INTEGRATION OF CATIA/SMARTEAM INTO CERN'S CORPORATE ENGINEERING DATA MANAGEMENT SYSTEM

T. Hakulinen, C. Delamare, P.-O. Friman, T. Pettersson, E. Van Uytvinck, D. Widegren,

CERN, Geneva, Switzerland

G. Fournier, SPI Numérique, Lyon, France

Abstract

We present a short overview of the strategy defined to integrate the 3D CAD system CATIA/Smarteam into CERN's corporate Engineering and Equipment Data Management System (EDMS), which is used to manage the information about the Laboratory's installations and technical infrastructure. A brief description of the existing EDMS architecture is given, describing the available project life cycle management features, including CATIA/Smarteam. An overview of the design office requirements on the new CAD system is also presented.

INTRODUCTION

This document describes very briefly the corporate engineering and equipment data management infrastructure which is known by its acronym – EDMS and the integration of CERN's new 3D CAD system CATIA/Smarteam into this data management backbone. The new CAD system replaces Euclid, the 25 years old CAD system used to build and integrate the LHC [1], and which will be switched off by the end of 2008. The integration of CATIA/Smarteam into the EDMS corporate backbone will offer the Organization an EDMS which can handle seamlessly all technical information about a facility from its inception to its dismantling, in industry parlance, a true Product Lifecycle Management – PLM, see [2] for a more detailed description.

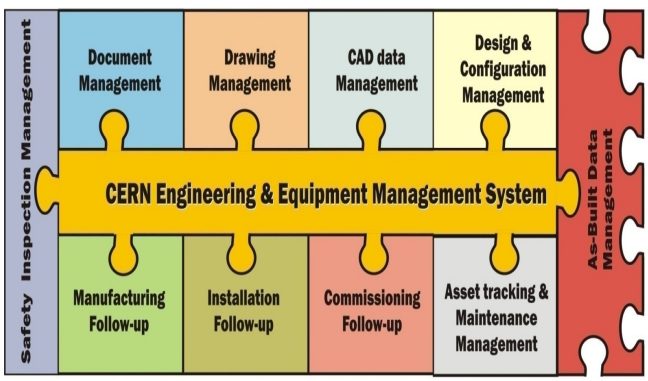

Figure 1: Components of EDMS at CERN

EDMS AT CERN – AN OVERVIEW

For technical data management and their associated work processes, CERN's EDMS relies on the standard functionality provided by a commercial product, Oracle Agile PLM. This activity typically covers standard project data management functions for handling project / assembly / work breakdown structures, Bills of Material (BOMs), configuration management, and document and drawing management. In addition to the usual system customization, a simplified Web interface has been developed in-house.

EDMS now manages roughly a million documents and drawings. On the average, almost 10000 new documents are registered every month. In total there are 5500 registered users of the system located at CERN, at collaborating institutes, and at suppliers around the world.

Due to the complexity and cost of many accelerator components, it is no longer sufficient to just manage the design processes but it has become crucial to be able to follow up both equipment interventions and equipment modifications. The results of actions in the predefined work flows with tasks and data import for the different manufacturing and test processes are logged in the EDMS using a dedicated application, the Manufacturing and Test Folder (MTF). Worth noticing is that the information related to the equipment production can be captured directly at the different manufacturing sites by the supplier without CERN intervention. The system has thus become a very important tool in the production follow-up and supply-chain management. Due to its detailed technical follow-up and capabilities of managing non-conformity reports, it is an essential element for quality assurance management. Specific tasks defined in the manufacturing work flow, reporting of successfully received and tested equipment, trigger email notifications to the different parties in the supply chain. Based on such notifications payments for delivered batches of components can be managed, the net result of which is that payments can be blocked until the components have been properly registered in the system. Since the installation and commissioning processes from a conceptual point of view are similar to the manufacturing follow-up, the same data management principles have been applied, and the equipment data is managed and organized in a comparable way. Data and events linked to physical equipment are managed and stored in an asset tracking system while the Agile PLM system takes care of the related documentation. However, as a result of the global system integration and the Web interfaces developed, the end-user does not have to worry about where the data is coming from or where it will be stored.

THE CAD SYSTEMS

CERN presently has three CAD systems deployed: AutoCAD, Euclid and CATIA/Smarteam. AutoCAD is primarily used for 2D design activities and is often used by members of external collaborations or technicians on a part-time basis as it is comparatively simple to manage. Euclid and CATIA/Smarteam are dedicated to professional designers who have received the appropriate training before starting to use the tools.

Smarteam & EDMS?

Although Smarteam replicates some of the features of the EDMS system and a direct CATIA-EDMS interface exists via a (small) third-party supplier, the decision was taken to use Smarteam for the CAD design data management. It will have no problem interfacing to CATIA, and support for both products comes from the same supplier, Dassault Systèmes. The usual problems experienced when linking two major applications together with a third party product are thus avoided. The third party product model was tried once in the domain of electronics design data management and clearly showed its weaknesses when the third party supplier went bankrupt. In agreement with the design offices, the use of Smarteam will be limited to the design office and professional designers, and only in conjunction with CATIA to avoid the emergence of a second generic data management system. All approval processes and technical document management will remain in the corporate EDMS environment. The customization of Smarteam will thus be minimized and purely oriented towards the designers' needs. Only equipment designs, equipment breakdown structures, and documents, where approval by project engineers and project managers is required, will be published in EDMS. The design offices will be able to maintain a better control of the many designs under development without undue distribution, and can decide themselves when an approval process should be launched. Any duplication of system features will be kept to the minimum necessary.

Once a design is considered ready for approval, the relevant data (drawings, structures, and 3D models in a neutral visualization format) will be exported to EDMS for approval using the standard tools available. If an approval request results in demands for changes in the proposed design from the concerned project engineers, these changes will be directly managed via versioning in CATIA/Smarteam. There will be no flow of design data from EDMS back into CATIA/Smarteam except in the case of data exchange with subcontractors and external institutes, which utilizes the publishing mechanisms of EDMS.

The proposed approval cycle model requires only that the design offices continue to follow the same successful baseline management model that was used for LHC.

DESIGN OFFICE REQUIREMENTS ON CATIA/SMARTEAM

An updated review of the design office processes was made during last autumn, and the results have been integrated into the overall development plan. The review pointed out a number of weaknesses in the present CAD environment and the different design processes used. The major issues include:

- The excessive number of tools creates confusion.
- Access rights management should be based on project and organisation.
- Integration with EDMS and CAD drawing archive with approval processes.
- Engineering change requests (ECR) and the subsequent approvals are not sufficiently visible for the concerned designers.
- Loss of control when drawing approved and manufacturing started.
- Approval of too many drawings simultaneously with too large a distribution list.
- Automatic links between technical specifications and MTF asset tracking system.
- Item-centric approach to CAD data management with full BOM features.

The CERN design offices are participating actively in the follow-up of the development plan, which is instrumental for the success of the project. At the same time, the design offices are reviewing their own processes, and the results of this exercise will be used in the specification of future developments of CATIA/Smarteam.

PRESENT SITUATION

CERN's CAD policy is conservative as the support team and the design offices have to maintain and use both the old 3D CAD system, Euclid as well as the new CATIA/Smarteam until Euclid is switched off. The production systems for LHC (Euclid, CDD for drawing archival, and CartWeb for title block and part list editing) have to be available in parallel with the ramping up of the Organization's new principal 3D CAD system. It should be noted that the complexity of the new CAD system is considerably higher than the old system, and will require a more intense and extensive support and training effort.

REPLACING EUCLID

The CATIA/Smarteam system offers the designers an environment with richer functionality than Euclid but at the expense of simplicity. In addition, as CATIA/Smarteam is really two products combined, the user interface is not as intuitive and coherent as expected. The design data that have Euclid origins will be managed

by Smarteam as files in either a neutral format or in CATIA format. The closing down of Euclid is planned for the end of 2008 and the migration effort in collaboration with the different design offices around CERN is ongoing since 2 years.

REPLACING THE INTERMEDIATE DFS CATIA STORAGE

Due to reliability issues with earlier versions of Smarteam, the designers using CATIA in production have stored the result of their work on the network distributed file system, the DFS. The latest Smarteam versions have improved markedly and a migration of the full CATIA designs stored on DFS into CATIA/Smarteam is underway. This means importing over 60000 CATIA 3D and 2D files and reconstructing all the various types of links between design files.

INTRODUCING CHANGE

While the introduction of CATIA/Smarteam increases the complexity of the designers' workplace it will also improve the design data management practices. However, compared to mastering CATIA, the effort required to learn to use Smarteam is limited and should not pose any major issues. In any case, training the CAD user community in the use of the new tools is a massive undertaking, towards which goal both the CAD support and the design offices are working closely together.

ITEM STRUCTURES AND PART LISTS

The management of equipment configurations in manufacturing and assembly cannot be done using only drawings. For this kind of activity, items and equipment structures are used. The part list (nomenclature) of an assembly should in general be based on the real composition of the assembly (BOM). In CATIA terms, this is the actual CATIA product structure that is mapped to a Smarteam document structure. However, special cases exist, where it may be necessary to deviate from this philosophy. The existing methodology in use at CERN calls for part lists to be manually created in the CartWeb application using the hierarchy of official EDMS drawings. The CartWeb part list editor is fully manual but allows certain liberties, like inclusion of non-CATIA designed components and old CERN standard parts, and free editing of part list entries in special cases. The CATIA/Smarteam implementation for managing part lists will be able to handle part lists coming from different sources and to resolve conflicts between them while enforcing CERN methodology and data coherency. This will be done using item structures that can be synchronized and at the same time allow for differences with the CAD document structures.

A CORPORATE EDMS SYSTEM

The EDMS system has become the standard tool for the Organization's engineering staff as far as the management of technical documentation is concerned. The different approval and distribution processes are well accepted and extensively used to trace project baseline evolutions. As described earlier, item structures (with versioning) and the BOM will be exported from Smarteam to EDMS. Both systems use Oracle as the underlying data repository, and the support team has an extensive and deep experience in this domain. The exported item descriptions and the associated technical documentation will follow the usual EDMS approval processes and during its life, the item will be referenced by all the different parts of the CERN EDMS (Figure 2). Modern protocols for the inter-system communication based on XML, Webservices, and .NET are being investigated. Similar solutions have already been deployed for import of manufacturing data into the EDMS.

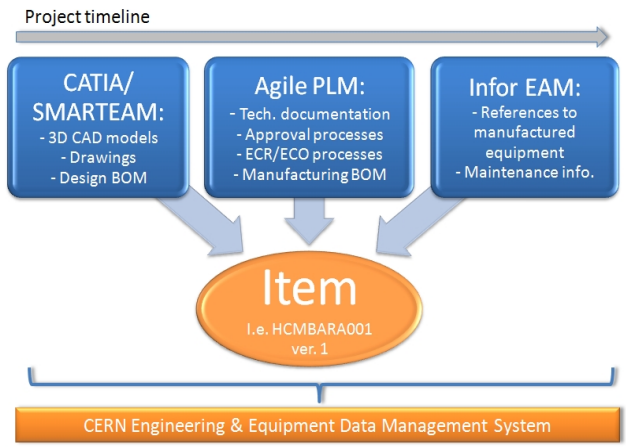

Figure 2: Item interaction with different parts of EDMS

CONCLUSIONS

The integration of CATIA/Smarteam into the corporate EDMS backbone is being done with strong collaboration between the CAD support team and the design offices, who are strongly contributing to clarify their needs based on experience collected using the Euclid-based design environment in the LHC project. The CATIA/Smarteam system is in production and more than 100 designers have received training either by the CAD support team directly or by an external trainer.

REFERENCES

[1] The Large Hadron Collider project; http://lhc.web.cern.ch/lhc/

[2] T. Pettersson, E. Van Uytvinck, P.-O. Friman, B. Feral, T. Hakulinen, Y. Boncompagni, C. Andrews, C. Delamare, S. Petit, D. Widegren, "EDMS AND CATIA/SMARTEAM INTEGRATION"; https://edms.cern.ch/document/884385