

VA TECH ESCHER WYSS GmbH Ravensburg

VA TECH combines Unigraphics and SAP R/3

Faster order processing through process integration.

by Dr. Arne Gaiser, DSC Software AG

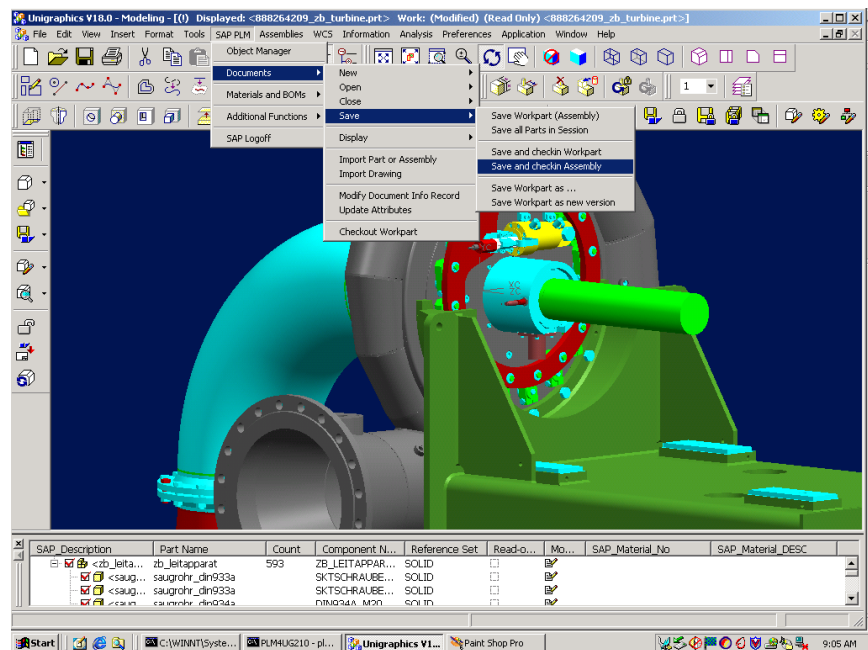
By combining SAP R/3 and Unigraphics, turbine builder VA TECH ESCHER WYSS has seamlessly integrated its engineering processes into its business processes, thereby improving order processing. As a typical company for single-piece production, VA TECH ESCHER WYSS has been using SAP R/3 for a number of years for commercial and logistic processes. By employing the system for the management of engineering data a firm basis for cooperation and order processing was created. For the implementation and adaptation of PLM integration for Unigraphics the project supervisors chose DSC Software AG.

VA TECH ESCHER WYSS

For more than 200 years, ESCHER WYSS has been a synonym for machine and plant engineering. Formerly been part of the Sulzer group, the company was acquired by VA TECH in 1999 and renamed to VA TECH ESCHER WYSS in 2000. Together with VA TECH VOEST MCE, VA TECH ELIN and VA TECH SAT it constitutes division VA TECH HYDRO. VA TECH HYDRO is one the largest suppliers of hydro power plants.

The enterprise supplies comprehensive one-stop solutions, ranging from overall hydraulic concepts incl. electromechanical and electronic systems to energy transfer and distribution.

At the VA TECH ESCHER WYSS location in Ravensburg, water turbines as well as controllable pitch propellers for marine and merchant ships are developed and manufactured. The core activities of the company are the design and construction of Kaplan, tubular and Francis turbines, compact turbines of all types for larger and smaller fall heights, as well as pump turbines and pumps for reservoir power stations and rotary valves as shut-off devices. Furthermore, the enterprise offers one-stop



project management, engineering services, process control incl. erection, commissioning and modernisation.

In 2001, the company employed a staff of about 400.

Objectives and tasks

"One of the main tasks was the reduction of the turnaround time from the customer's inquiry to turbine commissioning. "However, we also attach great importance to structured filing and retrieval of project-specific documents, which, due to the long service life of our prod-

ucts, may be required even a long time later" says Gerhard Brehm, head of IT at VA TECH ESCHER WYSS.

"This requires aggregate-oriented methods of design, early integration of logistic processes and a transparent way of following modification processes. Digital integration of design processes into our business processes was a necessary precondition in pursuing this objective. It allows for better planning of long-term contracts and, through reutilization of existing design documents, for the sales department gaining faster access", adds Hans-Ulrich Günther, Constructive Development at VA TECH ESCHER WYSS.

In order to achieve these objects, VA TECH decided on SAP as PLM system and on PLM integration for Unigraphics to manage engineering data compiled by means of the CAD system Unigraphics.

"We use SAP to process all our orders. Contracts and design worksheets form one unit. To extend SAP also for the management of our Unigraphics models and drawings is only logical", explains Gerhard Brehm.

"Moreover, via PLM integration, we can also use all applicable settings at VA TECH with regard to master data management, SAP classification, user and authorization concept and data archiving.

The integration of Unigraphics into SAP R/3 to us means taking another step towards a complete PLM system".

By introducing PLM integration for Unigraphics the following objectives were pursued:

- Improved handling of customer projects
- Reduction of turnaround time for design contracts from the customer's inquiry to the release of the construction documents.
- Management of all product-specific data and documents in SAP R/3 in accordance with ISO 9001.
- Improved cooperation and transparency for design processes.
- Automated and controlled release and modification processes
- Improved reuse of existing design documents
- Safety and authorization concept provided by R/3

- Company-wide access to design documents

These objectives were to be achieved by direct and in-depth integration of development processes, product data, documents and structures into SAP PLM.

The situation

Currently, both Unigraphics and the predecessor system Helix are used in parallel at VA TECH ESCHER WYSS. Unigraphics is the strategic design program in the group. Step by step, it is replacing the 2D-CAD system Helix. The decision to use Unigraphics proved to be advantageous even after the acquisition by the VA TECH group, as VA TECH, too uses the 3D system Unigraphics and both IT landscapes match.

In 2000, various PLM systems were evaluated. "It turned out that the central criterion was the ability to link design, contract and project data supplied by SAP R/3 with other documents, such as drawings, parts lists, correspondence, etc.

Today, the SAP system is already in use for any task in the field of logistics, commercial transactions and procurement," reports Gerhard Brehm.

Project management

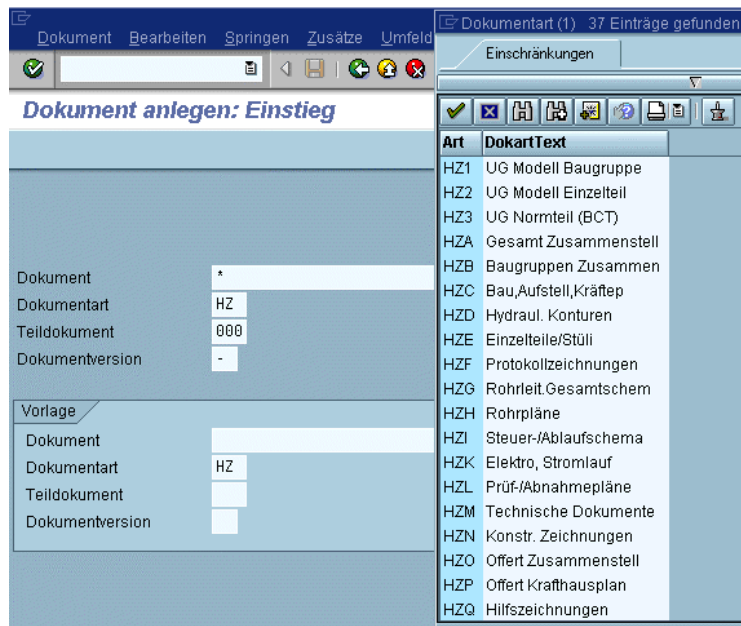
DSC Software AG was entrusted with the implementation and customization of PLM integration for Unigraphics. This was done in two steps.

In summer 2001, the first step was to launch a pilot project for PLM integration for Unigraphics. Specific processes were selected and the users trained. In time and content, this phase was closely connected to the company-wide introduction of Unigraphics. The important thing was that the design engineers, from the very beginning, managed their CAD data in SAP.

The second step was the introduction of a modification process and a process for the creation of TIFF files. In January 2002, the pilot project was turned into a fully operational system for production.

CAD integration was to meet the following requirements:

- Utilization of existing master data supplied by SAP
- Creation of document info records in SAP R/3 using the 3D components and sub-assemblies incl. drawing creation in SAP R/3. In SAP R/3 the necessary meta data and files are created and managed via the interface only.
- Structuring of document info records, material master records as well as further object links.
- Safe version management of documents.
- Secure transfer of SAP data to drawing title blocks.
- Process-controlled creation of TIFF files suitable for archiving and viewing with a viewer.
- Utilization of the SAP user and user authorization concept.



Document-oriented approach

PLM integration for Unigraphics means that Unigraphics data are incorporated into the VA TECH processes so as to provide for a process or document-oriented approach. Unigraphics models and drawings are consistently managed by the R/3 document management system. Based on Unigraphics, the following document management functions are available:

- Creating a new document
- Finding/Opening a document from R/3 for display/editing
- Saving a document
- Modifying a document info record
- Displaying a document info record
- Displaying a document: write-protected opening of the original document or viewing of a TIFF/VRML file
- Display of document info
- Display of the product structure using the SAP Product Structure Browser
- Importing documents
- Status management / Versioning

Every component, sub-assembly and drawing is represented as **SAP document** in R/3. A **SAP document** consists of two components: the **original** Unigraphics CAD file and the

pertaining document description (**document info record**). A document info record consists of an unambiguous document key, administrative data and information about the original document. The document key consists of document number, document type, document part and document version.

For fast and authorized access to and control of specific processes separate document types were devised: three types of documents for models and 15 types of documents for drawings (see illustration).

Models:

HZ1	UG Model Sub-Assembly
HZ2	UG Model Individual Component
HZ3	UG Standard Component (BCT)

Drawings:

HZA	Overall assembly drawing
HZB	Sub-assembly drawing
HZC	Constructional, erection plans
HZD	Hydraulic profiles
HZE	Individual components / Parts lists
HZN	Constructional drawings
HZO	General project drawing
HZP	Project drawing Power House
HZQ	Auxiliary drawings

The designer creates the document info record for the corresponding document for the proc-

ess. Later on, he creates the corresponding material master record or assigns the drawing to the corresponding material and links it to the pertaining documents. Every document type is split up into classes.

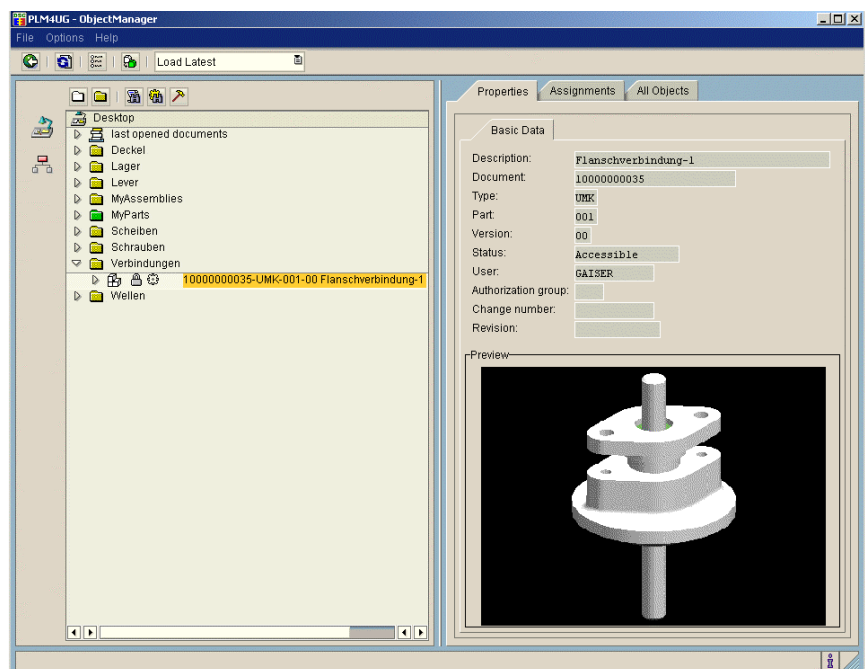
At the early stages of data acquisition, the designer classifies the corresponding characteristics. The classification system created on the document level in SAP by VA TECH is used for organising parts, sub-assemblies and drawings and serves for a fast access to and retrieval of components and documents, and for searching for similar and reusable components. In addition to this, designers can also use document selection in the Object Manager of PLM Integration. PLM Integration for Unigraphics ensures that Unigraphics models and drawings are securely filed in the electronic safe (vault) of R/3.

Management of structures

The design department creates document master records for all components, material master records, however, only for assembly drawings.

To allow unambiguous allocation of documents to the final product, the material master record is linked to the project drawing and the assembly drawing for production. Via a menu item of PLM Integration, an object link for the active component in Unigraphics can automatically and directly be created in SAP PLM.

In the R/3 system Unigraphics sub-assembly structures are represented as **document structures**. Unigraphics stores every individual component and every assembly in a separate file. Component files contain CAD geometries, sub-assembly files the references to pertaining components and sub-assemblies. The document parts list is automatically created and maintained by the Unigraphics-SAP interface in SAP. Once a sub-assembly is modified in Unigraphics, the document structure linked to it



is automatically updated when saving it in SAP. The SAP Product Structure Browser can be used for displaying the product structure. The Product Structure Browser breaks up the document references and groups the referenced objects so as to provide a quick overview. The Product Structure Browser allows all required documents incl. their versions, drawings and material links to be displayed at one glance.

Folders and Favourites

The **Object Manager** is available to designers. It is the **central information cockpit** for R/3 object management. It provides a structured and up-to-date overview of projects/products and R/3 objects contained therein, such as documents and materials. The Object Manager allows fast navigation through the data records, facilitates retrieval of data objects and allows direct access to the R/3 objects in which an interest is taken. This interface allows operations to be performed on marked R/3 objects, e.g. modifying, displaying or shifting (re-classifying) of objects.

Drawings management

Great emphasis is placed on efficient drawings management. VA TECH put forward the following demands:

- Automatic transfer of current information from document info record, material master record and classification to the title block of a drawing.
- Display of modification history on the drawing. The last five modification steps are to be displayed in the title block.
- Automatic creation of a TIFF file to be archived and viewed in combination with release strategy and management in SAP.
- Company-wide access to TIFF files for users without CAD system.

To produce the drawings, VA TECH uses the software UG/Tools. To accelerate the production of drawings VA TECH prepared certain templates for frames and title blocks. The drawing template contains all important settings, such as the frame layout, the margin settings, layer, colour and line settings and the title block attributes. A drawing is created just like a document info record for a model.

For drawings, various document types are available, depending on the application.

Automatic transfer of information to the title block of a drawing

Models and derived drawings are managed directly in SAP, which means that the modifications can be handled uniformly and transparently on a company-wide basis. Via PLM integration, meta data, such as title, document

EINZELTEILZEICHN. INCL STÜLI RAVENSBURG	
Ähnliche Ausführung	AEHNLICH
Ersatz für Zeichnung	ERSATZ
Ersetzt durch Zeichnung	ERSETZT
Format	Din A2
Fremdzeichnungsnummer	FREMD
Maßstab	1:1
Ursprungszeichnung	URSPRUNG
Sonderprüfung Name	
Sonderprüfung Freigabedatum	
Projektnummer (PSP Stufe 1)	123542435
Projektnummer gültig	ungültige PSP-Nummer
Projektname/Stichwort	DEMO_PLM
Baugruppe	12345
Ersteller	GOHL
Erstellungsdatum	31.05.2002
Geschäftsbereich	1011
PDM Kennzeichen	UG-Zeichnung

number, version, material and modification history are directly transferred to the title block of the Unigraphics drawing. When a drawing is created or the pertaining meta data are modified, the title block is updated. "All data relevant for the drawings are provided by SAP as the leading system. The automatic transfer of information to the title block ensures consistent management of design data. This also led to a considerable reduction of expenditure for maintenance of drawings", stresses Gerhard Brehm.

STICHWORT / PROJECT		DEMO_PLM		PROJECT NO		123542435		
ABMESSUNGEN / DIMENSION				MATERIAL				
TITEL/TITLE				GEWICHT / WEIGHT (kg)				
Zeichnung von Vierkant				STÜCK / PARTS				
				POSITION NO				
				MAT. STAMM / PARTLIST NO				
	DATE/DATE	NAME	MASSSTAB/SCALE			ISO / R 128		
GEZ / DRAWN	31.05.2002	GOHL	1:1			EUROPA		
QPR / CHECK T			SCHUTZVERMERK NACH DIN 36 BEACHTEN		URSPR / ORIGINAL			
QPR / CHECK A			NOTE PROTECTION DIN 36 1		AEHNL / REFERENCE			
GENEH / APPR			BAUGRUPPE / ASSEMBLY GRP		ERSETZT / REPLACED BY			
				12345		ERSATZ / SUBSTITUTE FOR		
						PLAN / DRAWING NO		
						891015312		
						AEND/REV		
						-		
						BL / SH1		
						-		
						VON / OF		
						-		

Visualization of CAD drawings on every workplace

The turbines produced by VA TECH frequently are in operation for more than 20 years. This means that the requirements as to archiving / reproduction are very high and that archive files must be prepared for every drawing created by

CAD. VA TECH uses the TIFF format for this purpose.

Moreover, this TIFF format allows users prompt access to the latest drawings without using the Unigraphics software. Creation of TIFF files is incorporated in a release process and is the result of status modifications. The TIFF file is then saved under the same document info record as the original Unigraphics drawing.

Release and modification strategies

In the course of order processing, data and information is often adapted and modified. So as to provide unambiguous proof of "verifier", "date of verification", "releasing person" and "date of release" – even within the scope of product liability – this information is noted down on the drawing. Formerly, the staff was ultimately responsible for drawing up the VA TECH guidelines for controlling, verifying and approving drawings and documents as well as for checking compliance with them. After introducing PLM integration for Unigraphics, the SAP system and the processes selected therein have become responsible for compliance with certain release procedures. This means that the procedures remain reproducible and comprehensible.

The solution to this problem was a combined updating and TIFF file creation process that is automatically started at particular status transfers. For this purpose a status network was introduced as the basis for all document types. It determines the positions the document is to run through prior to its release and who is entitled to a status change. Verifications, approvals and releases can only be performed by people authorized to do so. Altogether 5 release strategies were defined and a release strategy assigned to each of the 15 types of documents.

Abbr.	Meaning	Procedure
AA	Work request	
IA	In work	
ZU	Accessible	
SZ	Lock – accessible	
EF	Released by originator	TIFF file creation
PT	Verified - Engineering	TIFF file creation
PA	Verified - Order processing	TIFF file creation
GE	Approved	TIFF file creation
FR	Released	
SS	Lock release	
ZG	Rejected	

For documents HZG (auxiliary drawings) only a release by the originator is required. There are no further verifications and approvals. For documents type HZN (design drawings), however, the requirements are more comprehensive: Here both verification and approval by the Engineering Department as well as verification by the group manager or the head of the department are required. The drawing can only be released by the segment leader.

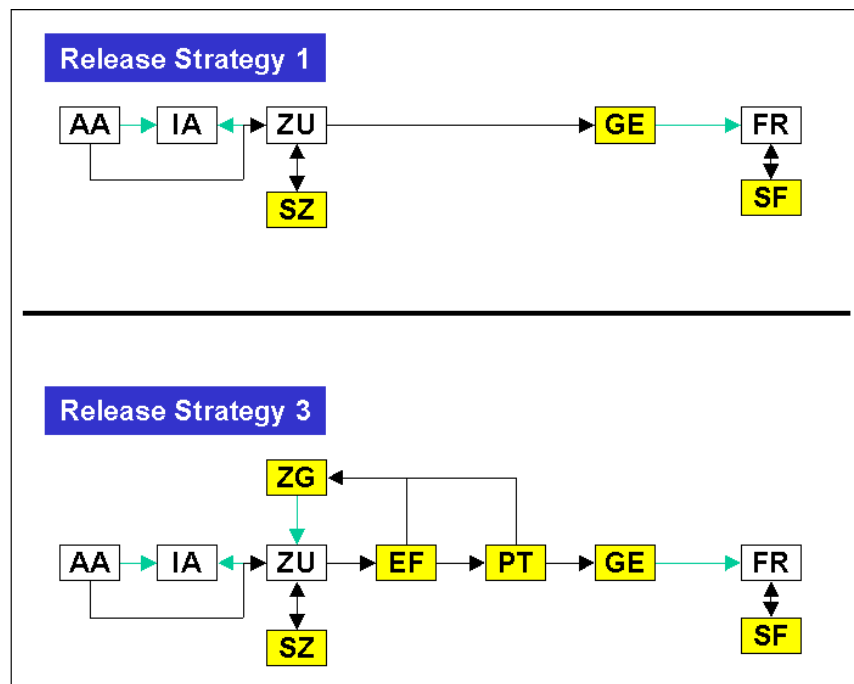


Illustration: Status network / Release strategy for document types - Auxiliary drawings (above) and Design drawings (below)

Creation of the TIFF file is included in the release process. Before producing the TIFF file, title block and modification history of the original Unigraphics drawing are updated. This is necessary to ensure that the current modification history is also included in the TIFF file used for archiving, reproduction and display purposes all over the company.

When changing over to status EF (originator release), PT (verified, Engineering), PA (verified, processing) and GE (Approved) the updating and TIFF file creation process is started by a user exit and is run automatically in the background as separate process on a separate server. Changeover to the release status is automatically performed by the process based on the status "approved".

When changing the status, a programme is executed first of all, which calls up the required function modules in the R/3 system for the modification history and for retrieving and saving the drawing files and which prepares the data of previous versions. The programme ensures that title block and modification history on the drawing are updated. In the original version, the modification history remains empty. In the course of the release procedure, which is dependent on the corresponding type of document, the lines and fields provided for modifications are gradually filled with information. When creating a new document version – which does not necessarily include a release – the corresponding next line is filled. Only the five last modification stages and their verification, approval and release statuses are displayed on the drawing, starting with the current version and going back up to four previous versions, if applicable. The data required for this purpose are read from the pertaining document

info records in the R/3 system and are transferred to the drawing via the attribute assignment available in Unigraphics.

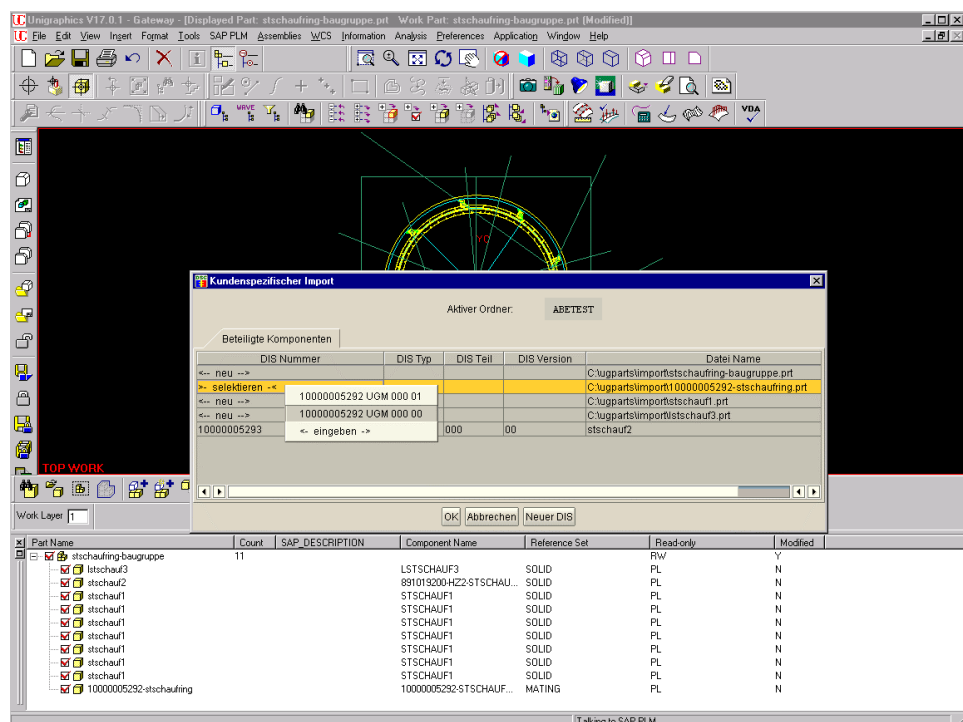
Following this, the process creates individual postscript files, sheet by sheet, of the drawing by sending the original Unigraphics drawing to a Unigraphics plot queue set up for this process. The Postscript files produced thus are then converted into TIFF format by the programme Ghostscript. If several sheets are produced from one drawing, the process automatically creates a multipage TIFF file. In SAP R/3, version 4.5 the TIFF file is saved as file 2 under the same document info record as the original Unigraphics drawing managed as file 1.

To display the TIFF files, the external operating system viewer, Wang Imaging, is available company-wide.

By automatising this process, VA TECH has been able to considerably reduce the turn-around time for offer and order processing!

Cooperation with external engineering companies

Cooperation with external engineering offices plays an important role. Many contractors re-



quest 3D draft drawings at an early stage of the project; non- or late compliance with this request often results in a penalty being imposed. This is why time-consuming layouts ready for detailing are outsourced to external engineering companies.

So as to provide for an efficient exchange of data with external companies, the standard import functionality provided by PLM integration for Unigraphics was extended.

This import function takes three basic situations into account:

- Very often, document info records have already been created in SAP, with the drawing, however, not being available. This is a typical situation for drawings produced by Helix. These 2D drawings by Helix, which are not consistent with master models, can be transferred to Unigraphics via data transfer and be archived with an existing document info record via the import function.
- Furthermore, Unigraphics drawings with a 3D model can be incorporated.
- In addition to this, complex Unigraphics assembly structures with nested sub-assemblies and derived drawing models can be imported.

For import, numerous verification functions have been implemented to ensure and verify if a model or drawing already exists, i.e. whether there is a document info record or an original. When importing, the user can decide whether an existing document is to be overwritten or to be stored as a new version or under a different document info record. A user interface helps taking decisions. For more complex structures, the references are also updated during the import.

This import function allows a real integration into the SAP document management system. It takes the document types, the status flow and the authorization concepts defined by VA TECH into consideration.

Currently VA TECH is examining whether the external engineering companies mentioned above can be directly integrated into the PLM process.

Prospects

The experience we have gained with PLM integration is most promising: "In addition to tighter business process integration and the cost reductions connected with this, it's the verified and readily accessible product data that are highly appreciated", says Gerhard Brehm. "We have reached our objective to manage all product-specific data uniformly in R/3. From engineering to distribution our business processes are now highly integrated. And, what's more, we have also succeeded in boosting productivity."

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