

EXAMPLE OF PLM-SYSTEM ADOPTION AT PJSC «UEC-UMPO» IN THE NETWORK OF INTERACTION ON THE PROJECT PD-14

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Abstract : The article describes the characteristics of the PLM-system, implemented on PJSC «UEC-UMPO». The concept of information support for project management is shown, the scheme of interaction of project participants is presented, the main tasks for the future are revealed.

1. Introduction

PJSC «UEC-UMPO» – one of the largest manufacturers of aircraft engines in Russia. At present, PJSC «UEC-UMPO» participates in cooperation with JSC «UEC-Aviadvigatel» in the project of creating PD-14 engine for the aircraft MS-21. The PD-14 project is notable for its branching, which has become the prerequisite for a creation of the Unified information space (UIS). As part of this task, a unique PLM (product lifecycle management) solution was developed and implemented, serving a geographically dispersed group of enterprises, which includes customers, the lead developer, a number of design bureaus and serial plants, and co-executors of the project.

Work on the project PD-14 began in 2009, initially the work in the UIS was governed by the statement of work. The document completely defined the form of the project support information system, and each participant of the cooperation had to fully ensure that its IT infrastructure met these requirements.

At the moment, the interaction of enterprises in the design of aircraft gas turbine jet engines is as follows: there is a database at the site of each participant, the data is exchanged through a distributed system for exchanging engineering data in the Teamcenter MultiSite Collaboration environment (Figure 1).

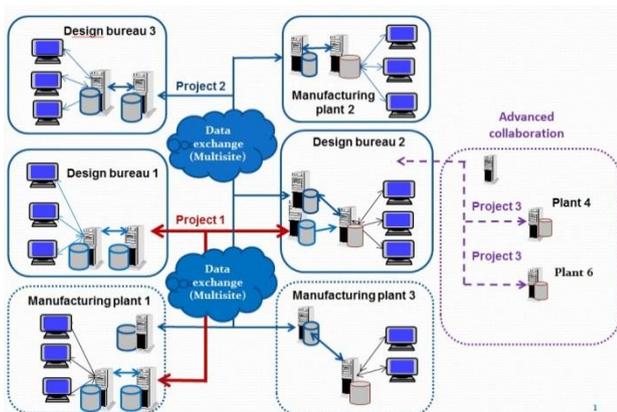


Figure 1. The scheme of interaction of the enterprises in the design of GTE

2. Project charter

At the first stage of the project, the levels of IT infrastructure, methods of computer-aided design and data management in cooperative enterprises were significantly different, and one of the first tasks was leveling of their potentials. IT-infrastructure in that enterprises has been rebuilt in short time.

The main principles of conducting this project were formulated:

1. Centralized storage of project data in a unified engineering data management system (PLM Teamcenter).
2. Providing collective interaction between project participants based on Teamcenter Multisite Collaboration technology.
3. Centralized management using the distributed project management system MS Project.
4. Use of videoconferencing in order to reduce travel expenses.
5. Applying data protection technologies for transmission between enterprises.

3. Organization of the UIS of project PD-14

To create a UIS, product lifecycle management system is needed. In the project of PD-14 creation, the PLM-system Teamcenter acts as this way. When it was put into commercial operation, the work of the whole design bureau changed, end-to-end design process has appeared.

Teamcenter PLM Software allows [3]:

- a) create and use a unified database of products and processes [4];
- b) organize a joint coordinated work of the designers on a unified electronic layout of the product;
- c) organize parallel work on design and technological departments on the product [5];
- d) use software licenses of different types (depending on the program module users are working with);
- e) formalize the processes of working with 3D-models.

The work begins with the "Structure Manager" application - one of the main applications for managing the product structure [5]. The application allows:

- configure the composition of the product;
- support the basic functions of editing a structure such as adding an element, deleting an element and change the attributes of an element's entry (count, position number and other);
- create a specification without using CAD in Teamcenter as a PDF file;
- use variant rules, which make it easier to maintain group assemblies.

The integrated CAD system NX is used for the design of 3D models.

4. NX product design software

NX product design software from Siemens PLM Software is a system for product design and calculations. NX is a 3D modeling system that allows to create products of any complexity. For designating software of this class, the abbreviation CAD/ CAM / CAE is used [2]. Prior to the introduction of NX and TCE, various CAD software (AutoCAD, Compass and even the drawing boards) could be used in one project. The work of the design engineer for different nodes was conducted on the file structure without the use of collective handling, which made it difficult to work with the current version of the frequently-modified model. It was not possible to see the complete construction of the node at the current moment, the complete node was assembled by one performer at the final stage, after the linker passed all the component parts of it. The use of the unified platform allowed to optimize data flows transmitted between specialists, to avoid unnecessary transformation processes from one system to another. The obvious advantages of implementing the NX software in the design bureau:

- a) independence from hardware and software;
- b) absence of problems in process of the exchange of geometric data;
- b) an extensive set of modules and ready-made solutions;
- g) better functionality in the development of control programs for CNC machines;

- d) The best functional capabilities in the design of parts, assemblies and for the creation of design and technological documentation;
- e) the possibility of accumulating and reusing development elaborations.

5. Information evolution of the project

The IT infrastructure of the project was based on the systems Teamcenter and NX. Gradually, the project moved to newer software versions. Transitions, as a rule, were caused by the requirements of the lead developer (JSC «UEC-Aviadvigatel»), as well as by the termination of technical support for existing software versions.

As the project progressed, the number of tasks provided by the Teamcenter PLM system increased (Figure 2).

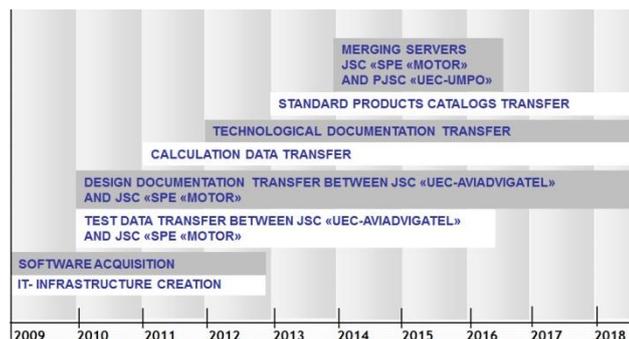


Figure 2. Bureau Informational Evolution of the project

In 2014, in connection with the restructuring of JSC «SPE «Motor» and its accession to PJSC «UEC-UMPO», a decision was made to merge the two servers.

Currently, as new versions of software are introduced, specialists are trained that allows to expand and deepen the use of NX and Teamcenter, they get necessary knowledge and tools for creating electronic layout of the product and data management. At the same time, instructions have been developed and are being implemented that define the requirements for working in NX under the management of PLM-system Teamcenter.

6. Architecture of interaction between project members

As the main architecture of interaction between the project members, "site-leader" approach was chosen. A website of the project was created (a "site-leader") on the territory of the lead developer of JSC «UEC-Aviadvigatel» in Perm. On the space of each member, the PLM server is deployed (Teamcenter). After that, communication channels were established and configured between the project server and each performer. The interaction is carried out using the technology of work through the MultiSite Collaboration implemented in a classic form. Communication channels are protected and encrypted. Initially, the "open VPN" software was used, and then the government-approved software and hardware complex for cryptographic data protection, providing network security for the corporate network of any topology with any number of tunnels. This system was described in the specifications of the main developer, and each company was obliged to purchase and to install it.

The data transfer is carried out as follows: the design documentation is developed and approved on the enterprise server, after which the data exchange operator transfers the documentation to the site-leader and notifies the recipient's enterprise. The recipient member takes the necessary data from the "site-leader".

Compared to the organization of the UIS without using the site-leader, the interaction scheme described above has several advantages:

- a) minimization of the costs of maintaining communication channels at each enterprise (compared to "each with each" network);
- b) to obtain the necessary information, each performer can search directly on the «site-leader», rather than search for it on the sites of the co-executors.

7. Project Infrastructure

To organize the described architecture on servers of all enterprises, a unified data model was deployed.

A Data Model is a way of presenting an information model of a product in a computing environment. When creating a data model in PD-14 project, a document-oriented approach was used, that is, each type of project documentation was represented with (one or another object).

One of the key tasks of the project was the organization of work with reference information. A centralized database of reference information was created, which included standard products (SP), purchased products (PP), catalogs of materials for the manufacture. The interaction scheme is shown in Figure 3.

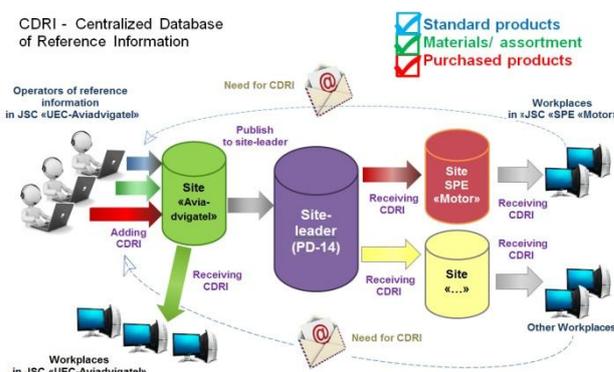


Figure 3. Managing RRI

The reference information is located in the Teamcenter database. If the co-executor had a need for SP, material or PP in the database, the co-executor formed an e-mail in which he described what he needed and sent it to the leading developer's address. Operators of reference information in JSC «UEC-Aviadvigatel» examined this problem and added the missing information to the site of their enterprise. Further, this information was published on the project site and became available to enterprises participating in the cooperation. Until 2013, each reference element was requested in this way, in 2013 the data exchange increased so much that it was not advisable to transfer separate objects. In 2013, all the material catalogs, SP's and PP's were transferred.

8. Agreement of electronic design documentation within the project

Management of design documentation in UIS is impossible without documents agreement in electronic form. Coordination of design documentation in Teamcenter is carried out using preconfigured business process templates.

Within the scope of PD-14 project, the design documentation negotiation process was implemented with the following features:

- built-in examination of design documentation;
- methods of routing changes;
- routes for returning the Design Documentation to the developer for rework.

At the end of the Design Documentation in the system, the document is assigned with the status «Approved» or «Technical studies». The «Approved» status is assigned to the Design Documentation after final approval.

If the Design Documentation is issued for particularly responsible details (assembly) or if their production is carried out at remote site, then the status «Technical studies» is assigned for this Design Documentation. After assigning the status «Technical studies», the

Design Documentation is sent out to the members of the cooperation for its further coordination. After this, the document is assigned with the status "Approved".

9. Conclusion

In conclusion, it should be noted that currently the Teamcenter PLM software within the PD-14 project continues to be actively implemented in the PJSC «UEC-UMPO», the following development steps are outlined:

- preparation for engineering infrastructure for other projects with JSC «UEC-Aviadvigatel» (expansion of computing facilities to support the work);
- integration with automated engineering process system;
- integration with the reference information management system "Semantic";
- transition to the newest up-to-date version of the NX design system;
- using of an intelligent component to solve various tasks within the project.

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