using traditional material removing machine tools. These processes will be specified at the information level which is currently passed to the shop floor. These processes normally are further refinements of the processes that are specified in a manufacturing process plan.

This AP will use the Manufacturing Process Plans for Machine Parts AP as an "umbrella". That is, this will decomposed the processes associated with NC machining that are identified in the "umbrella" AP and drive them to the detail level needed in a NC process plan. For example, the NC Process Plan AP might decompose the Manufacturing Process "mill part" into the processes that would define what features are being milled, the specific machine and cutting tools used, the fixturing required for each setup, the NC tool paths and how the part is fixtured on the machine.

Industry Need:

- The aerospace and automotive industries, to name a few, have a strong need to automate the generation of and/or the transfer of the information within a manufacturing process plan to the shop floor.
- The emergence of advanced feature-based design systems which can be used to automatically create NC tool paths.
- The emphasis on rapid part acquisition practices by the CALS program.
- The high level of interest in industry in developing integrated manufacturing applications.
- The need to establish more efficient and responsive turnaround time on machine parts
- An independent attempt to Caterpillar to implement the STEP Process Plan Resource model, in the absence of a supporting AP, proved to be difficult. This clearly indicates the need for APs in this area.

Industry Review:

The industries associated with PDES Inc. are in concurrence and activity support this AP project. This project extends the PDES Inc. CDIM-B4 activity to the AP development level.

CAM-I has expressed an interest in actively participating and contributing to this activity as it is scope.

IMPPACT (Integrated Modeling of Products and Processes using Advanced Computer Technologies) - an ESPRIT project to develop and demonstrate a new generation of computer integrated modelling systems for integrating product design, process and operation planning and generation of machine tool data for complex shapes - actively participated and contributed to this project.

Representatives from automotive (GM, Ford) and aerospace (GD, Northrop, Boeing) industries are participating and support this project.

Overlap with other AP's:

This project relates to BREP AP (interoperability) and Life Cycle APs (interoperability).

Part Owner:

William D. Cain
Martin Marietta Energy Systems, Inc.
PO Box 2009, Ms 8201, Bldg 9111
Oak Ridge, TN 37831
USA
Tel.: 615 574-3235
Fax: 615 574-5458
E-Mail: wdc@ornl:gov

Part Editor:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG		March '92
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)		June '93
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)		

AP Development Steps	Projected Date	Actual Date
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed	June '93	
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
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ATS CD Approval		
AP DIS Ballot Start Date		
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AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Product Operation

Documentation Number:

Scope Statement:

To provide the information pertaining to the product's operation, and operational resource requirements, as well as the operational assessment as it impacts design, manufacturing and support. The products being addressed in product operation include the end items as well as the operation of the support resources. This includes data typically found in Operation Manuals and ancillary materials.

Industry Need:

The aerospace, automotive and chemical industries, to name just a few, have a strong need to be able to be able to communicate a product's Operating Objectives, Inspection Information, Support equipment Requirements and Operational Fielded History. Much of today's technical publication documentation is focused around this type of data. Communication of this type are currently being performed in a manual, paper fashion that is very time consuming, error prone, and labor intensive; a more cost effective means is urgently needed.

The United States Air Force is providing partial funding for development of this AP. This funding is based upon active support for the Computer aided Acquisition and Logistics Support (CALS) initiative and the recognition of the potential role of STEP in CALS implementations.

Industry Review:

Overlap with other AP's:

Due to the nature of this AP (that of defining a product's change requirements) considerable interaction with other AP development efforts will occur. Specifically it is envisioned that Life Cycle Product Change Process AP requirements will be extracted through working relationships with Manufacturing Process Plans, Electrical/Electronics, Composites, Shipbuilding, and Technical Publication AP Planning Projects, as well as AP Project 203-Configuration Controlled Design. It is anticipated that the overlap between the project's scopes in the area of product change management will necessitate the joint development of several AICs as the individual projects AP AIMs are developed.

Part Owner:

Rick Bsharah
Rockwell International
201 N. Douglas St.
Mail Stop: GC10
El Segundo, CA 90245

Part Editor:

Tel: +1 213 647-6915
FAX: +1 213 647 2673

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	Sept. '91	Sept. '91
Candidate AP Summary submitted to PMAG		
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)	July '91	
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)	Jan '92	
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed	May '91	
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Product Procurement

Documentation Number:

Scope Statement:

The statement and description of the data required to support the requisition of a product. Specific elements to be addressed include lead time, recommended level of stock, and supplier history data classes for the supply support of a product in its post-production life cycle states. The products begin addressed in post-production procurement include the end item as well as the support resources (tool, machines, etc.) which support the end item.

Industry Need:

The aerospace, automotive and chemical industries, to name just a few, have a strong need to be able to communicate supply support or provisioning information. Today's "Just in Time" logistics support environments depend upon the rapid procurement (Lead Time, Recommended Level of Stock, and Supplier History) of parts and supplies. This need requires that the communication of procurement requirements be integrated with an organizations product definition databases. Communications of this type are currently being performed in a manual, paper fashion that is very time consuming, error prone, and labor intensive; a more cost effective means is urgently needed.

The United States Air Force is providing partial funding for development of this AP. This funding is based upon active support for the Computer aided Acquisition and Logistics Support (CALS) initiative and the recognition of the potential role of STEP in CALS implementations.

Industry Review:

Overlap with other AP's:

Due to the nature of this AP (that of defining a product's change requirements) considerable interaction with other AP development efforts will occur. Specifically it is envisioned that Life Cycle Product Change Process AP requirements will be extracted through working relationships with Manufacturing Process Plans, Electrical/Electronics, Composites, Shipbuilding, and Technical Publication AP Planning Projects, as well as AP Project 203-Configuration Controlled Design. It is anticipated that the overlap between the project's scopes in the area of product change management will necessitate the joint development of several AICs as the individual projects AP AIMs are developed.

Part Owner:

Rick Bsharah
Rockwell International - NAA
201 N. Douglas St. Mail Code GC10
El Segundo, CA 90245

Part Editor:

USA
Tel.: 213 647-6915
Fax: 213 647-6824
E-Mail: rbsharah@cirs4.naa.rockwell.com

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication	Sept. 91	Sept. '91
Candidate AP Summary submitted to PMAG	Nov '91	
Industry Reviews conducted on AP scope and requirements		
AP development and validation plan completed		
Application Reference Model (ARM)		
Validate ARM and submit to Qualification		
Application Interpreted Model (AIM)		
Validate AIM and submit to Qualification		
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
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AP CD Approval		
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ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Ships Electrical Systems

Documentation Number:

Scope Statement:

The ships electrical AP defines the information describing shipboard electrical systems and attached components/equipment to be exchanged between dissimilar product definition systems. It defines a base of required data which supports a corresponding set of required electrical activities. The AP concerns itself with four major application areas which correspond to major stages of electrical systems product life:

- Contract/Functional Design
- Detail Design
- Production Engineering
- Support Engineering

The specific applications to be support by life cycle stage are as follows:

- Contract/Functional Design
  - Equipment arrangement
  - Power & Lighting Systems Functional Design
  - Navigation Systems Functional Design
  - Power Load Analysis
  - Electrical System Testing
  - Electrical System Connectivity
  - System Bill of Material
  - Graphic Representation
- Detail Design Phase:
  - Cable Routing
  - Cable Rack and Rotation
  - Voltage Drop Analysis
- Production Engineering Phase
  - Equipment Hook-up Documentation
  - Cable Cutting list
- Support Engineering Phase
  - Product model cross reference to external product support database

Industry Need:

The Naval Sea Systems Command (NAVSEA) has the responsibility for the design, acquisition and service life support of Naval ships. During the course of the ship life cycle, NAVSEA contracts with numerous design agents, shipbuilders equipment vendors and logistics agents to fulfill this responsibility. These organizations have individually developed or acquired various computer systems to support their efforts. The result of their

individual selections and highly competitive nature of the Naval ship design, construction and service life support process present a generic need on the part of the Navy and the U.S. marine industry to transfer digital data among different computer systems.

This need for foreseen by many Navy and industry leaders, and was formally articulated in Toward More Productive Naval Shipbuilding, a National Academy of Science/National Research Council report sponsored by the National Shipbuilding Research Program (NSRP) and issued in December 1984. As a result, NIDDESC was formed in June of 1986 as a joint project of NAVSEA and the NSRP. NIDDESC has the charter to develop a product data transfer capability for NAVSEA and the marine industry.

The NIDDESC effort is a cost sharing, cooperative effort involving technical experts in CAD applications. Under the terms of the cooperative effort, industry participants waive profit and all but direct labor fringe overhead, with NAVSEA providing funding. The NIDDESC organization has participated in the development of IGES, and PDES/STEP since early 1987. NIDDESC Accomplishments to date include the development of the 3D Piping IGES Protocol which was based on the Navy's SEAWOLF submarine data transfer procedures and the Ship Structures Model included in the Tokyo draft of the IPIM.

Industry Review:

Development, review and approval of the proposed AP scope and requirements has been conducted by NIDDESC working group member organizations. The scope and requirements section describes the agreed upon NAVSEA/maringe industry requirement for this AP. The ships HVAC application protocol will further receive industry review and approval. The following individuals and organizations are responsible for the development of the AP scope and requirements:

Bath Iron Works
National Steel & Shipbuilding
Ingalls Shipbuilding
David Taylor Research Center
NAVSEA
Newport News Shipbuilding
Jonathon, Corp
NIST

Overlap with other AP's:

A need for product versioning and product structuring may overlap with those requirements found as part of AP 203.

Part Owner:

Douglas Martin
NASSCO/NIDDESC

Part Editor:

San Diego, CA
USA
Tel.: 619 544-8845
Fax:
E-Mail:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Sept. '91	
Industry Reviews conducted on AP scope and requirements	March '92	March '92
AP development and validation plan completed	March '92	March '92
Application Reference Model (ARM)	August '92	
Validate ARM and submit to Qualification	August '92	
Application Interpreted Model (AIM)	Nov. '92	
Validate AIM and submit to Qualification	Nov. '92	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
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ATS CD Approval		
AP DIS Ballot Start Date		

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AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Ships HVAC Systems

Documentation Number:

Scope Statement:

The ships HVAC AP defines the information describing shipboard heating, ventilation and air conditioning (HVAC) systems and attached components/equipment to be exchanged between dissimilar product definition systems. It defines a base of required data which supports a corresponding set of required HVAC related activities. The AP concerns itself with four major application areas which correspond to major stages of HVAC product life:

- Contract/Functional Design
- Detail Design
- Production Engineering
- Support Engineering

The specific application to be support by life cycle stage are as follows:

- Contract/Functional Design Phase
  - Equipment arrangement
  - Heating and Cooling Load Analysis
  - HVAC Duct Pressure Drop Analysis
  - HVAC Test Definition
  - HVAC system connectivity check
  - Graphic Representation
- Detail Design Phase:
  - Interference Analysis
  - HVAC System Connectivity check
  - Bill of Material
  - Graphic Representation
- Production Engineering Phase:
  - HVAC fabrication & assembly
  - HVAC installation & assembly
- Support Engineering Phase:
  - Product model cross reference to external product support databases.

Industry Review:

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Part Owner:

Douglas Martin
NASSCO/NIDDESC
San Diego, CA
USA
Tel.: 619 544-8845
Fax:

Part Editor:

E-Mail:

Percent Complete:

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Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Sept. '91	
Industry Reviews conducted on AP scope and requirements	Nov. '90	Nov. '90
AP development and validation plan completed	April '90	April '90
Application Reference Model (ARM)	Dec. '91	May '92
Validate ARM and submit to Qualification	Aug.'92	
Application Interpreted Model (AIM)	Sept. '92	
Validate AIM and submit to Qualification	Oct. '92	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
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AP Development Steps	Projected Date	Actual Date
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Ships Library Parts

Documentation Number:

Scope Statement:

This AP defines the structure and content necessary for the exchange of CAD Standard Parts as required for shipbuilding product models. The scope includes the project specific transfer of parts libraries required for distribution, structural, and outfit & furnishings (0 & F) systems.

1. Library transfer prior to or simultaneous with a product data set. Benefits of this type of library transfer:

    Reduction of the volume of data required to transfer a product data set.

    Separate control of configuration management of parts and systems

2. Library transfer would occur independent of product data transfer. Library items would be used by the receiving organization for original design work or re-work. Benefits of independent library transfer:

    Time & effort savings through re-use of existing part libraries at multiple organizations.

    Configuration management of library contents at a single organization with use at many.

    Delivery of digital part information from vendor or designer of the part.

This AP will be a resource used by other application-oriented information models. A minimum set of applications that are to be supported are the following:

Piping systems
Heating Ventilation & Air Conditioning (HVAC)
Electrical Distribution Systems
Ships Structure
Outfit & Furnishings
Combat Systems Equipment (Arrangement & Connectivity)

The AP will allow for the separate transfer of libraries of parametric and non-parametric parts that will be instanced once or more times in other product data sets. The library structure must contain the inherent geometry, topology and attributes required by the target product data sets.

Industry Need:

The Naval Sea Systems Command (NAVSEA) has the responsibility for the design, acquisition and service life support of Naval ships. During the course of the ship life cycle, NAVSEA contracts with numerous design agents, shipbuilders equipment vendors and logistics agents to fulfill this responsibility. These organizations have individually developed or acquired various computer systems to support their efforts. The result of their

individual selections and highly competitive nature of the Naval ship design, construction and service life support process present a generic need on the part of the Navy and the U.S. marine industry to transfer digital data among different computer systems.

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Industry Review:

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Lovdahl & Assoc.
General Dynamics, Electric Boat Division
Bath Iron Works
National Steel & Shipbuilding
Ingalls Shipbuilding
David Taylor Research Center
NAVSEA
Newport News Shipbuilding
Jonathon, Corp
NIST

Overlap with other AP's:

No overlap identified.

Part Owner:

Richard Lovdahl
Lovdahl & Associates/NIDDESC
Long Beach, CA
Tel.: 213-433-8376
USA
Fax:
E-Mail:

Part Editor:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Sept. '91	
Industry Reviews conducted on AP scope and requirements	Oct. '90	
AP development and validation plan completed	Oct. '90	
Application Reference Model (ARM)	Aug. '92	
Validate ARM and submit to Qualification	Aug. '92	
Application Interpreted Model (AIM)	Nov. '92	
Validate AIM and submit to Qualification	Nov. '92	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
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AP Development Steps	Projected Date	Actual Date
ATS CD Approval		
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AP DIS Ballot Closing Date		
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Ships Outfit & Furnishings

Documentation Number:

Scope Statement:

The outfit and furnishings AP defines the information describing shipboard outfit and furnishings (O&F) systems and attached components to be exchanged between dissimilar product definition systems. The AP defines a base of required data which supports a corresponding set of required O&F related activities. Included in the scope are non-structural bulkheads, ladders, protective coating, furnishings, deck coverings, scuttles, gratings, and insulation. The AP concerns itself with four major areas which correspond to major stages of O&F product life.

- Contractual/Functional Design
- Detail Design
- Production Engineering
- Service Life Engineering

The specific applications to be supported by life cycle stage include

- Contractual/Functional Design Phase:
  - Equipment Arrangement
  - Graphic Representation
  - Connectivity Check
  - Outfit & Furnishings System Testing
- Detail Design Phase
  - Interface Analysis
  - Connectivity Check
  - Bills of Material
  - Graphic Representation
- Production Engineering Phase:
  - O & F Fabrication & Assembly
  - O & F Installation & Assembly
- Service Life Engineering:
  - Product Model Cross Reference to External Product Support Databases.

Industry Need:

The Naval Sea Systems Command (NAVSEA) has the responsibility for the design, acquisition and service life support of Naval ships. During the course of the ship life cycle, NAVSEA contracts with numerous design agents, shipbuilders, equipment vendors, and logistics agents to fulfill this responsibility. These organizations have individually developed or acquired various computer systems to support their efforts. The result of their individual selections and highly competitive nature of the Naval ship design, construction and service life support process present a generic need on the part of the Navy and the

marine industry to transfer digital data among different computer systems.

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Industry Review:

Development, review and approval of the proposed AP scope and requirements has been conducted by NIDDESC working group member organizations. The scope and requirements section describes the agreed upon NAVSEA/maringe industry requirement for this AP. The ships HVAC application protocol will further receive industry review and approval. The following individuals and organizations are responsible for the development of the AP scope and requirements:

Ingalls Shipbuilding
Bath Iron Works
National Steel & Shipbuilding
David Taylor Research Center
NAVSEA
General Dynamics, EB Division.
Newport News Shipbuilding
Jonathon, Corp
JJH, Inc.
NIST

Overlap with other AP's:

A need for product versioning and product structuring may overlap with those requirements found as part of AP 203.

Part Owner:

Ron Wood
Ingalls Shipbuilding
Pascagoula, MS

Part Editor:

USA
Tel.: 601 935-3930
Fax:
E-Mail:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Sept. '91	
Industry Reviews conducted on AP scope and requirements	August '91	August '91
AP development and validation plan completed	Oct. '91	Oct. '91
Application Reference Model (ARM)	Oct. '92	
Validate ARM and submit to Qualification	Oct. '92	
Application Interpreted Model (AIM)	Dec. '92	
Validate AIM and submit to Qualification	Dec. '92	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
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AP Development Steps	Projected Date	Actual Date
AP DIS Approval		
ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Ships 3-D Piping Systems

Documentation Number:

Scope Statement:

The ships piping AP defines the information describing shipboard piping systems and attached components/equipment to be exchanged between dissimilar product definition systems. It defines a base of required data which supports a corresponding set of required piping-related activities. The AP concerns itself with four major application areas which correspond to major stages of piping product life:

- Contract/Functional Design
- Detail Design
- Production Engineering
- Support Engineering

The specific applications to be support by life cycle stage are as follows:

- Contract/Functional Design Phase:
  - Equipment arrangement
  - Piping flow analysis
  - Pipe sizing
  - Piping system testing.
  - Pipe system connectivity check
  - Graphic Representation
- Detail Design Phase:
  - Interference Analysis
  - Piping Connectivity check
  - Bill of Material
  - Pipe stress analysis
  - Graphic Representation
- Production Engineering Phase:
  - Pipe fabrication & assembly
  - Pipe installation & assembly
- Support Engineering Phase:
  - Product model cross reference to external product support databases

Industry Need:

The Naval Sea Systems Command (NAVSEA) has the responsibility for the design, acquisition and service life support of Naval ships. During the course of the ship life cycle, NAVSEA contracts with numerous design agents, shipbuilders, equipment vendors, and logistics agents to fulfill this responsibility. These organizations have individually developed or acquired various computer systems to support their efforts. The result of their individual selections and highly competitive nature of the Naval ship design, construction

and service life support process present a generic need on the part of the Navy and the marine industry to transfer digital data among different computer systems.

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Industry Review:

Development, review and approval of the proposed AP scope and requirements has been conducted by NIDDESC working group member organizations. The scope and requirements section describes the agreed upon NAVSEA/marine industry requirement for this AP. The ships piping application protocol will further receive industry review and approval. The following individuals and organizations are responsible for the development of the AP scope and requirements:

Ingalls Shipbuilding
Bath Iron Works
National Steel & Shipbuilding
David Taylor Research Center
NAVSEA
General Dynamics, EB Division.
Newport News Shipbuilding
Jonathon, Corp
JJH, Inc.
NIST

Overlap with other AP's:

A need for product versioning and product structuring may overlap with those requirements found as part of AP 203

Part Owner:

Part Editor:

Douglas Martin
NASSCO/NIDDESC
San Diego, CA
USA
Tel.: 619 544-8845
Fax:
E-Mail:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Sept. '91	
Industry Reviews conducted on AP scope and requirements	Nov. '90	Nov. '90
AP development and validation plan completed	April '90	April '90
Application Reference Model (ARM)	Nov. '91	March '92
Validate ARM and submit to Qualification	July '92	
Application Interpreted Model (AIM)	July '92	
Validate AIM and submit to Qualification	August '92	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
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ATS DIS Ballot Start Date		
ATS DIS Ballot Closing Date		
ATS DIS Approval		

Comments:

Part Number:

AP Title: Ships Structural Systems

Documentation Number:

Scope Statement:

The data transferred using this application protocol must include descriptions of all structural elements with sufficient detail to support the following applications on the receiving system:

1. Interference Analysis (e.e. 3D solid): A check for special conflicts of overlaps between the elements of the 3d structural model. Objects which may be considered in the analysis include:

    stiffeners

    plates

    other envelopes from other sources (e.g. Piping, HVAC, and Electrical equipment)

2. Connectivity Check: A checks on the functionality, validity, and integrity of the structural system. Where,

    Positional consistency checks verify that there are no gaps or overlaps between the elements of the 3D model which should be "connected".

    Alignment checking ensures that elements of the model are oriented properly with respect to those to which they are connected.

    End type compatibility checking ensures that stiffeners and plates match up properly.

    Required Data:

    structural connection topology

        connection tightness

    structural part location & orientation

    plate thickness

    plate displacement from mold surfaces

    stiffener end cut type

    scantling dimensions

    fit-up/assembly allowances

    part stock allowances

3. Assemblies and Basic Parts Lists: Produce assembly and part lists comprising the 3D model.

    Required Data:

    Structural part attributes, including:

    structural part ID

    structural assembly

    design zone

    reference to material catalog ID

material type
stock (material)
plate thickness
scantling dimensions
edge preparation
end-cut type

4. Graphic Presentation

Required Data:

ship geometry (reference and definition)
structural part location and orientation
structural part shape

5. Generation of plate stiffener fabrication instructions: Produce instructions for the N/C cutting and marking of plates on a burning machine. Produce instructions for the N/C cutting and marking of stiffeners by a robotic shape processor. Produce instructions for the bending of stiffeners.

Required Data:

plate thickness
stiffener dimensions
plate/stiffener material
stiffen path and twist (to generate inverse bending curves)

6. Finite Element Analysis: The definition of structural parts and the connection between them must be of sufficient detail to support the definition of finite elements (or a mesh generation) on the receiving system.

7. Weights, Moments, and Centers: Weights and centers for all structural applications shall be maintained to support moment calculations about three principal axes.

8. Penetration List: The data must support the generation of structural penetration list. Queries of sorts by the following criteria must be supported:

compartment
design zone
structural assembly
opening size
distribution system discipline
fabrication information (N/C, edge preparation)

Industry Review:

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Industry Review:

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JJH, Inc.

Overlap with other AP's:

A need for product versioning and product structuring may overlap with those requirements found as part of AP 203.

Part Owner:

Michael L. Gerardi
Bath Iron Works
Bath, ME

Part Editor:

M. Polini

USA
Tel.: 207-443-3311
Fax:
E-Mail:

Percent Complete:

AP Development Steps	Projected Date	Actual Date
Document Requirements for Product Data Communication		
Candidate AP Summary submitted to PMAG	Sept. '91	
Industry Reviews conducted on AP scope and requirements	Sept.'89	Sept. '89
AP development and validation plan completed	Feb. '90	Feb. '90
Application Reference Model (ARM)	Sept. '92	
Validate ARM and submit to Qualification	Sept. '92	
Application Interpreted Model (AIM)	Dec. '92	
Validate AIM and submit to Qualification	Dec. '92	
Conformance requirements and test purposes completed		
AP Part document completed and submitted to Qualification		
AP Part document submitted to Editing Committee		
Produce Abstract Test Suite (ATS)		
Develop AP Prototype Implementation		
Submit ATS to Qualification		
Submit ATS to Editing Committee		
AP CD Ballot Start Date		
AP CD Ballot Closing Date		
AP CD Approval		
ATS CD Ballot Start Date		
ATS CD Ballot Closing Date		
ATS CD Approval		
AP DIS Ballot Start Date		
AP DIS Ballot Closing Date		

AP Development Steps	Projected Date	Actual Date
AP DIS Approval		
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ATS DIS Approval		

Comments:

Proposed IPO Application Protocol Planning

AP Planning Title: APs for Near Net Shape Processes

Documentation Number:

Scope Statement:

The domain of discourse of this planning project is near net shape processing. Near net shape processing refers to the direct shaping of discrete parts or components such that few, if any, secondary operations are required to guarantee compliance with final part dimensional and tolerance requirements. Refer to the working white paper: "A Proposed Architecture for Developing a Suite of Application Protocols for STEP on Near Net Shape Processes for Producing Discrete Parts" for more details. The white paper discusses a taxonomy of near net shape processes. From this framework, this AP Planning Project will sequential initiate AP development in several important net shape manufacturing disciplines: casting, solid forming and hot consolidation.

Industry Need:

National government program requirements including the Department of Defense's Computer Aided Acquisition and Logistics (CALS) Program has stated future compliance with the DoD's electronic data interchange for procurement and acquisition.

National industrial need: Casting, solid forming and hot consolidation are a multi-million dollar industry. The discrete part industry can be automated by use of information technologies to shorten lead time and improve quality and efficiency.

Potential for APs in this domain include an AP for casting. Currently, the casting industry still operates in mostly paper environment. My migrating to an electronic environment, cast part design and production can be enhanced by concurrent engineering through STEP.

Breadth of industry participation in the planning project. Concurrent technologies Corporation (formerly Metalworking Technology Inc.) operates the National Center for Excellence in Metalworking Technology, CALS Shared Resource Center and the National Defense Center for Environmental Excellence. Domain expertise for casting include a) personnel from CTC, b) American Foundrymen's Society and c) participating foundries.

Funding allocated to support this project: From the CALS Shared Resource Center Program, currently 1-full time equivalent.

Industry Review:

Overlap with other AP's:

Manufacturing Process Plans APPP: Process Planning inputs will come from here.
Sheet Metal AP: Similarity in Die Design
Composites APPP: Similarity in Materials requirement.
Inspection Planning AP: NNS Processes involve post-processing including inspection and machining.
NC Process Plans for Machining AP: NNS processes involve post-processing including inspection and machining.

Part Owner:

Constantine D. Orogo
Concurrent Technologies Corporation
1450 Scalp Avenue
Johnstown, PA 15904
USA
Tel: +1 814 269 2647
Fax: +1 814 269 2666
Email: cdost+@pitt.edu

Part Editor:

Comments:

AP Planning Title: Process Plants

Documentation Number:

Scope Statement:

The Process Plants AP Planning Project (PPAPPP) will define the scopes and coordinate the development of a coherent suite of STEP Application Protocols to support product data exchange throughout the life-cycle of a process plant. The scope of the AP's that fall within this project will be checked for consistency and integration with other AP's. The scope to be covered by AP's in this project includes the equipment, piping, structures and systems which constitute a plant for processing chemicals, petrochemicals, petroleum, power and other products typically produced in a continuous process. The APs will support all phases of the life-cycle of a process plant, including preliminary and detailed design and engineering, construction, operations, maintenance and disposal.

The AEC Process Plant planning project will act as an umbrella organization for AP development in this area, encouraging international cooperation among related AP projects so that optimum benefit is obtained form each project, and omissions, incompatibilities and duplications are avoided. The subcommittee will also liaise with other AP projects in related industry sectors, such as shipbuilding and construction, to influence the development of these APs in a way that helps meet the needs of the Process industry. The subcommittee is currently producing a coordinate process plant activity model, which is being worked by funded efforts within the process industries. The most current version is attached.

Industry Need:

There are currently at least six projects international that have either been funded or are expecting funding this year which may contribute to candidate APs for the process industry, proving the importance of this area to industry world-wide. Two ESPRIT-funded projects, Atlas and Process Base, which propose to develop models addressing the life-cycle of a process plant, involve a total of twelve companies form eight European countries. The British government is matching industry funding in the Towards STEP for the Process Industries project (TSPS), which plans to access the industry's needs, identify how those needs are or should be addressed, and provide a proof of concept implementation. An AP planning project for off-shore oil rigs, currently being funded by the Norwegian government, has submitted a separate AP Planning Project summary.

In the U.S., the Process Data exchange Institute (PDXI), a consortium of twenty-nine member companies, is funding an AP development project which addresses the initial portion of the process plant life-cycle. Another U.S.-based project has involved three major companies in an effort to product an AP for the exchange of piping and instrumentation data.

Industry Review:

Overlap with other AP's:

This planning project will coordinate with the existing planning project for Shipbuilding, the proposed offshore Oil and Gas AP planning project, the proposed Building Systems planning project, as well as coordinate the inputs received form the funded projects mentioned in the Industry Need. In addition, this project will coordinate with other related industry-based groups.

Part Owner:

Barbara Goldstein
CAPCET/PDXT
1028 Claytonia
St. Louis, MO 63117
U.S.A
Tel.: +1 314 234 1158
Fax: +1 314 777 1704
Email: goldstein@mdcgwy.mdc.com

Part Editor:

Comments:

Proposed IPO Application Protocols

Part Number:

AP Title: Dimensional Inspection Process Planning for Coordinate Measuring

Documentation Number:

Scope Statement:

This Application Protocol (AP) specifies information requirements for exchange, access, and use of STEP for dimensional inspection of manufactured parts using coordinate measuring systems such as coordinate measuring machines (CMMs) and vision systems. This AP will provide specific data structures for generating DMIS inspection programs.

This AP will apply rules, constraints, and definitions of the measurement planning specified by U.S. ANSI B89.3.2 which is being developed.

This AP is a component of Manufacturing Process Planning Application Protocol. This AP will directly support the in-process inspection requirements of the NC Process Plan AP (currently under development).

The primary use of the AP will be part dimensional inspection and the archiving of inspection result data to a STEP database.

The following are considered out of scope for this AP:

- Inspection strategy generation
- Open set-up inspection, and
- Part Measurement using gages and manual measuring devices.

Industry Need:

The aerospace, automotive, and machinery industries, to name a few, have a critical need for improving methods for piece part inspection. These industries currently use, in most cases, drawing, process plans, and inspection plans, in paper form, to manually program or enter relevant data to CMMs and vision machines for inspecting discrete piece parts. This is both time consuming, error prone, and labor intensive. A more cost effective means is urgently needed.
In addition, the ESPRIT VIMP project has a direct need for this AP.

Industry Review:

In process

Overlap with other AP's:

This AP will use AP for Boundary Representation and AP for Surface Representation to

access part topology and surface data. This AP will interact with the Manufacturing Process Planning project which includes a suite of APs.

Part Owner:

Shaw C. Feng
NIST
Metrology A127
Gaithersburg, MD 20899
U.S.A.
Tel.: +1 301 975 3551
Fax: +1 301 258 9749
Email: feng@cme.nist.gov

Part Editor:

Percent Complete:

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Comments: