Product Life Cycle Support (PLCS)

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General

Q1   What is PLCS?

The Product Life Cycle Support (PLCS) initiative is a joint industry and government initiative to accelerate development of new standards for the exchange of assured product and support information, i.e. the information needed and created during the use and maintenance of complex products.

It is an international project to produce an approved standard based on an extension to International Organization for Standardization (ISO) 10303 STandard for the Exchange of Product Model Data (STEP). Work started in November 1999. It is anticipated that PLCS will become a full International Standard in 2004.

Within the ISO standards development framework, TC184/SC4/WG3/T8 is the working group responsible for the initiative.

Q2   What is PLCS, Inc.?

PLCS, Inc. is a legal entity headquartered in Charleston, South Carolina, USA. It was founded in September 1999 to undertake management of the PLCS initiative.

Current members of PLCS, Inc. include government organisations from Europe and the United States, leading private sector organisations, primarily in aerospace and defence and software vendors specializing in information management and product support applications.

Q3   What is the scope of the PLCS initiative?

PLCS is seeking to provide a mechanism to maintain the information needed to support complex assets such as ships, aircraft or engines, in line with the changing product over its full life cycle. The major PLCS deliverable will be a new ISO 10303 Application Protocol (AP) for product life cycle support: AP239

AP239 will provide extension to the capabilities of AP203 (Configuration Controlled Design) and AP214 (Automotive Design Process) and hence the PDM Schema/Modules, to address the requirements for Configuration Management over the full product life.

AP239 will also address the information requirements needed to define and deliver life cycle support for complex assets. This includes specification of:

- ❖ The identification and composition of a product design from a support viewpoint (as an extension of the PDM Modules);
- ❖ The definition of documents and their applicability to products and support activities (as an extension of the PDM Modules);
- ❖ The identification and composition of realized products;
- ❖ Configuration management activities, over the complete life cycle;
- ❖ The properties, states and behaviour of products for life cycle support;
- ❖ Activities required to sustain product function;
- ❖ The resources needed to perform such activities;
- ❖ The planning and scheduling of such activities;
- ❖ The capture of feedback on the performance of such activities, including the resources used;
- ❖ The capture of feedback on the usage and condition of a realized product;
- ❖ The definition of the support environment in terms of people, organizations, skills, experience and facilities
- ❖ The definition of classes of product, activities, states, people, organizations and resources.

Q4   What will the PLCS initiative deliver and when?

The PLCS initiative will deliver an international information exchange standard as an extension to ISO 10303 STEP. The following capabilities are enabled by the proposed standard:

- ❖ Activity Management – Capability to request, define, justify, approve, schedule and capture feedback on activities (work) and related resources
- ❖ Product Definition – Capability to define product requirements and their configuration, including relationships between parts and assemblies in multiple product structures (as-designed, as-built, as-maintained)
- ❖ Operational Feedback – Capability that describes and captures feedback on product properties, operating states, behaviour and usage
- ❖ Support Solution and Environment – Capability to define and maintain the necessary support solution for a product in a specified environment including the opportunity to provide support (scheduled downtime), tasks, facilities, special tools and equipment, and personnel knowledge and skills required. PLCS will also relate organizations, personnel and facilities with the product needing support.

Balloting of the PLCS modules started in September 2002 and is scheduled to complete in Oct/Nov 2003.

Q5   Why invent a new standard when you can share information by other means?

Standards play an important role in bringing consistency and interoperability to information exchanges.

AP 239 is the only standard to address the requirements of product support throughout the complete product life cycle from concept to disposal. Where adopted it will provide data independence in relation to processes, systems and format.

De facto standards, such as those used to drive the Internet, emerge through common use and where there is market pressure for a common approach. Large corporations, who derive commercial advantage from software sales based on their proprietary language/operating systems, are often responsible for promoting these de facto standards.

Where there are no common standards, interoperability and information exchange between software applications often depends upon proprietary interfaces being developed and maintained. The cost of these interfaces can be prohibitive.

Open data standards, such as those produced under the ISO organization, provide a route to interoperability that is independent of proprietary vendor formats. Lack of dependency on proprietary solutions also ensures access and exchange of information can be guaranteed throughout the complete life cycle of the product.

AP239 extends the ISO 10303 STEP standard from the design and manufacturing domains into the product support domain. This is critical for owners, operators and maintainers of complex products whose configuration changes over its life cycle. The ability to effectively manage legacy information is a major concern for operators of complex products with a long life cycle.

Q6   Is PLCS the only standard available for product support?

A number of standards exist that relate to product support. Typically they are a mixture of commercial and military standards and tend to be focussed on particular business issues related to either a piece of a business transaction/process or the presentation of specific content, e.g. maintenance manual or handbook.

The PLCS standard addresses a gap in the scope of existing standards by providing for the management of assured product and support information throughout the entire product life cycle from concept to disposal. PLCS is based on an extension to the STEP PDM Schema capability in ISO 10303. It also exploits the lessons learned by the process industry (www.epistle.ws) in developing a life-cycle approach data management for their domain (ISO 15926).

The STEP PDM Schema is a reference information model for a central, common subset of the data being managed within a Product Data Management (PDM) system. It represents a set of common requirements and data structures from a range of STEP Application Protocols within the design and development domains of discrete electro/mechanical parts and assemblies. It is not a specification for the functionality of the complete scope of all PDM system functionality and important interfaces exist with functionality needed for comprehensive PDM services that exist in STEP, but are not within the common scope of the core PDM schema.

During the development of the PLCS standard a number of formal liaisons have been established to maximise compatibility with relevant current standards and to benefit from the learning and experience that has gone before. These arrangements extend to other ISO/TC184/SC4 projects such as:

❖ AP 233 - System Engineering
❖ AP 214 - Core data for automotive mechanical design processes
❖ AP221 - Functional Data & Schematic Rep. for Process Plants

❖ AP203 E2 - Configuration controlled 3D designs of mechanical parts and assemblies

Also commercial standards bodies such as AECMA, ATA, POSC/Caesar and Joint Government organisations such as NATO

Q7   Is PLCS a data standard or a process standard?

PLCS is an information exchange standard based on an extension to ISO 10303, STEP. It will become an Application Protocol of the STEP standard, to be known as AP 239.

A variety of support related business processes were evaluated and optimised during the development of AP239. While PLCS does not mandate a specific process, it does provide flexibility and extensibility to allow the standard to be tailored to support business processes relevant to different industry requirements. The PLCS standard is aimed at complex high-value products with long life cycles and demanding in-service support requirements, e.g. aircraft, ships, oil rigs, power generation equipment etc.

Adopting PLCS provides an opportunity for businesses to improve their support related processes.

Q8   What is the difference between PLCS and PLM?

PLCS is a joint industry and government initiative to accelerate development of new standards for the exchange of assured product and support information. It is therefore an enabler of Product Lifecycle Management (PLM), which is a concept promoted by IT industry analysts and leading software vendors. PLM is a concept that describes a collaborative working environment for users to manage, track and control all product-related information over the complete product life cycle.

Q9   Is there a link between PLCS and my business processes?

Yes. Business processes are established to meet the specific requirements of an enterprise. They are likely to change over time as improvements are made to increase efficiency and performance or to accommodate new technology, e.g. Internet technology.

For this reason PLCS, Inc. is developing an information standard, not a process standard. AP 239 will however include an informative process model (called an Application Activity Model) to illustrate how the information standard can best be exploited.

This process model was developed in the first year of the PLCS project, to identify the generic exchange requirements likely to be applicable to all industries within the identified target profile, i.e. Original product and/or equipment manufacturers, operators or third party service providers.

Experienced engineers and managers from a representative cross section of the target industry profile developed the model.

The Application Activity Model provided by AP239 will assist business managers and software implementers to:

❖ Understand the information model and exchange sets (conformance classes) defined by AP239

❖ Identify targets for process improvement

❖ Identify the required exchange standards at organisational or system boundaries between organisations

Major business change programmes, potentially involving process re-engineering based on 'industry best practice' could benefit from a detailed understanding of the PLCS business model.

Q10 Who is using the PLCS Standard and which industries is it relevant to?

Application Protocol 239 (PLCS) is being developed to meet the needs of Governments, original product and/or equipment manufacturers, operators and third party service providers.

The common attributes that make PLCS attractive to this user community are:

❖ Complex high value products

❖ Many unique parts and product configurations,

❖ Long service life

❖ Demanding in-service support requirements

❖ In-service support costs that encompass a significant portion of the total cost of ownership

The following industry groups could equally benefit from the adoption of PLCS:

❖ Transportation – Commercial and Military Aircraft and associated Aero engines

❖ Transportation – Commercial and Military Truck Fleets

❖ Transportation – Commercial and Military Ships

❖ Transportation – Locomotives and Trackside equipment

❖ Heavy Industrial Machinery

❖ Power Generation

❖ Oil and Gas Process Plant

In developing the PLCS standard careful consideration has been given to the requirements of both commercial and military domains. Application Activity models and the single integrated information model have been rigorously tested against use cases and scenarios from both domains. For example, Rolls-Royce has significant interests in defence and civil aerospace, marine propulsion and energy markets. Rolls-Royce hope to realise significant benefits from application of PLCS in many areas of their business.

AP239 (PLCS) also provides a capability to tailor the standard to the specific requirements of a particular industry/environment or project through Reference Data. This provides unique levels of flexibility and extensibility in the use of the standard.

Q11 Does PLCS support Interactive Electronic Technical Publications (IETPs)?

PLCS will model the information needed to define, plan and report on the outcome of maintenance activities. It could therefore be used to define the architecture of a maintenance management system, or to support neutral data exchanges between many distributed maintenance management systems and a single master database/PDM system used to control the configuration of required all technical data.

PLCS does not prescribe the extent of information that shall be supplied to maintainers or its presentation format. It is expected to establish an unambiguous set of concepts, entities and attributes for the domain addressed by maintenance oriented IETPs

PLCS Membership

Q12 Can I become a member of PLCS, Inc.?

At this late stage in the development of the standard, membership of PLCS, Inc. is closed.

However, to increase awareness in PLCS and encourage widespread adoption by industry, PLCS, Inc. is planning to establish a technical committee within the OASIS organisation. Members of OASIS can join the PLCS technical committee to can gain early visibility of the PLCS standard and contribute to the development of standardised data exchanges which include industry testing and validation and usage guides. For more information on OASIS see http://www.oasis-open.org/

Q13 How can I review and comment on the PLCS standard?

AP239 is an international standardisation project in which anyone can participate by attending the meetings of the relevant ISO committee (ISO/TC 184/SC4). Details are provided at www.tc184-sc4.org. Most of the technical work to develop this standard is being done by PLCS, Inc.

The PLCS web site is continually updated as new material is released and provides a facility to register interest in AP 239. PLCS, Inc. welcomes all comments on the emerging standard. Comments should be channelled through the appropriate ISO working group, ISO/TC184/SC4/WG3/T8 and, in addition, any informal comments can be made via the public area of the PLCS web site (www.plcsinc.org).

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Business Benefits of PLCS

Q14 What business benefits will I get from implementing PLCS?

PLCS offers the potential for a wide range of business benefits including:

* ❖ Improved quality of assured product and support information throughout the product life cycle and across the supply chain
* ❖ Ability to bid for contracts specifying AP239 as a contractual requirement
* ❖ Reduced cost of acquiring, maintaining and delivering product configuration information
* ❖ Improved operational availability due to a reduction in the time taken to undertake essential maintenance and product upgrade operations
* ❖ Improved configuration management through common data definitions and provision of feedback on as-maintained configuration, usage, properties, operating state and behaviour.
* ❖ Re-use of data and consistent communication across compliant 'off the shelf' software applications
* ❖ Flexibility in accommodating changes in information management technology through adoption of an independent and open exchange format

The first implementations of the standard are likely to be undertaken by PLCS sponsor members using software developed by the software vendor members of PLCS, Inc.

Q15 What does PLCS do that cannot be done with my current IT systems?

PLCS is an information exchange standard. It provides a mechanism for exchanging assured product and support information between compliant software applications, using a standard exchange protocol and without the need for developing proprietary interfaces. It provides for data independence, allowing re-use in applications other than the authoring tool.

It has been designed to facilitate information exchanges at all phases of the product lifecycle, i.e. from concept to disposal. It ensures interoperability across enterprises and between systems/applications through the deployment of a single integrated suite of data modules, based on the ISO 10303 STEP standard

Through the use of reference data libraries, Application Protocol 239 (PLCS) provides extensibility to tailor the generic standard to specific needs of particular industries, organisations or projects.

Q16 My ERP and logistics applications already provide this functionality, why do I need PLCS?

It is true that there are software applications available today that meet the functionality addressed by PLCS. These applications are, however, typically based on proprietary exchange standards and data definitions. To facilitate an exchange of information between systems requires product specific interfaces to be developed and maintained.

Increasingly customers want to specify data exchanges using neutral standards in order to reduce infrastructure costs, manage legacy information and provide data independence and interoperability across enterprises and systems – this leads to the adoption of a common product data standard in a neutral format, such as ISO 10303 – STEP

The unique value proposition for PLCS can be summarized as follows:

- ❖ Only international standard for the exchange of assured product and support information
- ❖ Addresses the complete product life cycle from concept to disposal
- ❖ Facilitates the 'virtual single source' of assured product and support information
- ❖ Information independent from process, system and format
- ❖ Interoperability across enterprises and systems through integrated information model, in the form of an ISO 10303 STEP standard
- ❖ Supports 'extended enterprise' requirements for data exchange and information sharing
- ❖ Provides extensibility through the use of reference data allowing tailoring of the standard to suit different product operating domains.

Q17 How will PLCS improve my business processes?

During the first year of the PLCS initiative, the requirements for information exchange in the product support environment were developed from a detailed support process model, developed using the IDEF 0 methodology. This process model was validated using practical business scenarios provided by PLCS sponsors. This business process model represents 'industry best practice' and provides a baseline for comparison with other business process models.

Examples of the potential for process improvement include:

- ❖ In-service feedback provided in a neutral format that simplifies information exchange and ensures consistency in interpretation and communication of data
- ❖ Improved quality and access to information leading to reduced cost and reduction in rework
- ❖ Effective configuration management
- ❖ Flexibility in accommodating changes in information management technology
- ❖ Reduction in the need for a variety of IT solutions to support the proliferation of processes and tools.

Q18 How will PLCS meet its claim to free up legacy data?

PLCS will provide a common standard for the exchange of assured product and support information between different types of software applications. Adopting a common neutral format for data exchange avoids the risk of being locked into proprietary data formats.

Within the PLCS single integrated information model provision has been made to ensure that most information exchange requirements have been identified and accommodated.

Adopting PLCS compliant software avoids the cost of proprietary interface development and maintenance costs, which some studies have shown can be up to 70% of a departmental IT budget.

Another important aspect to consider is the longevity of data. The types of product that will benefit most from PLCS are complex, high value assets with an in-service life that is typically measured in decades. To guarantee the mapping and future use of legacy information it is recommended that the neutral format of AP239 be adopted.

Q19 How will PLCS help me support and operate software applications from different vendors?

The PLCS Standard defines the neutral data format required to facilitate bi-directional information exchange between software applications. The PLCS single integrated information model addresses all of the major data flows and/or transactions required to support a comprehensive product support process model.

By mapping the data import/export capability of existing software applications to the PLCS Schema it is possible to define the information exchange requirements in the form of a STEP-based neutral /open format, for example a Part 21 or Part 28 File (ISO 10303-21 or ISO 10303-28).

These file formats can be readily exchanged between PLCS compliant software applications, without the need for costly and time-consuming development of proprietary interfaces.

Information sharing occurs in a similar fashion, using the STEP architecture of the Standard Data Access Interface (SDAI) (ISO 10303-22). The SDAI enables software applications to have dynamic access to a repository of data.

PLCS Publication Strategy

Q20 PLCS (AP239) is an ISO project, why isn't all the material available on a public web site?

The PLCS information model and other supporting information required for ISO submission will be made available to the general public as soon as it has reached an appropriate level of stability and quality. The submission of draft AP239 modules commenced in July 2003, with approval of the full PLCS Application Protocol (AP239) anticipated in mid 2004. Copyright of all materials required to support the submission will pass to ISO on formal release of the approved standard.

Additional material that is not required for submission, but which relates to the implementation and use of the standard, will be placed in the public domain at the discretion of the Board of Directors of PLCS, Inc. As with the ISO submission, the PLCS, Inc. Board is applying the general principle of making information available as soon it reaches the appropriate level of stability and quality.

Q21 What is a data exchange set (DEX)?

For the purposes of developing the PLCS standard, a modular architecture has been used to construct a single integrated information model. This model has been developed in the EXPRESS language and will be published in XML (Extensible Markup Language) format. The basic building blocks of the integrated information model are referred to as modules.

A Data Exchange Set (DEX) is a subset of the overall PLCS information model, comprising of one or more data modules. DEXs support a specific business process or purpose and

can be related to existing information. PLCS, Inc. members have used their knowledge and support domain expertise to identify and define the capabilities enabled by each DEX. The use of DEX's will facilitate modular implementation of AP 239

Those applying PLCS and/or vendors providing software applications may claim conformance against a single DEX or a combination of DEXs.

DEXs differs from conformance classes (as defined in many of the STEP Application Protocols (AP) in the following ways:
- ❖   DEXs are defined to support specific business processes;
- ❖   DEXs are defined in a separate document from the PLCS Life Cycle Core AP
- ❖   DEXs may have additional constraints
- ❖   DEXs (as part of the PLCS) may specify the use of specific reference data.

Q22   How many DEXs are there and which areas do they cover?

The development of DEXs is an ongoing task, however to date (July 2003) 33 DEXs have been identified, covering the following topics:

- ❖   Requirements (1)
- ❖   Product Design and Behaviour (9)
- ❖   Work (10)
- ❖   Support Environment (8)
- ❖   Support System (5)

Each DEX is supported by a description that defines its scope and relationship to the individual modules required to provide the desired exchange capability. It is intended that usage guides will be produced for each DEX to ensure consistency in implementation and business application.

Q23   What is reference data, how is it used and how can it be customized?

Reference data is standardised computer interpretable data, which can be used to extend or tailor a data model, or to hold agreed descriptions of data to be shared between participants.

Within the PLCS standard (AP239), reference data is used mainly to define standard "types" or "classes" of things, such as classes of documents, types of task, fault codes etc.

Reference data may be standardised at any level (e.g. project, company, inter-company, trade group, national, international) and at any time, before, during or after the development of a given AP. Many current standards could be viewed as potential sources of reference data.

PLCS will use reference data to tailor and extend the AP239 information model in a controlled manner. This enables:

- ❖   Rapid adoption of the standard within a specific domain by using locally accepted reference data and
- ❖   Progressive extension of standardised exchange capability through the further standardisation of reference data over time and, where justified, without changing the core data model.

Reference data also provides a means for recording common descriptions for any types or classes (e.g. agreed categories of a product, agreed fault codes).

PLCS has based its approach to reference data on that adopted by ISO 15926 (Integration of life-cycle data for process plants including oil and gas production facilities). Further information can be found at http://www.iso15926.org/

Q24   Is there any Reference data available at no cost?

PLCS will provide an initial, exemplar set of reference data with AP239.

Most organisations that use PLCS will already have current standards that can be used as potential sources of reference data by AP239.

Q25   How do I deliver reference data that may be in a different system?

AP239 will include a module to identify the library (i.e. files) where required reference data is stored.

Q26   How do I register my reference data?

This issue has yet to be resolved within the ISO/TC184 SC4 community. A form of registration authority is required and work continues to identify a suitable host organisation and business model.

PLCS relationship with other standards bodies

Q27   Is there a relationship or conflict between other standards, e.g. AECMA S1000D / 2000M, ATA 2000 etc.?

In developing the PLCS standard, the relationship between the proposed ISO STEP Application Protocol (AP239) and other support related standards has been recognized. AP239 builds upon the functionality defined by other standards relevant to product support. These include AECMA S100D, AECMA 2000M, United States Military Specification 1388, United Kingdom Defence Standard 00-60, etc.

Throughout the development of AP239 potential for conflict with other standards was removed through ongoing dialogue. Many of the practitioners working on the development of the PLCS standard have a background in working with other standards, some are also members of others standards bodies.

In the specific instance of AECMA S1000D, a joint Memorandum of Understanding (MoU) exists between AECMA and PLCS. The MoU establishes a framework for co-operation between PLCS, Inc. and the AECMA Technical Publication Specification Management Group with the aim of ensuring compatibility between the two standards.

PLCS have utilised the ANSI/EIA 649 and the UK Defence Standard 05-57/4 Configuration Management standards for the CM framework. PLCS also harmonised their terminology dictionary with the emerging revision to ANSI/EIA 649 and the emerging EIA 836 (Configuration Management Data Exchange and Interoperability) standard.

Q28   Why can I not just exchange files using XML?

STEP and XML are complementary technologies. The Application Protocols in STEP, like AP 239, define precise and unambiguous semantics to support the automated exchange of computer sensible information about engineering products, without human intervention. XML (EXtensible Mark-Up Language) provides a generic, flexible language for information viewing or exchange. In recognition of the growing use of XML, ISO/TC184/SC4 have developed an XML-based implementation method for STEP modules and data (ISO 10303-28, or "Part 28").

XML can be used to exchange product life cycle support information, using local terminology and semantics, or using AP239 (PLCS)

Q29 Will PLCS conform to the EIA-836, Configuration Management Data Exchange and Interoperability standard?

PLCS has been working with EIA-836 to ensure compatibility between PLCS and EIA-836. Since EIA-836 grew out of a military standard, MIL-STD-2549, much of the terminology and data sets are military and government oriented. PLCS will maintain a neutral data set based on International consensus that will be fully compatible and compliment with EIA-836 data exchanges.

As part of their contribution to PLCS, US Department of Defense will develop a mapping table between AP 239 (PLCS) and the published EIA-836 standard, to ensure that users of EIA-836 and AP 239 can exchange product configuration information seamlessly. In addition, reference data included in the EIA-836 standard will be incorporated into PLCS.

Q30 What is the relationship of PLCS to the NATO Product Data Model (NPDM)?

AP239 and the NATO Product Data Model are closely related products. The two models share a common data architect. The PLCS initiative was originally conceived and launched from the NATO CALS Office, although not all NATO CALS participants chose to become sponsor members of PLCS, Inc.

In developing AP239, PLCS, Inc. have made a concerted effort to ensure it is a truly representative international standard with broad applicability to both commercial and military product and support environments.

Contracting for PLCS

Q31 When and how should a company contract for PLCS compliance?

Approval and release of Application Protocol 239 is recognition by ISO that the standard has reached a level of stability and maturity to allow it to be referenced as a contract requirement. The requirements for compliance with the PLCS standard will form part of the supplementary information provided for ISO ballot and approval. Full ISO approval is anticipated early in 2004.

Shortly after ISO approval, software vendors will be able to promote and make available applications that have been tested and have demonstrated compliance with the requirements of the AP 239. Thereafter, contracting for PLCS compliance will be a commercial decision taken on an opportunity basis.

Companies that have invested time and effort in the development and testing of PLCS as members or associates members of PLCS, Inc. will be best placed to understand and manage the commercial risks associated with contracting for PLCS compliance.

Q32 Will I be required to contract to the whole PLCS standard or just a part?

Once PLCS (AP 239) is released as an ISO standard, it is anticipated that owner/operators of complex high value assets will begin to contract for product and support solutions in accordance with capabilities defined in the standard.

Some of the government members of PLCS, Inc. have already declared their intention to contract to the PLCS standard once it is released. It is at the discretion of the contracting authority to identify which elements of the standard to invoke and the extent of conformance required within each element.

Software vendors will be required to demonstrate that their applications are conformant to the standard and guidelines for compliance testing and vendor rallies are currently being prepared by PLCS, Inc.

Conformance may be claimed against any or all the Conformance Classes within the Application Protocol. The number and scope of conformance classes will be determined by initial experience with the PLCS Data Exchange Set.

Q33 What is PLCS compliance?

Compliance with AP239 can be demonstrated in the same way as compliance with any other STEP AP, i.e. by demonstrating an ability to import and to export data files, using a implementation method recognised by ISO 10303 (e.g. Part 21, Part 28), that complies with a Conformance Class of the Application Protocol.

PLCS, Inc are currently developing some 30+ potential Conformance Classes, in the form of Data Exchange Sets (DEXs). Decisions have yet to be taken on which of these will be incorporated within AP239 as full Conformance Classes. PLCS, Inc. does not intend to offer a compliance testing service for the AP239 standard

To assist vendors and potential users of AP239, PLCS, Inc. is working to provide a web-based mechanism, supported by some sample data files, which will allow vendors to test their ability to generate and interpret compliant data exchange files and to present the results of such tests to the user community.

Responsibility for conducting the tests, for publishing the results and for any claims made will rest with individual vendors.

Q34 When will software vendors be PLCS compliant?

Once the PLCS standard (AP239) becomes an approved Application Protocol within the ISO framework, it is anticipated that software vendors will take the opportunity to develop products that meet the specified compliance requirements. This is conditional upon there being sufficient customer demand to warrant the cost of developing and proving compliance.

PLCS, Inc. software vendor members are committed to developing software applications that comply with the requirements of the standard.

The adoption of the PLCS standard by other software vendors will be a commercial decision, based on the demand from industry and the costs associated with development, testing and implementation. It is unlikely that these vendors will commit to PLCS prior to it becoming an approved Application Protocol.

As with any commercial organisation software vendors are likely to respond to customer demand – the higher the demand the quicker they are likely to develop compliant applications.

Implementing PLCS

Q35 Who has implemented PLCS and has it been tested?

.   In September 2001, two teams of PLCS, Inc. members independently developed PLCS technology demonstrations based on a part of the single integrated information model. The demonstrations concentrated on the core of the model dealing with product structures, configuration management and exchange of information in the form of a STEP Part 21 file.

These early technology demonstrations gave confidence in both the approach and in the ability of vendors to quickly produce application functionality that was compatible with the emerging requirement.

The two technology demonstrations were sponsored by:

❖ UK MoD, Rolls-Royce and LSC Group
❖ US DoD, Boeing, Aerosystems International and PTC

The technology demonstration showed the benefits of PLCS in providing

❖ Unambiguous and consistent product configuration information between the product and equipment manufacturers, Support Authority and Field Operations Authority

❖ Timely and accurate QA/Manufacturing records available throughout

❖ Comprehensive and unambiguous feedback collected with minimum effort

In an extension to the original scope of the demonstrators, the STEP Part 21 file from one demonstrator team was successfully read by the other team without further change, thereby demonstrating the value of exchange in a neutral format.

Further industry testing and pilot implementations are scheduled for completion before the formal approval of the Application Protocol.

Q36   When will the PLCS standard be stable enough to implement?

Prior to the submission of the draft standard to ISO, an extensive regime of in-house and industry testing will have been undertaken to prove the effectiveness and stability of the standard. To prove the effectiveness of information exchanges between compliant software applications, in-house and industry testing will be supplemented by vendor test rallies.

Submission of the first PLCS modules is scheduled to commence in August 2002. The submission follows a formal balloting process that will conclude when the PLCS Standard reaches the status of an approved Application Protocol (AP239), anticipated early in 2004. Further testing, including tailoring the standard through the use of Reference Data will continue in parallel with the balloting and approval cycle. Once approved, the Application Protocol is considered stable and a suitable framework on which to develop compliant software applications.

Based on experience and feedback from industrial use, further changes to the AP may be required but these changes are anticipated to be minor and will not fundamentally change the architecture of the AP. The modular approach adopted by PLCS, Inc. will make changes relatively quick and easy to accommodate, thereby reducing the risk to successful implementation.

Q37   What parts are there to the PLCS standard and can I implement them separately?

The PLCS Standard is based on a single integrated information model that addresses the complete product support domain and is described by the following four major areas:

❖ Support Engineering – Provide and sustain the support infrastructure
❖ Resource Management – Plan and record resource utilization against task
❖ Configuration Management – Manage change throughout the product lifecycle, with the provision for tracking product configuration information
❖ Maintenance and Feedback – Maintain, test, diagnose, calibrate, repair and modify physical product, including schedules, resources and feedback

The single integrated information model has been developed using a modular architecture, which enables groups of data modules (building bricks) to be combined to meet the specific functionality requirements of users.

In developing the standard, PLCS, Inc. has tried to anticipate the most likely requirements. Functionality to meet these anticipated requirements is presented within the single integrated information model as Data Exchange Sets (DEX's) – which are unique combinations of data modules that satisfy a business need.

It is anticipated that software vendors will provide functionality that is compliant with one or more of the DEX's and that users of the PLCS standard will implement one or more of the DEX's to meet their business requirement(s). A full description of the functionality supported by DEX's will be made available on the PLCS, Inc. web site, once model development is complete.

Q38 What will it cost me to maintain a PLCS environment?

When evaluating cost vs. benefit of product support environments, the cost of maintaining a PLCS compliant environment will be significantly less than the cost of maintaining a non-PLCS compliant infrastructure with comparable functionality.

The main reason for this is that a compliant PLCS infrastructure facilitates improvements in operating efficiency and effectiveness that cannot be achieved with a disparate, non-integrated infrastructure.

PLCS offers the potential for a wide range of business benefits including:

❖ Improved quality of assured product configuration information throughout the product life cycle and across the supply chain

❖ Reduced cost of acquiring, maintaining and delivering product configuration information

❖ Improved operational availability due to a reduction in the time taken to undertake maintenance and upgrade operations

❖ Improved configuration management through common data definitions and provision of feedback on as-maintained configuration, usage, properties, operating state and behaviour.

❖ Re-use of data and consistent communication across compliant COTS software applications

❖ Flexibility in accommodating changes in information management technology through adoption of an independent and open exchange format

The Return on Investment (RoI) from PLCS implementation is still to be proven, but provision is being made in plans for industry testing and early industry implementation to establish a cost baseline from which performance improvements can be measured.

Q39 When can I buy the PLCS system?

PLCS is not a system, it is an information exchange standard based on an extension to the ISO 10303 STEP standard.

Current sponsors of PLCS, Inc. include a number of leading software vendors who are committed to product life cycle support. Once the PLCS standard is stable and, subject to customer demand, it is anticipated that vendors will modify their products to include the capability for information exchanges using the PLCS format.

Q40 Is any PLCS training available?

During the final year of PLCS, as part of a planned transition to implementation, it is anticipated that some members of PLCS, Inc. and/or third party organisations will develop training courses related to PLCS. Topics under consideration include:

❖ PLCS - Delivering Business Benefit

❖ Introduction to PLCS, including background, scope, goals, process modelling, benefits, metrics etc.

❖ Technical and Architectural considerations of PLCS implementation including DEX development and documentation

❖ Developing PLCS compliant software applications
❖ PLCS Testing and participation in Vendor rallies
❖ PLCS Implementation including use of Reference Data

Q41 What investment must I make in PLCS to get started?

As a potential user, the degree of investment required to implement PLCS depends upon the anticipated scope of implementation.

At its most basic it could be as simple as installing two PLCS compliant software applications and using the exchange capability to share information between them.

Alternatively PLCS could be used as the foundation for a major business change initiative.

Whether the implementation is small or large scale, the recommended approach to implementation is evolutionary not revolutionary. Think big, start small and move fast.

Data integrity and accuracy is likely to be an issue, irrespective of the size of implementation. This is particularly true when implementing PLCS on products already in service. To ensure a successful implementation of PLCS, there are also many issues associated with the use of legacy information that must be addressed.

A user group or industry forum will be established to provide guidance, insight and feedback to early adopters of the PLCS standard.

Q42 What tools/resources are available to implement PLCS?

As the PLCS initiative transitions from a development activity to an implementation phase, resources to aid implementation will be developed and tested by PLCS sponsor members. Lessons learnt from industry testing and technology demonstrations will be used to refine knowledge gained from early implementations of the standard. Through the proposed OASIS technical committee, access to knowledge gained from early implementation of the PLCS standard, including use of detailed activity models, usage guides, test data, performance metrics and other tools will be shared, subject to appropriate confidentiality agreements being in place.

Software vendors who are also members of PLCS, Inc. are likely to offer implementation services and consultancy support related their applications.

Q43 Can I buy a PLCS application or will I have to build it myself?

Shortly after the approval by ISO of the Application Protocol, it is anticipated that software vendors will start to market PLCS compliant products.

Since the overall scope of PLCS is comprehensive and covers the product life cycle from concept to disposal, it is unlikely that any software application will meet all PLCS exchange requirements, from cradle to grave. It is more likely that, as with products that are available today, applications will address specific areas of functionality, e.g. technical documentation, maintenance planning and scheduling, configuration management, logistic support analysis. There is however a significant difference in that the import and export capability will be PLCS compliant, making information exchange between applications easier to implement.

As an industry user, it will be possible to take the published AP and develop applications that comply with the requirements. The industry trend in recent years however has been to adopt Commercial Off The Shelf (COTS) software that satisfies the majority of the individual business requirements. It is likely that some degree of tailoring will be required to fully meet the requirements/processes of individual companies, but this approach has been shown to be a more cost effective solution that developing applications from scratch.

One of the strengths of the proposed PLCS standard is the capability it provides for extending and tailoring to specific requirements through the use of reference data.

Q44 Which software vendors support the PLCS standard?

The software vendors participating in the development of PLCS offer a wide range of capabilities, domain expertise and knowledge. Some are specialists in product support while others provide broader capabilities associated with Product Lifecycle Management (PLM) and Enterprise Resource Planning (ERP)

The following software vendors are currently members of PLCS, Inc.:
- ❖ Aerosystems International Ltd
- ❖ Industrial and Financial Systems (IFS)
- ❖ LSC Group
- ❖ Parametric Technology Corporation (PTC)
- ❖ Pennant Information Services Ltd

Vendors are committed to enhancing their products to offer a PLCS (AP239) compliant exchange capability, based on an extension to the PDM schema capability in ISO 10303 STEP.

Q45 Are any software applications in development that will be PLCS compliant?

Subject to customer demand, the software vendor members of PLCS, Inc. are anticipating developing software applications that comply with the requirements of the standard. Since the standard is still under development, and therefore subject to change, there currently are no software applications commercially available.

Vendor members of PLCS, Inc. have developed early demonstrations of a compliant exchange capability, by making appropriate modifications to existing products. These early technology demonstrations have given confidence in both the approach and in the ability of vendors to quickly produce applications that are compatible with the emerging requirement.

Once PLCS becomes an approved Application Protocol within the ISO framework, it is anticipated that other software vendors will take the opportunity to develop products that meet the specified compliance requirements.

Q46 Can I apply PLCS to my mature product without adding to the cost?

PLCS will only be applied where the benefits outweigh the cost of implementation. The benefits of PLCS implementation are equally applicable to existing/mature products as they are to new products in the design and manufacture phases.

Depending upon the scope of implementation the cost/benefit will vary. One issue that is of particular importance for mature products however is the accuracy and timeliness of legacy information. Access to assured product and support information is a major consideration when implementing any information system and appropriate processes for information validation are essential for accurate configuration management.

Q47 What should I do before I implement PLCS?

The introduction of any new system or process should be preceded by a review of legacy information and associated systems/processes. This is necessary to give confidence that information being managed under the new system/process is accurate, representative and under configuration management.

The extent of data cleanup required will depend on the efficiency and effectiveness of existing processes and systems. Undertaking a review prior to implementation provides an ideal opportunity to consider improvements in process efficiency and to determine whether process change can be introduced to increase effectiveness. For example: "What impact could the introduction of Internet based technology have on the effectiveness your existing processes and systems?"

Q48   How much will it cost me to migrate legacy data to a PLCS format?

The answer to the question is indeterminate, since it depends upon how much legacy data there is, its quality, its current format and how much needs to be migrated.

One thing to consider when evaluating the pro's and con's of adopting PLCS is the potential for cost saving through the adoption of a neutral exchange standard.

Imagine the benefits to your business if:

❖   Product configuration information was always accurate, up to date and immediately accessible
❖   Maintenance information was precisely tailored to the specific task(s) to be performed, i.e. reflecting resources skills, facilities and material available.
❖   Spares and inventory costs were minimized through vendor involvement in an integrated reliable supply chain
❖   In-service feedback was accurate, included the operating context under which it was gathered and was readily available to product designers and support managers
❖   Change was easy to manage throughout the life cycle and the impact of change proposals could readily evaluated
❖   Unscheduled maintenance events could be dealt with efficiently and effectively

The PLCS standard has been developed to support the operating scenarios described above. Perhaps a more appropriate question is "What is the cost of NOT implementing PLCS?"

Q49   Are there any performance metrics?

The single integrated information model, which forms the heart of the PLCS standard (ISO 10303, AP239), is still under development and therefore there is little qualitative evidence available to substantiate the claims made for improvements in process efficiency, reduced infrastructure costs, reduced cost of ownership and increased information accuracy.

Early indications from technology demonstrations validate the claims of PLCS and give confidence that benefits will be realized once the standard is approved and deployed in industry.

The development process for PLCS includes testing and vendor rallies using realistic data. The requirements for testing include the establishment of a performance measurement baseline from which improvements can be measured. Some of this information will be made publicly available.

Q50   How does PLCS interface with my ERP system?

PLCS will provide a common standard for the exchange of product support information between different types of software applications, including ERP solutions. Adopting a common neutral format for data exchange avoids the possibility of being locked into proprietary data formats. Provision has been made within the PLCS integrated information model to ensure that information exchange requirements for ERP and other key systems

have been identified and accommodated. These are in the form of two-way data exchanges of information related to the support solution, the support environment, configuration management and resource and inventory management.

Q51 How can I implement a common source database with PLCS?

PLCS, Inc. has established a Memorandum of Understanding with the S1000D project managed by the AECMA Technical Publication Specification Management Group. Under this agreement, work is planned to demonstrate how AECMA 1000D modules can be stored and managed within a PLCS environment.

It is anticipated that guidance on how to use PLCS in managing Spec 1000D modules will be produced following these tests.

Q52 What impact will PLCS have on my suppliers and customers?

The PLCS initiative will deliver an international standard for the exchange of assured product and support information. The scope of the initiative addresses all phases of the product life cycle from concept to disposal. The open format of the standard enables all members of an extended enterprise, including customers, partners and Tier 1, Tier 2 and other suppliers to collaborate and exchange information without the need to develop and maintain expensive software application interfaces.

Customer and supplier involvement is important in the early stages of a design development, since decisions taken at that stage can have a significant influence on through-life costs. Collaboration can ensure an appropriate balance is achieved between requirements, performance and cost.

In today's competitive environment, suppliers who can provide information in a format that allows re-use will gain a competitive advantage. There is a growing trend to award contracts not just on cost but also on a contractor's proven collaborative commerce ability.

PLCS will facilitate collaboration within the extended enterprise, help reduce costs and improve product quality and ultimately product availability.